LCRB

UNITED STATES
DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION
Michael W. Straus, Commissioner

REGION 3
E. G. Nielsen, Regional Director

REPORT ON WATER SUPPLY OF THE LOWER COLORADO RIVER BASIN

PROJECT PLANNING REPORT

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Washington 25, D. C.

January 2, 1953

Air Mail

To: Regional Director, Boulder City, Nevada

From: Commissioner

Subject: Report on water supply of the Lower Colorado River Basin

Your "Report on Water Supply of the Lower Colorado River Basin", a copy of which was recently supplied us, has been examined with interest. I recommend that it be made available to the public at the earliest possible date.

In the memorandum of July 17, 1947, by which we transmitted to the Secretary of the Interior our interim report on the status of Colorado River investigations (H. Document 419, 80th Congress), it was pointed out that the term "stream depletions" was used therein without any implication that this is or is not an appropriate method of measuring the "beneficial consumptive use" with which the Colorado River Compact deals. A similar statement would be in order, I believe, in connection with your report's use of the term "consumptive use". I do not understand that by adoption of this term, accompanied as it is by a carefully framed technical definition, you intend to impute the same meaning to the terminology of the Colorado River Compact and the Boulder Canyon Project Act. I suggest that this be made clear either by attaching a copy of this memorandum to each copy of your study or in some other appropriate fashion.

Michael W Straus

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I. SYNOPSIS

This report has been prepared to fill an urgent need for a comprehensive analysis of the water supply of the Lower Colorado River Basin. There has been a definite need for a determination, in more detail than presented in the Department of Interior report "The Colorado River" (March 1946), of the average natural or virgin flows of streams and the rates of use of water to serve as the basis for planning future developments for the maximum utilization of water supplies presently and ultimately available.

The report presents detailed analyses and estimates of historic stream flow at selected gaging stations and other key points; an estimate of average natural or virgin flow at the same stations and points; rates of consumptive use of crops, natural vegetation, and other water consuming items; estimates of channel and evaporation losses; and considerable other information on water supply and use in the Lower Colorado River Basin.

A similar report covering the Upper Colorado River Basin was prepared in November 1948 by the Engineering Advisory Committee to the Upper Colorado River Basin Compact Commission. Together, these reports provide a basis for a comprehensive analysis of the water supply of the entire Colorado River Basin.

A. Definitions

Following is a list of definitions of technical words and terms as used throughout this report.

Consumptive Use: As defined in Appendix B, consumptive use is the sum of the volumes of water used by the vegetative growth of a given area in transpiration or building of plant tissue and that evaporated from adjacent soil, snow, or intercepted precipitation on the area in any specified time. However, as used in this report, effective precipitation has been deducted and wherever the term "consumptive use" is used it means consumptive use of irrigation or ground water estimated by the Blaney-Criddle method, unless otherwise indicated.

Evapotranspiration: Considered synonymous with consumptive use as defined above.

Historic or historical stream flow: The flow of any stream, recorded or estimated, for a historical period.

Virgin flow: The flow of any stream undepleted by the activities of man.

Undepleted or natural flow: Considered synonymous with virgin flow as defined above.

Transbasin diversions: The diversions of water from a drainage area of a stream or basin to the drainage area of another stream or basin.

Apportionment of historic channel losses in river sections: Apportionment was arbitrarily made to the contributor for water originating in the Lower Basin in accordance with the volumes conveyed. Losses on water contributed at Lee Ferry were undistributed.

Salvage: Reduction of the natural water losses through the activities of man.

Salvage of channel evaporation: Reduction of water surface evaporation resulting from flow reductions caused by man. Salvaged channel losses from water surface evaporation in stream sections for water originating in the Lower Basin were arbitrarily prorated among the contributors to the stream flow on the basis of the respective undepleted volumes conveyed in the stream sections. Salvage on water contributed at Lee Ferry was undistributed.

Salvage by the replacement of native vegetation: Salvage of channel losses caused by the replacement of native vegetation by crops and other beneficial uses were apportioned to the state in which the replacement occurred.

Salvaged or increased channel losses: These are caused by native growth changes in the river bottoms and flood plains and were apportioned to the state or states in which the change occurred.

Limitrophe Section: The section of the Colorado River which forms the common boundary between Mexico and the State of Arizona in length from the California-Baja California Boundary to the Arizona-Sonora Boundary.

Water consuming noncropped areas: Cities, towns, and areas consuming water incidential to irrigation farming.

Unmeasured inflows: Flows originating from ungaged areas were determined as the differential stream flows needed to balance the measured inflows and measured outflows adjusted for intervening stream depletions and channel losses in the stream sections.

Period of study: The study period used begins in October 1913 and ends in September 1945. Average historic and virgin flows were determined for this period and such items as water uses, water losses, diversions and reservoir storages and releases are averages for this period. Diversions and reservoir losses and storages which have started or have increased during the 32-year period must necessarily be shown as an average for the full period. Details of these determinations are explained in the report.

Depletions in Mexico: Apply only to that portion of Mexico tributary to the Gila River upstream from the Limitrophe Section of the Colorado River.

B. Maps

This report contains a general map of the Lower Colorado River Basin which shows the tributary networks of the Colorado River system downstream from Lee Ferry, the selected stream flow stations, and the drainage areas above key gaging stations and division points.

Another general map of the Lower Colorado River Basin was prepared which shows the tributary networks of the Lower Colorado River system, the irrigated land areas, and the selected Weather Bureau stations. This map is included in the Blaney-Harris report, Appendix B of this report.

C. Period of Study

Various periods have been used in the past to determine average stream flow. In the 1946 report "The Colorado River", prepared by

the Bureau of Reclamation, the 1897 to 1943 period was used to illustrate average and yearly stream flow for the Colorado River at Lee Ferry and for the Gila River at various key points and the mouth. Intermediate points were interpolated. The 1914 to 1945 period was chosen for the present study because it is believed to be a representative period of average stream flow as well as being a period for which sufficient hydrologic data are available to make a comprehensive analysis of water resources and stream depletions. Furthermore, the 1914 to 1945 period includes the above average runoff years from 1914 to 1929, inclusive, and the severe drought years from 1931 through 1940 and is adaptable to the study of holdover storage problems of stream flow equation in drought years.

Although different techniques and more refined analyses were used in the present studies, the results compare closely with those obtained in the earlier studies. Colorado River flows at Lee Ferry have been estimated for the 1914 to 1945 period as 96 percent of the historical and virgin flow estimated for the longer period in the 1946 report. In the Lower Basin, accretions between Lee Ferry and Yuma compare more closely for the two periods. The 1897-1943 average gain from Lee Ferry to the International Boundary in the 1946 report was estimated to be 1,450,000 acre-feet. However, the flow shown in that report for the boundary actually corresponds to the Colorado River at Yuma. The comparable estimate for the 1914 to 1945 period is 1,454,000 acre-feet. Refined estimates in the present study indicate an average period channel loss of 120,100 acre-feet between the

Yuma gage and the International Boundary, which must be considered when results of the two reports are compared.

Virgin flow for the 1914 to 1945 period was estimated to average 131,600 acre-feet more for the Gila River at the mouth than was estimated in the earlier study for the 1897 to 1943 period. This difference is attributed largely to refinements in estimating missing records, depletions, and channel losses rather than difference in period averages.

D. Water Contributions by States and Mexico

In determining the water contributions by the various states and Mexico, historic stream flow records at selected gaging stations were tabulated and the missing portions of historic records were estimated. Also, estimates were made of the contributions from ungaged areas, average man-made depletions, average depletions of ground-water basins, and channel losses in most of the stream sections.

Tables of historic stream flow are given in Appendix A. A summary of the average annual stream flow at selected gaging stations and division points together with the drainage areas upstream from the stations and division points is given in accompanying Table S1.

Accompanying Table S2 summarizes the average annual historic and virgin contributions by the states, the Gila River Basin in Mexico, and at the International Boundary, together with the respective drainage areas tributary to the Lower Colorado River.

Table S1
LOWER COLORADO RIVER BASIN
Historic Stream Flow and Drainage Areas at Selected Gaging Stations and Division Points

Average annual stream flow in 1,000 acre-feet based on 1914-1945 period.
Drainage areas in square miles.

Stream flow stations or division points in downstream order from Lee Ferry	Average historic flow	Drainage area
Colorado River at Lee Ferry, Arizona 1/	13,788.6	109,458
Little Colorado River above Zuni River, near Hunt, Arizona	8.1	3,685
Zuni River at New Mexico-Arizona State line 2/	12.7	1,075
Little Colorado River near Woodruff, Arizona	58.1	8,101
Puerco River at New Mexico-Arizona State line 3/	13.5	1,083
Little Colorado River at Grand Falls, Arizona	252.1	21,178
Little Colorado River at mouth 4/	413.4	26,906
Colorado River near Grand Canyon, Arizona	14,204.1	137,772
Virgin River at Littlefield, Arizona	231.7	5,092
Colorado River below Hoover Dam, Arizona-Nevada	13,694.0	167,750
Colorado River near Topock, Arizona	13,332.3	172,257
Bill Williams River at Planet, Arizona	135.2	5,144
Gila River at New Mexico-Arizona State line 5/	152.3	3,363
San Francisco River at New Mexico-Arizona State line 6/	74.3	1,917
Gila River at head of Safford Valley, near Solomon, Arizona	378.2	7,954
San Simon Creek at New Mexico-Arizona State line 7/	3.4	622
Gila River at Calva, Arizona	303.0	11,492
San Pedro River at Palominas, Arizona	30.0	741
Gila River at Kelvin, Arizona	434.9	18,031
Santa Cruz River near Nogales, Arizona	15.2	542
Santa Cruz River at Rillito, Arizona	29.7	3,523
Salt River at Granite Reef Dam, Arizona	1,331.8	12,907
Gila River at Gillespie Dam, Arizona 8/	712.4	49,626
Gila River near Dome, Arizona	456.9	58,084
Colorado River within Limitrophe Section at International Boundary 9/	10,344.5	242,983

1/ Combined flow of the Colorado River at Lees Ferry and the Paria River at Lees Ferry.
2/ Estimated historic flow derived in Table 22, Sheet 1.
3/ Estimated historic flow derived in Table 22, Sheet 2.
4/ Estimated historic flow derived in Table 22, Sheet 3.
5/ Estimated historic flow derived in Table 22, Sheet 5.
6/ Estimated historic flow derived in Table 22, Sheet 5.
7/ Estimated historic flow derived in Table 22, Sheet 6.
8/ Computed as flow of the Gila River below Gillespie Dam, Arizona, plus diversions by Gillespie and Enterprise Canals at Gillespie Dam.
9/ Estimated historic flow derived in Table 22, Sheet 11.

Table S2

LOWER COLORADO RIVER BASIN

Average Annual Water Contributions and Drainage Areas by States and Mexico

Based on 1914-1945 period — Unit: 1,000 acre-feet

Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
HISTORIC CONTRIBUTIONS								
Historic contributions at state lines	1,059.5	0	116.2	284.1	190.1	40.3	1/ 13,788.6	15,478.8
Out of state channel losses	0	0	8.2	184.1	19.9	33.2	2/ 4,888.9	5,134.3
Historic contributions at International Boundary	1,059.5	0	108.0	100.0	170.2	7.1	8,899.7	10,344.5
Percent	10.24	0	1.04	0.97	1.65	0.07	86.03	100.00
VIRGIN CONTRIBUTIONS								
Virgin contributions at state lines	2,176.0	16.1	131.8	297.1	231.9	46.8	3/ 15,638.5	18,538.2
Out of state channel losses	0	0	8.9	187.2	21.5	34.4	1,313.6	1,565.6
Virgin contributions at International Boundary	2,176.0	16.1	122.9	109.9	210.4	12.4	14,324.9	16,972.6
Percent	12.82	0.10	0.72	0.65	1.24	0.07	84.40	100.00
Drainage area in sq mi	100,306	3,599	13,922	10,892	3,659	1,147	4/ 109,458	242,983

1/ Historic contribution by Upper Basin at Lee Ferry.

2/ Includes channel losses of 1,156,800 acre-feet; main stream reservoir depletions of 1,175,100 acre-feet; and stream depletions by California of 2,557,000 acre-feet in excess of California contributions.

3/ Virgin contribution by Upper Basin at Lee Ferry.

4/ Drainage area upstream from Lee Ferry.

E. Stream Depletions

The Blaney-Criddle method of using climatological data as an index for evaluating evapotranspiration was used to estimate consumptive use of irrigation or ground water. The consultation services of Mr. H. F. Blaney and Mr. Karl Harris of the Division of Irrigation Engineering and Water Conservation, Soil Conservation Service, United States Department of Agriculture, were obtained to ensure the proper application of the method in the Lower Basin study.

A report on the consumptive use of irrigation and ground water rates in the Lower Colorado River Basin was prepared by Messrs. Blaney and Harris and is incorporated as Appendix B of this report. Appendix B gives in detail the technical background of the determination of consumptive use of irrigation and ground-water rates in the Lower Basin and lists the normal consumptive use of water rates at sites of use throughout the Lower Basin for all types of crops grown, all general types of native vegetation, and barren lands with high ground-water tables together with indexes for computing water uses by cities, towns, and other incidental areas and the reductions in consumptive use caused by shortages of water supply in specific areas.

Wherever the term "consumptive use" is used in this report it means consumptive use of irrigation or ground water estimated by the Blaney-Criddle method, unless otherwise indicated.

1. Man-Made Stream Depletions at Sites of Use

Stream depletions at sites of use by crops, cities and towns, and areas incidental to irrigation and irrigated farming were determined by application of unit rates of consumptive use to the 1914-1945 average

acreages. The areas of cropped, water-consuming noncropped lands incidental to irrigated farming, cities, and within the drainage area of the Lower Colorado River were determined by careful analysis of the reports of the county, state, city and Federal agencies, irrigation and agriculture departments of colleges and universities, water users' associations, irrigation districts, and private agencies, and of data obtained from interviews with farmers and other residents in the consumptive use areas. The following tabulation lists the average irrigated and water-consuming noncropped areas for the 1914-1945 period and the irrigated areas for 1945 as determined in each state and Mexico within the drainage area of the Lower Colorado River.

Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
			1914-1945 Average Irrigated Acreages			
522,565	39,392	8,605	14,999	18,677	3,988	608,226
			1945 Irrigated Acreages			
690,749	49,814	9,404	16,313	24,017	3,974	794,271
			1914-1945 Average Water-Consuming Noncropped Acreages			
69,699	4,209	2,178	3,876	4,018	1,021	85,001

Other stream depletions at sites of use determined for the 1914-1945 period were transbasin diversions, depletions by reservoir evaporation, and depletions of stream flow by accretions to surface and bank storage in reservoirs. Estimates were also made of the 1914-1945 average reductions of stream depletions at sites of use by withdrawals from ground-water storage, and the uses by native vegetation replaced by crops and other beneficial uses.

2. Channel Losses

Annual channel losses were estimated for all stream sections in the Lower Colorado River system downstream from the headwater areas for average historic and for virgin flow conditions. Estimates were made for only those segments in the headwater sections that had been influenced by the activities of man. The differences between average historic channel losses and the channel losses under virgin conditions represent salvaged channel losses. Accompanying Table S3 has been prepared to summarize the historic, virgin, and salvaged channel losses by the states and Mexico in the Lower Basin for the 1914-1945 period.

3. Summary of Stream Depletions

Accompanying Table S4 summarizes man-made stream depletions at sites of use and at the International Boundary by the states and Mexico in the Lower Colorado River Basin for the 1914-1945 period.

The average annual man-made stream depletions for the 1914-1945 period at selected gaging stations and division points in the Lower Basin are listed by the states and Mexico in accompanying Table S5.

F. Undepleted Stream Flows

The average annual virgin stream flows at selected gaging stations and division points in the Lower Colorado River system downstream from Lee Ferry to the Limitrophe Section at the International Boundary as based on the 1914-1945 period are listed in accompanying Table S6. This table also lists the drainage areas at the gaging stations and division points together with the undepleted runoff rates a square mile.

Table S3
LOWER COLORADO RIVER BASIN
Summary of Historic, Virgin, and Salvaged Channel Losses
for Selected River Sections

Average (1914-1945) — Units of 1,000 Acre-feet

State	Little Colorado River above mouth, Arizona	Gila River above Dome, Arizona	Colorado River Lee Ferry to International Boundary	Total
ARIZONA				
Historic	61.5	653.1	111.4	826.0
Virgin	57.3	949.7	198.4	1,205.4
Salvaged in State	1/ -4.2	296.6	87.0	379.4
CALIFORNIA				
Historic			0	0
Virgin			.1	.1
Salvaged in State			2/ 49.2	2/ 49.2
NEVADA				
Historic			12.5	12.5
Virgin			26.7	26.7
Salvaged in State			13.5	13.5
Salvaged out of State			.7	.7
NEW MEXICO				
Historic	20.5	162.0	8.8	191.3
Virgin	26.7	178.5	9.4	214.6
Salvaged in State	6.2	14.0	0	20.2
Salvaged out of State	0	2.5	.6	3.1
UTAH				
Historic			19.9	19.9
Virgin			25.2	25.2
Salvaged in State			3.7	3.7
Salvaged out of State			1.6	1.6
MEXICO				
Historic		32.6	.6	33.2
Virgin		36.9	.6	37.5
Salvaged in Mexico		3.1	0	3.1
Salvaged out of Mexico		1.2	0	1.2
UNDISTRIBUTED				
Historic			1,156.8	1,156.8
Virgin			2/ 1,313.6	2/ 1,313.6
Salvaged out of State			2/ 107.7	2/ 107.7
TOTAL				
Historic	82.0	847.7	1,310.0	2,239.7
Virgin	84.0	1,165.1	1,574.0	2,823.1
Salvaged in State	2.0	313.7	153.4	469.1
Salvaged out of State	0	3.7	110.6	114.3

1/ Negative value because growth changes have increased the uses by native vegetation as compared with virgin conditions.

2/ Salvage of 49,100 acre-feet a year which is included in the credit to California is included in virgin channel losses charged to undistributed stream flow as California depletions in excess of California contributions were charged to undistributed stream flow.

Table S4
LOWER COLORADO RIVER BASIN
Summary of Man-Made Stream Depletions in the Lower Basin

Average Annual Depletion in 1,000 acre-feet — October 1, 1913-September 30, 1945

Type of Use	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Consumptive use of irrigation water at sites of use:								
Cropped lands	1,418.3	130.8	23.3	21.8	34.2	7.3	--	1,635.7
Cities, towns, and farmsteads	99.3	4.8	4.2	5.1	5.5	1.6	--	120.5
Other noncropped areas	61.8	5.6	1.6	2.0	3.0	.7	--	74.7
Subtotal	1,579.4	141.2	29.1	28.9	42.7	9.6	--	1,830.9
Less water supplied by depletions of ground-water basins	176.3	--	--	--	--	--	--	176.3
Consumptive use of stream flow by above items at sites of use	1,403.1	141.2	29.1	28.9	42.7	9.6	--	1,654.6
Less uses by native vegetation replaced by above items	260.2	65.9	15.7	15.8	3.7	3.1	--	364.4
Net stream depletions at sites of use by above items	1,142.9	75.3	13.4	13.1	39.0	6.5	--	1,290.2
Stream depletions by reservoirs:								
Evaporation depletions	62.4	--	--	4.3	1.6	--	278.4	346.7
Accretions to surface storage	26.8	--	--	--	--	--	796.8	823.6
Accretions to bank storage	3.6	--	--	--	--	--	99.9	103.5
Transbasin exports	--	2,432.0	--	--	1.2	--	--	2,433.2
Total man-made stream depletions at sites of use	1,235.7	2,507.3	13.4	17.4	41.8	6.5	1,175.1	4,997.2
Less salvaged channel losses:								
Water surface evaporation	41.7	.1	.9	3.1	1.6	1.2	107.7	156.3
Decreased losses by growth change	77.5	--	--	4.4	--	--	--	81.9
Plus increased losses by growth change	--	16.8	2.4	--	--	--	--	19.2
Net man-made stream depletions at International Boundary	1,116.5	2,524.0	14.9	9.9	40.2	5.3	1,067.4	4,778.2

Table S5

LOWER COLORADO RIVER BASIN

Man-Made Stream Depletions at Selected Gaging Stations and Division Points

Average Annual Depletions in 1,000 Acre-feet — October 1, 1913-September 30, 1945

Gaging station or division point	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Colorado River at Lee Ferry (depletion by Upper Basin)	0	0	0	0	0	0	1,849.9	1,849.9
Little Colorado River above Zuni River, near Hunt, Arizona	23.0	0	0	0	0	0	0	23.0
Zuni River at New-Mex.-Ariz. State line	0	0	0	5.1	0	0	0	5.1
Little Colorado River near Woodruff, Ariz.	32.5	0	0	5.1	0	0	0	37.6
Puerco River at New Mex.-Ariz.State line	0	0	0	1.4	0	0	0	1.4
Little Colorado River at Grand Falls, Ariz.	49.3	0	0	6.5	0	0	0	55.8
Little Colorado River at mouth	50.5	0	0	6.5	0	0	0	57.0
Colorado River near Grand Canyon, Arizona	50.5	0	0	6.5	0	0	1,849.7	1,906.7
Virgin River at Littlefield, Arizona	.6	0	0	0	34.5	0	0	35.1
Colorado River below Hoover Dam, Ariz.-Nev.	57.2	0	14.2	6.5	41.8	0	2,962.8	3,082.5
Colorado River near Topock, Arizona	70.3	13.3	15.6	6.4	41.5	0	2,943.0	3,090.1
Bill Williams River at Planet, Arizona	3.8	0	0	0	0	0	0	3.8
Gila River at New Mex.-Ariz. State line	0	0	0	4.1	0	0	0	4.1
San Francisco R. at New Mex.-Ariz. State line	0	0	0	2.4	0	0	0	2.4
Gila R. at head of Safford Valley, near Solomon, Arizona	14.5	0	0	6.5	0	0	0	21.0
San Simon Creek at New Mex.-Ariz. State line	.1	0	0	0	0	0	0	.1
Gila River at Calva, Arizona	73.0	0	0	6.5	0	0	0	79.5
San Pedro River at Palominas, Arizona	0	0	0	0	0	1.1	0	1.1
Gila River at Kelvin, Arizona	104.3	0	0	6.5	0	1.1	0	111.9
Santa Cruz River near Nogales, Arizona	.6	0	0	0	0	5.4	0	6.0
Santa Cruz River at Rillito, Arizona	10.0	0	0	0	0	4.5	0	14.5
Salt River at Granite Reef Dam, Arizona	92.0	0	0	0	0	0	0	92.0
Gila River at Gillespie Dam, Arizona	1,069.7	0	0	5.2	0	5.5	0	1,080.4
Gila River near Dome, Arizona	937.4	0	0	4.0	0	5.3	0	946.7
Colorado River within Limitrophe Section at International Boundary	1,116.5	2,524.0	14.9	9.9	40.2	5.3	2,917.3	6,628.1

Table S6
LOWER COLORADO RIVER BASIN
Undepleted Stream Flow at Selected Gaging
Stations and Division Points

Average annual stream flow in 1,000 acre-feet based on 1914-1945 period. Drainage areas in square miles and runoff rate in acre-feet a square mile.

Stream flow stations or division points in downstream order from Lee Ferry	Average virgin flow	Drainage area	Undeplete runoff rate
Colorado River at Lee Ferry, Arizona 1/	15,638.5	109,458	142.9
Little Colorado River above Zuni River, near Hunt, Arizona	31.1	3,685	8.4
Zuni River at New Mex.-Ariz. State line	17.8	1,075	16.6
Little Colorado River near Woodruff, Ariz.	95.7	8,101	11.8
Puerco River at New Mex.-Ariz. State line	14.9	1,083	13.8
Little Colorado River at Grand Falls, Ariz.	307.9	21,178	14.5
Little Colorado River at mouth	470.4	26,906	17.5
Colorado River near Grand Canyon, Arizona	16,110.8	137,772	116.9
Virgin River at Littlefield, Arizona	266.8	5,092	52.4
Colorado River below Hoover Dam, Ariz.-Nev.	16,776.5	167,750	100.0
Colorado River near Topock, Arizona	16,422.4	172,257	95.3
Bill Williams River at Planet, Arizona	139.0	5,144	27.0
Gila River at New Mex.-Ariz. State line	156.4	3,363	46.5
San Francisco R. at New Mex.-Ariz.State line	76.7	1,917	40.0
Gila River at head of Safford Valley, near Solomon, Arizona	399.2	7,954	50.2
San Simon Creek at New Mex.-Ariz. State line	3.5	622	5.6
Gila River at Calva, Arizona	382.5	11,492	33.3
San Pedro River at Palominas, Arizona	31.1	741	42.0
Gila River at Kelvin, Arizona	546.8	18,031	30.3
Santa Cruz River near Nogales, Arizona	21.2	542	39.1
Santa Cruz River at Rillito, Arizona	44.2	3,523	12.5
Salt River at Granite Reef Dam, Arizona	1,423.8	12,907	110.3
Gila River at Gillespie Dam, Arizona	1,792.8	49,626	36.1
Gila River near Dome, Arizona	1,403.6	58,084	24.2
Colorado River within Limitrophe Section at International Boundary	16,972.6	242,983	69.9

1/ Flow from "Final Report, Engineering Advisory Committee to Upper Colorado River Basin Compact Commission", November 29, 1948.

II. ACKNOWLEDGMENTS

Valuable aid and assistance was received from many agencies. Federal agencies, which contributed greatly in making records and data available, were the Soil Conservation Service, Extension Service, Production and Marketing Administration, and Agricultural Adjustment Administration of the Department of Agriculture; Geological Survey; Bureau of Indian Affairs; Corps of Engineers; Weather Bureau; Bureau of the Census; and the International Boundary and Water Commission. Significant contributions were made by state engineers, state and county land and water commissioners, county agriculture agents, irrigation and agriculture departments of colleges and universities, irrigation districts, and water users' associations throughout the Lower Basin. The assistance furnished by the many farmers and business and professional men who contributed records and data is gratefully acknowledged.

Commissioner Michael W. Straus is in charge of all Bureau of Reclamation activities, with Regional Director E. G. Nielsen in charge of those activities within Region 3, which embraces all of the area with which these studies are concerned. Project planning within the region is under the general supervision of Regional Planning Engineer V. E. Larson and Area Engineer C. A. Pugh is in charge of the Phoenix Area Office. The studies were conducted and this report was prepared by personnel of the Phoenix Area Office under the direct supervision of Engineer L. E. Sullivan.

Harry F. Blaney, Principal Engineer, and Karl Harris, Senior Irrigation Engineer, of the Division of Irrigation Engineering and Water Conservation, Soil Conservation Service, United States Department of Agriculture assisted greatly by furnishing the consumptive use of water rates for the studies, preparing Appendix B of this report, and providing valuable guidance in the studies. In this connection, the cooperation and guidance of George D. Clyde, Chief of the Division of Irrigation Engineering and Water Conservation, is gratefully acknowledged.

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The services of the late W. J. Wagner of the Phoenix Area Office in compiling and analyzing crop and consumptive use data are gratefully remembered.

III. BASIC DATA

A. General Description of Area

The Lower Colorado River Basin includes parts of five states: Arizona, California, Nevada, New Mexico, and Utah and a small portion of Mexico in the State of Sonora. The term "Lower Basin" is used to refer not only to areas downstream from Lee Ferry to the Limitrophe Section of the International Boundary between the United States and Mexico which drain into the Colorado River, but also to the portion of the closed drainage basin of the Salton Sea in California. Diversions of Colorado River water to this latter area are treated as transbasin exports because there can be no return flow by gravity to the parent stream.

The Lower Colorado River Basin comprises a natural drainage area of about 133,500 square miles, exclusive of the Salton Sea Basin. It is about 22 percent larger than the Upper Basin, on which it is dependent for most of its water supply. However, excluding irrigated areas supplied by transbasin exports, most of the irrigated area in the Lower Colorado River Basin obtains its water supply from tributaries downstream from Lee Ferry. The major tributaries of the Colorado River downstream from Lee Ferry are: (1) the little Colorado River, (2) the Virgin River, (3) the Bill Williams River, and (4) the Gila River.

In general, the Lower Basin is arid except in the high altitudes of the headwater areas and dry farming is practiced with little success except in a few very small areas. In most areas where the precipitation is sufficient during the growing season to produce crops, the topography and soils are not favorable for agriculture.

Crops were grown by irrigation in the Lower Basin hundreds of years before any other part of what is now the United States was settled. In some places in the elevated areas of the northern and eastern parts of the Lower Basin the winters are cold and the growing season is very short. However, much of the southern portion is favored with a yearlong growing season and the cultivation of two or more crops on the same land during the year is a common practice where irrigation water supplies are adequate. The greater portion of the irrigated land is situated in the southern area.

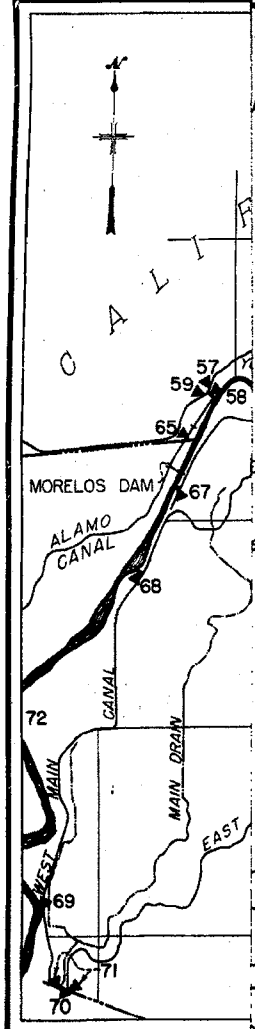
B. Maps of the Lower Colorado River Basin

A base map of the Lower Colorado River Basin was prepared which shows the tributary networks of the Colorado River system downstream from Lee Ferry, the selected stream flow stations, and the drainage areas above key gaging stations and division points. Accompanying Drawing No. 57-314-21 is a reduced print of this map.

Another base map of the Lower Colorado River Basin was prepared which shows the tributary networks of the Lower Colorado River system, the irrigated land areas, and the selected Weather Bureau stations. Drawing No. 57-314-22 is a reduced print of this map and is included in the Blaney-Harris report, Appendix B of this report.

C. Basic Data for Specific Areas

Data were compiled for specific areas scattered throughout the Lower Colorado River Basin in the following categories: (1) climatological data, (2) historic stream flow at key gaging stations, (3)



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30 SAN SIMON CREEK NEAR SOLOMON, ARIZONA
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32 SAN CARLOS RIVER NEAR PERIDOT, ARIZONA
33 GILA RIVER BELOW COOLIDGE DAM, ARIZONA
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35 SAN PEDRO RIVER AT CHARLESTON, ARIZONA
36 SAN PEDRO RIVER NEAR MAMMOTH, ARIZONA
37 ARAVAIPA CREEK NEAR FELDMAN, ARIZONA
38 GILA RIVER AT KELVIN, ARIZONA
39 SANTA CRUZ RIVER NEAR NOGALES, ARIZONA
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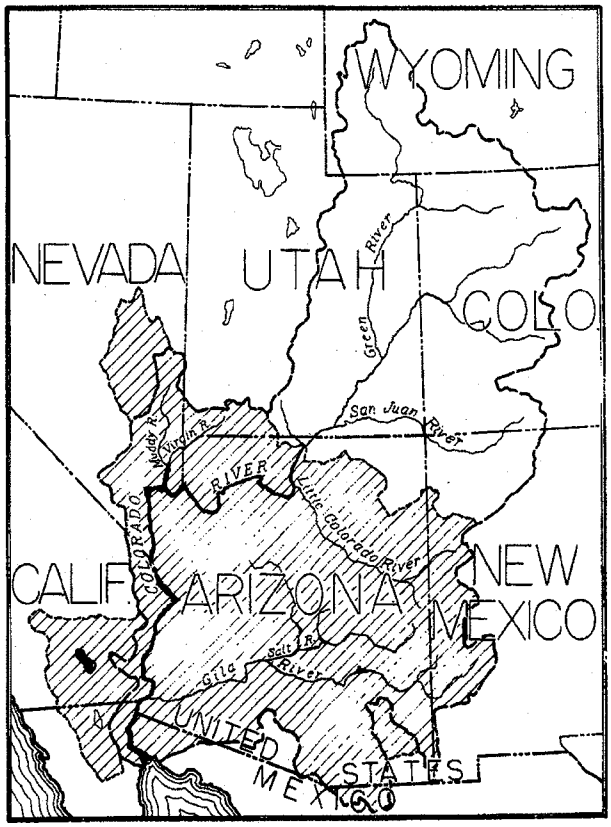
51 DIVERSIONS BY GILLESPIE CANAL AT GILLESPIE DAM, ARIZONA
52 DIVERSIONS BY ENTERPRISE CANAL AT GILLESPIE DAM, ARIZONA
53 GILA RIVER BELOW GILLESPIE DAM, ARIZONA
54 GILA RIVER NEAR DOME, ARIZONA



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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LOWER COLORADO RIVER BASIN
WATER SUPPLY

LOCATION MAP

SELECTED STREAM-FLOW STATIONS AND DRAINAGE AREAS

DRAWN	A.E.C.-F.H.G.	SUBMITTED	C.A.Pugh
TRACED	F.H.G.	RECOMMENDED	T.B.Cohen
CHECKED	A.B.W.-L.C.S.	APPROVED	

PHOENIX, ARIZONA APRIL 8, 1952 57-314-21

drainage areas above key gaging stations and other selected division points, (4) data required to evaluate depletions of ground-water basins, and (5) water using areas influenced by man.

The selection of the period of study was the first problem encountered in analyzing the water supply of the Lower Colorado River Basin. It was essential that the selected period be representative of average conditions and that reasonably accurate records be available. In general, records since 1914 are more complete for climatological data, stream flow, irrigation wells, cropped acreages, and other pertinent data than those during earlier periods.

After due consideration, the period from October 1, 1913 to September 30, 1945, was selected for study. In addition to the relative adequacy of records during this period, the runoff has fluctuated through a range that indicates a period of average stream flow.

1. Climatological Data

Climatological data on precipitation, temperatures, frost dates, and evaporation were needed in estimating (1) the consumptive use of irrigation water by crops and areas incidental to irrigation, (2) domestic and municipal uses, (3) channel and reservoir losses, and (4) in determining runoff from ungaged drainage areas. These data were tabulated from published and unpublished records, and estimates were made where necessary to supplement the recorded data. Climatological data used in the study are listed in Tables 1 through 5 in Appendix A. The derivation of these tables is described in the following paragraphs:

(a) Selected Weather Bureau Stations and Average Killing Frosts - The location and elevations of the Weather Bureau stations selected for the study are listed in Table 1 of Appendix A. These stations are scattered throughout the Lower Colorado River Basin and were selected on the basis of their location in respect to consumptive use areas and completeness of record during the period 1914 through 1945.

The recorded and estimated average dates of the last killing frost in the spring and first in autumn for the 1914-1945 period are listed in Table 1 of Appendix A for each of the selected Weather Bureau stations. Estimates for average frost dates for stations of incomplete 1914-1945 records were obtained by application of the percentage relationship of the 1914-1945 average to the average of the concurrent years of record at a related station to the average of the years of record at the station being estimated. Related stations are those with similar meteorological characteristics and approximately the same elevations.

(b) Temperature Records - Temperature data were compiled for all the selected stations that have records published by the Weather Bureau. Recorded and estimated average monthly and annual temperatures are listed in Table 2 of Appendix A for those selected stations having temperature records during the 1914-1945 period. Average monthly temperatures for stations of incomplete 1914-1945 records were estimated by applying the ratio of the 1914-1945 average to the average of the concurrent months of record at a related station to the average of the months of record at the station being estimated. Average annual

temperatures were computed as the mean of the average temperatures for the months of the year. In some cases, the records for a few years at a station were combined with records obtained at an adjacent station for other years during the 1914-1945 period and if necessary, averages for the combined record were correlated on a monthly percentage basis with a related station of complete record to derive estimated averages for the composite station. Records with only a few missing months were completed by estimating the missing months on the basis that the temperature for the missing month had the same percentage relationship to the average for the years of record that the same month at a related station of complete record had to the average for the concurrent years of record.

(c) Precipitation Records - Precipitation data were tabulated for all the selected stations from records of the Weather Bureau. The recorded or estimated average monthly and annual precipitation for each station for the period, 1914 through 1945, is listed in Table 3 of Appendix A. The average monthly precipitation for stations of incomplete 1914-1945 records was estimated by applying the same monthly percentage relationship to the average of the years of record at the station being estimated as that computed by comparing the 1914-1945 average monthly precipitation with the average for the concurrent years of record at a related station with a complete record. The average annual precipitation was computed as the sum of the average precipitation for the months of the year. The records obtained for a few years at some stations were combined with records obtained at adjacent stations for other years during the 1914-1945 period to derive

a composite record applicable to each station. If necessary to complete the 1914-1945 period, averages were estimated by correlation with a related station on the above-mentioned monthly ratio basis. Records with only a few missing monthly records during the period were completed by estimating records for the missing months on the basis that the precipitation for the missing month had the same percentage relationship to the average for the years of record that the same month at a related station with complete record had to the average for the concurrent years of record. Some studies required the use of published precipitation data other than that listed in Table 3.

(d) Evaporation Records - Evaporation records obtained during the 1914-1945 period at 15 stations are tabulated in Table 5 of Appendix A. In addition, records obtained at Davis Dam, Arizona, and Sacaton, Arizona, during water years 1948, 1949, and 1950, are included in Table 5. All records are from published data of the Weather Bureau and Bureau of Reclamation with the exception of the record for San Carlos Reservoir, Arizona. The record for San Carlos Reservoir is from unpublished data in the files of the Phoenix Office of the Weather Bureau.

(1) Average Evaporation - None of the evaporation records are complete for the period 1914 through 1945. However, average monthly and annual evaporation for the 1914-1945 period were estimated for the 17 stations by temperature correlation with the recorded evaporation and are listed in Table 4 of Appendix A. Average monthly evaporation estimates were obtained by application of the ratio of the 1914-1945 average monthly temperature to the average monthly

temperature of the concurrent years of evaporation records at the station to the average monthly evaporation recorded at the station. The average annual evaporation was computed as the sum of the average evaporation for the months of the year. Deviations from the above-mentioned method of estimation are discussed in the following paragraphs:

(a) Davis Dam - Temperature data are not available for the station at Davis Dam, Arizona, during the period 1914 through 1945. Comparison at adjacent stations of the average evaporation with the evaporation recorded for the years of record at Davis Dam indicated that the evaporation for the 1948-1950 period would be comparable with the 32-year average. The 1914-1945 average evaporation was considered the same as the recorded average listed on Sheet 1 of Table 5 of Appendix A.

(b) Lake Mead - Of the four land pans used in the Lake Mead evaporation record, the records of air temperatures are available for only the land pan at Boulder City. The average evaporation for Lake Mead was estimated by correlation with temperatures at Boulder City, Nevada.

(c) Sacaton - Average monthly evaporation for the 1914-1945 period at Sacaton, Arizona, was estimated by applying the average of the ratios of the 1914-1945 average to the average of the concurrent months of

record at Roosevelt and Mesa Experiment Farm to the average of the months of record at Sacaton. The average annual evaporation was computed as the sum of the average monthly estimates.

(2) Supplemental Estimates - The lack of sufficient evaporation records necessitated the use of estimated evaporation rates for many of the consumptive use areas throughout the Lower Colorado River Basin. Estimates of 1914-1945 average monthly and annual evaporation at the supplemental stations dispersed throughout the study area are listed in accompanying Table 1. These estimates were obtained on a monthly basis by temperature correlation with the average pan evaporation at two or more related stations. In selecting related stations, consideration was given to meteorological and topographical characteristics and latitude.

(3) Free Water Surface Evaporation - The evaporation data listed in Tables 4 and 5 of Appendix A and in accompanying Table 1 are recorded and estimated pan evaporation rates. A conversion factor of 0.70 was applied to these land pan rates to reduce them to free water surface evaporation rates for estimating the evaporation from reservoirs, streams, canals, and all other water surfaces.

2. Historic Stream Flow at Key Gaging Stations

Records of stream flow at key gaging stations were needed to form the bases for reconstructing the flow for the various reaches of the Colorado River and its tributaries, downstream from Lee Ferry, under virgin or natural conditions. These records were also needed to determine stream flow contributions of each state and to furnish data for use in other studies of water supply in the Lower Colorado River Basin.

Table 1

LOWER COLORADO RIVER BASIN

Estimates of Average Pan Evaporation in Inches at Supplemental Stations for 1914-1945 Period

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
ARIZONA													
Bagdad	1.9	2.5	4.7	6.8	9.3	11.0	11.1	9.5	7.7	5.6	3.1	1.8	75.0
Benson	3.1	3.8	6.5	9.2	11.0	12.0	10.7	8.8	7.7	6.2	4.1	2.8	85.9
Clifton	2.4	3.3	6.1	8.8	12.0	13.9	11.6	9.8	8.1	6.3	3.6	2.1	88.0
Fort Defiance	0.8	0.7	4.0	8.4	12.0	13.4	12.6	10.4	7.4	6.3	4.3	0.3	80.6
Gila Bend	4.0	4.9	8.0	10.6	13.4	13.3	15.7	13.3	10.6	7.9	5.2	3.7	110.6
Holbrook	1.8	1.3	5.5	8.2	9.3	11.0	9.8	8.2	6.5	6.2	3.0	1.6	72.4
Inner Canyon	3.2	4.4	7.5	10.4	14.5	17.1	16.7	14.5	10.8	7.2	4.9	3.0	114.2
Montezuma Castle	2.5	2.9	5.5	7.9	10.1	10.9	11.6	10.1	8.4	6.2	3.9	2.5	82.5
Nogales	2.2	2.8	5.3	7.7	10.0	11.4	10.6	8.9	7.7	5.9	3.5	2.0	78.0
Parker	3.7	4.7	7.6	10.1	12.2	13.1	13.6	12.0	9.5	6.7	5.3	3.7	102.2
Payson Ranger Station	1.2	1.8	3.9	6.3	7.9	8.8	9.1	7.8	7.1	4.2	2.2	1.4	61.7
Prescott	1.6	1.8	3.8	6.3	8.0	9.1	9.1	7.8	7.2	4.9	2.9	1.7	64.2
St. Johns	0.9	1.0	3.4	6.1	8.5	10.7	10.1	7.6	7.1	5.6	1.5	0.5	63.0
San Simon	3.8	4.4	6.9	9.6	10.9	12.0	10.6	8.7	7.6	6.1	4.4	3.0	88.0
Snowflake	1.4	2.2	3.0	5.7	6.6	7.8	8.4	6.9	5.3	5.5	2.1	1.1	56.0
Springerville	0.6	0.8	2.7	4.8	6.0	7.2	6.8	5.8	5.2	4.3	1.8	1.0	47.0
Supai	2.5	3.5	6.3	9.0	11.4	11.5	11.0	9.0	8.5	6.2	3.6	2.5	85.0
Tuba	1.5	2.4	5.1	8.4	11.8	13.6	13.1	11.0	8.3	6.2	3.7	1.3	86.4
Whiteriver	1.2	1.9	4.0	6.4	8.3	9.5	9.1	8.0	7.2	4.6	2.5	1.5	64.2
Winslow	1.2	1.3	5.6	8.2	9.3	10.1	9.8	8.2	6.3	4.7	1.8	1.1	67.6
NEVADA													
Caliente	1.2	1.7	4.5	6.8	10.8	13.5	13.0	9.5	8.6	6.0	1.9	0.9	78.4
Overton	3.0	4.0	7.0	10.0	12.0	12.7	12.9	12.8	9.5	6.2	4.5	3.2	97.8
NEW MEXICO													
Black Rock	1.4	2.2	4.2	8.4	11.9	13.3	12.6	10.4	7.6	6.3	2.4	1.5	82.2
Cliff	1.7	1.7	3.7	6.2	7.9	9.2	9.3	8.1	6.7	5.2	3.4	2.1	65.2
Gamerco	0.8	1.3	4.0	8.4	11.6	13.4	12.7	10.4	7.5	6.2	4.2	0.5	81.0
Glenwood	1.8	2.0	4.2	6.6	8.4	9.1	10.1	8.7	7.0	5.4	3.4	2.0	68.7
Luna Ranger Station	1.3	1.3	3.4	5.9	7.0	7.5	7.3	6.6	6.7	3.0	1.2	0.6	51.8
UTAH													
Cedar City	1.1	1.2	3.8	6.3	10.6	13.4	12.9	9.2	7.8	6.0	1.8	1.7	75.8
Kanab Power House	1.6	1.9	4.6	6.9	10.9	13.5	13.0	9.5	8.1	6.0	2.6	1.4	80.0
St. George	2.2	3.0	5.8	8.2	11.4	13.7	13.5	11.1	8.9	6.1	3.2	2.1	89.2
Zion National Park	2.3	2.9	5.5	7.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The period from October 1, 1913 to September 30, 1945 was selected for study. During this period the runoff has fluctuated through a range that indicates a period of average stream flow. Records of stream flow and other data available for the years prior to 1941 were considered inadequate for the required studies.

Records and estimates of stream flow at 49 key gaging stations are listed in Table 6 of Appendix A. Also included in Table 6 are records and estimates of 15 diversions and 8 return flows used in the studies. The annual flows listed in Table 6 are the sums of the monthly flows and because of rounding do not always agree with the published annual records. Published stream flow data other than those included in Table 6 were used in some studies. The historic average stream flow of the Colorado River within the Limitrophe Section at the International Boundary between the United States and Mexico was determined as 10,344,500 acre-feet a year. The flow at the boundary is made up of the sum of the flow at Yuma plus the recorded and estimated return flows of various drains and wasteways downstream from Yuma to the Arizona-Zonora boundary less the diversions for use in California by the Alamo Canal at Andrade, California, plus an estimated contribution from the drainage area downstream from Yuma less channel losses from Yuma to the International Boundary.

Estimates for stations of incomplete 1914-1945 records were made with extreme care by application of the methods considered most accurate as a result of exhaustive study. A detailed description of the records and estimates by stations is presented in the following paragraphs.

(a) Colorado River at Lee Ferry, Arizona. (Appendix A, Sheets 1 and 1A of Table 6) - The term "Lee Ferry" is defined in the Colorado River Compact as a point in the main stream of the Colorado River one mile below the mouth of the Paria River, and is the point of division between the Upper and Lower Basins of the Colorado River.

The record for the 1914 to 1945 period tabulated on Sheets 1 and 1A of Table 6 of Appendix A was obtained from page 30 of Appendix A of "Final Report, Engineering Advisory Committee to Upper Colorado River Basin Compact Commission", dated November 29, 1948. The record was computed as the sum of the flows of the Colorado River at Lees Ferry and the Paria River at Lees Ferry.

(b) Little Colorado River Basin - Stream flow records and estimates are tabulated on Sheets 2 through 13 of Table 6 of Appendix A for 12 gaging stations on the Little Colorado River and its tributaries. During the 1914 to 1945 period, the longest stream flow record in the Little Colorado River drainage area was obtained at Grand Falls, the lowest station on the main stream above the mouth in operation during that period. Runoff has been gaged continuously at this station since October 1, 1925. The flow of Chevelon Fork near Winslow has been gaged for 19 years and Clear Creek near Winslow for 15 years of the 32-year period, 1914 through 1945. The major flow of the Little Colorado River is derived from the contributions of Chevelon Fork and Clear Creek which drain the area north of Mogollon Rim. These tributaries have runoff characteristics similar to Tonto Creek, a tributary of the Salt River drainage area south of the Mogollon Rim, and the San Carlos River, a tributary of the Gila River. Chevelon Fork and the

San Carlos River have about the same runoff rates from comparable drainage areas. The record for Chevelon Fork near Winslow was extended to complete the 1914-1945 period by monthly correlation with the flow of the San Carlos River near Peridot, for those months with available records for the San Carlos River, and the remainder completed by monthly correlation with the flow of Tonto Creek near Roosevelt. The estimates were checked by annual correlation with the flow of the Verde River above Bartlett Dam. The estimated Chevelon Fork record was then correlated on a monthly basis with the record of Clear Creek near Winslow to complete the record at that station. The record for the Little Colorado River at Grand Falls was completed for the 1914 to 1945 period by monthly correlation with the sum of the records of Chevelon Fork near Winslow and Clear Creek near Winslow. Estimates for other stations throughout the Little Colorado River Basin were extended from monthly or annual correlations with the record at Grand Falls or a derivative record.

(1) Little Colorado River at St. Johns, Arizona. (Appendix A, Sheet 2 of Table 6) - Records at this station were available from June 1929 through September 1933 and from October 1935 through March 1940. The record for the 1914-1945 period was completed by correlation on an annual basis with the flow of the Little Colorado River above Zuni River, near Hunt, Arizona.

(2) Little Colorado River above Zuni River, near Hunt, Arizona. (Appendix A, Sheet 3 of Table 6) - Stream flow records for this station began in March 1940. The period from October 1913 through February 1940 was estimated by monthly correlation with the record of the Little Colorado River near Hunt, Arizona.

(3) Zuni River at Black Rock, New Mexico. (Appendix A, Sheet 4 of Table 6) - During the 1914-1945 period, records at this station are available from October 1913 through September 1930. Annual estimates were made for the remainder of the period by annual correlation with the precipitation at the Weather Bureau Station, Black Rock, New Mexico.

(4) Little Colorado River near Hunt, Arizona. (Appendix A, Sheet 5 of Table 6) - Records of stream flow at this station are available from May 1929 through October 1933 and from April 1940 through September 1945. The remainder of the period was estimated by monthly correlation with the flow of the Little Colorado River near Woodruff minus the flow of Silver Creek near Woodruff.

(5) Silver Creek near Woodruff, Arizona. (Appendix A, Sheet 6 of Table 6) - Records are available at this station from May 1929 through October 1933 and from October 1935 through September 1945. The record for the period was completed by monthly correlation with the record of the Little Colorado River near Woodruff. The estimates were checked by annual correlation with the flow of the Verde River above Bartlett Dam.

(6) Little Colorado River near Woodruff, Arizona. (Appendix A, Sheet 7 of Table 6) - During the 1914-1945 period, records of stream flow were obtained from October 1916 through March 1918, from January 1919 through December 1919, from May 1929 through December 1933, and from October 1935 through September 1945. The record was completed for the period by monthly correlation with the record of

the Little Colorado River at Grand Falls. The estimates were checked on an annual basis by correlation with the flow of the Verde River above Bartlett Dam.

(7) Puerco River at Gallup, New Mexico. (Appendix A, Sheet 8 of Table 6) - Stream flow records at this station began in May 1940. The record was extended by correlation on a monthly basis with the record of the Puerco River near Adamana, Arizona.

(8) Puerco River near Adamana, Arizona. (Appendix A, Sheet 9 of Table 6) - Records of stream flow have been obtained at this station since March 1940. The record for the period was completed by correlation with the flow of the Little Colorado River at Grand Falls minus the sum of the flows of the Little Colorado River near Woodruff, Chevelon Fork near Winslow, and Clear Creek near Winslow. Monthly estimates were made by using individual monthly curves for July through October, grouping February, March, and April as a wet period and combining November, December, January, May and June as dry months. The estimates were checked by annual correlation with the flow of the Verde River above Bartlett Dam.

(9) Chevelon Fork near Winslow, Arizona. (Appendix A, Sheet 10 of Table 6) - During the 1914-1945 period, records were obtained at this station from January 1916 through December 1919, from April 1929 through February 1934, and from October 1935 through September 1945. This station was selected as the key station for the extension of records throughout the Little Colorado River Basin because of the marked relationship of the topographical and meteorological

characteristics of this drainage area with the watersheds of the San Carlos River and Tonto Creek. The records for this station were extended by monthly correlation with the recorded flows of the San Carlos River near Peridot and Tonto Creek near Roosevelt. However, a good correlation was not obtained for the month of June and June estimates were derived by correlation with the average precipitation at Pinedale and Winslow. Annual correlation with the flow of the Verde River above Bartlett Dam checked the estimates for Chevelon Fork.

(10) Clear Creek near Winslow, Arizona. (Appendix A, Sheet 11 of Table 6) - During the 1914-1945 period, records are available for this station from April 1929 through January 1934 and from October 1935 through September 1945. The remainder of the period was estimated on a monthly basis by correlation with the flow of Chevelon Fork near Winslow. The estimates were checked by annual correlation with the flow of the Verde River above Bartlett Dam.

(11) Little Colorado River at Grand Falls, Arizona. (Appendix A, Sheets 12 and 12A of Table 6) - This station is the lowest on the main stream of the Little Colorado River obtaining stream flow records during the period from October 1, 1913 through September 30, 1945. Stream gaging began at a downstream station near Cameron in June 1947, but the record is too short to provide a basis for deriving reliable estimates.

Stream flow records are available for the Little Colorado River at Grand Falls from October 1925 through September 1945. The record was completed for the 1914-1945 period by correlation on a monthly basis with the sum of the flows of Chevelon Fork near Winslow

and Clear Creek near Winslow. Annual correlation with the flow of the Verde River above Bartlett Dam checked the estimates.

(12) Moenkopi Wash near Tuba, Arizona. (Appendix A, Sheet 13 of Table 6) - Moenkopi Wash is the farthest downstream of the gaged tributaries of the Little Colorado River. Stream flow records were obtained at the station near Tuba from July 1926 through September 1945. The record for the remainder of the study period was estimated by monthly correlation with the recorded precipitation at the Weather Bureau station, Tuba City.

(c) Colorado River near Grand Canyon, Arizona. (Appendix A, Sheets 14 and 14A of Table 6) - Records of stream flow have been obtained at this station from October 1922 through September 1945. The record was extended for the study period by monthly correlation with the sum of the flows of the Colorado River at Lee Ferry, the Little Colorado River at Grand Falls, and Moenkopi Wash near Tuba.

(d) Bright Angel Creek near Grand Canyon, Arizona. (Appendix A, Sheet 15 of Table 6) - Records are available for stream flow at this station from October 1923 through September 1945. The record for the 1914-1945 period was completed by annual correlation with precipitation at Grand Canyon. The annual estimates were distributed on a monthly basis by application of the monthly percentage relationship derived from averages for the period of record at the station.

(e) Virgin River Basin - Stream flow records and estimates are tabulated on Sheets 16 and 17 of Table 6 for two gaging stations on the Virgin River. However, published stream flow data for other stations within the basin were used in some studies.

(1) Virgin River at Virgin, Utah. (Appendix A, Sheet 16 of Table 6) - The missing records of stream flow for a few months at this station prior to 1926 during the 1914-1945 period were estimated by monthly correlation with the flow of the Santa Clara River near Central, Utah, for the period 1910 through 1930.

(2) Virgin River at Littlefield, Arizona. (Appendix A, Sheet 17 of Table 6) - Stream flow records for this station began in October 1929. Records for the period from September 1913 to October 1929 were estimated by monthly correlation with the flow of the Virgin River at Virgin, Utah. Some adjustments to estimates of low flows were made in consideration for the flow of springs a short distance upstream from the station.

(f) Diversions from Lake Mead to Henderson, Nevada, Area - Diversion by pumping from Lake Mead six miles upstream from Hoover Dam to the Henderson, Nevada, area for municipal and industrial use began April 7, 1942. Records of these diversions are tabulated on Sheet 18 of Table 6, Appendix A.

(g) Colorado River below Hoover Dam, Arizona-Nevada. (Appendix A, Sheets 19 and 19A of Table 6) - The records for this station, from October 1933 to November 1939, were published as Colorado River near Willow Beach, Arizona, for a site 10 miles downstream from Hoover Dam. Records at the present site, one mile downstream from Hoover Dam, have been obtained from November 1939 through September 1945. The period from October 1913 through September 1933 was estimated by correlation on a monthly basis with the flow of the Colorado River near Topock, Arizona, as revised for this study.

(h) Colorado River near Topock, Arizona. (Appendix A, Sheets 20 and 20A of Table 6) - Records of discharge for this station have been published since January 1, 1917. However, the Geological Survey does not consider that the accuracy of records prior to 1924 warrant detailed comparison with records at other stations for determination of behavior of the Colorado River in the intervening reaches. The record for the period from October 1, 1913 to September 30, 1923 as tabulated in Table 6 of Appendix A was derived by correlating the sum of the flows of the Colorado River near Topock and the Bill Williams River at Planet with the flow of the Colorado River above the Gila River on a monthly basis, and subtracting the flow of the Bill Williams River at Planet from the correlation results to obtain the estimates for the Colorado River near Topock. The flow of the Colorado River above the Gila River prior to construction of Parker Dam was computed as the sum of the flow of the Colorado River at Yuma plus diversions at Laguna Dam less flow of the Gila River near Dome. The Geological Survey classifies the records obtained for the Colorado River at Yuma as excellent since January 1926, and excellent for the Gila River near Dome from 1929. Storage began in Havasu Lake in July 1938. The correlation curves for each month were derived from records for the period of concurrent excellent records for the Colorado River at Yuma and the Gila River near Dome prior to July 1, 1938. Months with no flow in the Gila River near Dome, from January 1926 through September 1928, were considered as having excellent records.

(i) Bill Williams River at Planet, Arizona. (Appendix A, Sheet 21 of Table 6) - During the 1914-1945 period, stream flow records

are available for this station from October 1913 through December 1915 and from October 1928 through September 1945. The flows for the remainder of the period were estimated on an annual basis with the average of the precipitation at Walnut Grove, Walnut Creek Ranger Station, and Prescott. The annual estimates were distributed on a monthly basis by applying the monthly percentage relationship derived from averages of the period of record at the station.

(j) Diversions to Colorado River Aqueduct. (Appendix A, Sheet 22 of Table 6) - Diversions by the Colorado River Aqueduct for the Metropolitan Water District of Southern California began in January 1939. Water is diverted by pumping from Havasu Lake about 1.8 miles upstream from Parker Dam. Water diverted by pumping from Havasu Lake, less flow returned from the Gene and Copper Basin Reservoirs, is tabulated on Sheet 22 of Table 6.

(k) Gila River Basin - Stream flow and diversion records and estimates are tabulated in Table 6 of Appendix A, on Sheets 23 through 54 for 27 stream flow stations and 5 diversions throughout the Gila River drainage area. Published stream flow data for other stations within the basin were used in some studies.

(1) Gila River near Red Rock, New Mexico. (Appendix A, Sheet 23 of Table 6) - During the study period, records for this station have been published by the Geological Survey from October 1913 through December 1914 and from October 1930 through September 1945. Records and estimates for the remainder of the period were obtained from reports of the State Engineer of New Mexico.

(2) Gila River below Blue Creek, near Virden, New Mexico. (Appendix A, Sheet 24 of Table 6) - Records of discharge are available for this station from May through November 1914, March through September 1915, and from July 1927 through September 1945. Estimates to complete the 1914-1945 period were derived on a monthly basis by correlation with the flow of the Gila River near Red Rock, New Mexico.

(3) Gila River near Clifton, Arizona. (Appendix A, Sheets 25 and 25A of Table 6) - During the 1914 through 1945 period, discharge records were obtained at this station from March 1928 through September 1933 and from May 1935 through September 1945. Records at the station at Guthrie, 5½ miles upstream, are available for the period from October 1913 through June 1918. The 1914-1945 record was completed by estimates derived by monthly correlation of the sum of the flows of the Gila River near Clifton and the San Francisco River at Clifton with the flow of the Gila River at head of Safford Valley near Solomon. Estimates for the Gila River near Clifton were obtained by subtracting the flow of the San Francisco River at Clifton from the estimates derived by the correlation.

(4) San Francisco River near Glenwood, New Mexico. (Appendix A, Sheet 26 of Table 6) - Stream flow records for this station are available from November 1928 through September 1945 except for six months during 1932. The flows for October, November, and December of 1913 and January 1914 were estimated by application of the drainage area ratio to the recorded flows of the San Francisco River near Alma, New Mexico, for the respective months. The remaining months of missing

records were estimated by monthly correlation with the flow of the San Francisco River at Clifton for months of record available at that station and the balance of the missing record was derived from monthly correlation with the flow of the Gila River at Red Rock, New Mexico.

(5) San Francisco River at Clifton, Arizona. (Appendix A, Sheets 27 and 27A of Table 6) - Discharge records are available at this station during the 1914-1945 period from October 1913 through June 1918, except for January 1916, and from August 1927 through September 1945, except for the period from October 1933 through April 1935, which was estimated on a monthly basis by correlation with the flow of the San Francisco River near Glenwood, New Mexico. The remaining period of missing records was estimated by monthly correlation with the sum of the flows of the Gila River near Clifton and the San Francisco River at Clifton. Estimates of missing records for the sum of flows of the San Francisco and Gila Rivers at and near Clifton had been derived from monthly correlation with the flow of the Gila River at head of Safford Valley.

(6) Willow Creek Diversion from Black River, near Morenci, Arizona. (Appendix A, Sheet 28 of Table 6) - These diversions began in April 1945 by pumping from the Black River, a tributary of the Salt River, into the headwaters of Eagle Creek, a tributary of the Gila River, for mining, metallurgical treatment of ores, and domestic supply in vicinity of Morenci, Arizona. Records of all diversions were obtained at a point on Willow Creek just downstream from the end of the diversion pipe line.

(7) Gila River at head of Safford Valley, near Solomon, Arizona (Appendix A, Sheets 29 and 29A of Table 6) - Records of stream flow for this station are available from June 1914 through September 1945. The eight months of missing records were estimated by monthly correlation with the sum of the flows of the San Francisco and Gila Rivers at and near Clifton, Arizona.

(8) San Simon Creek near Solomon, Arizona. Appendix A, Sheet 30 of Table 6) - Discharge records at this station are available from June 1931 through September 1932 and from May 1935 through September 1945. Annual estimates for the missing period of records were derived by seasonal correlation with precipitation at San Simon, Arizona. The year was divided into two seasons, a wet period from June through September and dry period from October through May.

(9) Gila River at Calva, Arizona. (Appendix A, Sheets 31 and 31A of Table 6) - Records of stream flow were obtained at this station from October 1929 through September 1945. Records for the period were extended by subtracting the flow of the San Carlos River near Peridot from the flow of the Gila River near San Carlos and at Coolidge Dam. Studies indicated that the contribution from the intermediate drainage area and channel losses were comparable during the missing period of record.

(10) San Carlos River near Peridot, Arizona. (Appendix A, Sheet 32 of Table 6) - Records of discharge at this station are available for partial years 1914 and 1915 and from October 1929 through September 1945. Estimates for the period of missing records were

obtained from Table 4-B in Enclosure 6 to accompany "Report on Survey, Flood Control, Gila River and Tributaries above Salt River, Arizona and New Mexico", dated December 1, 1945, and published by War Department, United States Engineer Office, Los Angeles, California. The estimates were derived from seasonal relationship curves of runoff and precipitation.

(11) Gila River below Coolidge Dam, Arizona. (Appendix A, Sheets 33 and 33A of Table 6) - The seven missing months of record for this station from October 1913 through April 1914 were obtained from estimates published in "Distribution of Waters of the Gila River", 4th Annual Report (1939) of Gila Water Commissioner to United States District Court.

(12) San Pedro River at Palominas, Arizona. (Appendix A, Sheet 34 of Table 6) - Stream flow records were obtained at this station from June 1930 through September 1933 and from May 1935 through June 1941. Records for the remainder of the 1914-1945 period were estimated by monthly correlation with the flow of the San Pedro River at Charleston, Arizona.

(13) San Pedro River at Charleston, Arizona. (Appendix A, Sheet 35 of Table 6) - The complete record for this station for the 1914-1945 period has been published by the Geological Survey.

(14) San Pedro River near Mammoth, Arizona. (Appendix A, Sheet 36 of Table 6) - Discharge records for this station are available from May 1931 through June 1941. The 1914-1945 record was completed by estimates derived by monthly correlation of the sum of the flows of the San Pedro River near Mammoth and Aravaipa Creek near Feldman with

the flow of the Gila River at Kelvin minus the flow of the Gila River below Coolidge Dam. Estimates for the San Pedro River near Mammoth were obtained by subtracing the recorded and estimated flows of Aravaipa Creek near Feldman from the estimates derived by the correlation.

(15) Aravaipa Creek near Feldman, Arizona. (Appendix A, Sheet 37 of Table 6) - Stream flow records were obtained at this station from May 1931 through June 1941. Records for the remainder of the period were estimated by monthly correlation with the sum of the flows of the San Pedro River near Mammoth and Aravaipa Creek near Feldman. Estimates for this summation of flows for the period of incomplete records have been derived by monthly correlation with the flow of the Gila River at Kelvin less flow of the Gila River below Coolidge Dam.

(16) Gila River at Kelvin, Arizona. (Appendix A, Sheets 38 and 38A of Table 6) - Discharge records at this station are complete for the 1914-1945 period.

(17) Santa Cruz River near Nogales, Arizona. (Appendix A, Sheet 39 of Table 6) Stream flow records at this station are available from October 1913 through June 1920, excepting the months of December 1914 and July 1916, from May 1921 through June 1922, from May 1930 through December 1933, and from July 1935 through September 1945. Estimates for the period of incomplete records were derived by correlation with the flow of the Santa Cruz River at Tucson on an annual basis.

(18) Santa Cruz River at Tucson, Arizona. (Appendix A, Sheet 40 of Table 6) - Records of stream flow at this station are complete for the 1914-1945 period.

(19) Rillito Creek near Tucson, Arizona. (Appendix A, Sheet 41 of Table 6) - The Geological Survey has published a complete record of discharge at this station for the period 1914 through 1945.

(20) Santa Cruz River at Rillito, Arizona. (Appendix A, Sheet 42 of Table 6) - Stream flow records were obtained at this station from October 1939 through September 1945. Records for the remaining period were estimated by monthly correlation with the sum of the flow of the Santa Cruz River at Tucson plus the flow of Rillito Creek near Tucson.

(21) Salt River near Roosevelt, Arizona. (Appendix A, Sheets 43 and 43A of Table 6) - Records of discharge at this station are complete for the 1914-1945 period.

(22) Tonto Creek near Roosevelt, Arizona. (Appendix A, Sheet 44 of Table 6) - Stream flow records at this station are available from October 1913 through December 1940. Records of monthly flow for the remainder of the period were derived from a correlation curve based on a few concurrent records of discharge of Tonto Creek above Gun Creek, near Roosevelt, Arizona.

(23) Verde River below Bartlett Dam, Arizona. (Appendix A, Sheets 45 and 45A of Table 6) - Records of discharge were obtained at this station or at sites near McDowell and above Camp Creek during the period 1914 through 1945. The Geological Survey considers that the records at the several sites are comparable.

(24) Diversions for City of Phoenix from Verde River at McDowell, Arizona. (Appendix A, Sheet 46 of Table 6) - Water has been diverted from the Verde River at McDowell for use in the City of Phoenix

since February 1922. Monthly records of these diversions as published by the Geological Survey and furnished by the Salt River Valley Water Users' Association are tabulated on Sheet 46 of Table 6 in Appendix A.

(25) Salt River at Granite Reef Dam, Arizona. (Appendix A, Sheets 47 and 47A of Table 6) - Records of flow of the Salt River immediately upstream from diversions at Granite Reef Dam have been obtained by the Salt River Valley Water Users' Association for the period 1914 through 1945. These records were computed as the sum of the total diversions by the two canals at Granite Reef Dam plus spills over Granite Reef Dam.

(26) Diversions from Salt River at Granite Reef Dam, Arizona. (Appendix A, Sheets 48 and 48A of Table 6) - Records of diversions from the Salt River at Granite Reef Dam for irrigation of lands in the Salt River Valley in the vicinity of Phoenix, Arizona, are complete for the period 1914 through 1945. Records show net diversions which were computed as the sum of the discharges of the two canals at Granite Reef Dam less flow returned to the river from the canals by wasteways between the dam and irrigated lands. Monthly diversions as published by the Geological Survey and furnished by the Salt River Valley Water Users' Association are tabulated on Sheets 48 and 48A of Table 6.

(27) Salt River below Granite Reef Dam, Arizona. (Appendix A, Sheets 49 and 49A of Table 6) - Complete records of monthly flows of the Salt River below Granite Reef Dam for the 1914-1945 period were computed from data furnished by the Salt River Valley Water Users' Association. These records include spills over Granite Reef Dam and water returned to

the river by wasteways and sluicing, and represent the total flow at Granite Reef Dam less net diversions for irrigation.

(28) Agua Fria River at Lake Pleasant Dam, Arizona. (Appendix A, Sheet 50 of Table 6) - Records of discharge at this station are published by the Geological Survey from October 1914 through September 1919 and from October 1933 through September 1945. Records for the remainder of the period from October 1913 through September 1914 and from October 1919 through September 1933 were furnished by the Maricopa County Municipal Water Conservation District No. 1.

(29) Diversions by Gillespie Canal at Gillespie Dam, Arizona. (Appendix A, Sheet 51 of Table 6) - Diversions by the Gillespie Canal began during the latter part of 1921 from the left abutment of Gillespie Dam. Records of diversions are published by the Geological Survey from June 1935 through September 1945. Annual estimates of diversions prior to June 1935 were obtained from "Arizona Stream Flow Summary", a report of the Colorado River Commission of Arizona published in March 1940.

(30) Diversions by Enterprise Canal at Gillespie Dam, Arizona. (Appendix A, Sheet 52 of Table 6) - The Enterprise Canal diverted water from the Gila River throughout the period 1914 through 1945. Following construction of Gillespie Dam in 1921, diversions to the canal have been made from the right abutment of the dam. Records of diversions at this station are published by the Geological Survey from October 1939 through September 1945. Records from June 1935 through September 1938 were computed as the difference obtained by subtracting the sum of recorded diversions by Gillespie Canal plus

recorded flows of the Gila River below Gillespie Dam from the combined discharge of the Gila River below Gillespie Dam and of the Gillespie and Enterprise Canals at Gillespie Dam as reported in Geological Survey Water-Supply Paper 1049. The record from October 1938 through September 1939 was obtained by computing the monthly flows from discharge measurements reported in Geological Survey Water-Supply Paper 879. The history of irrigation of the area obtaining its water supply from the Enterprise Canal indicates that average diversions from October 1913 through May 1935 would be comparable to average diversions during the period of recorded measurements. The average for the 1914-1945 period was thus estimated to be the same as the mean for the period of record.

(31) Gila River below Gillespie Dam, Arizona. (Appendix A, Sheets 53 and 53A of Table 6) - Records of stream flow at this station are available for the period extending from September 1921 through September 1945. Annual flows for water years, 1914 through 1921, were derived from correlation on an annual basis of the flow of the Gila River below Gillespie Dam, plus diversions by the Enterprise and Gillespie Canals, with the sum of the recorded flows of the Salt River below Granite Reef Dam, the Gila River at Kelvin, the Santa Cruz River at Rillito, and the Agua Fria River at Lake Pleasant Dam. The estimates derived from the correlations were adjusted for diversions at Gillespie Dam to obtain estimates for the flow of the Gila River below Gillespie Dam.

The period from October 1921 through September 1928 was selected for deriving the correlation curves. In general, the stream

flow records at the selected stations during the 1914-1928 period have not been affected by changes in ground-water and surface-water storage to the extent evident in years subsequent to 1928. The ground-water profile for the Phoenix area shows the average ground-water level rising steadily from 1914 to 1920, leveling for 1921, and then declining at about the same rate as the previous rise to approximately the same level in 1928 as it was in 1914. Diversions at Granite Reef Dam remained about the same throughout the period and the increased irrigated acreage obtained a water supply from better irrigation efficiency, reclamation of seeped land, and pumping from the ground-water reservoir. Storage had not been started at San Carlos Reservoir on the Gila River, Lake Pleasant on the Agua Fria River, or Bartlett Reservoir on the Verde River, and the rivers were live streams throughout most of the year.

(32) Gila River near Dome, Arizona. (Appendix A, Sheets 54 and 54A of Table 6) - Records of stream flow at this station are complete for the period 1914 through 1945.

(l) Colorado River at Yuma, Arizona. (Appendix A, Sheets 55 and 55A of Table 6) - Records of discharge at this Station are complete for the period 1914 through 1945.

(m) Diversions and Return Flows at and below Imperial Dam - Records and estimates of diversions and return flows used in determining consumptive use of irrigation water in Arizona and California downstream from Imperial Dam, and in estimating the flow of the Colorado River within the Limitrophe Section at the International Boundary between the United States and Mexico are tabulated on sheets 56 through 71 of

Table 6 in Appendix A for 8 diversions and 8 return flows. Published data on diversions and return flow, other than that tabulated in Table 6, were used in some studies.

(1) All-American Canal near Imperial Dam, Arizona-California. (Appendix A, Sheet 56 of Table 6) - First diversion to the All-American Canal began in February 1939 but prior to October 1940 the water was used only for priming the canal. Records of diversions are available from October 1939 through September 1945. Flows from February through September 1939 were estimated by applying the percentage relationships to flows of the All-American Canal above Pilot Knob Wasteway, which were derived by comparison of flows in the All-American Canal near Imperial Dam with the flows above Pilot Knob Wasteway in September 1940.

(2) All-American Canal above Pilot Knob Wasteway, California. (Appendix A, Sheet 57 of Table 6) - Flow in the canal at this station began February 5, 1939, and complete records of diversions are available.

(3) Pilot Knob Wasteway near Pilot Knob, California. (Appendix A, Sheet 58 of Table 6) - Water is diverted from the All-American Canal at this station for use in Mexico or return to the Colorado River. First flow through the wasteway occurred on February 5, 1939, and complete records of flow at this station are published by the Geological Survey.

(4) All-American Canal below Pilot Knob Wasteway, California. Appendix A, Sheet 59 of Table 6) - Flow in the canal at this station began September 11, 1939, and is diverted for irrigation in Imperial and

Coachella Valleys in California. Records of diversions at this station are published by the Geological Survey from September 1939 through February 1941. Records for the period subsequent to February 1941 were computed by subtracting the flow diverted by Pilot Knob Wasteway from the flow in the All-American Canal above Pilot Knob Wasteway.

(5) Yuma Canal at Laguna Dam, Arizona-California. (Appendix A, Sheets 60 and 60A of Table 6) - Records of diversions at this station are complete for period 1914 through 1945. Records for this station were published in Geological Survey Water-Supply Paper 1049 as Yuma Main Canal at Laguna Dam, near Yuma, Arizona.

(6) Yuma Main Canal Wasteway at Yuma, Arizona. (Appendix A, Sheet 61 of Table 6) - Yuma Main Canal Wasteway returns water from the Yuma Main Canal to the Colorado River half a mile downstream from the gaging station on the Colorado River at Yuma. Records of discharge at this station are complete for the period 1914 through 1945.

(7) Yuma Main Canal below Colorado River Siphon, at Yuma, Arizona. (Appendix A, Sheet 62 of Table 6) - Records of flow at this station are available from January 1924 through September 1945. Flows during the period from October 1913 through December 1923 were estimated on an annual basis by deducting the sum of the recorded discharge of the Yuma Main Canal Wasteway, plus estimates of diversions from Yuma Canal for irrigation in California, plus estimates of canal losses between Laguna Dam and the station below the Colorado River Siphon, from the recorded diversions by the Yuma Canal at Laguna Dam. Annual canal losses upstream from the siphon were computed for the 1925-1940 period by deducting from the recorded diversions by the Yuma Canal at Laguna

Dam the sum of the recorded flows of the wasteway, the canal below the Colorado River Siphon, and estimated diversions for irrigation in California. Records subsequent to 1940 were not used because water to the Yuma Main Canal has been supplied from the All-American Canal since August 1941. The hydraulic properties of the canal were determined for each year of the 1914-1940 period, assuming an average cross-section with capacities determined as average flow for annual diversions by the Yuma Canal at Laguna Dam. The average relationship between canal losses and hydraulic radii was determined for the 1925-1940 period and applied to estimate the annual losses for the 1914-1924 period.

(8) Water Pumped for Unit B of Yuma Mesa Auxiliary Project. (Appendix A, Sheet 63 of Table 6) - Complete records of pumping at this station were obtained by the Bureau of Reclamation since pumping for irrigation started in July 1922. The water is diverted from the Yuma Main Canal (East Main) through a supply canal to the pumping plant.

(9) Water Pumped at Yuma Mesa Pumping Plant. (Appendix A, Sheet 64 of Table 6) - Complete records of pumping at this station were obtained by the Bureau of Reclamation since pumping operations began November 4, 1943. Water is supplied to the pumping plant by the Gila Gravity Main Canal at a point about 21 canal miles from Imperial Dam and is pumped for use on the Yuma Mesa Division of the Gila Project.

(10) Diversions for Use in California by Alamo Canal at Andrade, California. (Appendix A, Sheets 65 and 65A of Table 6) - These diversions include diversions from the Colorado River at Volcano Lake for use in California during the period August 1916 through September 1921. Records of total diversions by the Alamo Canal at

Andrade, California, for the 1914-1945 period, and from the Colorado River at Volcano Lake, in Mexico, for the period of diversions, August 1916 through September 1921, are published by the Geological Survey. These diversions supplied water for irrigation of lands in Imperial Valley in Mexico and also, prior to February 1942, in Imperial Valley in California. Since February 1942, irrigation water for Imperial Valley in California has been supplied by the All-American Canal. Records of deliveries of water by the Alamo Canal to lands in Mexico for the period from October 1913 through December 1941, and of water entering California from the Alamo Canal system from January 1922 through December 1941, were obtained from the International Boundary and Water Commission. These records had been secured and furnished by the Imperial Irrigation District. By deduction of deliveries to Mexico and California from gross diversions to the Alamo Canal at Andrade, losses from the canal were computed on a monthly basis for the period 1922 through 1941. Assuming an average cross-section for the canal, the hydraulic radius was computed for each month from October 1913 through January 1942 by applying average flow for the month. Monthly diversions from the Colorado River at Volcano Lake were included in determining the capacities for months from August 1916 through September 1921. The average relationship between losses and hydraulic radii for each month of the year was determined for the period of recorded losses, January 1922 through December 1941, and applied to the hydraulic radii for the remainder of period, October 1913 through January 1942, to estimate monthly canal losses. Losses were apportioned to California and Mexico in proportion to deliveries

by the canal. Losses apportioned to California were added to deliveries to determine the diversions for California at Andrade for the 1922-1941 period, and the remainder of monthly estimates of diversions for California for the October 1913 through January 1942 period were computed by deducting deliveries and losses apportioned to Mexico from gross diversions. The delivery to Mexico for January 1942 was estimated to be the same as the average of January deliveries for years with approximately the same irrigated acreage as 1942, or 165,159 acres.

(11) California Drainage Canal near Yuma, Arizona. (Appendix A, Sheet 66 of Table 6) - Records of discharge of this drain to the Colorado River are available from October 1913 through April 1920, from October 1921 through March 1925, and from January 1937 through September 1945. Monthly estimates from May 1920 through September 1921 were determined by prorating between records of the same month in prior and subsequent years. Annual discharges for water years 1936 and 1937 and calendar years 1934, 1935, and 1936 are published in Geological Survey Water-Supply Paper 1049. Estimates of annual discharge for water years 1925 through 1935 were determined by prorating between annual records for 1924 and 1936, giving consideration to the calendar year records for 1934, 1935, and 1936. The annual estimates were distributed on a monthly basis by application of the monthly percentage relationship derived from averages for the period of records.

(12) Cooper Wasteway near Yuma, Arizona. (Appendix A, Sheet 67 of Table 6) - The Cooper Wasteway returns water from the Yuma Main Canal (West Main) to the Colorado River on the Arizona side about

8½ miles downstream from the gaging station on the Colorado River at Yuma. The wasteway was completed in March 1927. Records of discharge are available from June 1935 through September 1945, and for calendar years 1934 and 1935. On the basis that discharge for early years is believed to be about the same as that for first years of record, the discharges for years prior to 1934 were estimated to be the average of the recorded flows for 1936 and 1937. The annual estimates were distributed on a monthly basis by application of the monthly percentage relationship derived from averages for the period of record.

(13) Eleven-Mile Wasteway near Yuma, Arizona. (Appendix A, Sheet 68 of Table 6) - Eleven-Mile Wasteway returns water from the Yuma Main Canal (West Main) to the Colorado River on the Arizona side about 11 miles downstream from the gaging station on the Colorado River at Yuma. The wasteway was in operation throughout the period 1914 through 1945. Records of discharge are available from January 1924 through December 1934, from April 1935 through September 1945, and for calendar year 1935 without monthly distribution for January, February, and March. Discharge for water year 1935 was computed by adjustment of annual discharge for calendar year 1935. Annual discharges for 1914-1924 period were estimated on the basis that discharge during this period is about the same as that for the first years of record. Annual estimates were distributed on a monthly basis by application of the monthly percentage relationship derived from averages for the period of records.

(14) Twenty-one Mile Wasteway near Yuma, Arizona. (Appendix A, Sheet 69 of Table 6) - Twenty-one Mile Wasteway returns water from the Yuma Main Canal (West Main) to the Colorado River on the Arizona side about 21 miles downstream from the gaging station on the Colorado River at Yuma. Discharge began in March 1939 and records at this station are complete.

(15) Main Drain from Yuma Project, Arizona. Appendix A, Sheet 70 of Table 6) - Drainage water in the Valley Division of the Yuma Project is collected by the Main Drain and is pumped across the Arizona-Sonora boundary for irrigation in Mexico. Prior to about 1924 the drainage water discharged to the Colorado River just upstream from Arizona-Sonora boundary. Discharge began in January 1919 and records at this station are complete, except for monthly distribution from January through May in 1919.

(16) East and West Main Canals at Arizona-Sonora Boundary. (Appendix A, Sheet 71 of Table 6) - After entering Arizona through the Colorado River Siphon, the Yuma Main Canal divides into East and West Main Canals to distribute irrigation water to lands of the Valley Division of the Yuma Project. These two canals extend to the Arizona-Sonora boundary and discharge excess irrigation water by gravity across the boundary for irrigation in Mexico. The West Main Canal was completed in 1915, and the East Main Canal in 1913 or 1914. Records of discharge of the two canals are available from January 1924 through June 1928, from January 1932 through December 1933, and from April 1935 through September 1945, except that after May 1944, waste water from the West Main Canal was returned to the Colorado River through the

Twenty-one Mile Wasteway. Annual discharges for calendar years 1934 and 1935 are also available. The combined discharge of the two canals is tabulated on Sheet 71 of Table 6 of Appendix A. Discharges for October, November, and December of 1923, and July, August, and September of 1928 were estimated as the average of recorded discharges for the respective months for 1924 through 1927. Estimates for October, November, and December of 1931 were derived as the averages for the respective monthly records for 1932 and 1933. Estimates of discharge for water years 1934 and 1935 were derived by adjustment of the annual discharges for calendar years 1934 and 1935 with recorded monthly discharges. Average discharge for the 1914 through 1945 period was estimated to be the same as the average of the recorded and estimated discharges for water years 1924 through 1928 plus 1932 through 1945.

(n) Colorado River within Limitrophe Section at International Boundary. (Appendix A, Sheets 72 and 72A of Table 6) - This tabulation was prepared by combining the record of the flow of the Colorado River at the Yuma gaging station with records and estimates of downstream return flows by drains and wasteways and deducting diversions from the Colorado River downstream from Yuma gaging station for use in the United States. The records were computed as the sum of the records or estimates for the flows of the Colorado River at Yuma, the Yuma Main Canal Wasteway at Yuma, the California Drainage Canal near Yuma, the Pilot Knob Wasteway near Pilot Knob, the Cooper Wasteway near Yuma, the Eleven-Mile Wasteway near Yuma, the Twenty-one Mile Wasteway near Yuma, the Main Drain from Yuma Project, and the East

and West Main Canals at the Arizona-Sonora boundary less the diversions for use in California by the Alamo Canal at Andrade, California.

The record tabulated for this synthetic or constructed station represents the measured contributions of the United States to the flow of the Colorado River between the California-Baja California and Arizona-Sonora boundaries. To obtain the historic flow for this station, these tabulated flows would need to be adjusted for unmeasured contributions and losses between Yuma and the California-Baja California boundary and along the Arizona boundary of the Limitrophe Section.

(o) Recent Records - Records for 1946, 1947, and 1948 as published by the Geological Survey where available for the several selected stations have been appended to the respective tables as subsequent records.

3. Drainage Areas Above Key Gaging Stations

Stream flow contributions from intermediate drainage areas are important factors in the hydrologic equations of stream sections. As the study included the determination of the stream flow contributions from the several states and Mexico in the Lower Colorado River Basin and records of stream flow are not generally available at state lines, it was necessary to estimate the stream flow contributions from ungaged drainage areas in solving the hydrologic equations at state lines as well as at key gaging stations. The estimates of runoff were made considering the size of the drainage area involved as well as other runoff factors. Drainage areas upstream from selected gaging stations, state lines, and other division points were

determined by careful measurement on the best available maps. The measurements were compared with published and unpublished data of the Geological Survey and checked the measurements of that agency at all points for which data were available.

Accompanying Table 2 was prepared to summarize the drainage areas upstream from gaging stations and other division points in the Lower Colorado River drainage system downstream from Lee Ferry to the Limitrophe Section of the International Boundary between the United States and Mexico. The measurements of the Geological Survey are listed for all points for which the data of that agency were available. Apparent discrepancies between the listed drainage areas and published data are the result of the practice of rounding figures that are published.

A summary of the estimated and recorded average 1914-1945 stream flow at selected gaging stations together with the drainage area tributary to each is given in accompanying Table 3. Estimates of stream flow contributions from ungaged drainage areas are discussed in the section of this report on analyses.

4. Depletions of Ground-Water Basins

Ground water is water stored in and transmitted through the porous materials below the land surface. The porosity of the material, which is the proportion of the total volume consisting of voids and interstices that can be occupied by water, determines the quantity of water that the formation can store. The permeability of the material determines how freely water can move through the formation, thus its availability. The upper surface of the zone of saturation is called the

Table 2

LOWER COLORADO RIVER BASIN

Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Little Colorado River at St. Johns, Arizona	1	897	-	-	44	-	-	941
Carrizo Wash at New Mexico-Arizona State line	2	-	-	-	1,815	-	-	1,815
Intermediate drainage area	3	322	-	-	66	-	-	388
Carrizo Wash at mouth (2/3)	4	322	-	-	1,881	-	-	2,203
Miscellaneous to balance	5	541	-	-	-	-	-	541
Little Colorado River above Zuni River near Hunt, Arizona (1/4/5)	6	1,760	-	-	1,925	-	-	3,685
Zuni River at Black Rock, New Mexico	7	-	-	-	692	-	-	692
Intermediate drainage area	8	-	-	-	383	-	-	383
Zuni River at N.Mex.-Ariz. State line (7/8)	9	-	-	-	1,075	-	-	1,075
Intermediate drainage area	10	685	-	-	817	-	-	1,502
Zuni River at mouth (9/10)	11	685	-	-	1,892	-	-	2,577
Miscellaneous to balance	12	19	-	-	-	-	-	19
Little Colorado River near Hunt,Ariz. (6/11/12)	13	2,464			3,817			6,281
Silver Creek near Woodruff, Arizona	14	942	-	-	-	-	-	942
Miscellaneous to balance	15	878	-	-	-	-	-	878
Little Colorado River near Woodruff, Arizona (13/14/15)	16	4,284	-	-	3,817	-	-	8,101
Puerco River at Gallup, New Mexico	17	-	-	-	558	-	-	558
Intermediate drainage area	18	-	-	-	525	-	-	525
Puerco River at New Mex.-Ariz. State Line (17/18)	19	-	-	-	1,083			1,083

Table 2 (Continued)
LOWER COLORADO RIVER BASIN
Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Puerco River at New Mex.-Ariz. State line	19	-	-	-	1,083	-	-	1,083
Miscellaneous to balance	20	134	-	-	146	-	-	280
Puerco River above confluence with Black Creek, near Houck, Arizona (19/20)	21	134	-	-	1,229	-	-	1,363
Black Creek at mouth	22	458	-	-	229	-	-	687
Miscellaneous to balance	23	707	-	-	-	-	-	707
Puerco River near Adamana, Ariz. (21/22/23)	24	1,299			1,458			2,757
Intermediate drainage area	25	350	-	-	-	-	-	350
Puerco River at mouth (24/25)	26	1,649	-	-	1,458	-	-	3,107
Chevelon Fork near Winslow, Arizona	27	1,008	-	-	-	-	-	1,008
Clear Creek near Winslow, Arizona	28	607	-	-	-	-	-	607
Miscellaneous to balance	29	8,355	-	-	-	-	-	8,355
Little Colorado River at Grand Falls, Arizona (16/26/27/28/29)	30	15,903	-	-	5,275	-	-	21,178
Moenkopi Wash near Tuba, Arizona	31	2,486	-	-	-	-	-	2,486
Miscellaneous to balance	32	2,804	-	-	-	-	-	2,804
Little Colorado River at Coconino dam site (30/31/32)	33	21,193	-	-	5,275	-	-	26,468
Intermediate drainage area	34	27	-	-	-	-	-	27
Little Colorado River near Cameron, Ariz. (33/34)	35	21,220	-	-	5,275	-	-	26,495
Intermediate drainage area	36	411	-	-	-	-	-	411
Little Colorado River at mouth (35/36)	37	21,631	-	-	5,275	-	-	26,906

Table 2 (Continued) Sheet 3 of 7

LOWER COLORADO RIVER BASIN

Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Colorado River at Lee Ferry, Arizona 1/	38	-	-	-	-	-	-	109,458
Intermediate drainage area	39	776	-	-	-	-	-	776
Colorado River at Marble Canyon Dam Site Mile 32.8 (38/39)	40	776	-	-	-	-	-	110,234
Intermediate drainage area	41	60	-	-	-	-	-	60
Colorado River at Marble Canyon Dam Site Mile 39.5 (40/41)	42	836	-	-	-	-	-	110,294
Little Colorado River at mouth	37	21,631	-	-	5,275	-	-	26,906
Miscellaneous to balance	43	572	-	-	-	-	-	572
Colorado River near Grand Canyon, Arizona (42/37/43)	44	23,039	-	-	5,275	-	-	137,772
Bright Angel Creek near Grand Canyon, Arizona	45	100	-	-	-	-	-	100
Kanab Creek at mouth	46	1,642	-	-	-	677	-	2,319
Miscellaneous to balance	47	5,595	-	-	-	-	-	5,595
Colorado River at Bridge Cany. Dam Site (44/45/46/47)	48	30,376	-	-	5,275	677	-	145,786
Virgin River at Virgin, Utah	49	-	-	-	-	934	-	934
Intermediate drainage area	50	1,898	-	253	-	2,007	-	4,158
Virgin River at Littlefield, Ariz. (49/50)	51	1,898	-	253	-	2,941	-	5,092
Muddy River near St. Thomas, Nevada	52	-	-	8,384	-	-	-	8,384
Miscellaneous to balance	53	185	-	1,055	-	41	-	1,281
Virgin River at mouth (51/52/53)	54	2,083	-	9,692	-	2,982	-	14,757

Table 2 (Continued) Sheet 4 of 7

LOWER COLORADO RIVER BASIN

Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Colorado River at Bridge Canyon dam site	48	30,376	-	-	5,275	677	-	145,786
Virgin River at mouth	54	2,083	-	9,692	-	2,982	-	14,757
Miscellaneous to balance	55	4,409	-	2,798	-	-	-	7,207
Colorado River below Hoover Dam, Ariz.-Nev. (48/54/55)	56	36,868	-	12,490	5,275	3,659	-	167,750
Intermediate drainage area	57	2,356	719	1,432	-	-	-	4,507
Colorado River near Topock, Arizona (56/57)	58	39,224	719	13,922	5,275	3,659	-	172,257
Bill Williams River at Planet, Arizona	59	5,144	-	-	-	-	-	5,144
Gila River near Red Rock, New Mexico	60	-	-	-	2,857	-	-	2,857
Intermediate drainage area	61	-	-	-	361	-	-	361
Gila River below Blue Creek, near Virden, New Mexico (60/61)	62	-	-	-	3,218	-	-	3,218
Intermediate drainage area	63	-	-	-	145	-	-	145
Gila River at New Mexico-Arizona State line (62/63)	64	-	-	-	3,363	-	-	3,363
Intermediate drainage area	65	526	-	-	148	-	-	674
Gila River near Clifton, Arizona (64/65)	66	526	-	-	3,511	-	-	4,037
San Francisco River near Glenwood, New Mexico	67	92	-	-	1,572	-	-	1,664
Intermediate drainage area	68	-	-	-	253	-	-	253
San Francisco River at New Mexico-Arizona State line (67/68)	69	92	-	-	1,825	-	-	1,917
Intermediate drainage area	70	818	-	-	54	-	-	872

Table 2 (Continued) Sheet 5 of 7

LOWER COLORADO RIVER BASIN

Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
San Francisco River at Clifton, Arizona	71	910	-	-	1,879	-	-	2,789
Intermediate drainage area	72	40	-	-	-	-	-	40
San Francisco River at mouth (71/72)	73	950	-	-	1,879	-	-	2,829
Gila River near Clifton, Arizona	66	526	-	-	3,511	-	-	4,037
Miscellaneous to balance	74	1,088	-	-	-	-	-	1,088
Gila River at head of Safford Valley, near Solomon, Arizona (73/66/74)	75	2,564	-	-	5,390	-	-	7,954
San Simon Creek at New Mex.-Ariz. State line	76	395	-	-	227	-	-	622
Intermediate drainage area	77	1,654	-	-	-	-	-	1,654
San Simon Creek near Solomon, Ariz. (76/77)	78	2,049	-	-	227	-	-	2,276
Miscellaneous to balance	79	1,262	-	-	-	-	-	1,262
Gila River at Calva, Arizona (75/78/79)	80	5,875	-	-	5,617	-	-	11,492
San Carlos River near Peridot, Arizona	81	1,038	-	-	-	-	-	1,038
Miscellaneous to balance	82	359	-	-	-	-	-	359
Gila River below Coolidge Dam, Ariz. (80/81/82)	83	7,272	-	-	5,617	-	-	12,889
San Pedro River at Palominas, Arizona	84	92	-	-	-	-	649	741
Intermediate drainage area	85	428	-	-	-	-	47	475
San Pedro River at Charleston, Ariz. (84/85)	86	520	-	-	-	-	696	1,216
Intermediate drainage area	87	2,391	-	-	-	-	-	2,391
San Pedro River near Mammoth, Arizona (86/87)	88	2,911	-	-	-	-	696	3,607
Aravaipa Creek near Feldman, Arizona	89	538	-	-	-	-	-	538
Miscellaneous to balance	90	340	-	-	-	-	-	340

Table 2 (Continued)
LOWER COLORADO RIVER BASIN
Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Gila River below Coolidge Dam, Arizona	83	7,272	-	-	5,617	-	-	12,889
San Pedro River at mouth	91	3,789	-	-	-	-	696	4,485
Miscellaneous to balance	92	657	-	-	-	-	-	657
Gila River at Kelvin, Arizona (83/91/92)	93	11,718	-	-	5,617	-	696	18,031
Santa Cruz River near Nogales, Arizona	94	185	-	-	-	-	357	542
Intermediate drainage area	95	1,604	-	-	-	-	46	1,650
Santa Cruz River at Tucson, Arizona (94/95)	96	1,789	-	-	-	-	403	2,192
Rillito Creek near Tucson, Arizona	97	916	-	-	-	-	-	916
Miscellaneous to balance	98	415	-	-	-	-	-	415
Santa Cruz River at Rillito, Ariz. (96/97/98)	99	3,120	-	-	-	-	403	3,523
Salt River near Roosevelt, Arizona	100	4,306	-	-	-	-	-	4,306
Tonto Creek near Roosevelt, Arizona	101	841	-	-	-	-	-	841
Verde River below Bartlett Dam, Arizona	102	6,159	-	-	-	-	-	6,159
Miscellaneous to balance	103	1,601	-	-	-	-	-	1,601
Salt River at Granite Reef Dam, Arizona (100/101/102/103)	104	12,907	-	-	-	-	-	12,907
Agua Fria River at Lake Pleasant Dam, Arizona	105	1,459	-	-	-	-	-	1,459
Miscellaneous to balance	106	13,706	-	-	-	-	-	13,706
Gila River below Gillespie Dam, Arizona (93/99/104/105/106)	107	42,910	-	-	5,617	-	1,099	49,626
Intermediate drainage area	108	8,410	-	-	-	-	48	8,458
Gila River near Dome, Arizona (107/108)	109	[illegible]			[illegible]		[illegible]	[illegible]

Table 2 (Continued) Sheet 7 of 7

LOWER COLORADO RIVER BASIN

Summary of Drainage Areas by States and in Mexico in Square Miles

Gaging Station or Division Point	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Total
Colorado River near Topock, Arizona	58	39,224	719	13,922	5,275	3,659	-	172,257
Bill Williams River at Planet, Arizona	59	5,144	-	-	-	-	-	5,144
Gila River near Dome, Arizona	109	51,320	-	-	5,617	-	1,147	58,084
Miscellaneous to balance	110	4,617	2,716	-	-	-	-	7,333
Colorado River at Yuma, Arizona (58/59/109/110)	111	100,305	3,435	13,922	10,892	3,659	1,147	242,818
Intermediate drainage area	112	1	164	-	-	-	-	165
Colorado River at California-Baja California International Boundary (111/112)	113	100,306	3,599	13,922	10,892	3,659	1,147	242,983

1/ The drainage area for Item 38, Colorado River at Lee Ferry, Arizona, (109,458) was computed as Colorado River at Lees Ferry (107,886) plus Paria River at Lees Ferry (1,568) plus 4 square miles as the drainage area downstream from the gaging stations at Lees Ferry to the Compact point. Total drainage areas for all points on main stream of the Colorado River include this drainage area of 109,458 square miles.

Table 3
LOWER COLORADO RIVER BASIN
Stream Flow and Drainage Areas at Selected Gaging Stations
October 1, 1913-September 30, 1945

Average annual flow in 1,000 acre-feet
Drainage areas in square miles

Stream flow stations in downstream order from Lee Ferry	Average historic flow	Drainage area
Colorado River at Lee Ferry, Arizona 1/	13,788.6	109,458
Little Colorado River at St. Johns, Arizona	6.6	941
Little Colorado River above Zuni River, near Hunt, Arizona	8.1	3,685
Zuni River at Black Rock, New Mexico	18.4	692
Little Colorado River near Hunt, Arizona	23.1	6,281
Silver Creek near Woodruff, Arizona	23.1	942
Little Colorado River near Woodruff, Arizona	58.1	8,101
Puerco River at Gallup, New Mexico	7.2	558
Puerco River near Adamana, Arizona	55.1	2,757
Chevelon Fork near Winslow, Arizona	45.3	1,008
Clear Creek near Winslow, Arizona	77.0	607
Little Colorado River at Grand Falls, Arizona	252.1	21,178
Moenkopi Wash near Tuba, Arizona	15.7	2,486
Colorado River near Grand Canyon, Arizona	14,204.1	137,772
Bright Angel Creek near Grand Canyon, Arizona	29.3	100
Virgin River at Virgin, Utah	160.2	934
Virgin River at Littlefield, Arizona	231.7	5,092
Colorado River below Hoover Dam, Arizona-Nevada	13,694.0	167,750
Colorado River near Topock, Arizona	13,332.3	172,257
Bill Williams River at Planet, Arizona	135.2	5,144
Gila River near Red Rock, New Mexico	153.5	2,857
Gila River below Blue Creek, near Virden, New Mex.	155.0	3,218
Gila River near Clifton, Arizona	160.6	4,037
San Francisco River near Glenwood, New Mexico	64.7	1,664
San Francisco River at Clifton, Arizona	161.4	2,789
Gila River at head of Safford Valley, near Solomon, Arizona	378.2	7,954

Table 3 (Continued) Sheet 2 of 2

LOWER COLORADO RIVER BASIN

Stream Flow and Drainage Areas at Selected Gaging Stations

October 1, 1913-September 30, 1945

Average annual flow in 1,000 acre-feet

Drainage areas in square miles

Stream flow stations in downstream order from Lee Ferry	Average historic flow	Drainage area
San Simon Creek near Solomon, Arizona	12.4	2,276
Gila River at Calva, Arizona	303.0	11,492
San Carlos River near Peridot, Arizona	50.5	1,038
Gila River below Coolidge Dam, Arizona	331.4	12,889
San Pedro River at Palominas, Arizona	30.0	741
San Pedro River at Charleston, Arizona	54.6	1,216
San Pedro River near Mammoth, Arizona	61.0	3,607
Aravaipa Creek near Feldman, Arizona	23.0	538
Gila River at Kelvin, Arizona	434.9	18,03[illegible]
Santa Cruz River near Nogales, Arizona	15.2	542
Santa Cruz River at Tucson, Arizona	16.1	2,192
Rillito Creek near Tucson, Arizona	16.8	916
Santa Cruz River at Rillito, Arizona	29.7	3,52[illegible]
Salt River near Roosevelt, Arizona	706.5	4,30[illegible]
Tonto Creek near Roosevelt, Arizona	107.9	84[illegible]
Verde River below Bartlett Dam, Arizona 2/	522.4	6,15[illegible]
Salt River at Granite Reef Dam, Arizona	1,331.8	12,90[illegible]
Salt River below Granite Reef Dam, Arizona 3/	352.1	12,90[illegible]
Agua Fria River at Lake Pleasant Dam, Arizona	128.3	1,45[illegible]
Gila River at Gillespie Dam, Arizona 4/	712.4	49,62[illegible]
Gila River below Gillespie Dam, Arizona	641.5	49,62[illegible]
Gila River near Dome, Arizona	456.9	58,08[illegible]
Colorado River at Yuma, Arizona	11,684.4	242,81[illegible]
Colorado River within Limitrophe Section at International Boundary 5/	10,386.3	242,98[illegible]

1/ Sum of Colorado River at Lees Ferry and Paria River at Lees Ferry.

2/ Combination of the published records for the gaging sites near McDowell, above Camp Creek, and below Bartlett Dam.

3/ Computed as flow of the Salt River at Granite Reef Dam, Arizona, less net diversions for irrigation at Granite Reef Dam.

4/ Computed as flow of the Gila River below Gillespie Dam, Arizona, plus diversions by Gillespie and Enterprise Canals at Gillespie Da[illegible]

5/ Measured contributions from the United States as derived in Appendix Sheet 72A of Table 6.

ground-water table or ground-water level and is almost never a flat surface. The ground-water table is not static but rises and falls as water is added or taken from the zone of saturation.

In the hydrologic cycle, there is a close interrelationship between surface water and ground water. In some areas, ground water contributes to the flow of the streams, whereas, in other areas, the streams feed the ground water. For example: When water percolating through the soils and rock reaches an impermeable layer or the zone of saturation, it moves laterally under the force of gravity until it is stored in a confined area or emerges as springs or seeps where the water table intersects the land surface and contributes to the streams. On the other hand, in arid regions and in areas of heavy ground-water withdrawal by pumping, the streams contribute to the ground water. It is, therefore, evident that man-made developments may disturb the interrelationship of ground water and surface water in the hydrologic cycle as it existed under natural or virgin conditions. In this study of water supply of the Lower Colorado River Basin it was, therefore, necessary to determine the extent of the effect of changes in ground-water storage caused by man-made developments on the flow of streams at key gaging stations throughout the drainage area.

(a) General - Changes in ground-water storage usually effect changes in the surface flow of the streams in their drainage areas and, consequently, are important factors in the hydrologic equations of the various stream sections throughout the Lower Colorado River Basin. Increases in ground-water storage caused by man-made

developments represent depletions of stream flow, whereas, the consumptive use requirements of an area, which are supplied by depletions of ground-water storage, are not depletions of stream flow for the period of study. For example, irrigation water is usually applied to land in excess of the consumptive use requirements of the crops and incidental areas and a portion of the water percolates to the ground-water basin of the area. If the additional ground-water does not return to the stream but causes a rise in the natural ground-water level, the accretion to ground-water storage represents a depletion of the flow of the stream for the period of study. If the ground water is maintained at the natural level by pumping or drainage, the effect of ground-water storage on the flow of the stream remains the same as under natural or virgin conditions for the period of study. However, if the natural ground-water level is lowered by pumping or drainage the quantity withdrawn for the period of study represents an addition to the surface water supply of the area and may either increase the flow of the stream in that river section or supply a portion of the consumptive use requirements of the area. Ground-water reservoir depletions are withdrawals of ground water which had been stored under natural conditions prior to the period of study.

Some areas in the Lower Colorado River Basin obtain a portion or all of their water supply for irrigation and domestic and municipal uses by pumping from ground-water basins located within the natural drainage area of the Lower Colorado River. A study was made of ground-water data in all areas for the period, 1914 through 1945, and it was determined that depletions of ground-water storage were evident only in

four areas. These four areas are located in the Gila River drainage area. The effect of a semiperched ground-water table beneath the irrigated area of the Yuma Mesa in Arizona is discussed in a footnote to Table 12 in the section of this report on analyses. This area was the only area in which a general rise in the ground-water table was evident.

The average annual depletions of ground-water storage for the 32-year period, 1914 through 1945, were derived from the total change in storage estimated for each area for the period. Total change in ground-water storage was obtained by applying a coefficient for specific yield to the total 32-year change in volume of the water-bearing formation estimated for each area.

The ground-water tables for the years 1914 and 1945 in the various areas were determined from available well measurements obtained in the respective years. Ground-water contour maps prepared from data obtained in 1914 or indicative of 1914 conditions were available for about half of the total area involved in the study. In areas where irrigation and well development occurred subsequent to 1914, the natural ground-water level was determined from measurements taken when wells were drilled and the 1914 ground-water table was considered the same as the natural ground-water level.

Differences in the 1914 and 1945 elevations of the ground-water table at the points of measurement were plotted on maps of suitable scale and ground-water fluctuation contours were drawn. The areas enclosed by each contour were measured by planimeter and the computed average area between contours was multiplied by the contour interval to obtain the volume of change in the ground-water reservoir between

contours. The algebraic sum of the volumes between contours resulted in the total change in volume of the ground-water basin for the area.

The specific yield or coefficient of drainage of a water-bearing formation is the ratio of the volume of water the formation will yield by gravity to its own volume. After due consideration of available data, a specific yield coefficient of 15 percent was selected as a reasonable average coefficient for the water-bearing formations of the areas under study. However, a specific yield of 16 percent was applied in the Safford Valley study in accordance with the results of many tests made in Safford Valley and reported in Geological Survey Water-Supply Paper 1103.

The derivations of the estimates of average annual depletions of the ground-water basins are described in the following paragraphs.

(b) Safford Valley - This area of 120 square miles lies along the Gila River from the head of Safford Valley near Solomon, Arizona, to Calva, Arizona. Most of the development of ground water for irrigation in the area began after 1938.

A maximum decline of 9 feet in the water table was recorded for a small area and a maximum rise of 10 feet was shown in another small area. With some sections showing a decline and others a rise in the ground-water table, the average decline for the 1914 to 1945 period was only 0.02 feet. Ground-water was withdrawn from 1,280 acre-feet of aquifer during the period. Based on specific yield of 16 percent, the total depletion of ground water storage for the 32-year period was 200 acre-feet, which was an average of only 6 acre-feet a

year. Average flow in this stream section of the Gila River was not affected by changes in ground-water storage during the 1914-1945 period.

(c) Upper Santa Cruz River - This area of 626 square miles along the Santa Cruz River extends upstream from the Pima-Pinal County boundary through Pima and Santa Cruz Counties in Arizona to about nine miles north of the International Boundary between the United States and Mexico.

Irrigation by wells began in several areas along the Santa Cruz River prior to 1914. Well development has been more or less continuous since 1914 with spasmodic increases during periods economically favorable to agriculture. A marked decline in the general ground-water level of the area has been noted since increasingly heavier pumping began in 1941. In general, the fall in the ground-water level from 1914 to 1945 increases proceeding downstream with a maximum decline of 69 feet in the vicinity of Rillito, Arizona. Average decline for the entire area from 1914 to 1945 was 11.09 feet. Based on specific yield of 15 percent, the total depletion of ground-water storage for the area was 666,300 acre-feet for the 32-year period, 1914 through 1945, or an average annual depletion of 20,800 acre-feet.

(d) Pinal County and Maricopa County Upstream from Gillespie Dam - This area of 2,665 square miles is located in the Gila River Basin in central Arizona upstream from Gillespie Dam on the Gila River and downstream from Kelvin on the Gila River, Pima-Pinal County boundary on the Santa Cruz River, Granite Reef Dam on the Salt River, and Lake Pleasant Dam on the Agua Fria River. Ground-water data for

1914 was available for most of this area although most of the well development for irrigation has occurred since 1920. Wide fluctuations in the general ground-water level have occurred during the 1914-1945 period because of accretions to the ground-water reservoir from diversions of surface water to the irrigated lands and subsequent heavy pumping for drainage and irrigation. A maximum decline in the ground-water level of 98 feet for the period was recorded for a small area about four miles west of Marinette, Arizona. A decline in the water table of 40 feet occurred in an area about two miles west of Phoenix, 73 feet for an area in the vicinity of Higley, and 75 feet for an area about two miles south of Eloy. A maximum rise in the water table of 70 feet was recorded for a small area near the Arizona Canal west of Cambelback Mountain. There were rises in the water table of 18 feet near Buckeye, 20 feet a few miles west of Casa Grande, and 5 feet for an area a few miles south of Maricopa.

The area was divided into 11 districts to facilitate the study and an average decline in the ground-water table of 16.71 feet was determined for the entire area from 1914 to 1945. Based on specific yield of 15 percent, the total depletion of ground-water storage for the entire area was 4,274,700 acre-feet for the 32-year period, 1914 through 1945, or an average annual depletion of 133,600 acre-feet.

(e) Gillespie Dam to Dome - This area of 1,082 square miles lies along the Gila River in Maricopa and Yuma Counties between Gillespie Dam and Dome, Arizona. Most of the well development for irrigation in the area has occurred since 1920. There has been a

gradual downward trend of the ground-water table since heavier pumping began about 1925 with a maximum decline of 30 feet in an area in Mohawk Valley near Tyson, Arizona.

An average decline in the ground-water table of 6.73 feet was determined for the entire area for the 1914-1945 period. Based on specific yield of 15 percent, the total depletion of ground-water storage for the area was 699,300 acre-feet for the 32-year period or an average annual depletion of 21,900 acre-feet.

(f) Summary - Accompanying Table 4 has been prepared to summarize the depletions of ground-water basins in the Lower Colorado River Basin during the period, 1914 through 1945.

5. Water Using Areas Influenced by Man

It was necessary to determine the water using areas which man has influenced in order to provide data as a basis for estimating the effect of man-made developments in depleting the flow of the Colorado River downstream from Lee Ferry. The water using areas influenced by men were considered to be those areas on which the use of water has been changed by developments of man since pioneer settlement of the areas as distinguished from natural uses. The types of water using areas investigated in the study were as follows: irrigated areas, water consuming non-cropped areas, storage reservoirs, and river channel areas exposed to evaporation and transpiration losses. Areas which consumed water under natural conditions were not investigated unless they were influenced to some extent by the activities of man. Activities of man which have influenced channel losses include the use of water by man at upstream sites, transbasin diversions, changes in the regimen of the streams

caused by regulation and channelization, the replacement of native vegetation by crops and other beneficial uses, and changes in native vegetation caused by the introduction by man of plants or trees with different consumptive use rates.

Only those water using areas were investigated that are situated within the natural drainage area of the Colorado River downstream from Lee Ferry to the Limitrophe Section of the International Boundary between the United States and Mexico. Depletions of Colorado River stream flow by uses of Colorado River water in areas located outside of the drainage area of the Colorado River were considered to be the exports or total diversions of Colorado River water transported by the respective canals and aqueducts situated outside of the drainage area of the Colorado River.

(a) Irrigated Areas - Irrigated areas are those on which water other than natural precipitation, regardless of source, is applied by man to produce crops or prepare land for the production of crops. Most of the irrigated land in the Lower Colorado River Basin is located in the southern portion of the basin and the greater portion of this irrigated area is favored with a yearlong growing season. Because of the favorable climate, double cropping of the same land is a common practice in much of the irrigated area.

The areas of irrigated land within the drainage area of the Lower Colorado River were determined by careful analysis of the data on crops compiled from various sources for the several agricultural areas and fully described in the following section on cropped areas

as distinguished from irrigated areas. Irrigated land was considered as only that land on which irrigation water was actually applied for the production of crops or preparation of the land for the production of crops during each year investigated. The use of water by unirrigated idle land within agricultural areas was considered to be supplied by natural precipitation. The average area irrigated for the 1914-1945 period and the area irrigated in 1945 in each state within the natural drainage area of the Colorado River downstream from Lee Ferry to the Arizona-Sonora boundary and in Mexico within the drainage area of the Gila River were determined to be as follows:

Arizona Acres	California Acres	Nevada Acres	New Mexico Acres	Utah Acres	Mexico Acres	Total Acres
			1914-1945 average			
522,565	39,392	8,605	14,999	18,677	3,988	608,226
			Year 1945			
690,749	49,814	9,404	16,313	24,017	3,974	794,271

This tabulation does not include farmsteads and other areas incidental to irrigation. Those areas are listed and described in a later section of this chapter of the report.

Any apparent discrepancies between the acreages listed in the foregoing tabulation and irrigated areas published in other reports of the Bureau of Reclamation and other agencies are problems of definition of the term "irrigated land" rather than matters of inconsistency.

Table 4
LOWER COLORADO RIVER BASIN
Depletions of Ground-Water Basins

Average annual depletion in acre-feet — October 1, 1913-September 30, 1945

Ground-water basin	Area in square miles	Volume dewatered in acre-feet	Average decline of water table in feet	Specific yield in percent	Total depletion in acre-feet	Average annual depletion in acre-feet
Safford Valley	120	1,280	0.02	16	200	6
Upper Santa Cruz River	626	4,442,000	11.09	15	666,300	20,800
Pinal County and Maricopa County upstream from Gillespie Dam						
Florence-Coolidge area	239	3,628,000	23.72	15	544,200	17,000
Sacaton area	170	660,000	6.07	15	99,000	3,100
Eloy area	356	5,466,000	23.99	15	819,900	25,600
Casa Grande area	229	1,056,000	7.21	15	158,400	4,950
Maricopa area	160	754,000	7.36	15	113,100	3,550
St. John Mission area	168	1,434,000	13.34	15	215,100	6,700
Magma area	48	279,000	9.08	15	41,800	1,300
Queen Creek area	190	3,442,000	28.31	15	516,300	16,150
Salt River area	660	6,621,000	15.67	15	993,100	31,050
Agua Fria River area	227	4,949,000	34.07	15	742,400	23,200
Buckeye area	218	209,000	1.50	15	31,400	1,000
Total	2,665	28,498,000	16.71	15	4,274,700	133,600
Gillespie Dam to Dome	1,082	4,662,000	6.73	15	699,300	21,900

(b) Cropped Areas - Cropped areas are the areas of the various crops cultivated in the irrigated areas. Areas on which irrigation water was applied to prepare the land for the production of crops by leaching or other soil building practices were considered cropped areas. The fact that water may have been applied to land from which no crops were harvested, because of factors other than shortages of water, was not used as a basis for reducing either the cropped acreage or the amount of water that acreage would use consumptively. In localities where double cropping was practiced, the cropped areas exceeded the irrigated areas by quantities equal to the acreages double cropped. In all other localities the cropped areas were the same as the irrigated areas.

Data on crops in the agricultural areas of the Lower Colorado River Basin were obtained from various sources. The crop reporting services of the county agriculture agents, Agricultural Adjustment Administration, Production and Marketing Administration, Soil Conservation Service, irrigation and agriculture departments of colleges and universities, state land and water commissioners, water users' associations, irrigation districts, and the Bureau of Reclamation were consulted to obtain acreages in crops. Data from those sources were supplemented by such additional data as could be found in published reports of Federal and state agencies, private reports when available, and by contacting individuals whose occupation and length of residence in the community placed them in a position to have reasonably authoritative information.

Except for areas supplied with water from Bureau of Reclamation projects or constructed with funds obtained through some other Federal agency, continuous long-term crop reports were not usually available. In many cases regular annual reports for a period of time could be supplemented with intermittent reports and the missing years estimated on the basis of the changes indicated in the available reports, of agricultural practices in the area and adjoining or similar areas, and of general agricultural economic conditions. In a few cases crop and acreage data were meager and spotty. These areas are almost entirely in the mountainous regions where natural meadows have been converted to irrigated land. Such data as could be obtained from local sources were supplemented with data obtained from census reports and other reliable sources. It is recognized that the crop data, thus obtained, is subject to error. However, because the areas are small, some comprising as little as 10 acres, and these areas are generally at elevations where precipitation is high and growing season short, the effect of the error on the water use is negligible on the tribuatary stream and was considered to be nil on the flow of the main stream of the Colorado River.

Data on crops in the portion of Mexico situated within the drainage area of the Gila River were furnished by the International Boundary and Water Commission.

Accompanying Table 5 has been prepared to summarize the average acreage of the various crops cultivated during the 1914-1945 period in each state within the natural drainage area of the Colorado River downstream from Lee Ferry to the Arizona-Sonora boundary and in Mexico within the drainage area of the Gila River. Crop acreages for 1945 are listed in accompanying Table 6.

Table 5
LOWER COLORADO RIVER BASIN
Acreages of Crops Within the Natural Drainage Area of the Lower Colorado River Basin

Average area in acres — October 1, 1913-September 30, 1945

Crops	Arizona	California 1/	Nevada	New Mexico	Utah	Mexico 2/	Total
Alfalfa	131,380	13,065	2,781	4,531	8,231	1,509	161,497
Alfalfa and grain	34,718						34,718
Beans	3,140	14	2	312		398	3,866
Carrots	1,077	72					1,149
Citrus	12,112	48					12,160
Corn	12,584	503	576	2,497	1,609	512	18,281
Cotton	155,882	18,377		544			174,803
Dates	287	38					325
Deciduous fruits	2,737	25	77	140	1,963	153	5,095
Flax	3,075	892					3,967
Grapes	506	83					589
Lettuce - fall	8,063	85					8,148
Lettuce - spring	10,752	85		16			10,853
Melons	9,768	409	8	23			10,208
Misc. hay & pasture	70,126	1,634	2,280	1,006	1,578		76,624
Miscellaneous truck	4,806	800	781	306	772	235	7,700
Nurseries & flowers	53	1					54
Nuts	1,276	53					1,329
Olives	108						108
Potatoes - sweet	547	3					550
Potatoes - white	1,039		64	182	301	655	2,241
Rice	87						87
Small grains	79,722	2,616	2,042	4,400	4,024	526	93,330
Soil building crops	2,199	146					2,345
Sorghums	34,521	1,437	172	1,093	392		37,615
Sugar beet seed	1,572	1	1	41	275		1,890
Tomatoes	115	3					118
Total	582,252	40,390	8,784	15,091	19,145	3,988	669,650

1/ Does not include Imperial and Coachella Valleys in Salton Sea drainage area.

Table 6

LOWER COLORADO RIVER BASIN

Acreage of Crops Within the Natural Drainage Area of the Lower Colorado River Basin in 1945

Crops	Arizona	California 1/	Nevada	New Mexico 2/	Utah	Mexico	Total
Alfalfa	193,539	28,253	3,758	4,310	12,200	1,496	243,556
Alfalfa and grain	55,375						55,375
Beans	2,983	2		241		398	3,624
Carrots	8,255	265					8,520
Citrus	20,642	126					20,768
Corn	9,133	676	1,956	2,760	1,410	524	16,459
Cotton	166,131	1,012		635			167,778
Dates	662	83					745
Deciduous fruits	1,473		45	148	2,135	153	3,954
Flax	13,919	7,038					20,957
Grapes	301		1				302
Lettuce - fall	24,486	1,142					25,628
Lettuce - spring	19,858						19,858
Melons	18,907	3,605		45			22,557
Misc. Hay & Pasture	107,435	3,781	1,563	1,401	1,200		115,380
Miscellaneous Truck	13,898	337	785	510	825	237	16,592
Nurseries & Flowers	108						108
Nuts	1,166	18					1,184
Olives	90						90
Potatoes - sweet	864						864
Potatoes - white	3,893		163	215	260	654	5,185
Rice	162						162
Small grains	114,673	3,776	1,009	4,416	5,120	512	129,506
Soil building crops	4,690	113					4,803
Sorghums	51,432	1,760	300	1,735			55,227
Sugar Beet Seed	3,925				1,500		5,425
Tomatoes	444	18					462
Total	838,444	52,005	9,580	16,416	24,650	3,974	945,069

1/ Does not include Imperial and Coachella Valleys in the Salton Sea drainage area.

2/ Portion of Mexico in the Gila River drainage area.

(c) Water Consuming Noncropped Areas - Water consuming noncropped areas for cities, towns, and areas incidental to irrigation and irrigated farming.

(1) Cities and Towns - Phoenix is the largest city situated within the natural drainage area of the Colorado River. Acreage and population data available for the City of Phoenix for the period, 1880 to 1950, were used to provide the basis for estimating the average area of other cities in the Lower Colorado River Basin for the 1914-1945 period. The data for Phoenix were supplemented by area-population relationships determined for a few small towns with population between 150 and 2,500 to define the correlation curve for estimating the acreages of the small towns and villages.

Acreages within the incorporated area of the City of Phoenix were obtained from city maps and recorded plats for 11 separate periods between 1880 and 1950. Population data for Phoenix obtained for the 8 decennial censuses (1880 to 1950) were then used to determine the area-population relationship during the 1880-1950 period. An area-population relationship curve was derived by combining the correlation for Phoenix with the supplemental correlation, and the average acreage of other cities and towns for 1914 to 1945 were computed from acreages determined from the curve by application of population data recorded in the censuses for the several cities and towns. Where census data were not available for villages but were recorded as precincts, estimates of town population were made and an average acreage estimated as a summation of all the small villages within the drainage area of each stream section.

(2) Incidental Areas - Incidental areas were considered to be water consuming noncropped areas adjacent to or forming a part of the farms and those areas which consume water as a result of the practice of irrigation. These areas include farmsteads, canals, laterals, drains, waste ditches, roads, and railroads, which are within the irrigation development areas and outside the areas of cities and towns.

A study of aerial photographs for over 60,000 acres of irrigated farm land in the vicinity of Phoenix determined the total incidental area to be 6.79 percent of the irrigated area. The study area comprised 98 sections scattered throughout the Salt River Valley area and selected as representative of average conditions of the irrigation development area. To provide for differences in the consumptive use rates by the various types of incidental areas, four classes of incidental areas were established as follows: (1) farmsteads, 1.75 percent; (2) water surfaces of canals, laterals, drains, and waste ditches, 0.49 percent; (3) areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads, and railroads, 2.77 percent; and (4) surfaces of roads and roadbeds of railroads, 1.78 percent. These percentages were applied to estimate the incidental areas in the various agricultural areas. In those areas where there were no railroads, percentages of 2.54 and 1.77 were applied in estimating the respective areas of vegetation within rights-of-way and the surfaces of roadbeds.

(3) Summary - Accompanying Table 7 has been prepared to summarize the average acreage of the water consuming noncropped areas within the natural drainage area of the Lower Colorado River Basin.

Table 7
LOWER COLORADO RIVER BASIN
Acreage of Water Consuming Noncropped Areas

Average area in acres — October 1, 1913-September 30, 1945

Location	Water consuming noncropped areas					
		Incidental areas				
	Cities and towns	Farmsteads	Water surfaces of canals, laterals, drains, and waste ditches	Areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads & railroads	Surfaces of roads and roadbeds of railroads	Total
Arizona	34,583	9,062	2,547	14,293	9,214	69,699
California 1/	1,535	689	192	1,092	701	4,209
Nevada	1,608	150	42	226	152	2,178
New Mexico	2,891	264	74	381	266	3,876
Utah	2,795	327	91	474	331	4,018
Mexico 2/	750	70	20	110	71	1,021
Total	44,162	10,562	2,966	16,576	10,735	85,001

1/ Includes only that portion of California within the natural drainage area of the Colorado River.
2/ Includes only that portion of Mexico within the drainage area of the Gila River.

(d) Channel Areas - The major causes of losses in stream channels are evaporation from the exposed water surfaces and wetted channel areas, and the consumptive use of water by vegetation in the flood plains of the streams. As the activities of man have caused changes in these areas of evaporation and vegetative use, it was necessary to determine the acreages of channel areas influenced by man in the drainage area of the Lower Colorado River Basin. With the exception of the headwaters upstream from any man-made developments, all channel areas of the Colorado River and its tributaries downstream from Lee Ferry to the Limitrophe Section of the International Boundary were measured and estimated from the available aerial photographs, plan and profile maps of the Lower Colorado River drainage system, and other maps where necessary. Channel areas and the determination of channel losses for the 1914-1945 period and for virgin conditions are fully discussed in the section of this report on analyses.

(e) Reservoir Depletions - Reservoirs formed by man-made developments effect changes in the use of water in the areas inundated and the increased losses constitute depletions of stream flow by man. Prior to the formation of reservoirs, there were river channel losses and other natural consumptive uses in the areas inundated. These water uses by evaporation and transpiration were supplied by portions of precipitation, ground water, and surface runoff within the reservoir area. When reservoirs were formed, the water uses under natural conditions were replaced by reservoir evaporation and constitute salvage deductible from the gross reservoir evaporation losses in determining depletions of stream flow by reservoirs.

All man-made reservoirs and stock tanks or ponds in the Lower Colorado River Basin were investigated for the 1914-1945 period and average annual depletions are summarized on accompanying Table 8.

Changes in reservoir storage effect changes in stream flow. Accretions of storage constitute depletions of stream flow and withdrawals from storage increase the flow of the stream. The evaluation of the effect of surface storage in reservoirs of the Lower Colorado River Basin during the 1914-1945 period is discussed in detail in the section of this report on analyses.

The operation of reservoirs effects changes in ground-water storage in the vicinity of the reservoirs and the resultant accretions to ground-water storage for the period of investigation constitute depletions of stream flow. The determination of reservoir bank storage for the 1914-1945 period in the Lower Colorado River Basin is discussed in detail in the section of this report on analyses.

(f) Transbasin Diversions - Diversions of water from the drainage area of a stream or basin to the drainage area of another stream or basin are transbasin diversions. If the streams involved are not of the same drainage system, there is no return flow to the system and diversions at the points of export are considered depletions of stream flow at the respective points. When the streams involved are tributaries of the same drainage system, the export diversions are depletions of the flow of the stream of runoff origin at the export point and the water transferred is an import to the other tributary for rerouting within the over-all stream system of the basin.

Table 8

LOWER COLORADO RIVER BASIN

Stream Depletions Resulting From Changes in Evaporation and Transpiration Within Reservoir Areas Following Development

Average annual depletion in 1,000 ac-ft — Oct. 1, 1913-Sept. 30, 1945

Stream section or reservoir	Location	Average annual depletio
LITTLE COLORADO RIVER		
Little Colorado River upstream from St.Johns,Ariz.	Arizona	3.3
St. Johns to gage above Zuni River near Hunt,Ariz.	Arizona	1.6
Zuni River upstream from Black Rock, New Mexico	New Mexico	4.1
Zuni River from Black Rock to New Mex.-Ariz.State line	New Mexico	.1
Silver Creek	Arizona	.8
Woodruff gage to Grand Falls, Arizona	Arizona	3.4
VIRGIN RIVER		
Virgin River upstream from Littlefield, Arizona	Utah	1.6
MAIN STREAM OF COLORADO RIVER		
Grand Canyon to Hoover Dam:		
Small reservoirs in Hualpai Indian Reservation	Arizona	.2
Lake Mead - Hoover Dam	Ariz.-Nevada	242.2
Topock to Yuma:		
Havasu Lake - Parker Dam	Ariz.-Calif.	12.9
Headgate Rock Diversion Reservoir	Ariz.-Calif.	.1
Imperial Diversion Reservoir	Ariz.-Calif.	2.8
Laguna Diversion Reservoir	Ariz.-Calif.	20.4
GILA RIVER		
San Francisco River upstream from Glenwood, New Mex.	New Mexico	.1
Small reservoirs from head of Safford Valley to Calva	Arizona	.2
San Carlos Reservoir - Coolidge Dam	Arizona	12.2
Picacho Reservoir in Pinal County	Arizona	8.3
Salt River:		
Upper Salt River small reservoirs	Arizona	.6
Roosevelt Lake - Roosevelt Dam	Arizona	21.4
Apache Lake - Horse Mesa Dam	Arizona	3.5
Canyon Lake - Mormon Flat Dam	Arizona	1.3
Sahuaro Lake - Stewart Mountain Dam	Arizona	.8
Verde River:		
Upper Verde River small reservoirs	Arizona	1.3
Bartlett Reservoir - Bartlett Dam	Arizona	.6
Lake Pleasant on Agua Fria River	Arizona	2.9
TOTAL		346.7

(1) Transbasin Exports - Export diversions for use outside of the natural drainage area of the Lower Colorado River during the 1914-1945 period are described in the following paragraphs.

(a) Newcastle Project, Utah - It was estimated that average annual diversions of 1,200 acre-feet for the 1914-1945 period were made from the headwaters of the Santa Clara River, a tributary of the Virgin River of the Colorado River drainage system to Pinto Creek in the Bonneville Basin (Great Basin) for use in the vicinity of Newcastle, Utah.

(b) Colorado River Aqueduct - Diversions to the Colorado River Aqueduct by pumping from Havasu Lake on the Colorado River began January 7, 1939. The water is transported by the aqueduct for use in Pacific slope basins in Southern California. Recorded export diversions by the Colorado River Aqueduct totaled 464,000 acre-feet for the 7-year period, 1939-1945. This amount distributed over the 32-year period, 1914-1945, averages 14,500 acre-feet a year.

(c) All-American Canal - The All-American Canal diverts water from the Colorado River at Imperial Dam. Water transported by the canal below Pilot Knob Wasteway is exported

from the natural drainage area of the Colorado River for use in Imperial and Coachella Valleys in California within the drainage area of the Salton Sea. Since diversions began September 11, 1939, recorded exports by the All-American Canal below Pilot Knob Wasteway have totaled 10,940,000 acre-feet for the 1939-1945 period. This amount distributed over the 32-year period, 1914-1945, averages 341,900 acre-feet a year.

(d) Alamo Canal - Prior to February 1942, the Alamo Canal, lying almost wholly in Mexico, diverted water from the Colorado River about a mile upstream from the International Boundary at Andrade, California, for use in the Imperial Valley in Mexico and California within the Salton Sea Basin. During 1916-1921, part of the deliveries by the Alamo Canal system were supplied by diversions from the Colorado River at Volcano Lake in Mexico. Since 1940, Alamo Canal has received part of its water from the All-American Canal at Pilot Knob Wasteway and since February 1942, Colorado River water for use in the Imperial Valley in California has been supplied by the All-American Canal and deliveries have been made by the Alamo Canal

for use in Mexico only. It was estimated that diversions by Alamo Canal at Andrade, California and from Volcano Lake in Mexico for use in California totaled 66,418,500 acre-feet during the 1914-1942 period. This amount distributed over the 32-year period, 1914-1945, averages 2,075,600 acre-feet a year. The derivation of this estimate has been discussed in detail in the section of this report on historic stream flow at key gaging stations.

(2) Transtributary Diversions - Transfers of water between tributary drainage areas within the stream system of the Lower Colorado River Basin and diversions bypassing key gaging stations are discussed in the section of this report on analyses pertaining to the routing of water from the headwaters downstream from Lee Ferry to the International Boundary.

IV. ANALYSES

A. Stream Depletions

Because water consumed or withheld is not subject to downstream conveyance losses, the sum of the individual stream depletions at sites of use downstream from Lee Ferry is greater than the total stream depletion measured at the International Boundary for the Lower Colorado River Basin. The reduction in channel losses constitutes a salvage that is deductible from the depletion at sites of use in determining depletion of the Colorado River at the International Boundary between the United States and Mexico. In estimating the stream depletion at the International Boundary it was, therefore, necessary to determine the man-made stream depletions at sites of use for the 1914-1945 period, and the channel losses between sites of use and the International Boundary for historic flows during the 1914-1945 period and for virgin flow conditions.

1. Man-Made Stream Depletions at Sites of Use

Stream depletions at sites of use for crops and noncropped areas were determined by application of unit rates of consumptive use of irrigation water to the 1914-1945 average acreages of crops, cities and towns, and areas incidental to irrigation and irrigated farming. Other stream depletions at sites of use determined for the 1914-1945 period were transbasin diversions, depletions by reservoir evaporation, and depletions of stream flow by accretions to surface and bank storage in reservoirs. Evaluations were also made of the

1914-1945 average reductions of stream depletions at sites of use by depletions of ground-water storage, and the uses by native vegetation replaced by crops and other beneficial uses.

The determination of the acreages of areas using water as a result of man-made developments has been discussed in the section of this report on basic data.

(a) Unit Rates of Consumptive Use of Irrigation Water - Various methods have been used to estimate the amount of water consumed by agricultural crops and native vegetation and it has been demonstrated that reasonable estimates can be obtained by using climatological data as an index for evaluating evapotranspiration. Mr. Harry F. Blaney and associates of the Research Division of Irrigation Engineering and Water Conservation of the Soil Conservation Service of the United States Department of Agriculture developed empirical formulas for estimating monthly, seasonal, and annual rates of consumptive use from climatological data. This method, commonly called the Blaney-Criddle method, was used by the Engineering Advisory Committee to the Upper Colorado River Basin Compact Commission to estimate consumptive use in the Upper Colorado River Basin in 1948.

The procedure is to correlate existing measured consumptive use data for different crops and native vegetation with monthly temperatures, percent of daytime hours, and frost-free (growing) period, or irrigation season, to establish a consumptive use coefficient for each kind of vegetation. The coefficients so developed are used together with climatological data to compute consumptive

use rates for crops and native vegetation in areas for which only climatological data are available.

Because climatological and crop data were generally available for agricultural areas throughout the Lower Colorado River Basin it was decided to employ the Blaney-Criddle method to estimate consumptive use in the Lower Colorado River Basin. The consultation services of Harry F. Blaney, Principal Irrigation Engineer, and Karl Harris, Senior Irrigation Engineer, of the Division of Irrigation Engineering and Water Conservation, Soil Conservation Service, United States Department of Agriculture, were obtained to ensure the proper application of the method and to determine consumptive use of water rates.

A report on rates of consumptive use of water in the Lower Colorado River Basin was prepared by Messrs. Blaney and Harris and is incorporated as Appendix B of this report. These rates were used to estimate consumptive use in the Lower Colorado River Basin.

Mr. Blaney and Mr. Harris made a field inspection trip throughout the Lower Colorado River Basin to obtain material to supplement research data for the preparation of their report. A general location map of the Lower Colorado River Basin showing irrigated areas and selected climatological stations was furnished Messrs. Blaney and Harris together with climatological and other data. Consumptive use rates based on coefficients furnished by Messrs. Blaney and Harris were computed for their report.

The Blaney-Harris report gives in detail the technical background of the determination of consumptive use of water rates in the Lower Colorado River Basin and lists the normal consumptive use of

irrigation water rates at sites of use throughout the Lower Colorado River Basin for all types of crops grown, all general types of native vegetation, and barren lands with high ground-water tables together with indexes for computing water uses by cities, farmsteads, and other incidental areas.

If the water supply for an area was short during the latter part of the irrigation season, the resultant reduction in consumptive use was indicated in the Blaney-Harris report as a percentage reduction of the total normal consumptive use of irrigation water by the 1914-1945 average acreage of crops in each area of water shortage. The percentage reduction for an area was determined as the relationship of all shortages during the 1914-1945 period to the full water supply required for the area during the period.

(b) Consumptive Use of Irrigation Water by Crops - The unit rates of consumptive use of irrigation water by crops listed in the Blaney-Harris report were applied to the average 1914-1945 acreages determined for the various crops in 68 separate areas throughout the Lower Colorado River Basin to determine the average annual consumptive use of irrigation water by crops at sites of use for the 1914-1945 period. The derivation of these evaluations are shown in accompanying Table 9. The numbers given in Table 9 for the agricultural areas correspond with the numbers shown for the irrigation areas on the location map in Appendix B, Drawing No. 57-314-22. The first letter or letters in the designation apply to the state or Mexico in which the irrigation area is situated; the last letter or letters signify the stream (Colorado, Little Colorado, Virgin, Bill Williams, or Gila River); and the numeral is the sequence of the irrigation areas in a state in downstream order on the streams.

Table 9

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA

Agricultural Area and Number

Crop	A-1-LC Springerville Area Acres	Rate Feet	Use Ac-ft	A-2-LC St. Johns Area Acres	Rate Feet	Use Ac-ft	A-3-LC Concho Area Acres	Rate Feet	Use Ac-ft	A-4-LC Silver Creek Area Acres	Rate Feet	Use Ac-ft
Alfalfa	1,408	1.81	2,548	1,562	2.17	3,390				1,274	1.75	2,230
Beans	61	.43	26	31	.67	21	69	0.67	46	119	.49	58
Corn	391	.85	332	585	1.16	679	52	1.16	60	861	.93	801
Deciduous fruits	40	.71	28	6	1.17	7	11	1.17	13	110	.77	85
Misc. hay & pasture	1,176	1.50	1,764	1,499	1.82	2,728				1,301	1.41	1,834
Miscellaneous truck	66	.81	53	35	1.31	46	55	1.31	72	135	.88	119
Potatoes - white										47	.66	31
Small grains	2,291	.81	1,856	791	.86	680	46	.86	40	1,683	.77	1,296
Sorghums				6	.89	5				15	.74	11
Total	5,433		6,607	4,515		7,556	233		231	5,545		6,465

Crop	A-5-LC Woodruff Area Acres	Rate Feet	Use Ac-ft	A-6-LC Black Creek Area Acres	Rate Feet	Use Ac-ft	A-7-LC Holbrook Area Acres	Rate Feet	Use Ac-ft	A-8-LC Hopi, Ganado & Leupp Area Acres	Rate Feet	Use Ac-ft
Alfalfa	209	2.47	516	142	1.91	271	578	2.72	1,572	220	2.29	504
Beans				4	.61	2	120	.89	107	15	.82	12
Corn				318	1.06	337	610	1.38	842	453	1.33	602
Deciduous fruits							34	1.61	55			
Melons				22	.85	19				15	1.03	15
Misc. hay & pasture	45	2.10	95	70	1.60	112	112	2.34	262	62	1.94	120
Miscellaneous truck							73	1.76	128	15	1.41	21
Potatoes - white				1	.77	1				12	.99	12
Small grains	159	1.02	162	22	.91	20	366	1.08	395	47	1.02	48
Sorghums							32	1.30	42			
Less water shortage					20%	152					20%	267
Total	413		773	579		610	1,925		3,403	839		1,067

Table 9 (Continued

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA (Continued)

Agricultural Area and Number

Crop	A-9-LC Moenkopi			A-1-C Kanab Creek			A-2-C Havasu Creek			A-3-C Hualpai Reservation & Meriwitica		
	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	176	2.40	422	1,283	2.32	2,977	30	3.32	100	19	3.32	63
Beans	7	.83	6									
Corn	505	1.39	702	320	1.34	429	50	1.66	83	45	1.66	75
Deciduous fruits	25	1.43	36	14	1.26	18	15	2.30	35	15	2.30	35
Grapes	1	1.29	1									
Melons	50	1.13	57									
Misc. hay & pasture	57	2.04	116	200	1.96	392	35	2.86	100			
Miscellaneous truck	3	1.57	5	78	1.38	108	26	2.52	66	8	2.52	20
Small grains - fall				108	1.27	137						
Small grains - spring	7	.99	7	108	1.09	118						
Less water shorgage		20%	270									
Total	831		1,082	2,111		4,179	156		384	87		193

Crop	A-4-C Grand Wash			A-1-V Short Creek			A-2-V Littlefield			A-5-C Davis Dam to Topock		
Alfalfa	20	3.30	66	18	2.40	43	300	3.88	1,164	128	4.81	616
Corn				41	1.38	57						
Deciduous fruits	10	2.21	22	7	1.35	9	3	2.73	8			
Grapes										6	3.18	19
Misc. hay & pasture							165	3.39	559			
Miscellaneous truck	5	2.40	12	4	1.48	6	100	2.94	294	6	1.99	12
Small grains - fall							94	1.58	149	214	1.70	364
Small grains - spring	20	1.52	30	5	1.05	5	94	1.24	117	214	1.13	242
Sorghums							25	1.77	44			
Total	55		130	75		120	781		2,335	568		1,253

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA (Continued)

Crop	A-1-BW Bill Williams River (Big Sandy) Area Acres	Rate Feet	Use Ac-ft	A-2-BW Bill Williams River (Santa Maria) Area Acres	Rate Feet	Use Ac-ft	A-6-C Colorado River Indian Reservation Area Acres	Rate Feet	Use Ac-ft	A-7-C North and South Gila Valleys Area Acres	Rate Feet	Use Ac-ft
Alfalfa	530	3.21	1,701	453	3.21	1,454	1,145	4.44	5,084	2,596	4.71	12,227
Corn	222	1.58	351	96	1.49	143	34	1.87	64			
Cotton							1,495	2.56	3,827	1,223	2.53	3,094
Dates	5	2.44	12									
Deciduous fruits	19	2.13	40	5	2.13	11						
Flax										165	2.24	370
Grapes	5	1.92	10									
Lettuce - fall										28	.85	24
Lettuce - spring										27	1.12	30
Melons	51	1.32	67				1	1.39	1			
Misc. hay & pasture	985	2.73	2,689	247	2.73	674	565	4.19	2,367	486	4.47	2,172
Miscellaneous truck				58	2.33	135	211	1.82	384	110	2.14	235
Nuts										31	3.41	106
Potatoes - sweet	15	2.33	35									
Potatoes - white				39	1.07	42						
Rice							80	3.71	297			
Small grains - fall	262	1.45	380	258	1.45	374	155	1.58	245	201	1.87	376
Small grains - spring	262	1.03	270	257	1.03	265	155	1.02	158	202	1.30	263
Soil bldg.crops - fall										20	1.62	32
Soil bldg.crops - spring										19	1.21	23
Sorghums	61	1.37	84				209	1.64	343	444	1.65	733
Total	2,417		5,639	1,413		3,098	4,050		12,770	5,552		19,685

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in ac-ft — October 1, 1913-September 30, 194

ARIZONA (Continued)

Crop	Agricultural Area and Number					
	A-8-C Yuma Valley			A-9-C Yuma Mesa		
	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	13,584	4.71	63,981	37	5.06	187
Beans	55	.90	50			
Carrots - fall	142	1.83	260			
Carrots - Spring	142	2.42	344			
Citrus	44	3.48	153	809	3.62	2,929
Corn	35	1.85	65			
Cotton	12,260	2.53	31,018			
Dates	25	3.77	94	11	3.92	43
Deciduous fruits	38	3.16	120	1	3.70	4
Flax	2,464	2.24	5,519			
Grapes	9	2.91	26	2	3.41	7
Lettuce - fall	1,876	.85	1,595			
Lettuce - spring	1,877	1.12	2,102			
Melons	1,828	1.87	3,418	2	1.94	4
Misc. hay & pasture	3,797	4.47	16,973	2	4.77	10
Miscellaneous truck	204	2.14	437	2	2.25	4
Nurseries and flowers	25	3.77	94	2	3.92	8
Nuts	1,166	3.41	3,976			
Potatoes - sweet	9	3.41	31			
Potatoes - white	12	1.06	13	1	1.10	1
Rice	7	3.65	26			
Small grains - fall	1,063	1.87	1,988			
Small grains - spring	1,064	1.30	1,383			
Soil bldg.crops - fall	967	1.62	1,567	113	1.68	190
Soil bldg.crops - spring	968	1.21	1,171	112	1.25	140
Sorghums	3,308	1.65	5,458	2	1.72	3
Sugar beet seed	14	2.48	35			
Tomatoes	18	1.79	32	2	1.86	4
Total	47,001		141,929	1,098		3,534

Table 9 (Continued) Sheet 5 of 13

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet October 1, 1913-September 30, 1945

ARIZONA (Continued)

	Agricultural Area and Number											
	A-1-G Duncan Valley			A-2-G Alpine			A-3-G San Francisco River			A-4-G Eagle Creek		
Crop	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	1,219	2.96	3,608	12	0.88	11	152	2.20	334	200	2.62	524
Corn							20	1.05	21	50	1.10	55
Cotton	1,186	1.72	2,040									
Deciduous fruits				4	0.07	0						
Misc. hay & pasture										56	2.18	122
Miscellaneous truck	138	2.02	279				12	1.42	17	10	1.76	18
Small grains - fall	558	1.39	776							100	1.21	121
Small grains - spring	559	1.11	620	9	0.41	4	108	.86	93	100	1.03	103
Sorghums	860	1.12	963									
Less water shortage		12%	994									
Total	4,520		7,292	25		15	292		465	516		943

	A-5-G Portal			A-6-G San Simon Creek			A-7-G Safford Valley			A-8-G San Carlos Ind.Res.		
Alfalfa	1	2.08	2	263	3.24	852	8,716	3.33	29,024	30	3.35	101
Beans				163	.93	152	50	.99	50			
Corn				43	1.47	63	852	1.38	1,176	384	1.54	591
Cotton				18	1.91	34	10,523	1.99	20,941			
Deciduous fruits	35	1.01	35	2	2.04	4	30	2.07	62	5	2.26	11
Misc. hay & pasture				8	2.79	22	1,387	2.86	3.967	75	2.86	215
Miscellaneous truck				59	2.23	132	208	2.26	470	33	2.48	82
Potatoes - white							50	1.16	58			
Small grains - fall				8	1.37	11	2,446	1.30	3,180	188	1.17	220
Small grains - spring	2	.89	2	8	1.17	9	2,447	.92	2,251	188	.84	158
Sorghums				180	1.46	263	8	1.40	11	14	1.21	17
Sugar beet seed							280	1.89	529			
Less water shortage								14%	8,641			

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA (Continued)

Crop	A-9-G Hereford Valley Area Acres	Rate Feet	Use Ac-ft	A-10-G Middle San Pedro River Area Acres	Rate Feet	Use Ac-ft	A-11-G Lower San Pedro River Area Acres	Rate Feet	Use Ac-ft
Alfalfa	131	3.20	419	1,971	3.15	6,209	697	3.06	2,133
Beans				4	.89	4			
Corn	30	1.19	36	388	1.31	508	132	1.39	183
Deciduous fruits				20	1.79	36			
Lettuce - fall				10	.58	6			
Lettuce - spring				6	.89	5			
Melons				16	1.13	18			
Misc. hay & pasture	12	2.71	33	101	2.67	270	92	2.58	237
Miscellaneous truck	15	1.90	29	157	1.97	309	39	2.14	83
Potatoes - white				8	1.13	9			
Small grains - fall	37	1.66	61	431	1.49	642	140	1.29	181
Small grains - spring	36	1.23	44	430	1.31	563	140	1.13	158
Sorghums	59	.95	56	45	1.14	51			
Tomatoes				14	1.44	20			
Total	320		678	3,601		8,650	1,240		2,975

	A-12-G Coolidge Dam to Kelvin			A-13-G San Rafael Ranch		
Alfalfa	275	3.12	858			
Misc. hay & pasture				300	2.20	660
Miscellaneous truck	74	2.13	158			
Small grains - fall	65	1.35	88			
Small grains - spring	65	1.16	75			
Total	479		1,179	300		660

Table 9 (Continued)

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA (Continued)

Crop	A-14-G Santa Cruz County Area Acres	Rate Feet	Use Ac-ft	A-15-G Pima County Area Acres	Rate Feet	Use Ac-ft	A-16-G Pinal County Area Acres	Rate Feet	Use Ac-ft	A-17-G Black River Area Acres	Rate Feet	Use Ac-ft
Alfalfa	277	2.92	809	1,717	3.70	6,353	13,261	3.38	44,822			
Beans	210	.77	162	1,371	1.02	1,398	270	1.06	286			
Carrots - fall							76	1.28	97			
Carrots - spring							75	2.03	152			
Citrus				59	2.60	153						
Corn	511	1.09	557	1,076	1.65	1,775	1,171	1.63	1,909			
Cotton	24	1.51	36	6,482	2.07	13,418	31,545	2.31	72,869			
Dates							23	3.15	72			
Deciduous fruits				1	2.36	2	248	2.69	667			
Flax	13	1.91	25				161	2.74	441			
Grapes							7	2.45	17			
Lettuce - fall	14	.57	8	36	.68	24	389	.76	296			
Lettuce - spring	34	.82	28	13	.69	9	90	.71	64			
Melons				17	1.41	24	97	1.67	162			
Misc. hay & pasture	1,225	2.43	2,977	4,764	3.48	16,579	15,173	3.80	57,657	110	1.07	118
Miscellaneous truck	158	1.90	300	372	1.51	562	365	1.37	500			
Potatoes - sweet	1	1.90	2				6	2.92	18			
Potatoes - white	1	1.12	1	29	1.19	34	101	.99	100			
Small grains - fall	177	1.45	257	1,542	1.68	2,591	5,503	1.46	8,034			
Small grains - spring	178	1.23	219	1,542	1.11	1,712	5,502	.95	5,227	36	.62	22
Sorghums	264	.94	248	1,201	1.13	1,357	2,927	1.41	4,127			
Tomatoes							5	1.64	8			
Less water shortage								12%	23,703			
Total	3,087		5,629	20,222		45,991	76,995		173,822	146		140

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

ARIZONA (Continued)

Crop	A-18-G Fort Apache Indian Reservation Area Acres	Rate Feet	Use Ac-ft	A-20-G Salt River Canyon to Roosevelt Area Acres	Rate Feet	Use Ac-ft	A-22-G Verde River Upstream from Camp Verde Area Acres	Rate Feet	Use Ac-ft	A-24-G Fort McDowell Indian Reservation Area Acres	Rate Feet	Use Ac-ft
Alfalfa	487	2.14	1,042	20	3.55	71	3,095	2.88	8,914	2	2.93	6
Beans	9	.68	6				413	.95	392			
Corn	1,066	.90	959				259	1.43	370	14	1.54	22
Deciduous fruits	32	1.16	37	1	2.39	2	475	1.85	879			
Grapes							18	1.65	30			
Misc. hay & pasture	149	1.76	262				650	2.42	1,573	44	3.37	148
Miscellaneous truck	141	1.30	183	3	2.63	8	511	2.04	1,042	6	1.38	8
Potatoes - white	3	.84	3									
Small grains - fall							871	1.30	1,132	45	1.12	50
Small grains - spring	60	.78	47	18	.88	16	871	.96	836	45	.69	31
Sorghums	1	.91	1							3	1.32	4
Total	1,948		2,540	42		97	7,163		15,168	159		269

Crop	A-19-G Cherry Creek Area Acres	Rate Feet	Use Ac-ft	A-21-G Tonto Creek Area Acres	Rate Feet	Use Ac-ft	A-23-G Middle Verde River Area Acres	Rate Feet	Use Ac-ft	A-25-G Upper Agua Fria Riv. Area Acres	Rate Feet	Use Ac-ft
Alfalfa	67	2.08	139	155	2.40	372	25	2.28	57	100	2.88	288
Corn				6	1.25	8	10	1.10	11	100	1.42	142
Deciduous	18	1.19	21	122	1.52	185	7	1.40	10			
Misc. hay & pasture	24	1.65	40	43	1.97	85	26	1.86	48			
Miscellaneous truck	3	1.35	4	13	1.70	22	33	1.56	51	10	2.02	20
Small grains -fall				360	1.04	374						
Small grains - spring	44	.85	37	360	.82	295	17	.93	16	100	1.00	100
Total	156		241	1,059		1,341	118		193	310		550

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 194

ARIZONA (Continued)

Crop	Agricultural Area and Number: A-26-G Maricopa Co. upstream from Gillespie Dam			A-27-G Gillespie Dam to Dome		
	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	65,014	3.23	209,995	7,781	4.00	31,124
Alfalfa & grain	34,030	3.35	114,001	688	4.09	2,814
Beans	167	1.05	175	2	1.09	2
Carrots - fall	321	1.45	465			
Carrots - spring	321	2.02	648			
Citrus	11,200	2.89	32,368			
Corn	1,854	1.67	3,096			
Cotton	88,168	2.28	201,023	2,958	2.58	7,632
Dates	208	3.18	661	15	3.74	56
Deciduous fruits	1,384	2.71	3,751			
Flax	244	2.73	666	28	2.75	77
Grapes	458	2.47	1,131			
Lettuce - fall	5,710	.76	4,340			
Lettuce - spring	8,700	.71	6,177	5	1.03	5
Melons	7,667	1.73	13,264	2	1.96	4
Misc. hay & pasture	34,701	3.82	132,558	382	4.49	1,715
Miscellaneous truck	1,218	1.65	2,010	34	2.05	70
Nurseries and flowers	26	3.18	83			
Nuts	72	2.94	212	7	3.58	25
Olives	108	3.18	343			
Potatoes - sweet	516	2.94	1,517			
Potatoes - white	735	.98	720			
Small grains - fall	21,392	1.45	31,018	727	1.81	1,316
Small grains - spring	21,392	.95	20,322	727	1.22	887
Sorghums	24,499	1.45	35,524	358	1.65	591
Sugar beet seed	1,278	2.23	2,850			
Tomatoes	76	1.62	123			
Total	331,459		819,041	13,714		46,318

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 194

CALIFORNIA 1/

Crop	Agricultural Area and Number					
	C-1-C Palo Verde District			C-2-C Yuma Valley		
	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	10,372	4.77	49,474	2,693	4.71	12,684
Beans				14	.90	13
Carrots - fall	30	1.78	53	5	1.83	9
Carrots - spring	31	2.40	74	6	2.42	15
Citrus				48	3.48	167
Corn	475	1.92	912	28	1.85	52
Cotton	14,772	2.62	38,703	3,605	2.53	9,121
Dates	2	3.80	8	36	3.77	136
Deciduous fruits	10	3.24	32	15	3.16	47
Flax	468	2.75	1,287	424	2.24	950
Grapes	83	2.99	248			
Lettuce - fall	47	.86	40	38	.85	32
Lettuce - spring	47	1.05	49	38	1.12	43
Melons	343	1.94	665	66	1.87	123
Misc. hay & pasture	769	4.51	3,468	865	4.47	3,867
Miscellaneous truck	769	2.09	1,607	31	2.14	66
Nurseries and flowers				1	3.77	4
Nuts	28	3.50	98	25	3.41	85
Potatoes - sweet	1	3.50	4	2	3.41	7
Small grains - fall	1,137	1.82	2,069	171	1.87	320
Small grains - spring	1,137	1.25	1,421	171	1.30	222
Soil bldg. crops - fall				73	1.62	118
Soil bldg. crops - spring				73	1.21	88
Sorghums	541	1.70	920	896	1.65	1,478
Sugar beet seed	1	2.48	2			
Tomatoes	1	1.86	2	2	1.79	4
Total	31,064		101,136	9,326		29,651

1/ Areas C-1-SS and C-2-SS, Imperial and Coachella Valleys, are in the Salton Sea drainage area. Inasmuch as this drainage area is not contributory to Colorado River stream flow, the uses of Colorado River water by the Imperial and Coachella Valleys during the 1914-1945 period would be the total diversions of Colorado River water transported by canals situated outside of the natural drainage area of the Colorado River.

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 194

NEVADA

Crop	N-1-V Virgin River Area Acres	Rate Feet	Use Ac-ft	N-2-V Meadow Valley Wash Area Acres	Rate Feet	Use Ac-ft
Alfalfa	760	4.30	3,268	519	2.36	1,225
Beans				2	.87	2
Corn				394	1.43	563
Deciduous fruits	20	3.10	62	37	1.45	54
Melons	3	1.69	5			
Misc. hay & pasture	206	3.77	777	1,862	2.01	3,743
Miscellaneous truck	173	3.35	580	41	1.59	65
Potatoes - white				64	1.03	66
Small grains - fall	335	1.95	653			
Small grains - spring	334	1.40	468	283	1.02	289
Sorghums	81	1.86	151	25	1.29	32
Total	1,912		5,964	3,227		6,039

Crop	N-3-V Muddy River Area Acres	Rate Feet	Use Ac-ft	N-2-C 1/ Hoover Dam to Davis Dam Area Acres	Rate Feet	Use Ac-ft
Alfalfa	1,440	4.21	6,062	62	4.81	298
Corn	182	1.88	342			
Deciduous fruits	20	2.98	60			
Melons	5	1.60	8			
Misc. hay & pasture	212	3.69	782			
Miscellaneous truck	567	3.21	1,820			
Small grains - fall	543	1.92	1,043	5	1.70	8
Small grains - spring	542	1.37	743			
Sorghums	66	1.82	120			
Sugar beet seed	1	2.25	2			
Total	3,578		10,982	67		306

1/ N-1-C or Las Vegas Valley area obtains its irrigation water supply by pumping from an underground reservoir which is considered an enclosed ground-water basin as reported in Water Resources Bulletin No. 3, published in 1947 by the Office of the State Engineer of Nevada in cooperation with the Geological Survey. Thus, the consumptive use of water from this ground-water basin is not a depletion of Colorado Rive flow. During the 1914-1945 period, there was an annual average of 1,203 acres of crops with consumptive use of 4,023 acre-feet at site of use.

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 194

NEW MEXICO

Crop	NM-2-LC 1/ Zuni River Area Acres	Rate Feet	Use Ac-ft	NM-3-LC Puerco River Area Acres	Rate Feet	Use Ac-ft
Alfalfa	949	1.92	1,822	34	1.91	65
Beans	147	.63	93	1	.62	1
Corn	476	1.09	519	48	1.06	51
Melons	23	.88	20			
Misc. hay & pasture	61	1.59	97	271	1.59	431
Miscellaneous truck	56	1.06	59	10	1.19	12
Potatoes - white	2	.79	2			
Small grains	1,947	1.00	1,947	15	.84	13
Total	3,661		4,559	379		573

	NM-1-G Gila River upstream from Virden			NM-3-G San Francisco River		
Alfalfa	2,139	2.43	5,198	633	1.74	1,101
Beans	14	.73	10	150	.48	72
Corn	1,272	1.21	1,539	701	.88	617
Cotton	11	1.52	17			
Deciduous fruits	4	1.23	5	136	.75	102
Lettuce - spring	16	.88	14			
Misc. hay & pasture	137	2.04	279	537	1.41	757
Miscellaneous truck	84	1.37	115	45	.86	39
Potatoes - white	172	.91	157	8	.64	5
Small grains	1,172	.99	1,160	659	.75	494
Sorghums	709	1.00	709	100	.78	78
Sugar beet seed	41	1.70	70			
Total	5,771		9,273	2,969		3,265

	NM-2-G Virden Valley		
Alfalfa	776	2.96	2,297
Cotton	533	1.72	917
Miscellaneous truck	111	2.02	224
Small grains - fall	304	1.39	423
Small grains - spring	303	1.11	336
Sorghums	284	1.12	318
Less water shortage		12%	542
Total	2,311		3,973

1/ NM-1-LC area is in that portion of Carrizo Wash drainage area contributory to the closed basin surrounding Quemado. Consumptive use of water in this area is not a depletion of Colorado River flow. During the 1914-1945 period, there was an annual average of 1,334 acres of crops with consumptive use of 1,623 acre-feet at site of use.

Table 9 (Continued)
LOWER COLORADO RIVER BASIN
Consumptive Use of Irrigation Water by Crops at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

UTAH

Crop	Agricultural Area and Number					
	U-1-C Kanab Creek			U-1-V Virgin River		
	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
Alfalfa	2,340	2.00	4,680	5,891	2.74	16,141
Corn	400	1.20	480	1,209	1.58	1,910
Deciduous fruits	45	1.11	50	1,918	1.78	3,414
Misc. hay & pasture	200	1.67	334	1,378	2.33	3,211
Miscellaneous truck	65	1.22	79	707	1.95	1,379
Potatoes - white				301	1.01	304
Small grains - fall	250	1.06	265	1,762	1.44	2,537
Small grains - spring	250	.92	230	1,762	1.17	2,062
Sorghums				392	1.40	549
Sugar beet seed				275	1.40	385
Less water shortage					12%	3,827
Total	3,550		6,118	15,595		28,065

MEXICO

	M-1-G San Pedro River			M-2-G Santa Cruz River		
Alfalfa	273	3.20	874	1,236	2.81	3,473
Beans				398	.80	318
Corn	92	1.19	109	420	1.19	500
Deciduous fruits				153	1.61	246
Miscellaneous truck	13	1.90	25	222	1.81	402
Potatoes - white	50	1.09	55	605	.97	587
Small grains - fall	77	1.66	128	186	1.43	266
Small grains - spring	78	1.23	96	185	1.17	216
Total	583		1,287	3,405		6,008

(c) Consumptive Use of Irrigation Water by Noncropped Areas - The 1914-1945 average annual comsumptive use of irrigation water by noncropped areas at sites of use was computed by applying unit rates of use to the respective 1914-1945 average acreages determined for cities, towns, and areas incidental to irrigation and irrigated farming. Data for computing unit rates of use were obtained from the Blaney-Harris report.

The annual use an acre by city, town, and farmstead areas was computed, as outlined in the Blaney-Harris report, by application of the 1914-1945 average annual consumptive use factor (F) of the various areas on the basis that the City of Pasadena, California, with annual "F" of 62.89 has an annual consumptive use of 1.89 acre-feet an acre of domestic or irrigation water. The rate for the City of Pasadena was based on data that were considered most complete and suitable for transposing to areas in the Lower Colorado River Basin.

The use rates for the areas of vegetation within the rights-of-way for canals, laterals, drains, waste ditches, roads, and railroads were computed by application of coefficients of 0.65 in areas of yearlong growth and 0.80 in areas other than yearlong growth to the 1914-1945 average consumptive use factors (F) for the respective growing periods. Effective precipitation during the respective growing season was deducted to determine the unit rate for consumptive use of irrigation water.

The consumptive use of water by the water surfaces of canals, laterals, drains, and waste ditches in the various areas was computed by applying the water surface evaporation rate for the period that water was exposed in the channels to the respective 1914-1945 average

channel areas. The water surface evaporation rates were determined by applying a coefficient of 0.70 to the 1914-1945 average recorded or estimated pan evaporation rates. Estimated pan evaporation rates are listed in Table 1 in the section of this report on basic data and recorded and partially estimated pan evaporation rates are tabulated in Tables 4 and 5 in Appendix A. As these water surfaces were effects of man-made developments, the precipitation falling on the water surfaces during the period that water was exposed in the channels constituted salvage and was deducted from the evaporation to determine the stream depletions at sites of use.

The Blaney-Harris report considers that the consumptive use requirements of the surfaces of roads and railroad roadbeds are supplied by precipitation only and thus there is no consumptive use of irrigation water by these areas.

Because of the erratic flows of tributary streams and the lack of regulatory storage, surface irrigation water is applied to the fields furing the nongrowing season in most areas, other than those of yearlong growth, throughout the Lower Colorado River Basin in an attempt to store water in the soil for use during the growing period. Consequently, there is a consumptive use of irrigation water during the nongrowing season in these areas. In the Blaney-Harris report, it is estimated that an inch of irrigation water is used consumptively during the nongrowing season in those areas where the practice of winter diversions of surface water is incidental to irrigated farming. This rate has been applied to the acreages determined as being irrigated during the nongrowing season in areas other than those of yearlong growth.

Accompanying Table 10 has been prepared to show the derivation of the average annual consumptive use of irrigation water by non-cropped areas at sites of use in the Lower Colorado River Basin for the 1914-1945 period.

(d) Stream Depletions by Reservoirs - When reservoirs are formed by man-made developments, the increased uses of water within the reservoir area and the water withheld by accretions of surface and bank storage constitute depletions of stream flow.

Stream depletions resulting from changes in evaporation and transpiration within reservoir areas in the Lower Colorado River Basin during the 1914-1945 period have been discussed in the section of this report on basic data and average depletions at sites of use were listed in Table 8 in that report section.

Records of storage were available for all the larger storage reservoirs in the Lower Colorado River Basin and accretions in surface storage for the 1914-1945 period and average annual depletions were readily determined. The smaller reservoirs throughout the Lower Colorado River Basin were filled and emptied annually or more often. Consequently, changes in storage in the smaller reservoirs had no appreciable effect on average stream flows for the 1914-1945 period and were not determined.

Accretions and withdrawals of bank storage are dependent upon the porosity and permeability of the underground material in the vicinity of the reservoirs as well as the elevation of the reservoir surfaces. However, the data on porosity, permeability, and ground-water levels required to evaluate reservoir bank storage are not available. Data for

Table 10

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Noncropped Areas at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

Agricultural area and number		Cities, towns, and farmsteads			Water surfaces of canals, laterals, drains, and waste ditches			Areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads and railroads			Nongrowing season in areas other than yearlong growth. Winter use on cropped areas		
		Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
ARIZONA													
A-1-LC	Springerville	450	1.51	680	27	1.69	46	138	1.81	250	5,433	0.08	435
A-2-LC	St. Johns	430	1.62	697	22	2.68	59	115	2.12	244	4,515	.08	361
A-3-LC	Concho	100	1.62	162	1	2.68	3	6	2.12	13	233	.08	19
A-4-LC	Silver Creek	672	1.56	1,048	27	1.89	51	154	1.75	270	5,545	.08	444
A-5-LC	Woodruff	82	1.66	136	2	3.08	6	10	2.41	24	413	.08	33
A-6-LC	Black Creek	110	1.50	165	3	3.64	11	16	1.90	30	579	.08	46
A-7-LC	Holbrook	1,720	1.70	2,924	9	3.52	32	53	2.65	140	1,925	.08	154
A-8-LC	Hopi, Ganado & Leupp	170	1.60	272	4	3.77	15	21	2.25	47	839	.08	67
A-9-LC	Moenkopi	170	1.62	275	4	4.18	17	21	2.33	49	831	.08	66
A-1-C	Kanab Creek	127	1.63	207	10	3.70	37	54	2.31	125	2,111	.08	169
A-2-C	Havasu Creek	10	1.93	19	1	4.16	4	4	3.14	13	156	.08	12
A-3-C	Hualpai Reservation & Meriwitica	10	1.93	19	1	4.16	4	2	3.14	6	87	.08	7
A-4-C	Grand Wash	1	1.88	2	1	4.48	4	1	3.19	3	55	.08	4
A-1-V	Short Creek	25	1.63	41	1	3.68	4	2	2.28	5	75	.08	6
A-2-V	Littlefield	75	2.00	150	4	4.87	19	20	3.71	74	781	.08	62
A-5-C	Davis Dam to Topock	10	2.21	22	3	5.47	16	16	3.74	60	-	-	-
A-1-BW	Big Sandy	60	1.95	117	12	3.22	39	61	3.09	188	2,417	.08	193
A-2-BW	Santa Maria	125	1.95	244	7	3.22	23	39	3.09	121	1,413	.08	113
A-6-C	Colorado River Indian Reservation	231	2.14	494	20	5.50	110	112	3.51	393	-	-	-
A-7-C	North and South	80	2.12	170	20	5.75	115	130	3.77	490	-	-	-

Table 10 (Continued)

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Noncropped Areas at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

Agricultural area and number		Cities, towns, and farmsteads			Water surfaces of canals, laterals, drains, and waste ditches			Areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads, and railroads			Nongrowing season in areas other than yearlong growth. Winter use on cropped areas		
		Area	Rate	Use	Area	Rate	Use	Area	Rate	Use	Area	Rate	Use
		Acres	Feet	Ac-ft	Acres	Feet	Ac-ft	Acres	Feet	Ac-ft	Acres	Feet	Ac-ft
ARIZONA (Continued)													
A-8-C	Yuma Valley	2,570	2.12	5,448	199	5.75	1,144	1,127	3.77	4,249	-	-	-
A-9-C	Yuma Mesa	16	2.21	35	4	6.52	26	25	3.92	98	-	-	-
A-1-G	Duncan Valley	470	1.89	888	21	2.95	62	120	2.84	341	4,339	0.08	347
A-2-G	Alpine	25	1.35	34	-	-	-	-	-	-	-	-	-
A-3-G	San Francisco River	565	1/	4,803	1	3.02	3	7	2.10	15	292	.08	23
A-4-G	Eagle Creek	620	1/	4,903	3	3.25	10	13	2.50	33	516	.08	41
A-5-G	Portal	11	1.71	19	-	-	-	1	2.02	2	38	.08	3
A-6-G	San Simon Creek	135	1.88	254	4	4.07	16	19	3.18	60	-	-	-
A-7-G	Safford Valley	1,770	1.94	3,434	127	3.29	418	718	3.23	2,319	25,917	.08	2,073
A-8-G	San Carlos Indian Res.	115	2.00	230	5	4.72	24	25	3.19	80	917	.08	73
A-9-G	Hereford Valley	25	1.94	49	2	3.80	8	9	3.14	28	320	.08	26
A-10-G	Middle San Pedro River	500	1.93	965	17	4.02	68	99	3.06	303	3,565	.08	285
A-11-G	Lower San Pedro River	210	1.93	405	6	4.13	25	31	2.94	91	1,240	.08	99
A-12-G	Coolidge Dam to Kelvin	638	1/	5,633	2	4.13	8	13	3.01	39	465	.08	37
A-13-G	San Rafael Ranch	10	1.93	19	1	3.06	3	8	2.65	21	300	.08	24
A-14-G	Santa Cruz County	1,910	1.93	3,686	15	3.21	48	84	2.82	237	3,025	.08	242
A-15-G	Pima County	4,303	2.06	8,864	98	4.02	394	555	2.76	1,532	-	-	-
A-16-G	Pinal County	4,270	2.13	9,095	333	4.90	1,632	1,881	3.15	5,925	-	-	-
A-17-G	Black River	3	1.60	5	1	1.62	2	4	1.40	6	-	-	-
A-18-G	Fort Apache Ind. Res.	274	1.69	463	10	2.26	23	54	2.09	113	1,948	.08	156
A-19-G	Cherry Creek	3	1.84	6	1	2.49	2	4	2.03	8	-	-	-
A-20-G	Salt River Canyon	1	2.08	2	10	3.34	33	1	3.38	3	42	.08	3

Table 10 (Continued)

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Noncropped Areas at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

Agricultural area and number		Cities, towns, and farmsteads			Water surfaces of canals, laterals, drains, and waste ditches			Areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads, and railroads			Nongrowing season in areas other than yearlong growth. Winter use on cropped areas		
		Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft
ARIZONA (Continued)													
A-21-G	Tonto Creek	19	1.83	35	5	2.29	11	29	2.29	66	-	-	-
A-22-G	Verde River upstream from Camp Verde	4,735	1.90	8,996	35	2.92	102	198	2.75	545	-	-	-
A-23-G	Middle Verde River	192	1.79	344	1	1.90	2	3	2.19	7	-	-	-
A-24-G	Fort McDowell Indian Reservation	3	2.13	6	1	5.71	6	4	2.72	11	-	-	-
A-25-G	Upper Agua Fria River	305	1.86	567	2	2.55	5	9	2.77	25	-	-	-
A-26-G	Maricopa Co. upstream from Gillespie Dam	14,689	2.11	30,994	1,398	3.95	5,522	7,905	3.18	25,138	-	-	-
A-27-G	Gillespie Dam to Dome	600	2.21	1,326	66	6.02	397	372	3.74	1,391	-	-	-
CALIFORNIA													
	City of Needles	900	2.21	1,989	-	-	-	-	-	-	-	-	-
C-1-C	Palo Verde District	1,074	2.17	2,331	149	5.65	842	846	3.80	3,215	-	-	-
C-2-C	Yuma Valley	250	2.12	530	43	5.75	247	246	3.77	927	-	-	-
NEVADA													
N-1-V	Virgin River	243	2.11	513	9	5.26	47	49	3.83	188	1,912	0.08	153
N-2-V	Meadow Valley Wash	1,000	1.61	1,610	16	3.61	58	89	2.30	205	3,227	.08	258
N-3-V	Muddy River	360	2.07	745	17	5.27	90	86	4.02	348	3,400	.08	272
	Henderson & Boulder City	2/		1,400	-	-	-	-	-	-	-	-	-

Table 10 (Continued)

LOWER COLORADO RIVER BASIN

Consumptive Use of Irrigation Water by Noncropped Areas at Sites of Use

Average annual use in acre-feet — October 1, 1913-September 30, 1945

Agricultural area and number		Cities, towns, and farmsteads			Water surfaces of canals, laterals, drains, and waste ditches			Areas of vegetation within rights-of-way for canals, laterals, drains, waste ditches, roads, and railroads			Nongrowing season in areas other than yearlong growth. Winter use on cropped areas		
		Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac-ft	Area Acres	Rate Feet	Use Ac ft
NEW MEXICO													
NM-2-LC	Zuni River	265	1.55	411	18	3.38	61	93	1.92	179	-	-	-
NM-3-LC	Puerco River	1,690	1.53	2,586	2	3.65	7	10	1.85	19	379	0.08	30
NM-1-G	Gila River upstream from Virden	560	1.73	969	28	2.67	75	147	2.40	353	5,771	.08	462
NM-2-G	Virden Valley	140	1.89	265	11	2.95	32	56	2.84	159	2,219	.08	178
NM-3-G	San Francisco River	500	1.53	765	15	2.33	35	75	1.73	130	2,969	.08	238
UTAH													
U-1-C	Kanab Creek	442	1.53	676	17	3.43	58	90	1.98	178	3,550	.08	284
U-1-V	Virgin River	2,680	1.78	4,770	74	3.78	280	384	2.65	1,018	15,127	.08	1,210
MEXICO													
M-1-G	San Pedro River	10	1.94	19	3	3.57	11	16	3.14	50	583	.08	47
M-2-G	Santa Cruz River	810	1.93	1,563	17	3.13	53	94	2.71	255	3,405	.08	272

1/ Includes industrial use.

2/ 1914-1945 average annual water pumped from Lake Mead for Henderson area (1,200 acre-feet) less estimated 10 percent return flow or 1,100 acre-feet. Boulder City average area (1914-1945) of 154 acres at 2.05 acre-feet an acre or 300 acre-feet.

estimating factors other than bank storage in the hydrologic equations for stream sections are generally available and inflow-outflow relationships have been used to provide the bases for determining changes in bank storage.

Because the smaller reservoirs were filled and emptied annually and changes in surface storage were not determined for them, bank storage by the smaller reservoirs in the Lower Colorado River Basin was considered to have no appreciable effect on 1914-1945 average stream flow. The storage was very small in Bartlett Reservoir on the Verde River, Lake Pleasant on the Agua Fria River, and San Carlos Reservoir on the Gila River on September 30, 1945. These reservoirs were not in operation at the start of the study period and the effect of accretions to ground-water storage in their vicinity would be negligible on the 1914-1945 average flow of their respective streams. Estimates of bank storage were not determined for the three reservoirs.

Bank storage in Lake Mead was determined as the differential in the hydrologic equation resulting from inflow-outflow studies on an annual basis. Total capacity of Lake Mead is 32,359,000 acre-feet and storage began in February 1935. The annual contributions of runoff from the ungaged drainage area upstream from Hoover Dam were determined for water years 1914 through 1934 as the differentials of the annual hydrologic equations resulting from the recorded and estimated flows of the Colorado River below Hoover Dam and the sums of the recorded and estimated flows of the Colorado River near Grand Canyon, Bright Angel Creek near Grand Canyon, and the Virgin River at

Littlefield less channel losses and stream depletions downstream from the stream gaging stations to Hoover Dam. Annual contributions of runoff from the ungaged drainage area were then estimated for 1935 through 1945 by percentage correlation with the average of the precipitation at six Weather Bureau stations scattered throughout the ungaged drainage area based on the relationship of the average unmeasured runoff and average precipitation for the 1914-1934 period. The adequacy of the resultant unmeasured runoff relationship of the 1914-1934 period to the 1914-1945 period was corroborated by comparison with the runoff relationships of the same periods for the Bill Williams River at Planet, Arizona, the Virgin River at Virgin, Utah, and the Gila River near Red Rock, New Mexico.

Annual accretions and withdrawals of bank storage at Lake Mead were then determined for the water years 1935 through 1945 as the differentials of the annual hydrologic equations resulting from the recorded flow of the Colorado River below Hoover Dam and the sum of the measured inflows and estimated inflow from the intermediate drainage area less (1) stream depletions by crops and noncropped areas downstream from the gaging stations to Hoover Dam, (2) channel losses downstream from the gaging stations to the reservoir area, (3) estimated channel losses under natural conditions within the reservoir area, (4) reservoir depletions by increased evaporation and transpiration within the reservoir area, and (5) changes in surface storage in Lake Mead. The total bank storage for the 1914-1945 period was determined as the algebraic sum of the annual accretions and withdrawals and the annual depletion by bank storage was computed as the average for the 32-year period.

The total capacity of Havasu Lake is 716,600 acre-feet and storage began in July 1938. Records of the flow of the Colorado River below Parker Dam are available since October 1934 and are considered to be excellent by the Geological Survey. Backwater at the Topock gaging station began November 4, 1939, as the result of storage in Havasu Lake and records of the flow of the Colorado River near Topock since that date are considered to be only good by the Geological Survey. Results of an inflow-outflow study for the Colorado River section between the gages near Topock and below Parker Dam for the 1938-1945 period as determined by the records of the gaging stations indicated an inflow from the intermediate drainage area of a quantity not consistent with the runoff capabilities of the watershed. Therefore, the inflow-outflow study could not be used to evaluate bank storage.

Total bank storage determined for Lake Mead was 12.5 percent of the total accretion of surface storage in that reservoir for the period of study. On the basis that bank storage in Havasu Lake would bear the same relationship to surface storage accretion as that determined for Lake Mead, it was estimated that total bank storage in Havasu Lake for the period would be 12.5 percent of the total surface storage accretion of 672,900 acre-feet or 84,100 acre-feet. Average annual bank storage for the 32-year period would thus be 2,600 acre-feet.

The Salt River storage system in Arizona comprises four reservoirs and the dams, considered in downstream order together with dates of completion and respective reservoir capacities, are Roosevelt, 1911, 1,398,000 acre-feet; Horse Mesa, 1927, 245,000 acre-feet; Mormon Flat, 1925, 58,000 acre-feet; and Stewart Mountain, 1930, 70,000 acre-

feet. Storage in Roosevelt Lake was 182,200 acre-feet on October 1, 1913 and total storage in the system on September 30, 1945, was 970,300 acre-feet. This increase of 788,100 acre-feet in surface storage indicated an accretion to bank storage for the 1914-1945 period. The wide fluctuations in surface storage over the 1914-1945 period and during the individual years indicated that there were also wide fluctuations in the bank storage in the vicinity of the reservoirs. However, the correlative data necessary for the determination of the increments and decrements of bank storage on an annual basis would require the estimation for individual years of other factors in the hydrologic equation. Errors in the estimates of these factors for individual years could result in estimates of changes in bank storage not consistent with the quantities of water involved. Estimates prepared on a long-term basis tend to extenuate these inconsistencies and provide better correlation relationships. Therefore, the evaluation of bank storage in the Salt River Reservoir system was based on average annual conditions for the 1914-1945 period because the inadequacy of recorded data and the relatively small quantity of stream depletion involved did not warrant further refinement.

Measurements of inflow to the Salt River Reservoir system have been recorded or estimated throughout the 1914-1945 period for gages on the Salt River and Tonto Creek near Roosevelt. Granite Reef Dam on the Salt River about four miles downstream from the Verde River is the nearest downstream gaging station at which records are complete for the 1914-1945 period. Measurements of the flow of Tonto Creek at the present site above Gun Creek since January 1941 were adjusted for

downstream contributions to complete the record at the downstream site near Roosevelt for the 1914-1945 period. There were 1,140 square miles of drainage area tributary to the Salt River, exclusive of the Verde River, between the inflow gages above Roosevelt Lake and the Station at Granite Reef Dam during the 1914-1945 period. Prior to 1925, the flow of the Verde River was measured near the mouth. From 1925 through 1941, there were 440 square miles of ungaged Verde River drainage area above the mouth and from 1942 through 1945, the ungaged drainage area above the mouth of the Verde River was 461 square miles.

The high gradient and general proximity of the contributory area to the main streams are among the chararacteristics that identify the ungaged drainage area as an area with high runoff in relation to precipitation. On the basis of the relationship of runoff to precipitation in other stream sections of the Salt River drainage system with similar drainage characteristics, a runoff rate of 10 percent of the precipitation was adopted as a conservative estimate. The average annual contribution from the ungaged drainage area was computed from a total runoff derived for the 1914-1945 period by applying the average runoff rate to the 1,140 square miles in the Salt River section for the entire period and average runoff rates for 1925-1941 and 1942-1945 to 440 and 461 square miles in the Verde River section for their respective periods.

The average annual stream depletion by bank storage in the Salt River Reservoir system was determined for the 1914-1945 period as the differential of the 1914-1945 average annual inflow-outflow

relationship for the stream section between Granite Reef Dam and upstream gages adjusted for other 1914-1945 average depletions within the intermediate drainage and reservoir areas.

Stream depletions at sites of use by the water withheld by accretions of surface and bank storage in reservoirs within the Lower Colorado River Basin are summarized in accompanying Table 11.

(e) Transbasin Diversions - Export diversions of water of the Lower Colorado River system for use outside of the natural drainage area of the Lower Colorado River during the 1914-1945 period were discussed in the section of this report on basic data. Transbasin exports are summarized in the following tabulation:

Diversion	Export stream	State	1914-1945 average annual export in acre-feet
New Castle Project	Virgin	Utah	1,200
Colorado River Aqueduct	Colorado	California	14,500
All-American Canal	Colorado	California	341,900
Alamo Canal	Colorado	California	2,075,600
Total			2,433,200

The depletive effects of transtributary diversions or transfers of water between tributary drainage areas within the stream system of the Lower Colorado River drainage area and diversions bypassing key gaging stations are reflected in changes in the conveyance losses in the affected stream sections. These changes are discussed in this section of the report in connection with the routing of water from the headwaters downstream from Lee Ferry to the International Boundary under historic and virgin conditions.

Table 11
LOWER COLORADO RIVER BASIN
Stream Depletion by Change in Storage in Reservoirs at Sites of Use

Depletion in 1,000 acre-feet — October 1, 1913-September 30, 1945

Reservoir	Location		Change in storage in reservoirs			
			Surface storage		Bank storage	
	River	State	Total accretion	Average annual accretion	Total accretion	Average annual accretion
Lake Mead	Colorado	Arizona-Nevada	24,827.0	775.8	3,114.0	97.3
Havasu Lake	Colorado	Arizona-California	672.9	21.0	84.1	2.6
San Carlos Reservoir	Gila	Arizona	54.7	1.7	Negligible	0
Salt River Reservoir System	Salt	Arizona	788.1	24.6	115.2	3.6
Bartlett Reservoir	Verde	Arizona	3.1	.1	Negligible	0
Lake Pleasant	Agua Fria	Arizona	12.0	.4	Negligible	0
Total			26,357.8	1/ 823.6	3,313.3	103.5

1/ This quantity is the summation of the individual items and does not check the average indicated by the total accretions because of rounding of the individual averages

There were no imports of water to the Lower Colorado River system from outside drainage areas during the 1914-1945 period.

(f) Depletions of Ground-water Basins - Withdrawals of ground-water which had been stored under natural conditions prior to the 1914-1945 period supplied a portion of the consumptive use requirements of some areas during the period and stream depletions at sites of use were reduced to the extent of the respective ground-water depletions. Ground-water depletions at sites of use were discussed and tabulated in Table 4 in the section of this report on basic data.

(g) Summary - Average annual consumptive use of irrigation water by crops and noncropped areas at sites of use for the 1914-1945 period are summarized in accompanying Table 12.

A general summary of 1914-1945 average annual man-made depletions at sites of use is given in accompanying Table 13.

2. Channel Losses

Channel losses are natural depletions of stream flow which may be affected by the activities of man. Therefore, it was necessary to determine channel losses because they are important factors in the hydrologic equations of stream sections. The activities of man have caused changes in the evaporation from exposed water surfaces and wetted channel areas, and in the consumptive use of water by vegetation in the flood plains of the streams. Estimates of the depletions by these major causes of losses in stream channels were made for all stream sections from the headwaters downstream from Lee Ferry to the Limitrophe Section of the International Boundary for 1914-1945 average conditions and for virgin conditions.

Table 12
LOWER COLORADO RIVER BASIN
Summary of Consumptive Use of Irrigation Water
by Crops and Noncropped Areas at Sites of Use

Average annual use in 1,000 acre-feet October 1, 1913-September 30, 1945

Agricultural area and number		Crops	Cities, towns, and farmsteads	Other noncropped areas	Total
ARIZONA					
A-1-LC	Springerville	6.6	0.7	0.7	8.0
A-2-LC	St. Johns	7.6	.7	.7	9.0
A-3-LC	Concho	.2	.2	0	.4
A-4-LC	Silver Creek	6.5	1.0	.8	8.3
A-5-LC	Woodruff	.8	.1	.1	1.0
A-6-LC	Black Creek	.6	.2	.1	.9
A-7-LC	Holbrook	3.4	2.9	.3	6.6
A-8-LC	Hopi, Ganado, and Leupp	1.1	.3	.1	1.5
A-9-LC	Moenkopi	1.1	.3	.1	1.5
A-1-C	Kanab Creek	4.2	.2	.3	4.7
A-2-C	Havasu Creek	.4	0	0	.4
A-3-C	Hualpai Res. & Meriwitica	.2	0	0	.2
A-4-C	Grand Wash	.1	0	0	.1
A-1-V	Short Creek	.1	.1	0	.2
A-2-V	Littlefield	2.3	.2	.2	2.7
A-5-C	Davis Dam to Topock	1.3	0	.1	1.4
A-1-BW	Big Sandy	5.6	.1	.4	6.1
A-2-BW	Santa Maria	3.1	.2	.3	3.6
A-6-C	Colorado River Indian Res.	12.8	.5	.5	13.8
A-7-C	North & South Gila Valleys	19.7	.2	.6	20.5
A-8-C	Yuma Valley	141.9	5.4	5.4	152.7
A-9-C	Yuma Mesa 1/	8.5	.1	.3	8.9
A-1-G	Duncan Valley	7.3	.9	.8	9.0
A-2-G	Alpine	0	0	0	0
A-3-G	San Francisco River	.5	4.8	0	5.3
A-4-G	Eagle Creek	.9	4.9	.1	5.9
A-5-G	Portal	.1	0	0	.1
A-6-G	San Simon Creek	1.5	.3	.1	1.9
A-7-G	Safford Valley	53.1	3.4	4.8	61.3
A-8-G	San Carlos Indian Res.	1.4	.2	.2	1.8
A-9-G	Hereford Valley	.7	0	.1	.8
A-10-G	Middle San Pedro River	8.6	1.0	.7	10.3
A-11-G	Lower San Pedro River	3.0	.4	.2	3.6
A-12-G	Coolidge Dam to Kelvin	1.2	5.6	.1	6.9
A-13-G	San Rafael Ranch	.7	0	.1	.8
A-14-G	Santa Cruz County	5.6	3.7	.5	9.8
A-15-G	Pima County	46.0	8.9	1.9	56.8
A-16-G	Pinal County	173.8	9.1	7.6	190.5
A-17-G	Black River	.1	0	0	.1

Table 12 (Continued)
LOWER COLORADO RIVER BASIN
Summary of Consumptive Use of Irrigation Water
by Crops and Noncropped Areas at Sites of Use

Average annual use in 1,000 acre-feet October 1, 1913-September 30, 1945

Agricultural area and number		Crops	Cities, towns, and farmsteads	Other noncropped areas	Total
ARIZONA (Continued)					
A-18-G	Fort Apache Indian Res.	2.5	0.5	0.3	3.3
A-19-G	Cherry Creek	.2	0	0	.2
A-20-G	Salt River Canyon to Roosevelt	.1	0	0	.1
A-21-G	Tonto Creek	1.3	0	.1	1.4
A-22-G	Verde River upstream from Camp Verde	15.2	9.0	.6	24.8
A-23-G	Middle Verde River	.2	.3	0	.5
A-24-G	Fort McDowell Indian Res.	.3	0	0	.3
A-25-G	Upper Agua Fria River	.6	.6	0	1.2
A-26-G	Maricopa County upstream from Gillespie Dam	819.0	31.0	30.7	880.7
A-27-G	Gillespie Dam to Dome	46.3	1.3	1.8	49.4
ARIZONA Total		1,418.3	99.3	61.7	1,579.3
CALIFORNIA					
	City of Needles	0	2.0	0	2.0
C-1-C	Palo Verde District	101.1	2.3	4.1	107.5
C-2-C	Yuma Valley	29.7	.5	1.2	31.4
CALIFORNIA Total		130.8	4.8	5.3	140.9
NEVADA					
N-1-V	Virgin River	6.0	.5	.4	6.9
N-2-V	Meadow Valley Wash	6.0	1.6	.5	8.1
N-3-V	Muddy River	11.0	.7	.7	12.4
	Henderson Area & Boulder City	0	1.4	0	1.4
N-2-C	Hoover Dam to Davis Dam	.3	0	0	.3
NEVADA Total		23.3	4.2	1.6	29.1
NEW MEXICO					
NM-2-LC	Zuni River	4.6	0.4	0.2	5.2
NM-3-LC	Puerco River	.6	2.6	.1	3.3
NM-1-G	Gila River upstream from Virden	9.3	1.0	.9	11.2

Table 12 (Continued)
LOWER COLORADO RIVER BASIN
Summary of Consumptive Use of Irrigation Water
by Crops and Noncropped Areas at Sites of Use

Average annual use in 1,000 acre-feet October 1, 1913-September 30, 1945

Agricultural area and number	Crops	Cities, towns, and farmsteads	Other noncropped areas	Total
NEW MEXICO (Continued)				
NM-2-G Virden Valley	4.0	0.3	0.4	4.7
NM-3-G San Francisco River	3.3	.8	.4	4.5
NEW MEXICO Total	21.8	5.1	2.0	28.9
UTAH				
U-1-C Kanab Creek	6.1	.7	.5	7.3
U-1-V Virgin River	28.1	4.8	2.5	35.4
UTAH Total	34.2	5.5	3.0	42.7
MEXICO				
M-1-G San Pedro River	1.3	0	.1	1.4
M-2-G Santa Cruz River	6.0	1.6	.6	8.2
MEXICO Total	7.3	1.6	.7	9.6
LOWER BASIN TOTAL	1,635.7	120.5	74.3	1,830.5

1/ Drainage investigations indicate that the practice of irrigation on Yuma Mesa has caused a semiperched ground-water table beneath the irrigated area with an average annual return flow of only 300 acre-feet to the Colorado River system for the 1914-1945 period. Average annual (1914-1945) stream depletion by man on Yuma Mesa would thus be the water pumped to the mesa by the Yuma Mesa and "B" lift pumping plants (1,900 acre-feet plus 7,300 acre-feet) less return flow of 300 acre-feet or 8,900 acre-feet. This depletion has been distributed to crops and noncropped areas in proportion to the respective consumptive use requirements computed for them.

Table 13
LOWER COLORADO RIVER BASIN
Man-Made Depletions at Sites of Use

Average annual depletion in 1,000 acre-feet — October 1, 1913-September 30, 1945

Type of Use	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Cropped lands 1/	1,418.3	130.8	23.3	21.8	34.2	7.3	-	1,635.7
Cities, towns, and farmsteads 1/	99.3	4.8	4.2	5.1	5.5	1.6	-	120.5
Other noncropped areas 1/	2/ 61.8	2/ 5.6	1.6	2.0	3.0	.7	-	2/ 74.7
Stream depletions by reservoirs:								
Evaporation depletions	62.4	-	-	4.3	1.6	-	278.4	346.7
Accretions to surface storage	26.8	-	-	-	-	-	796.8	823.6
Accretions to bank storage	3.6	-	-	-	-	-	99.9	103.5
Transbasin exports	-	2,432.0	-	-	1.2	-	-	2,433.2
Subtotal	1,672.2							5,537.9
Less water supplied by depletions of ground-water basins	176.3	-	-	-	-	-	-	176.3
Total	1,495.9	2,573.2	29.1	33.2	45.5	9.6	1,175.1	5,361.6

1/ The quantities listed for these types are the consumptive uses of irrigation water at sites of use. Net depletions at sites of use are these quantities less the uses by the native vegetation in these areas under virgin conditions.

2/ Depletions by water surface evaporation and vegetative growth along the All-American Canal from Imperial Dam to Pilot Knob were estimated to average 400 acre-feet a year for the 32-year period. On the basis of proportionate use of diversions, these depletions were distributed as 100 acre-feet a year to Arizona and 300 acre-feet a year to California and the respective depletions are included in these totals as additions to depletions listed in Tables 10 and 12.

(a) Evaporation from Channel Water Surfaces - The evaporation from the water surfaces of stream channels was computed by applying the evaporation rate for free water surface for the period of exposure to the areas of exposure determined for the respective stream sections. As reservoir depletions were considered as only the increased losses within the reservoir area as compared with natural conditions, water surface evaporation from stream sections containing reservoirs were determined on the basis of conditions existing without reservoir development.

Recorded and estimated land pan evaporation rates for stations dispersed throughout the Lower Colorado River Basin are listed in Tables 4 and 5 of Appendix A and in Table 1 in the section of this report pertaining to climatological data. A conversion factor of 0.70 was applied to these land pan rates to reduce them to free water surface evaporation rates. Most of the flood channel areas of the Lower Colorado River are occupied by native vegetation which shaded the water surface during high-water periods. It was estimated that the average evaporation rate from these shaded areas would be 50 percent of the normal free water surface evaporation. These shaded areas were determined from aerial photographs and the reduced rates were applied in computing the water surface evaporation from them.

The average area of the water surface for each of the several stream sections of the Colorado River system was computed by applying the length of the river section to the average width of water surface determined for the section. The average width of water surface was determined from a solution of the hydraulic properties of the

stream section based on average flow and the average slope of the section and average cross-section determined from plan and profile maps. Where plan and profile maps were not available, the average cross-sections were determined from aerial photographs and other maps supplemented by data obtained by field inspection. The average cross-section was computed as the weighted average of the cross-sections measured at intervals of one to five miles.

Average annual evaporation from the surface of most of the stream sections of tributaries of the Colorado River was determined for the 1914-1945 period by application of the average annual water surface evaporation rate determined for one or more stations in the vicinity to the 1914 1945 average annual area of water surface of the stream section. The average annual width of water surface was determined by solution of the hydraulic properties of the stream section by application of average capacity based on average flow throughout the year. The average annual flow for the stream section was considered the average of the historical inflow and outflow recorded or estimated for the 1914-1945 period.

Average annual evaporation under virgin flow conditions for the 1914-1945 period was then determined by this method using the same criteria except that the capacity was changed to correspond with the increase in average annual flow over average historic stream flow as indicated by average annual depletions for the period. The reductions in evaporation losses under historic conditions constitute salvages deductible from man-made depletions at sites of use.

The average annual water surface evaporation for 1914-1945 historic and virgin flow conditions was determined on an annual basis

as described above for all stream sections on tributaries of the Lower Colorado River except in the Gila River drainage system downstream from Granite Reef Dam on the Salt River and on the Gila River downstream from the confluence of the Salt and Gila Rivers. Appreciable changes in water surface evaporation between virgin and historic flow conditions were indicated for only a few of these stream sections. The narratives of early explorers and statements of early settlers indicate that there have been some changes in the cross-sections and hydraulic properties of some stream sections since man-made developments were started in the Lower Colorado River Basin but the data were not generally adequate to provide bases for estimating the changes that may have occurred. The small differences between historic and virgin flows, the relatively small flows involved, and the inadequacy of topographical and other data did not warrant further refinement in the estimates as derived for the above-mentioned stream sections. However, various refinements were added to the foregoing method in determining water surface evaporation for stream sections in the Lower Gila River system and the main stream of the Colorado River.

Water surface evaporation from the stream section downstream from Granite Reef Dam on the Salt River to the confluence of the Salt and Gila Rivers and thence downstream on the Gila River to Gillespie Dam was estimated on the basis of average monthly historic and virgin flow conditions. Hydraulic properties were determined from capacities based on average flow during the months and the average monthly evaporation rates were applied to the average monthly areas determined for historic and virgin conditions. Average annual depletions were

distributed equally throughout the year in determining virgin flow conditions. The capacities of the Salt River section were based on the average monthly historic flows of the Salt River below Granite Reef Dam and the capacities of the Gila River section were based on the historic flows of the Gila River at Gillespie Dam upstream from diversions at the dam.

Estimates of water surface evaporation from the stream section of the Gila River between Gillespie Dam and Dome were derived on an average monthly basis for the 1914-1945 period with capacities based on averages of the flows of the Gila River below Gillespie Dam and the Gila River near Dome. Average annual depletions were distributed equally throughout the year in deriving virgin flow conditions.

Water surface evaporation from the stream section of the Gila River between Dome and the mouth was estimated for 1914-1945 historic and virgin flow conditions on an average monthly basis with capacities based on flows of the Gila River near Dome.

Estimates of water surface evaporation from stream sections of the main stream of the Colorado River downstream from Lee Ferry were derived on an average monthly basis for 1914-1945 historic and virgin flow conditions with average cross-sections and slopes determined by measurements on plan and profile maps. Cross-sections were measured at intervals of one mile and average slopes determined from the elevations at each end of the selected stream sections.

Capacities or rates of flow for the section from Lee Ferry to Grand Canyon were based on steady flow of the averages of the monthly flows of the Colorado River at Lee Ferry and near Grand

Canyon. Irrigation practices in many areas upstream from Lee Ferry and Grand Canyon reflect the lack of an assured water supply throughout the growing season. Except in a few areas with developed storage, heavy diversions usually start before the growing season and continue as long as flow is available. In this manner the irrigation period is sustained by return flows. Assuming that diversions start in the latter part of April and that by August depletions are less than return flow, average annual irrigation depletions were distributed as April, 5 percent; May, 45 percent; June, 35 percent; and July, 15 percent in adjusting 1914-1945 average historic flows to reflect virgin flow conditions.

Capacities for the stream section from Grand Canyon to Hoover Dam were based on averages of the flows of the Colorado River near Grand Canyon and below Hoover Dam with increased irrigation depletions distributed on the same basis as upstream from Grand Canyon, and reservoir evaporation and storage depletions distributed as they occurred monthly. However, because of topographical changes, the stream section was divided into two segments with a segment from Grand Canyon to Pierce Ferry and thence to Hoover Dam.

Rates of flow for the stream section from Hoover Dam to Davis Dam were based on average monthly flows of the Colorado River below Hoover Dam and capacities for the section from Davis Dam to Topock were determined from averages of the flows of the Colorado River below Hoover Dam and near Topock.

The capacities of the stream section from Topock to Laguna Dam were based on averages of the monthly flows of the Colorado River

near Topock and at Laguna Dam. Flow of the Colorado River at Laguna Dam was computed as the flow of the Colorado River at Yuma plus diversions at Laguna and Imperial Dams less flow of the Gila River near Dome. Rates of flow for the stream section from Laguna Dam to Yuma and thence to the International Boundary were determined from average monthly flows of the Colorado River at Yuma. Increases in average annual irrigation depletions downstream from Topock were distributed equally throughout the year and transbasin diversions and reservoir evaporation and storage depletions were distributed as they occurred monthly.

Levees to protect the Palo Verde District and the areas downstream from Laguna Dam to the International Boundary had been constructed prior to the 1914-1945 period. These channel improvements reduced the cross-section of the stream in the river sections involved for the 1914-1945 period and the reduced area of exposed water surface during periods of high flows effected reductions in water surface evaporation as compared with natural conditions. Although the river overflowed some of the levee sections a few times during the 1914-1945 period, the areas were inundated for only short periods and the increase of evaporation was considered negligible for average 1914-1945 conditions.

(b) Consumptive Use of Water by Native Vegetation in Channel Areas - The consumptive use of water by native vegetation in the channels and flood plains of streams was computed by applying unit rates of use to areas of various densities and types of vegetation as determined by field surveys. Because stream depletions by river

bottom growth are important factors in the hydrologic equations of stream sections, a survey was made of all areas in the Lower Colorado River system downstream from the headwater sections of tributaries. However, only those areas in the headwater sections were surveyed which apparently had been influenced to some extent by the activities of man. In conducting the field survey, personnel marked the areas of native vegetation on aerial photographs together with appropriate notes on densities and types of vegetation indicative of present conditions. The narratives of early explorers, statements of early settlers, early photographs, and other historical data provided the bases for adjusting the data obtained by the survey for present conditions to conform with average conditions for the 1914-1945 period and to reflect virgin conditions.

The vegetation was classified in five types: namely, (1) salt cedar, (2) cottonwood, (3) baccharis and other phreatophytic brushes, (4) mesquite, and (5) tules. Volume densities of the various types of vegetation were computed on a percentage basis from the areal and vertical densities determined from the aerial photographs and field survey in accordance with the method outlined in Geological Survey Water-Supply Paper 1103, "Use of Water by Bottom-Land Vegetation in Lower Safford Valley, Arizona".

Unit rates of normal consumptive use were computed by applying the appropriate consumptive use coefficient (K) to the consumptive use factors (F) of the respective areas. The consumptive use coefficients for the various types of native vegetation as originally developed are for areas of 100 percent volume densities.

These were modified for application to areas with less than 100 percent density by multiplying by the actual volume densities in terms of percent. The consumptive use coefficients (K) of the various types of vegetation for 100 percent volume density were obtained from the Blaney-Harris report. The effective precipitation for the respective stream sections was subtracted from the total consumptive use requirement to obtain the rate of stream depletion for each type and density of native vegetation at the respective sites of use. The rates for the various types and densities of vegetation at sites of use are listed in the Blaney-Harris report, Appendix B of this report.

The rates were applied to the areas of each type and density of vegetation determined for the respective stream sections to compute the stream depletions by native vegetation at sites of use for average 1914-1945 and virgin conditions.

(c) Replacement of Native Vegetation - The areas of native vegetation that have been replaced by crops, cities and towns, roads and railroads, and areas incidental to irrigation and irrigated farming were determined for the various stream sections and the respective rates of use by the native vegetation for virgin conditions were applied to determine the stream depletions by these areas under virgin conditions. The natural depletions of stream flow by these areas prior to the settlement by man represent salvages deductible from the consumptive use by man-made developments at the respective sites of use in determining stream depletions by these developments in the various stream sections.

(d) Summary of Channel Losses - Accompanying Table 14 has been prepared to summarize channel losses at sites of use in the Lower Colorado River Basin together with salvages or increased losses effected by (1) the reduction of water surface evaporation caused by reduced flows during the 1914-1945 period, (2) the replacement of native vegetation by crops and other beneficial uses, and (3) changes in types and density of native vegetation attributable to man.

3. Summary

Accompanying Table 15 has been prepared to summarize the man-made stream depletions at sites of use in the Lower Colorado River Basin and to compute the net man-made stream depletions in the Lower Colorado River Basin as measured at the International Boundary between the United States and Mexico. The derivations of the salvaged channel losses listed in this table are shown in the notes accompanying Table 23.

B. Water Contributions by States

The average annual contributions to the flow of the Colorado River and its tributaries by the several states and Mexico in the Lower Basin were determined for the 1914-1945 period under historic and under virgin flow conditions. The derivation of the historic and virgin contributions at selected gaging stations, state lines, and other division points downstream from the headwaters in the Lower Basin to the Limitrophe Section at the International Boundary is shown in Tables 22 and 23 at the end of this section. These routing tables present detailed analyses of the historic and virgin contributions and the derivation of each item is discussed in the notes accompanying each table.

Table 14
LOWER COLORADO RIVER BASIN
Channel Losses and Salvage at Sites of Use
Annual Averages in 1,000 Acre-Feet for 1914-1945 Period and Virgin Flow Conditions

River section	Water surface evaporation			Native Vegetation			
	Conditions			Conditions		Salvage	
	Virgin	1914-1945	Salvage	Virgin	1914-1945	Replace-ment	Growth change
MAIN STREAM OF THE COLORADO RIVER, LEE FERRY TO INTERNATIONAL BOUNDARY							
Colorado River, Lee Ferry to Grand Canyon	21.1	20.9	.2	-	-	-	-
Grand Wash	-	-	-	.1	0	.1	-
Colo.R.,Grand Canyon to Hoover Dam	82.1	79.8	2.3	-	-	-	-
Hoover Dam to Topock	170.7	149.2	21.5	209.0	234.4	.2	*25.6
Topock to Yuma	349.0	253.7	95.3	554.1	488.2	75.6	* 9.7
Yuma to International Boundary	10.4	8.1	2.3	110.4	34.4	77.4	* 1.4
LITTLE COLORADO RIVER							
Little Colo.R.upstream from St.Johns	-	-	-	a 0.3	0	0.3	-
St.Johns to gage above Zuni River	0.3	0.3	0	5.7	6.7	1.3	* 2.3
Zuni River from Black Rock to New Mexico-Arizona State line	.5	.5	0	7.3	3.0	1.6	2.7
Zuni River from State line to mouth	.3	.3	0	4.5	4.5	0	0
Little Colorado R. from gage above Zuni River to gage near Hunt,Ariz.	0	0	0	.4	.4	0	0
Silver Creek	-	-	-	a .6	0	.6	-
Little Colo.R.,Hunt to Woodruff	.3	.3	0	3.1	3.1	0	0
Puerco River upstream from Gallup	-	-	-	a 1.9	0	.2	1.7
Puerco River from Gallup to New Mexico-Arizona State line	.2	.2	0	-	-	-	-
Puerco River from State line to Adamana	.6	.6	0	.7	.4	.3	0
Puerco River from Adamana to mouth	.2	.2	0	1.7	1.7	0	0
Little Colorado River from Woodruff to Grand Falls, Arizona	3.7	3.6	.1	43.6	48.4	.4	* 5.2
Moenkopi Wash above Tuba, Arizona	-	-	-	a .2	0	.2	-
Little Colorado River from Grand Falls to mouth	6.2	6.1	.1	1.7	1.7	0	0

Table 14 (Continued) Sheet 2 of 3

LOWER COLORADO RIVER BASIN

Channel Losses and Salvage at Sites of Use

Annual Averages in 1,000 Acre-Feet for 1914-1945 Period and Virgin Flow Conditions

River section	Water surface evaporation			Native vegetation			
	Conditions			Conditions		Salvage	
	Virgin	1914-1945	Salvage	Virgin	1914-1945	Replacement	Growth change
VIRGIN RIVER							
Virgin River upstream from Littlefield	-	-	-	a 4.7	0	4.7	-
Virgin River, Littlefield to mouth	15.8	15.8	0	27.1	25.5	6.1	*4.5
Meadow Valley Wash	-	-	-	4.2	0	4.2	-
Muddy River	-	-	-	9.4	0	6.3	3.1
BILL WILLIAMS RIVER							
Big Sandy River	-	-	-	a 3.7	0	3.7	-
Santa Maria River	-	-	-	a 2.2	0	2.2	-
GILA RIVER							
Gila River upstream from Virden	-	-	-	a 8.9	0	8.9	-
Virden to New Mex.-Ariz.State line	.8	.8	0	5.0	2.1	2.9	0
New Mex.-Ariz.State line to Clifton	1.3	1.3	0	8.7	4.0	4.3	.4
San Francisco River above Glenwood, New Mexico	-	-	-	a 2.2	0	2.2	-
San Francisco River from Glenwood to New Mex.-Ariz.State line	.6	.6	0	-	-	-	-
San Francisco River from State line to Clifton, Arizona	1.2	1.2	0	0.3	0	.3	-
Gila River from gage near Clifton to head of Safford Valley	1.0	1.0	0	.5	0	.5	-
San Simon Creek from New Mex.-Ariz. State line to Solomon, Arizona	.6	.6	0	-	-	-	-
Gila River from head of Safford	5.8	5.8	0	45.6	40.1	3.3	2.2

Table 14 (Continued)
LOWER COLORADO RIVER BASIN
Channel Losses and Salvage at Sites of Use
Annual Averages in 1,000 Acre-Feet for 1914-1945 Period and Virgin Flow Conditions

River section	Water surface evaporation			Native vegetation			
	Conditions			Conditions		Salvage	
	Virgin	1914-1945	Salvage	Virgin	1914-1945	Replacement	Growth change
GILA RIVER (Continued)							
Gila River from Calva to Coolidge Dam	10.7	10.7	0	11.1	10.8	0.3	0
San Pedro River in Mexico	-	-	-	a .3	0	.3	-
San Pedro River from Palominas, Ariz. to Charleston, Arizona	.3	.3	0	11.4	10.5	.6	.3
San Pedro R.from Charleston to Mammoth, Arizona	1.1	1.1	0	43.2	44.5	4.6	*5.9
San Pedro R.from Mammoth to mouth	.3	.3	0	13.2	9.4	2.1	1.7
Gila R.from Coolidge Dam to Kelvin	4.6	4.5	.1	9.7	8.0	2.1	* .4
Santa Cruz R.upstream from Nogales gage	-	-	-	a 3.0	0	3.0	-
Santa Cruz R.from Nogales to Rillito	6.6	1.2	5.4	55.4	23.5	23.6	8.3
Salt River above Roosevelt gage	-	-	-	a .7	0	.7	-
Tonto Creek above Roosevelt gage	-	-	-	a .9	0	.9	-
Verde River above Bartlett Dam	-	-	-	a 5.4	0	5.4	-
Verde R.from Bartlett to mouth	4.4	4.0	.4	4.2	3.9	.3	0
Salt River from above Roosevelt Lake to Granite Reef Dam	11.7	12.3	* .6	19.1	19.3	0	* .2
Gila River from Kelvin to Gillespie Dam and downstream from Granite Reef Dam on Salt R.,Rillito on Santa Cruz R.,and Lake Pleasant on Agua Fria R.	44.5	32.9	11.6	401.7	335.1	99.8	*33.2
Gila R.from Gillespie Dam to Dome	51.7	34.1	17.6	367.4	223.8	12.9	130.7
TOTAL	808.6	652.3	156.3	1/ 2,014.5	1,587.4	364.4	62.7

a In headwater sections upstream from points of flow routing.
* Increased losses for 1914-1945 conditions as compared with virgin flow conditions.
1/ Includes 35,000 acre-feet (33,300 replacement of native vegetation and 1,700 decreased losses because of native growth change) in headwater sections upstream from points of flow routing and marked with "a"

Table 15
LOWER COLORADO RIVER BASIN
Summary of Man-Made Stream Depletions in the Lower Basin

Average annual depletion in 1,000 acre-feet — October 1, 1913-September 30, 1945

Type of Use	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Consumptive use of irrigation water at sites of use:								
Cropped lands	1,418.3	130.8	23.3	21.8	34.2	7.3	-	1,635.7
Cities, towns, and farmsteads	99.3	4.8	4.2	5.1	5.5	1.6	-	120.5
Other noncropped areas	61.8	5.6	1.6	2.0	3.0	.7	-	74.7
Subtotal	1,579.4	141.2	29.1	28.9	42.7	9.6	-	1,830.9
Less water supplied by depletions of ground-water basins	176.3	-	-	-	-	-	-	176.3
Consumptive use of stream flow by above items at sites of use	1,403.1	141.2	29.1	28.9	42.7	9.6	-	1,654.6
Less uses by native vegetation replaced by above items	260.2	65.9	15.7	15.8	3.7	3.1	-	364.4
Net stream depletions at sites of use by above items	1,142.9	75.3	13.4	13.1	39.0	6.5	-	1,290.2
Stream depletions by reservoirs:								
Evaporation depletions	62.4	-	-	4.3	1.6	-	278.4	346.7
Accretions to surface storage	26.8	-	-	-	-	-	796.8	823.6
Accretions to bank storage	3.6	-	-	-	-	-	99.9	103.5
Transbasin exports	-	2,432.0	-	-	1.2	-	-	2,433.2
Total man-made stream depletions at sites of use	1,235.7	2,507.3	13.4	17.4	41.8	6.5	1,175.1	4,997.2
Less salvaged channel losses:								
Water surface evaporation	41.7	.1	.9	3.1	1.6	1.2	107.7	156.3
Decreased losses by growth change	77.5	-	-	4.4	-	-	-	81.9
Plus increased losses by growth change	-	16.8	2.4	-	-	-	-	19.2
Net man-made stream depletions at International Boundary	1,116.5	2,524.0	14.9	9.9	40.2	5.3	1,067.4	4,778.2

1. Contributions From Drainage Areas Between Selected Division Points

The contributions from most of the drainage areas between gages were determined as the differentials needed to balance the measured inflows and measured outflows adjusted for intervening stream depletions and channel losses in the stream sections. The contributions from the drainage areas of a few of the sections were estimated by application of unit runoff rates derived from precipitation correlation with rates determined for other watersheds with similar runoff characteristics. The total inflow between gages in some sections was prorated among contributors on the basis of their respective drainage areas. However, many apportionments were estimated by consideration of the average precipitation in the respective segments of a section and other runoff characteristics. The derivation of the estimated inflows between gages and their distribution among the contributors in the sections is discussed in the notes accompanying Table 22, "Analysis of Contributions by States Based on Mean Historic Runoff for the 1914-1945 Period", at the end of this section of the report.

Accompanying Table 16 has been prepared to summarize the contributions from drainage areas between selected division points in the Lower Basin. The table also lists the drainage areas in square miles and the runoff rates of the respective segments.

2. Historic Contributions

Because the gaging stations are not located at state lines, historic contributions by states consist of measured flows at gages adjusted for runoff from unmeasured areas and intervening stream depletions and channel losses. The stream flow contributions at selected gages and the

Table 16
LOWER COLORADO RIVER BASIN
Stream Flow Contributions From Drainage Areas Between Selected Division Points

Average stream flow in 1,000 acre-feet — October 1, 1913-September 30, 1945

River section	State	Measured inflow	Measured outflow plus losses	Unmeasured contri-bution	Area in square miles	Acre-feet a square mile
Little Colorado River upstream from St. Johns, Arizona as measured at the gage	Ariz.	-	24.8	-	897	27.6
	New Mex.	-	1.8	-	44	40.3
Total		-	26.6	-	941	28.3
Little Colorado River between St. Johns and gage above Zuni River near Hunt	Ariz.			4.1	541	7.6
	Ariz.			1.8	322	5.5
	New Mex.			3.8	685	5.5
	New Mex.			.4	300	1.4
	New Mex.			0	830	0
	New Mex.			.4	66	5.5
Total		6.6	17.1	10.5	2,744	3.8
Zuni River between Black Rock, New Mex. and New Mex.-Ariz. State line	New Mex.			2.1	383	5.5
Total	(estimated)	18.4	20.5	2.1	383	5.5
Zuni River between New Mexico-Arizona State line and mouth of Zuni River	Ariz.			3.8	685	5.5
	New Mex.			3.3	610	5.5
	New Mex.			.3	207	1.4
Total	(estimated)	12.7	20.1	7.4	1,502	4.9
Little Colorado River between gage above Zuni River and gage (below Zuni River) near Hunt, excluding Zuni R.	Ariz.			.1	19	5.5
Total		23.4	23.5	.1	19	5.5
Little Colorado River between gage near Hunt & gage near Woodruff	Ariz.			16.3	878	18.6
Total		46.2	62.5	16.3	878	18.6
Puerco River between Gallup, New Mex. and New Mex.-Ariz. State line	New Mex.			6.5	525	12.3
Total	(estimated)	7.2	13.7	6.5	525	12.3
Puerco River between New Mexico-Arizona State line and gage near Adamana, Arizona	Ariz.			1.6	134	12.3
	Ariz.			22.3	458	48.8
	Ariz.			6.6	707	9.3
	New Mex.			1.8	146	12.3
	New Mex.			11.2	229	48.8
Total		13.5	57.0	43.5	1,674	26.0

Table 16 (Continued)
LOWER COLORADO RIVER BASIN
Stream Flow Contributions From Drainage Areas Between Selected Division Points

Average stream flow in 1,000 acre-feet — October 1, 1913-September 30, 1945

River section		State	Measured inflow	Measured outflow plus losses	Unmeasured contribution	Area in square miles	Acre-feet a square mile
Puerco River between gage near Adamana and mouth of Puerco River		Ariz.			3.3	350	9.3
	Total		55.1	58.4	3.3	350	9.3
Little Colorado River between gage near Woodruff and gage at Grand Falls, Arizona, excluding Puerco River		Ariz.			78.7	8,355	9.4
	Total		236.9	315.6	78.7	8,355	9.4
Little Colorado River between gage at Grand Falls and mouth		Ariz.			22.1	3,242	6.8
		Ariz.			131.3	springs	-
	Total	(estimated)	267.8	421.2	153.4	3,242	47.3
Colorado River between Lee Ferry and gage near Grand Canyon excluding Little Colorado River		Ariz.			23.0	1,408	16.3
	Total		14,202.0	14,225.0	23.0	1,408	16.3
Virgin River upstream from Littlefield, Arizona as measured at the gage		Ariz.	-	45.9	-	1,898	24.2
		Nev.	-	6.1	-	253	24.2
		Utah	-	48.6	-	2,007	24.2
		Utah	-	166.2	-	934	177.9
	Total		-	266.8	-	5,092	52.4
Colorado River between gage near Grand Canyon and gage below Hoover Dam		Ariz.			355.8	11,831	30.1
		Nev.			135.4	8,076	16.8
		Nev.			0	4,161	0
		Utah			16.4	677	24.2
		Utah			.7	41	16.8
	Total		14,465.1	14,973.4	508.3	24,786	20.5
Colorado River between gage below Hoover Dam and gage near Topock		Ariz.			13.4	2,356	5.7
		Calif.			4.1	719	5.7
		Nev.			8.1	1,432	5.7
	Total		13,694.0	13,719.6	25.6	4,507	5.7

Table 16 (Continued)
LOWER COLORADO RIVER BASIN
Stream Flow Contributions From Drainage Areas Between Selected Division Points

Average stream flow in 1,000 acre-feet — October 1, 1913-September 30, 1945

River section	State	Measured inflow	Measured outflow plus losses	Unmeasured contri-bution	Area in square miles	Acre-feet a square mile
Gila River between gage near Virden, N.Mex. and New Mex.-Ariz. State Line	New Mex.			4.9	145	33.6
	Total (estimated)	155.0	159.9	4.9	145	33.6
Gila River between New Mexico-Arizona State line and gage near Clifton, Arizona	Ariz.			17.7	526	33.6
	New Mex.			4.9	148	33.6
	Total	152.3	174.9	22.6	674	33.6
San Francisco River upstream from Glenwood, New Mexico as measured at the gage	Ariz.	-	3.7	-	92	40.3
	New Mex.	-	63.4	-	1,572	40.3
	Total	-	67.1	-	1,664	40.3
San Francisco River between gage near Glenwood and New Mex.-Ariz. State line	New Mex.			10.2	253	40.3
	Total (estimated)	64.7	74.9	10.2	253	40.3
San Francisco River between New Mex.-Arizona State line and gage at Clifton, Arizona	Ariz.			87.8	818	107.3
	New Mex.			5.8	54	107.3
	Total	74.3	167.9	93.6	872	107.3
Gila River between gage near Clifton and gage at head of Safford Valley	Ariz.			62.9	1,128	55.8
	Total	322.2	385.1	62.9	1,128	55.8
San Simon Creek upstream from New Mexico-Arizona State line as estimated at the State line	Ariz.	-	2.2	-	395	5.6
	New Mex.	-	1.3	-	227	5.6
	Total (estimated)	-	3.5	-	622	5.6
San Simon Creek between New Mexico-Arizona State line and gage near Solomon	Ariz.			11.5	1,654	7.0
	Total	3.4	14.9	11.5	1,654	7.0
Gila River between gage at head of Safford Valley and gage at Calva, Ariz.	Ariz.			20.3	1,262	16.1
	Total	390.6	410.9	20.3	1,262	16.1
Gila River between gage at Calva and gage below Coolidge Dam, Ariz.	Ariz.			13.7	359	38.2
	Total	353.5	367.2	13.7	359	38.2
San Pedro River upstream from Palominas, Arizona, as measured at the gage	Ariz.	-	3.9	-	92	42.0
	Mex.	-	27.2	-	649	42.0
	Total	-	31.1	-	741	42.0

Table 16 (Continued)
LOWER COLORADO RIVER BASIN
Stream Flow Contributions From Drainage Areas Between Selected Division Points

Average stream flow in 1,000 acre-feet — October 1, 1913-September 30, 1945

River section	State	Measured inflow	Measured outflow plus losses	Unmeasured contribution	Area in square miles	Acre-feet a square mile
San Pedro River between Palominas and gage at Charleston, Arizona	Ariz.			32.6	428	76.2
	Mex.			3.6	47	76.2
Total		30.0	66.2	36.2	475	76.2
San Pedro River between Charleston and gage near Mammoth, Ariz.	Ariz.			62.3	2,391	26.1
Total		54.6	116.9	62.3	2,391	26.1
Gila River between Coolidge Dam and gage at Kelvin, Ariz. including flow of Aravaipa Creek	Ariz.			75.2	1,535	49.0
Total		392.4	476.6	75.2	1,535	49.0
Santa Cruz River upstream from gage near Nogales, Ariz., as measured at the gage	Ariz.	-	7.2	-	185	39.1
	Mex.	-	14.0	-	357	39.1
Total		-	21.2	-	542	39.1
Santa Cruz River between gage near Nogales and gage at Rillito, Ariz., including flow of Rillito Creek	Ariz.			83.2	2,935	28.3
	Mex.			1.8	46	39.1
Total		15.2	100.2	85.0	2,981	28.5
Salt River between gage near Roosevelt and gage at Granite Reef Dam	Ariz.			100.2	1,601 1/	70.0
Total		1,336.8	1,437.0	100.2	1,601 1/	70.0
Gila River between gage at Kelvin and gage below Gillespie Dam, Ariz.	Ariz.			94.7	13,706	6.9
Total		1,934.9	2,029.6	94.7	13,706	6.9
Gila River between gage below Gillespie Dam and gage near Dome, Arizona	Ariz.			29.7	8,410	3.5
	Mex.			.2	48	3.5
Total		712.4	742.3	29.9	8,458	3.5
Colorado River between gage near Topock and Limitrophe Section at International Boundary	Ariz.			19.4	4,618	4.2
	Calif.			12.1	2,880	4.2
Total		13,924.4	13,955.9	31.5	7,498	4.2

1/ The average annual unmeasured contribution of 100,200 acre-feet a year from this section was based on an average annual rate of 70.0 acre-feet a square mile from 1,140 square miles tributary to the Salt River and Tonto Creek for the full 32-year period plus 440 square miles of Verde River drainage area for 17 years (1925 through 1941) and 461 square miles of Verde River drainage area for 4 years (1942 through 1945).

unmeasured inflows between the gages and state lines were routed from the headwaters of the tributaries in the Lower Colorado River Basin to state lines and downstream points to the Limitrophe Section of the Colorado River at the International Boundary. Channel losses for the river sections between gages, downstream points, and the International Boundary were prorated among the contributors on the basis of their respective contributions to the sections. All items in the routing of historic flows were computed as averages for the 1914-1945 period.

Records and estimates of stream flow at the selected gaging stations together with diversions and return flows used in the routing are listed in Table 6 of Appendix A. The unmeasured stream flow contributions are itemized in Table 16.

The consumptive use of irrigation water by crops and non-cropped areas in the sections are listed in Table 12. The depletion by water surface evaporation and vegetative growth along the All-American Canal between Imperial Dam and Pilot Knob is listed in a footnote to Table 13.

Stream depletions by reservoir evaporation and changes in surface and bank storage are itemized in Tables 8 and 11.

Depletions by ground-water basins are listed in Table 4.

Transbasin exports are summarized in a tabulation in the analyses section of this report in connection with stream depletions by transbasin diversions.

Channel losses in the river sections are itemized in Table 14.

The detailed analysis of historic contributions by states together with explanatory notes for each item in the routing is given in Table 22 at the end of this section of the report. Accompanying Table 17 summarizes the average annual historic flows at state lines for the 1914-1945 period.

The channel losses on water conveyed out of the states to the Limitrophe Section at the International Boundary were prorated among the contributors on the basis of the proportionate part of the total water transported through the downstream channel sections.

3. Virgin Contributions

The 1914-1945 average annual virgin stream flow contributions at selected gages, state lines, and downstream points to the International Boundary were computed by adding the upstream man-made stream depletions to the historic contributions at the gages in the headwaters of the tributaries of the Lower Colorado River and routing the resultant undepleted stream flows downstream together with the incremental unmeasured inflows between points.

Historic and virgin channel losses from water surface evaporation and river bottom growth in the several river sections are itemized in Table 14 together with the salvages and increased losses under historic conditions as compared with virgin conditions.

Salvaged channel losses from water surface evaporation in stream sections were prorated among the contributors on the basis of the respective undepleted volumes conveyed in the sections.

Table 17
LOWER COLORADO RIVER BASIN
Average Annual Historic Contributions at State Lines
for 1914-1945 Period

	1,000 Acre-feet
ARIZONA	
Little Colorado River at mouth	381.0
Bright Angel Creek near Grand Canyon	29.3
Virgin River at Littlefield	45.3
Bill Williams River at Planet	135.2
Gila River near Dome	372.8
Ungaged area tributary to Colorado River	207.3
Subtotal	1,170.9
Less Arizona share of main stem channel losses within State	111.4
Net contribution at State line	1,059.5
CALIFORNIA	
Stream depletions by California in area tributary to the Colorado River exceed contributions by 2,557,000 acre-feet a year	
Net contribution at State line	0
NEVADA	
Virgin River at Littlefield	6.1
Ungaged area tributary to Colorado River	114.4
Subtotal	120.5
Less Nevada share of main stem channel losses within State	4.3
Net contribution at State line	116.2
NEW MEXICO	
Zuni River at Black Rock	18.4
Puerco River at Gallup	7.2
Gila River below Blue Creek, near Virden	155.0
San Francisco River near Glenwood	61.0
Ungaged area tributary to Little Colorado River	27.3
Ungaged area tributary to Gila River	22.4
Subtotal	291.3
Less channel losses within State downstream from gaging stations	7.2
Net contribution at State line	284.1
UTAH	
Virgin River at Littlefield	180.3
Ungaged area tributary to Colorado River	9.8
Net contribution at State line	190.1
MEXICO	
San Pedro River at Palominas, Arizona	26.1
Area tributary to San Pedro River downstream from Palominas	3.6
Santa Cruz River near Nogales, Arizona	8.6
Area tributary to Santa Cruz River downstream from Nogales	1.8
Area tributary to Gila River between Gillespie Dam and Dome	.2
Net inflow to the United States from Mexico	40.3
UNDISTRIBUTED	
Historic contribution of Colorado River at Lee Ferry	13,788.6
Sum of contributions at State lines	15,478.8

Salvages of channel losses caused by the replacement of native vegetation by crops and other beneficial uses were credited to the state in which the replacement occurred.

The decreased or increased channel losses caused by native growth changes in the river bottoms and the flood plains were credited or charged to the state in which the change occurred. If these changes in channel losses were in sections on the Colorado River between two states, the increased or decreased losses were apportioned equally between the two states.

Thus, the virgin channel losses apportioned to a state were the apportioned historic channel losses plus salvaged channel losses from water surface evaporation, plus salvaged channel losses from replacement of native vegetation, plus or minus the changes in losses because of native growth changes in the channels.

The detailed analysis of virgin contributions by states together with explanatory notes for each item in the routing is given in Table 23 at the end of this section of the report.

Accompanying Table 18 summarizes the average annual virgin flows at state lines in the Lower Colorado River Basin for the 1914-1945 period.

4. Summary

The 1914-1945 average annual water contributions by the states and Mexico in the Lower Colorado River Basin for historic and virgin flow conditions are summarized in accompanying Table 19.

The 1914-1945 average annual man-made stream depletions by states and Mexico at selected gaging stations and division points in the Lower Colorado River Basin are listed in accompanying Table 20.

Table 18
LOWER COLORADO RIVER BASIN
Average Annual Virgin Contributions at State Lines
Based on 1914-1945 Period

	1,000 acre-feet
ARIZONA	
Little Colorado River at mouth	431.5
Bright Angel Creek near Grand Canyon	29.3
Virgin River at Littlefield	45.9
Bill Williams River at Planet	139.0
Gila River near Dome	1,310.2
Ungaged area tributary to Colorado River	411.6
Subtotal	2,367.5
Less Arizona share of main stem channel losses within State	191.5
Net virgin contribution at State line	2,176.0
CALIFORNIA	
Ungaged area tributary to Colorado River	16.2
Less California share of channel losses within State	.1
Net virgin contribution at State line	16.1
NEVADA	
Virgin River at Littlefield, Arizona	6.1
Ungaged area tributary to Colorado River	143.5
Subtotal	149.6
Less Nevada share of main stem channel losses within State	17.8
Net virgin contribution at State line	131.8
NEW MEXICO	
Zuni River at Black Rock	23.5
Puerco River at Gallup	8.6
Gila River below Blue Creek, near Virden	157.3
San Francisco River near Glenwood	63.4
Ungaged area tributary to Little Colorado River	31.6
Ungaged area tributary to Gila River	27.1
Subtotal	311.5
Less channel losses within State downstream from gaging stations	14.4
Net virgin contribution at State line	297.1
UTAH	
Virgin River at Littlefield, Arizona	214.8
Ungaged area tributary to Colorado River	17.1
Net virgin contribution at State line	231.9
MEXICO	
San Pedro River at Palominas, Arizona	27.2
Area tributary to San Pedro River downstream from Palominas	3.6
Santa Cruz River near Nogales, Arizona	14.0
Area tributary to Santa Cruz River downstream from Nogales	1.8
Area tributary to Gila River between Gillespie Dam and Dome	.2
Net virgin inflow to the United States from Mexico	46.8
UNDISTRIBUTED	
Virgin contribution of Colorado River at Lee Ferry	15,638.5
Sum of virgin contributions at State lines	18,538.2

Table 19
LOWER COLORADO RIVER BASIN
Average Annual Water Contributions by States and Mexico

Based on 1914-1945 period — Unit: 1,000 Acre-feet

	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
HISTORIC CONTRIBUTIONS								
Historic contributions at state lines	1,059.5	0	116.2	284.1	190.1	40.3	1/ 13,788.6	15,478.8
Out of state channel losses	0	0	8.2	184.1	19.9	33.2	2/ 4,888.9	5,134.3
Historic contributions at International Boundary	1,059.5	0	108.0	100.0	170.2	7.1	8,899.7	10,344.5
Percent	10.24	0	1.04	0.97	1.65	0.07	86.03	100.00
VIRGIN CONTRIBUTIONS								
Virgin contributions at state lines	2,176.0	16.1	131.8	297.1	231.9	46.8	3/ 15,638.5	18,538.2
Out of state channel losses	0	0	8.9	187.2	21.5	34.4	1,313.6	1,565.6
Virgin contributions at International Boundary	2,176.0	16.1	122.9	109.9	210.4	12.4	14,324.9	16,972.6
Percent	12.82	0.10	0.72	0.65	1.24	0.07	84.40	100.00

1/ Historic contribution by Upper Basin at Lee Ferry.
2/ Includes channel losses of 1,156,800 acre-feet; main stream reservoir depletions of 1,175,100 acre-feet; and stream depletions by California of 2,557,000 acre-feet in excess of California contributions.
3/ Virgin contribution by Upper Basin at Lee Ferry.

Table 20
LOWER COLORADO RIVER BASIN
Man-Made Stream Depletions at Selected Gaging Stations and Division Points

Average annual depletions in 1,000 acre-feet — October 1, 1913-September 30, 1945

Gaging station or division point	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Colorado River at Lee Ferry (depletion by Upper Basin)	0	0	0	0	0	0	0	1,849.9
Little Colorado River above Zuni River, near Hunt, Arizona	23.0	0	0	0	0	0	0	23.0
Zuni River at New Mex.-Ariz. State line	0	0	0	5.1	0	0	0	5.1
Little Colorado River near Hunt, Ariz.	23.0	0	0	5.1	0	0	0	28.1
Little Colorado River near Woodruff, Ariz.	32.5	0	0	5.1	0	0	0	37.6
Puerco River at New Mex.-Ariz. State line	0	0	0	1.4	0	0	0	1.4
Little Colorado River at Grand Falls, Ariz.	49.3	0	0	6.5	0	0	0	55.8
Little Colorado River at mouth	50.5	0	0	6.5	0	0	0	57.0
Colorado River near Grand Canyon, Ariz.	50.5	0	0	6.5	0	0	1,849.7	1,906.7
Virgin River at Littlefield, Arizona	.6	0	0	0	34.5	0	0	35.1
Colorado River below Hoover Dam, Ariz.-Nev.	57.2	0	14.2	6.5	41.8	0	2,962.8	3,082.5
Colorado River near Topock, Arizona	70.3	13.3	15.6	6.4	41.5	0	2,943.0	3,090.1
Bill Williams River at Planet, Arizona	3.8	0	0	0	0	0	0	3.8
Gila River at New Mex.-Ariz. State line	0	0	0	4.1	0	0	0	4.1
San Francisco River at New Mex.-Ariz. State line	0	0	0	2.4	0	0	0	2.4
Gila River at head of Safford Valley, near Solomon, Arizona	14.5	0	0	6.5	0	0	0	21.0
Gila River at Calva, Arizona	73.0	0	0	6.5	0	0	0	79.5
San Pedro River at Palominas, Arizona	0	0	0	0	0	1.1	0	1.1
Gila River at Kelvin, Arizona	104.3	0	0	6.5	0	1.1	0	111.9
Santa Cruz River near Nogales, Arizona	.6	0	0	0	0	5.4	0	6.0
Santa Cruz River at Rillito, Arizona	10.0	0	0	0	0	4.5	0	14.5
Salt River at Granite Reef Dam, Ariz.	92.0	0	0	0	0	0	0	92.0
Gila River at Gillespie Dam, Ariz.	1,069.7	0	0	5.2	0	5.5	0	1,080.4
Gila River near Dome, Arizona	937.4	0	0	4.0	0	5.3	0	946.7
Colorado River within Limitrophe Section at International Boundary	1,116.5	2,524.0	14.9	9.9	40.2	5.3	2,917.3	6,628.1

The 1914-1945 average annual virgin stream flows at selected gaging stations and division points in the Lower Colorado River Basin together with the undepleted runoff rates a square mile are listed in accompanying Table 21.

The detailed analysis of water contributions by states based on mean historic runoff for the 1914-1945 period is given in accompanying Table 22. The table is followed by notes discussing each item in the routing study.

The water contributions by states based on mean virgin runoff for the 1914-1945 period are analyzed in detail in accompanying Table 23. Each item in the virgin flow routing study is discussed in notes following the table.

Table 21

LOWER COLORADO RIVER BASIN

Undepleted Stream Flow at Selected Gaging Stations and Division Points

Average annual stream flow in 1,000 acre-feet based on 1914-1945 period. Drainage areas in square miles and runoff rate in acre-feet a square mile.

Stream flow stations or division points in downstream order from Lee Ferry	Average virgin flow	Drainage area	Undepleted runoff rate
Colorado River at Lee Ferry, Arizona 1/	15,638.5	109,458	142.9
Little Colorado River at St. Johns, Ariz.	26.6	941	28.3
Little Colorado River above Zuni River, near Hunt, Arizona	31.1	3,685	8.4
Zuni River at Black Rock, New Mexico	23.5	692	34.0
Zuni River at New Mex.-Ariz. State line	17.8	1,075	16.6
Zuni River at mouth	20.4	2,577	7.9
Little Colorado River near Hunt, Arizona	51.2	6,281	8.2
Silver Creek near Woodruff, Arizona	31.6	942	33.5
Little Colorado River near Woodruff, Ariz.	95.7	8,101	11.8
Puerco River at Gallup, New Mexico	8.6	558	15.4
Puerco River at New Mex.-Ariz. State line	14.9	1,083	13.8
Puerco River near Adamana, Arizona	57.1	2,757	20.7
Puerco River at mouth	58.5	3,107	18.8
Little Colorado River at Grand Falls, Ariz.	307.9	21,178	14.5
Moenkopi Wash near Tuba, Arizona	17.0	2,486	6.8
Little Colorado River at mouth	470.4	26,906	17.5
Colorado River near Grand Canyon, Arizona	16,110.8	137,772	116.9
Bright Angel Creek near Grand Canyon, Ariz.	29.3	100	293.0
Virgin River at Littlefield, Arizona	266.8	5,092	52.4
Colorado River below Hoover Dam; Ariz.-Nev.	16,776.5	167,750	100.0
Colorado River near Topock, Arizona	16,422.4	172,257	95.3
Bill Williams River at Planet, Arizona	139.0	5,144	27.0
Gila River below Blue Creek, near Virden, New Mexico	157.3	3,218	48.9
Gila River at New Mex.-Ariz. State line	156.4	3,363	46.5
Gila River near Clifton, Arizona	169.0	4,037	41.9
San Francisco River near Glenwood, New Mex.	67.1	1,664	40.3
San Francisco River at New Mex.-Ariz.State line	76.7	1,917	40.0
San Francisco River at Clifton, Arizona	168.8	2,789	60.5

Table 21 (Continued)

LOWER COLORADO RIVER BASIN

Undepleted Stream Flow at Selected Gaging Stations and Division Points

Average annual stream flow in 1,000 acre-feet based on 1914-1945 period.
Drainage areas in square miles and runoff rate in acre-feet a square mile.

Stream flow stations or division points in downstream order from Lee Ferry	Average virgin flow	Drainage area	Undepleted runoff rate
Gila River at head of Safford Valley near Solomon, Arizona	399.2	7,954	50.2
San Simon Creek at New Mex.-Ariz.State line	3.5	622	5.6
San Simon Creek near Solomon, Arizona	14.4	2,276	6.3
Gila River at Calva, Arizona	382.5	11,492	33.3
San Carlos River near Peridot, Arizona	51.4	1,038	49.5
Gila River below Coolidge Dam, Arizona	425.8	12,889	33.0
San Pedro River at Palominas, Arizona	31.1	741	42.0
San Pedro River at Charleston, Arizona	55.6	1,216	45.7
San Pedro River near Mammoth, Arizona	73.6	3,607	20.4
Gila River at Kelvin, Arizona	546.8	18,031	30.3
Santa Cruz River near Nogales, Arizona	21.2	542	39.1
Santa Cruz River at Rillito, Arizona	44.2	3,523	12.5
Salt River near Roosevelt, Arizona	710.3	4,306	165.0
Tonto Creek near Roosevelt, Arizona	108.4	841	128.9
Verde River below Bartlett Dam, Ariz. 2/	544.3	6,159	88.4
Salt River at Granite Reef Dam, Arizona	1,423.8	12,907	110.3
Agua Fria River at Lake Pleasant Dam, Ariz.	129.5	1,459	88.8
Gila River at Gillespie Dam, Ariz.	1,792.8	49,626	36.1
Gila River near Dome, Arizona	1,403.6	58,084	24.2
Colorado River within Limitrophe Section at International Boundary	16,972.6	242,983	69.9

1/ Flow from "Final Report, Engineering Advisory Committee to Upper Colorado River Basin Compact Commission", November 29, 1948.

2/ The runoff data listed for this station are based on the combination of the published records for the gaging sites near McDowell, above Camp Creek, and below Bartlett Dam under the assumption that the records at the several sites are comparable.

Table 22
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
LITTLE COLORADO RIVER FROM ST. JOHNS, ARIZONA TO GAGE ABOVE ZUNI RIVER NEAR HUNT, ARIZONA									
Little Colorado River at St. Johns, Ariz.	1	4.8	0	0	1.8	0	0	0	6.6
Estimated inflow, St. Johns to Zuni River	2	5.9	0	0	4.6	0	0	0	10.5
Consumptive use, St. Johns to Zuni River	3	.4	0	0	0	0	0	0	.4
Reservoir evaporation depletion	4	1.6	0	0	0	0	0	0	1.6
Volumes conveyed, St. Johns to Zuni River	5	8.7	0	0	6.4	0	0	0	15.1
Channel losses, St. Johns to Zuni River	6	$ 4.0	0	0	¢ 3.0	0	0	0	7.0
Little Colorado River above Zuni River near Hunt, Arizona	7	4.7	0	0	3.4	0	0	0	8.1
ZUNI RIVER FROM BLACK ROCK, NEW MEXICO, TO NEW MEXICO-ARIZONA STATE LINE									
Zuni River at Black Rock, New Mexico	8	0	0	0	18.4	0	0	0	18.4
Estimated inflow, Black Rock to State line	9	0	0	0	2.1	0	0	0	2.1
Consumptive use, Black Rock to State line	10	0	0	0	4.2	0	0	0	4.2
Reservoir evaporation depletion	11	0	0	0	.1	0	0	0	.1
Volumes conveyed, Black Rock to State line	12	0	0	0	16.2	0	0	0	16.2
Channel losses, Black Rock to State line	13	0	0	0	$ 3.5	0	0	0	3.5
Zuni River at New Mex.-Ariz. State line	14	0	0	0	12.7	0	0	0	12.7
ZUNI RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO MOUTH NEAR HUNT, ARIZONA									
Estimated inflow, State line to mouth	15	3.8	0	0	3.6	0	0	0	7.4
Volumes conveyed, State line to mouth	16	3.8	0	0	16.3	0	0	0	20.1
Channel losses, State line to mouth	17	$ .9	0	0	¢ 3.9	0	0	0	4.8
Zuni River at mouth near Hunt, Ariz.	18	2.9	0	0	12.4	0	0	0	15.3

Table 22 (Continued

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Historic Runoff

For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
LITTLE COLORADO RIVER FROM GAGE ABOVE ZUNI RIVER TO GAGE NEAR HUNT, ARIZONA									
Estimated inflow excluding Zuni River	19	0.1	0	0	0	0	0	0	0.1
Volumes conveyed to gage near Hunt	20	7.7	0	0	15.8	0	0	0	23.5
Channel losses to gage near Hunt	21	$ .1	0	0	¢ .3	0	0	0	0.4
Little Colorado River near Hunt, Ariz.	22	7.6	0	0	15.5	0	0	0	23.1
LITTLE COLORADO RIVER FROM GAGE NEAR HUNT TO GAGE NEAR WOODRUFF, ARIZONA									
Silver Creek near Woodruff, Arizona	23	23.1	0	0	0	0	0	0	23.1
Estimated inflow, Hunt to Woodruff	24	16.3	0	0	0	0	0	0	16.3
Consumptive use, Hunt to Woodruff	25	1.0	0	0	0	0	0	0	1.0
Volumes conveyed, Hunt to Woodruff	26	46.0	0	0	15.5	0	0	0	61.5
Channel losses, Hunt to Woodruff	27	$ 2.5	0	0	¢ .9	0	0	0	3.4
Little Colorado River near Woodruff, Ariz.	28	43.5	0	0	14.6	0	0	0	58.1
PUERCO RIVER FROM GALLUP, NEW MEXICO, TO NEW MEXICO-ARIZONA STATE LINE									
Puerco River at Gallup, New Mexico	29	0	0	0	7.2	0	0	0	7.2
Estimated inflow, Gallup to State line	30	0	0	0	6.5	0	0	0	6.5
Volumes conveyed, Gallup to State line	31	0	0	0	13.7	0	0	0	13.7
Channel losses, Gallup to State line	32	0	0	0	$ .2	0	0	0	.2
Puerco River at New Mex.-Ariz. State line	33	0	0	0	13.5	0	0	0	13.5
PUERCO RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE NEAR ADAMANA, ARIZONA									
Estimated inflow, State line to Adamana	34	30.5	0	0	13.0	0	0	0	43.5
Consumptive use, State line to Adamana	35	.9	0	0	0	0	0	0	.9
Volumes conveyed, State line to Adamana	36	29.6	0	0	26.5	0	0	0	56.1
Channel losses, State line to Adamana	37	$ 0.5	0	0	¢ 0.5	0	0	0	1.0

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
PUERCO RIVER FROM GAGE NEAR ADAMANA TO MOUTH									
Estimated inflow, Adamana to mouth	39	3.3	0	0	0	0	0	0	3.3
Volumes conveyed, Adamana to mouth	40	32.4	0	0	26.0	0	0	0	58.4
Channel losses, Adamana to mouth	41	$ 1.1	0	0	¢ .8	0	0	0	1.9
Puerco River at mouth	42	31.3	0	0	25.2	0	0	0	56.5
LITTLE COLORADO RIVER FROM GAGE NEAR WOODRUFF TO GRAND FALLS, ARIZONA									
Chevelon Fork near Winslow, Arizona	43	45.3	0	0	0	0	0	0	45.3
Clear Creek near Winslow, Arizona	44	77.0	0	0	0	0	0	0	77.0
Estimated inflow, Woodruff to Grand Falls	45	78.7	0	0	0	0	0	0	78.7
Consumptive use, Woodruff to Grand Falls	46	8.1	0	0	0	0	0	0	8.1
Reservoir evaporation depletion	47	3.4	0	0	0	0	0	0	3.4
Volumes conveyed to Grand Falls	48	264.3	0	0	39.8	0	0	0	304.1
Channel losses, Woodruff to Grand Falls	49	$ 45.2	0	0	¢ 6.8	0	0	0	52.0
Little Colorado River at Grand Falls, Ariz.	50	219.1	0	0	33.0	0	0	0	252.1
LITTLE COLORADO RIVER FROM GRAND FALLS TO MOUTH									
Moenkopi Wash near Tuba, Arizona	51	15.7	0	0	0	0	0	0	15.7
Estimated inflow, Grand Falls to mouth	52	153.4	0	0	0	0	0	0	153.4
Volumes conveyed, Grand Falls to mouth	53	388.2	0	0	33.0	0	0	0	421.2
Channel losses, Grand Falls to mouth	54	$ 7.2	0	0	¢ .6	0	0	0	7.8
Little Colorado River at mouth	55	381.0	0	0	32.4	0	0	0	413.4
HISTORIC CONTRIBUTION OF COLORADO RIVER AT LEE FERRY, ARIZONA									
Colorado River at Lee Ferry, Arizona	56	-	-	-	-	-	-	13,788.6	13,788.6

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
COLORADO RIVER FROM LEE FERRY TO GAGE NEAR GRAND CANYON, ARIZONA									
Estimated inflow, Lee Ferry to Grand Canyon	57	23.0	0	0	0	0	0	0	23.0
Volumes conveyed, Lee Ferry to Grand Canyon	58	404.0	0	0	32.4	0	0	13,788.6	14,225.0
Channel losses, Lee Ferry to Grand Canyon	59	$ .6	0	0	0	0	0	¢ 20.3	20.9
Colorado River near Grand Canyon, Arizona	60	403.4	0	0	32.4	0	0	13,768.3	14,204.1
COLORADO RIVER FROM GAGE NEAR GRAND CANYON TO GAGE BELOW HOOVER DAM									
Bright Angel Creek near Grand Canyon, Ariz.	61	29.3	0	0	0	0	0	0	29.3
Virgin River at Littlefield, Arizona	62	45.3	0	6.1	0	180.3	0	0	231.7
Estimated inflow, Grand Canyon to Hoover Dam	63	355.8	0	135.4	0	17.1	0	0	508.3
Consumptive use, Grand Canyon to Hoover Dam	64	6.7	0	28.8	0	7.3	0	0	42.8
Lake Mead reservoir evaporation depletion	65	0	0	0	0	0	0	242.2	242.2
Accretion of surface storage in Lake Mead	66	0	0	0	0	0	0	775.8	775.8
Bank storage in Lake Mead	67	0	0	0	0	0	0	97.3	97.3
Small reservoir evaporation depletion	68	.2	0	0	0	0	0	0	.2
Volumes conveyed, Grand Canyon to Hoover Dam	69	826.9	0	112.7	32.4	190.1	0	12,653.0	13,815.1
Channel losses, Grand Canyon to Hoover Dam	70	$ 7.2	0	$ 1.0	¢ .3	¢ 1.7	0	¢ 110.9	121.1
Colo. River below Hoover Dam, Ariz.-Nev.	71	819.7	0	111.7	32.1	188.4	0	12,542.1	13,694.0
COLORADO RIVER FROM GAGE BELOW HOOVER DAM TO GAGE NEAR TOPOCK, ARIZONA									
Estimated inflow, Hoover Dam to Topock	72	13.4	4.1	8.1	0	0	0	0	25.6
Consumptive use, Hoover Dam to Topock	73	1.4	2.0	.3	0	0	0	0	3.7
Volumes conveyed, Hoover Dam to Topock	74	831.7	2.1	119.5	32.1	188.4	0	12,542.1	13,715.9
Channel losses, Hoover Dam to Topock	75	$ 23.3	0	$ 3.3	¢ .9	¢ 5.3	0	¢ 350.8	383.6
Colorado River near Topock, Arizona	76	808.4	2.1	116.2	31.2	183.1	0	12,191.3	13,332.3

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 Acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM GAGE NEAR VIRDEN, NEW MEXICO, TO NEW MEXICO-ARIZONA STATE LINE									
Gila River below Blue Creek, near Virden	77	0	0	0	155.0	0	0	0	155.0
Estimated inflow, Virden to State line	78	0	0	0	4.9	0	0	0	4.9
Consumptive use, Virden to State line	79	0	0	0	4.7	0	0	0	4.7
Volumes conveyed, Virden to State line	80	0	0	0	155.2	0	0	0	155.2
Channel losses, Virden to State line	81	0	0	0	$ 2.9	0	0	0	2.9
Gila River at New Mex.-Ariz. State line	82	0	0	0	152.3	0	0	0	152.3
GILA RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE NEAR CLIFTON, ARIZONA									
Estimated inflow, State line to Clifton	83	17.7	0	0	4.9	0	0	0	22.6
Consumptive use, State line to Clifton	84	9.0	0	0	0	0	0	0	9.0
Volumes conveyed, State line to Clifton	85	8.7	0	0	157.2	0	0	0	165.9
Channel losses, State line to Clifton	86	$ .3	0	0	¢ 5.0	0	0	0	5.3
Gila River near Clifton, Arizona	87	8.4	0	0	152.2	0	0	0	160.6
SAN FRANCISCO RIVER FROM GAGE NEAR GLENWOOD, NEW MEXICO, TO NEW MEXICO-ARIZONA STATE LINE									
San Francisco River near Glenwood	88	3.7	0	0	61.0	0	0	0	64.7
Estimated inflow, Glenwood to State line	89	0	0	0	10.2	0	0	0	10.2
Volumes conveyed, Glenwood to State line	90	3.7	0	0	71.2	0	0	0	74.9
Channel losses, Glenwood to State line	91	0	0	0	$ .6	0	0	0	.6
San Francisco River at State line	92	3.7	0	0	70.6	0	0	0	74.3
SAN FRANCISCO RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE AT CLIFTON, ARIZONA									
Estimated inflow, State line to Clifton	93	87.8	0	0	5.8	0	0	0	93.6
Consumptive uses, State line to Clifton	94	5.3	0	0	0	0	0	0	5.3
Volumes conveyed, State line to Clifton	95	86.2	0	0	76.4	0	0	0	162.6
Channel losses, State line to Clifton	96	$ .6	0	0	¢ .6	0	0	0	1.2

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM GAGE NEAR CLIFTON, ARIZONA, TO HEAD OF SAFFORD VALLEY, ARIZONA									
Imported water from Black River	98	.2	0	0	0	0	0	0	.2
Estimated inflow, Clifton to Safford Valley	99	62.9	0	0	0	0	0	0	62.9
Consumptive use, Clifton to Safford Valley	100	5.9	0	0	0	0	0	0	5.9
Volumes conveyed, Clifton to Safford Valley	101	151.2	0	0	228.0	0	0	0	379.2
Channel losses, Clifton to Safford Valley	102	$ .4	0	0	¢ .6	0	0	0	1.0
Gila River at head of Safford Valley, Ariz.	103	150.8	0	0	227.4	0	0	0	378.2
SAN SIMON CREEK FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE NEAR SOLOMON, ARIZONA									
San Simon Creek at New Mex.-Ariz. State line	104	2.1	0	0	1.3	0	0	0	3.4
Estimated inflow, State line to Solomon	105	11.5	0	0	0	0	0	0	11.5
Consumptive use, State line to Solomon	106	1.9	0	0	0	0	0	0	1.9
Volumes conveyed, State line to Solomon	107	11.7	0	0	1.3	0	0	0	13.0
Channel losses, State line to Solomon	108	$ .5	0	0	¢ .1	0	0	0	.6
San Simon Creek near Solomon, Arizona	109	11.2	0	0	1.2	0	0	0	12.4
GILA RIVER FROM HEAD OF SAFFORD VALLEY TO GAGE AT CALVA, ARIZONA									
Estimated inflow, head of valley to Calva	110	20.3	0	0	0	0	0	0	20.3
Reservoir evaporation depletion	111	.2	0	0	0	0	0	0	.2
Consumptive use, head of valley to Calva	112	61.8	0	0	0	0	0	0	61.8
Volumes conveyed, head of valley to Calva	113	120.3	0	0	228.6	0	0	0	348.9
Channel losses, head of valley to Calva	114	$15.8	0	0	¢30.1	0	0	0	45.9
Gila River at Calva, Arizona	115	104.5	0	0	198.5	0	0	0	303.0

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM CALVA TO GAGE BELOW COOLIDGE DAM, ARIZONA									
San Carlos River near Peridot, Arizona	116	50.5	0	0	0	0	0	0	50.5
Estimated inflow, Calva to Coolidge Dam	117	13.7	0	0	0	0	0	0	13.7
Consumptive use, Calva to Coolidge Dam	118	.4	0	0	0	0	0	0	.4
San Carlos Reservoir evaporation depletion	119	12.2	0	0	0	0	0	0	12.2
Accretion of surface storage in San Carlos Reservoir	120	1.7	0	0	0	0	0	0	1.7
Volumes conveyed, Calva to Coolidge Dam	121	154.4	0	0	198.5	0	0	0	352.9
Channel losses, Calva to Coolidge Dam	122	$ 9.4	0	0	¢12.1	0	0	0	21.5
Gila River below Coolidge Dam, Arizona	123	145.0	0	0	186.4	0	0	0	331.4
SAN PEDRO RIVER FROM GAGE AT PALOMINAS, ARIZONA, TO GAGE AT CHARLESTON, ARIZONA									
San Pedro River at Palominas, Arizona	124	3.9	0	0	0	0	26.1	0	30.0
Estimated inflow, Palominas to Charleston	125	32.6	0	0	0	0	3.6	0	36.2
Consumptive use, Palominas to Charleston	126	.8	0	0	0	0	0	0	.8
Volumes conveyed, Palominas to Charleston	127	35.7	0	0	0	0	29.7	0	65.4
Channel losses, Palominas to Charleston	128	$5.9	0	0	0	0	¢4.9	0	10.8
San Pedro River at Charleston, Arizona	129	29.8	0	0	0	0	24.8	0	54.6
SAN PEDRO RIVER FROM CHARLESTON TO GAGE NEAR MAMMOTH, ARIZONA									
Estimated inflow, Charleston to Mammoth	130	62.3	0	0	0	0	0	0	62.3
Consumptive use, Charleston to Mammoth	131	10.3	0	0	0	0	0	0	10.3
Volumes conveyed, Charleston to Mammoth	132	81.8	0	0	0	0	24.8	0	106.6
Channel losses, Charleston to Mammoth	133	$35.0	0	0	0	0	¢10.6	0	45.6
San Pedro River near Mammoth, Arizona	134	46.8	0	0	0	0	14.2	0	61.0

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM COOLIDGE DAM TO GAGE AT KELVIN, ARIZONA									
Estimated inflow, Coolidge Dam to Kelvin	135	75.2	0	0	0	0	0	0	75.2
Consumptive use, Coolidge Dam to Kelvin	136	10.5	0	0	0	0	0	0	10.5
Volumes conveyed, Coolidge Dam to Kelvin	137	256.5	0	0	186.4	0	14.2	0	457.1
Channel losses, Coolidge Dam to Kelvin	138	$15.2	0	0	¢ 5.2	0	¢ 1.8	0	22.2
Gila River at Kelvin, Arizona	139	241.3	0	0	181.2	0	12.4	0	434.9
SANTA CRUZ RIVER FROM GAGE NEAR NOGALES, ARIZONA, TO GAGE AT RILLITO, ARIZONA									
Santa Cruz River near Nogales, Arizona	140	6.6	0	0	0	0	8.6	0	15.2
Water obtained from average depletion of ground-water basin in Santa Cruz and Pima Counties	141	20.8	0	0	0	0	0	0	20.8
Estimated inflow, Nogales to Rillito	142	83.2	0	0	0	0	1.8	0	85.0
Consumptive use, Nogales to Rillito	143	66.6	0	0	0	0	0	0	66.6
Volumes conveyed, Nogales to Rillito	144	44.0	0	0	0	0	10.4	0	54.4
Channel losses, Nogales to Rillito	145	$20.0	0	0	0	0	¢ 4.7	0	24.7
Santa Cruz River at Rillito, Arizona	146	24.0	0	0	0	0	5.7	0	29.7
SALT RIVER FROM ABOVE ROOSEVELT RESERVOIR TO GRANITE REEF DAM, ARIZONA									
Salt River near Roosevelt, Arizona	147	706.5	0	0	0	0	0	0	706.5
Tonto Creek near Roosevelt, Arizona	148	107.9	0	0	0	0	0	0	107.9
Verde River below Bartlett Dam, Arizona	149	522.4	0	0	0	0	0	0	522.4
Estimated inflow to Granite Reef Dam	150	100.2	0	0	0	0	0	0	100.2
Consumptive use, Roosevelt to Granite Reef	151	.3	0	0	0	0	0	0	.3
Export diversions for City of Phoenix	152	10.2	0	0	0	0	0	0	10.2
Reservoir evaporation depletions from Salt River Reservoir system	153	27.0	0	0	0	0	0	0	27.0

Table 22 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Historic Runoff
For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
SALT RIVER FROM ABOVE ROOSEVELT RESERVOIR TO GRANITE REEF DAM, ARIZONA (Continued)									
Accretions of surface storage in Salt River Reservoir system	154	24.6	0	0	0	0	0	0	24.6
Bank storage in Salt River Reservoir system	155	3.6	0	0	0	0	0	0	3.6
Volumes conveyed to Granite Reef Dam	156	1,371.3	0	0	0	0	0	0	1,371.3
Channel losses to Granite Reef Dam	157	$ 39.5	0	0	0	0	0	0	39.5
Salt River at Granite Reef Dam, Arizona	158	1,331.8	0	0	0	0	0	0	1,331.8
GILA RIVER FROM GAGE AT KELVIN TO GILLESPIE DAM, ARIZONA									
Agua Fria River at Lake Pleasant Dam	159	128.3	0	0	0	0	0	0	128.3
Import diversions for City of Phoenix	152	10.2	0	0	0	0	0	0	10.2
Water obtained from average depletion of ground-water basin in this stream section	160	133.6	0	0	0	0	0	0	133.6
Estimated inflow to Gillespie Dam	161	94.7	0	0	0	0	0	0	94.7
Lake Pleasant evaporation depletion	162	2.9	0	0	0	0	0	0	2.9
Accretion of surface storage in Lake Pleasant	163	.4	0	0	0	0	0	0	.4
Picacho Reservoir evaporation depletion	164	8.3	0	0	0	0	0	0	8.3
Consumptive use in this stream section	165	1,071.2	0	0	0	0	0	0	1,071.2
Volumes conveyed to Gillespie Dam	166	881.1	0	0	181.2	0	18.1	0	1,080.4
Channel losses to Gillespie Dam	167	$300.1	0	0	¢ 61.7	0	¢ 6.2	0	368.0
Gila River at Gillespie Dam, Arizona	168	581.0	0	0	119.5	0	11.9	0	712.4
Diversions by Gillespie Canal	169	63.2	0	0	0	0	0	0	63.2
Diversions by Enterprise Canal	170	7.7	0	0	0	0	0	0	7.7
Gila River below Gillespie Dam, Arizona	171	510.1	0	0	119.5	0	11.9	0	641.5

Table 22 (Continued) Sheet 10 of 11

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Historic Runoff

For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM GILLESPIE DAM TO GAGE NEAR DOME, ARIZONA									
Water obtained from average depletion of ground-water basin in this stream section	172	21.9	0	0	0	0	0	0	21.9
Estimated inflow, Gillespie Dam to Dome	173	29.7	0	0	0	0	.2	0	29.9
Consumptive use, Gillespie Dam to Dome	174	49.4	0	0	0	0	0	0	49.4
Volumes conveyed, Gillespie Dam to Dome	175	583.2	0	0	119.5	0	12.1	0	714.8
Channel losses, Gillespie Dam to Dome	176	$210.4	0	0	¢43.1	0	¢4.4	0	257.9
Gila River near Dome, Arizona	177	372.8	0	0	76.4	0	7.7	0	456.9
COLORADO RIVER FROM GAGE NEAR TOPOCK TO LIMITROPHE SECTION AT INTERNATIONAL BOUNDARY									
Bill Williams River at Planet, Arizona	178	135.2	0	0	0	0	0	0	135.2
Estimated inflow, Topock to Limitrophe Section	179	19.4	12.1	0	0	0	0	0	31.5
Consumptive use, Topock to Limitrophe Section	180	196.0	139.2	0	0	0	0	0	335.2
Transbasin export diversions	181	0	2,432.0	0	0	0	0	0	2,432.0
Reservoir evaporation depletions	182	0	0	0	0	0	0	36.2	36.2
Accretion of surface storage in Havasu Lake	183	0	0	0	0	0	0	21.0	21.0
Bank storage in Havasu Lake	184	0	0	0	0	0	0	2.6	2.6
Volumes conveyed, Topock to Limitrophe Section	185	1,139.8	0	116.2	107.6	183.1	7.7	9,574.5	11,128.9
Channel losses, Topock to Limitrophe Section	186	$ 80.3	0	¢ 8.2	¢ 7.6	¢12.9	¢.6	¢ 674.8	784.4
Historic flow, Colorado River within Limitrophe Section at International Boundary	187	1,059.5	0	108.0	100.0	170.2	7.1	8,899.7	10,344.5

Table 22 (Continued)

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Historic Runoff

For the 1914-1945 Period

Unit: 1,000 acre-feet

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
Sum of measured contributions from the United States within the Limitrophe Section	188	-	-	-	-	-	-	-	10,386.3
Estimated inflow, Yuma to Limitrophe Section	189	-	-	-	-	-	-	-	.7
Volumes conveyed to Limitrophe Section	190	-	-	-	-	-	-	-	10,387.0
Channel losses, Yuma to Limitrophe Section	191	-	-	-	-	-	-	-	42.5
Historic flow, Colorado River within Limitrophe Section at International Boundary	192	-	-	-	-	-	-	-	10,344.5

$. Losses within state.
¢. Losses out of state.

Notes Accompanying Table 22
Analysis of Contributions by States Based on Mean Historic Runoff for the 1914-1945 Period

Item No.

1. Total is the average annual historical flow at the gage at St. Johns, Arizona (Appendix A, Sheet 2 of Table 6). The portion from New Mexico was estimated by applying the average runoff rate a square mile of the San Francisco River near Glenwood, New Mexico, to the drainage area in New Mexico upstream from the gage at St. Johns, Arizona. The Arizona portion was computed as the difference between the total and the New Mexico portion.

2. The contribution from New Mexico for this section is furnished by Carrizo Wash. Because of the similarity of watersheds, the runoff rate of the Zuni River downstream from Black Rock, New Mexico, was applied to the drainage area of Carrizo Wash excluding the closed basin of 830 square miles near Quemado, New Mexico, and an additional 300 square miles in New Mexico. The 300 square miles was considered to be partially contributory and an estimated runoff rate of 25 percent of the Zuni River rate was applied. New Mexico's contribution was computed to be 4,600 acre-feet a year and the contribution from Carrizo Wash in Arizona was computed to be 1,800 acre-feet a year. The additional 4,100 acre-feet apportioned to Arizona represents the inflow to the main stream section other than Carrizo Wash and was estimated as the differential needed to balance the measured flow of the Little Colorado River above Zuni River near Hunt, Arizona.

3. Consumptive use of irrigation water by crops and noncropped areas in the Concho area (A-3-LC in Table 12); all in Arizona.

4. Stream depletion by small reservoirs in this stream section (See Table 8); all in Arizona.

5. Item 1 plus Item 2 minus Items 3 and 4.

6. Channel losses in this section were estimated to average 7,000 acre-feet a year (See Table 14). On the basis of proportional volumes conveyed, these losses were apportioned as 3,000 acre-feet to New Mexico and 4,000 acre-feet to Arizona.

7. Item 5 minus Item 6 (See Appendix A, Sheet 3 of Table 6 for total).

Item No.

8. Average annual historical flow of the Zuni River at the gage at Black Rock, New Mexico (Appendix A, Sheet 4 of Table 6); all in New Mexico.

9. The differential needed to balance the measured flow of the Little Colorado River near Hunt, Arizona, was estimated to be 9,600 acre-feet a year. Prorating this quantity on the basis of drainage area, the contribution of the area in New Mexico between Black Rock and the State line was computed to be 2,100 acre-feet a year. An area of 207 square miles in New Mexico contributory to Atarque Creek which contributes to the Zuni River downstream from the State line was considered to contribute at a rate of 25 percent of the runoff rate of the balance of the watershed in the section upstream from the gage on the Little Colorado River near Hunt to the gages at Black Rock on the Zuni River and above Zuni River near Hunt on the Little Colorado River. Consideration was given to this reduced rate in computing the normal rate for application to the balance of the watershed.

10. Consumptive use of irrigation water by crops and noncropped areas; all in New Mexico. Table 12 lists 5,200 acre-feet for NM-2-LC, Zuni River area in New Mexico. This total was distributed as 1,000 acre-feet upstream from Black Rock and 4,200 acre-feet in this river section from Black Rock to the New Mexico-Arizona State line.

11. Stream depletions by small reservoirs (see Table 8); all in New Mexico.

12. Item 8 plus Item 9 minus Items 10 and 11.

13. Channel losses (see Table 14); all in New Mexico.

14. Item 12 minus Item 13.

15. The runoff rates determined by the method discussed in detail for Item 9 were applied in this stream section. On this basis, the annual contributions were computed to be 3,600 acre-feet from New Mexico and 3,800 acre-feet from Arizona.

16. Item 14 Plus Item 15.

17. Channel losses of 4,800 acre-feet a year were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

18. Item 16 minus Item 17.

Item No.

19. The runoff rate determined for Items 9 and 15 was applied to this drainage area of 19 square miles; all in Arizona.

20. Item 7 plus Item 18 plus Item 19.

21. Channel losses of 400 acre-feet a year were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

22. Item 20 minus Item 21 (see Appendix A, Sheet 5 of Table 6 for total).

23. Average annual historical flow of Silver Creek at the gage near Woodruff (see Appendix A, Sheet 6 of Table 6); all in Arizona.

24. Computed as the differential needed to balance the measured flow of the Little Colorado River near Woodruff adjusted for depletions and channel losses; all in Arizona.

25. Consumptive use of irrigation water by crops and noncropped areas (A-5-LC in Table 12); all in Arizona.

26. Item 22 plus Items 23 and 24 minus Item 25.

27. Channel losses of 3,400 acre-feet a year in this section prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

28. Item 26 minus Item 27 (see Appendix A, Sheet 7 of Table 6 for total).

29. Average annual historical flow of the Puerco River at the gage at Gallup (see Appendix A, Sheet 8 of Table 6); all in New Mexico.

30. The contribution from this drainage area was estimated by applying a runoff rate derived from precipitation correlation with the runoff rate of the Puerco River at Gallup; all in New Mexico.

31. Item 29 plus Item 30.

32. Channel losses in this section were all in New Mexico (see Table 14).

33. Item 31 minus Item 32.

Item No.

34. The contribution from that portion of the drainage area in New Mexico and Arizona contributory to the Puerco River upstream from Black Creek was estimated by applying the runoff rate determined for Item 30 to the respective drainage areas in New Mexico and Arizona. The average historical flow of Black Creek at mouth was estimated by correlation of the flow of Puerco River at Gallup with a few measured flows of Black Creek obtained near the mouth near Houck, Arizona. The contribution from Black Creek was prorated between New Mexico and Arizona on the basis of the respective drainage areas. The contribution from the drainage area from Black Creek to the gage on the Puerco River near Adamana (all in Arizona) was estimated as the differential needed to balance the measured flow near Adamana adjusted for channel losses and contributions from upstream drainage areas. The total contributions from New Mexico and Arizona in this section were obtained from the summations of the respective contributions from the three divisions.

35. Consumptive use of irrigation water by crops and noncropped areas (A-6-LC in Table 12); all in Arizona.

36. Item 33 plus Item 34 minus Item 35.

37. Channel losses of 1,000 acre-feet a year were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

38. Item 36 minus Item 37 (see Appendix A, Sheet 9 of Table 6 for total).

39. The contribution from the drainage area from the gage near Adamana to the mouth of the Puerco River was estimated by applying the same runoff rate that was determined for the section between Black Creek and Adamana and discussed under Item 34; all in Arizona.

40. Item 38 plus Item 39.

41. Channel losses of 1,900 acre-feet a year were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

42. Item 40 minus Item 41.

43. Average annual historical flow of Chevelon Fork at the gage near Winslow (see Appendix A, Sheet 10 of Table 6); all in Arizona.

44. Average annual historical flow of Clear Creek at the gage near Winslow (see Appendix A, Sheet 11 of Table 6); all in Arizona.

Item No.

45. Computed as the differential needed to balance the measured flow of the Little Colorado River at Grand Falls adjusted for depletions and channel losses; all in Arizona.

46. Consumptive use of irrigation water by crops and noncropped areas in this section (A-7-LC plus A-8-LC in Table 12); all in Arizona.

47. Stream depletion by small reservoirs in this section (see Table 8); all in Arizona.

48. Item 28 plus Items 42, 43, 44, and 45 minus Items 46 and 47.

49. Estimated channel losses of 52,000 acre-feet a year in this section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

50. Item 48 minus Item 49 (see Appendix A, Sheet 12A of Table 6 for total).

51. Average annual historical flow of Moenkopi Wash at the gage near Tuba (see Appendix A, Sheet 13 of Table 6); all in Arizona.

52. Contribution from the unmeasured drainage area between Grand Falls and the new gaging station on the Little Colorado River near Cameron was estimated by applying the runoff rate of Moenkopi Wash near Tuba. Considering upstream depletions, the runoff rate of Moenkopi Wash near Tuba was estimated to be 6.8 acre-feet a square mile. With a drainage area of 2,831 square miles, the unmeasured inflow between Grand Falls and the gage near Cameron was computed to be 19,300 acre-feet a year; all in Arizona. The gaging station near Cameron has not been in operation for a period long enough to provide records as a basis for estimating a long-time flow.

The drainage area between the gage near Cameron and the mouth of the Little Colorado River is only 411 square miles. However, several springs in this river section make a large contribution to the flow of the river. The contribution from this area (all in Arizona) was estimated to be 134,100 acre-feet a year by computing the differential needed to balance the estimated flow of the Little Colorado River at mouth (see Item 55).

Assuming the runoff rate of the 411 square miles of drainage area between the Cameron gage and the mouth of the Little Colorado River to be the same as for the area immediately upstream from the gage, the contribution from the springs would be 131,300 acre-feet a year or about 181 cubic feet a second. The Geological Survey measured the flow of the springs as 196 second-feet in early summer

Item No.

52. (Continued)
of 1950. Although this single measurement may not be representative of the average flow of the springs, it does serve as a rough check on the estimated flow derived from the difference in flows at Lees Ferry and Grand Canyon on the main stream of the Colorado River.

Total unmeasured inflow between Grand Falls and the mouth of the Little Colorado River would be 19,300 plus 134,100 or 153,400 acre-feet a year; all from Arizona.

53. Item 50 plus Items 51 and 52.

54. Estimated channel losses of 7,800 acre-feet a year were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

55. Item 53 minus Item 54. The total flow at the mouth was computed as the differential needed to balance the measured flow of the Colorado River near Grand Canyon adjusted for other unmeasured inflow and channel losses shown in Items 57 and 59.

56. Average annual historical flow of the Colorado River at Lee Ferry for the 1914-1945 period as given in the final report of the Engineering Advisory Committee to Upper Colorado River Basin Compact Commission, dated November 29, 1948 (see Appendix A, Sheet 1A of Table 6).

57. This area excludes the Little Colorado River drainage basin. The contribution from this area was estimated by applying the runoff rate of the Paria River at Lees Ferry adjusted for upstream depletions to the 1,408 square miles of intermediate drainage area contributory to the Colorado River; all in Arizona.

58. Item 55 plus Items 56 and 57.

59. Estimated channel losses of 20,900 acre-feet a year were prorated on the basis of the respective volumes conveyed as shown in Item 58 (see Table 14 for total).

60. Item 58 minus Item 59 (see Appendix A, Sheet 14A of Table 6 for total).

61. Average annual historical flow of Bright Angel Creek at the gage near Grand Canyon (see Appendix A, Sheet 15 of Table 6); all in Arizona.

Item No.

62. Average annual historical flow of the Virgin River at the gage at Littlefield, Arizona. The contributions from Arizona and Nevada were estimated by applying the runoff rate of the section between the gages at Virgin, Utah, and Littlefield, Arizona, with consideration given to depletions by each state in the section between Virgin and Littlefield. The contribution from Utah was computed as the balance of the measured flow at Littlefield (see Appendix A, Sheet 17 of Table 6).

63. The derivation of the total estimated inflow to this section has been described in this report in connection with bank storage in Lake Mead in the analyses section discussing stream depletions by reservoirs.

The average annual estimated inflow from the Utah portion of the Kanab Creek drainage area was estimated by applying the runoff rate determined in Item 62 for the Virgin River between the gages at Virgin and Littlefield under virgin flow conditions.

The balance of the estimated inflow was apportioned among the States of Arizona, Nevada, and Utah by applying estimated unit rates of runoff to the respective contributory drainage areas. These unit runoff rates were solved algebraically on the basis that the ratios between the unit runoff rates and the average precipitation of the respective areas are the same.

64. Consumptive use of irrigation water by crops and noncropped areas as determined for each state in this stream section (see Table 12. For Arizona: The sum of A-1-C, A-2-C, A-3-C, A-4-C, and 1,300 acre-feet of A-2-V distributed as downstream from the gage on Virgin River at Littlefield, Arizona. For Nevada: The sum of N-1-V, N-2-V, N-3-V, and the Henderson area and Boulder City. For Utah: U-1-C, the Kanab Creek area in Utah).

65. Evaporation depletion by Lake Mead apportioned to undistributed stream flow (see Table 8).

66. Stream depletion by the average annual accretion of surface storage in Lake Mead apportioned to undistributed stream flow (see Table 11).

67. Stream depletion by the average annual accretion of bank storage in Lake Mead apportioned to undistributed stream flow (see Table 11).

68. Stream depletion by evaporation from small reservoirs in this river section (see Table 8, small reservoirs in Hualpai Indian Reservation); all in Arizona.

Item No.

69. Item 60 plus Items 61, 62, and 63 minus Items 64, 65, 66, 67, and 68.

70. Estimated channel losses of 121,100 acre-feet a year were prorated among the various contributors on the basis of the respective volumes conveyed as shown in Item 69 (see Table 14, Grand Canyon to Hoover Dam on Colorado River, 79,800 acre-feet; and Littlefield to mouth on Virgin River, 41,300 acre-feet).

71. Item 69 minus Item 70 (see Appendix A, Sheet 19A of Table 6 for total).

72. The total estimated inflow was computed as the differential needed to balance the measured flow of the Colorado River near Topock adjusted for depletions and channel losses in the section. The estimated inflow was prorated among Arizona, California, and Nevada on the basis of the respective drainage areas in each state.

73. Consumptive use of irrigation water by crops and noncropped areas as determined for each state in this river section (see Table 12. A-5-C for Arizona; City of Needles for California; and N-2-C for Nevada).

74. Item 71 plus Item 72 minus Item 73.

75. Estimated channel losses of 383,600 acre-feet a year were prorated among the various contributors on the basis of the respective volumes conveyed as shown in Item 74 (see Table 14 for total).

76. Item 74 minus Item 75 (see Appendix A, Sheet 20A of Table 6 for total).

77. Average annual historical flow of the Gila River at the gage below Blue Creek, near Virden (see Appendix A, Sheet 24 of Table 6); all in New Mexico.

78. The differential needed to balance the measured flow of the Gila River near Clifton, Arizona, when adjusted for stream depletions and channel losses between the two gages, was estimated as 27,500 acre-feet a year. Prorating this quantity on the basis of drainage areas, the contribution of the area in New Mexico between the gage near Virden and the State line was computed to be 4,900 acre-feet a year.

79. Consumptive use of irrigation water by crops and noncropped areas in this stream section (NM-2-G in Table 12); all in New Mexico.

80. Item 77 plus Item 78 minus Item 79.

Item No.

81. Channel losses in this river section (see Table 14); all in New Mexico.

82. Item 80 minus Item 81.

83. As in Item 78, the average annual inflow between the gages near Virden and near Clifton was prorated on the basis of the respective drainage areas. The total estimated inflow between the State line and the Clifton gage was thus computed to be 22,600 acre-feet a year with contributions of 17,700 and 4,900 acre-feet a year from Arizona and New Mexico, respectively.

84. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-1-G in Table 12); all in Arizona.

85. Item 82 plus Item 83 minus Item 84.

86. Estimated channel losses of 5,300 acre feet a year in this river section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

87. Item 85 minus Item 86 (see Appendix A, Sheet 25A of Table 6 for total).

88. Average annual historical flow of the San Francisco River at the gage near Glenwood, New Mexico (see Appendix A, Sheet 26 of Table 6 for total). The flow was prorated between Arizona and New Mexico on the basis of their respective drainage areas with consideration for upstream depletions of 2,400 acre-feet a year in New Mexico.

89. The estimated inflow between the Glenwood gage and the State line was computed by applying the unit runoff rate at the Glenwood gage (adjusted for upstream depletions) to the drainage area in this river section; all in New Mexico.

90. Item 88 plus Item 89.

91. Estimated channel losses of 600 acre-feet a year between the Glenwood gage and the State line were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total). Arizona's proportion was negligible.

92. Item 90 minus Item 91.

Item No.

93. The total estimated inflow for this section was computed as the differential needed to balance the measured flow of the San Francisco River at the gage at Clifton adjusted for depletions and channel losses in the section. This quantity was prorated on the basis of the drainage areas in New Mexico and Arizona contributory to this stream section.

94. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-3-G in Table 12); all in Arizona.

95. Item 92 plus Item 93 minus Item 94.

96. Estimated channel losses of 1,200 acre-feet a year between the State line and the Clifton gage were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

97. Item 95 minus Item 96 (see Appendix A, Sheet 27A of Table 6 for total).

98. Importation of water from the Black River, a tributary of the Salt River, began in April 1945 for use in the vicinity of Morenci, Arizona. The average was determined on a 32-year basis (see Appendix A, Sheet 28 of Table 6). The contribution was all from Arizona.

99. The estimated inflow to this river section was computed as the differential needed to balance the measured flow of the Gila River at head of Safford Valley adjusted for depletions and channel losses in the section; all in Arizona.

100. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-4-G in Table 12); all in Arizona.

101. Item 87 plus Items 97, 98, and 99 minus Item 100.

102. Estimated channel losses of 1,000 acre-feet a year in this river section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

103. Item 101 minus Item 102 (see Appendix A, Sheet 29A of Table 6 for total).

Item No.

104. The average historical flow of San Simon Creek at the New Mexico-Arizona State line was estimated by applying the weighted average runoff in acre-feet a square mile of San Simon Creek at Rodeo, New Mexico, and San Simon, Arizona. This average runoff as converted to represent the average for the study period and adjusted for upstream depletions was prorated between New Mexico and Arizona on the basis of the respective drainage areas and the Arizona portion corrected for the stream depletions.

105. Estimated inflow was computed as the differential needed to balance the measured flow of San Simon Creek near Solomon adjusted for depletions and channel losses in the section; all in Arizona.

106. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-6-G in Table 12); all in Arizona.

107. Item 104 plus Item 105 minus Item 106.

108. Estimated channel losses of 600 acre-feet a year in this stream section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

109. Item 107 minus Item 108 (see Appendix A, Sheet 30 of Table 6 for total).

110. The estimated inflow to this stream section was computed as the differential needed to balance the measured flow of the Gila River at Calva adjusted for depletions and channel losses in the section; all in Arizona.

111. Stream depletion by small reservoirs in this section (see Table 8); all in Arizona.

112. Consumptive use of irrigation water by crops and noncropped areas in this river section (see Table 12. A-7-G, Safford Valley, 61,300 acre-feet; plus 500 acre-feet of A-8-G, San Carlos Indian Reservation distributed as upstream from the gage on Gila River at Calva); all in Arizona.

113. Item 103 plus Items 109 and 110 minus Items 111 and 112.

114. The estimated channel losses in this river section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

115. Item 113 minus Item 114 (see Appendix A, Sheet 31A of Table 6 for total).

Item No.

116. Average annual historical flow of the San Carlos River at the gage near Peridot (see Appendix A, Sheet 32 of Table 6); all in Arizona.

117. The estimated inflow to this stream section was computed as the differential needed to balance the measured flow of the Gila River at the gage below Coolidge Dam adjusted for consumptive use by crops and noncropped areas, channel losses, and evaporation depletion and change in storage in San Carlos Reservoir; entire contribution from Arizona.

118. Consumptive use of irrigation water by crops and noncropped areas in this stream section (see A-8-G in Table 12. The total of 1,800 acre-feet for this area was distributed as 500 acre-feet on Gila River upstream from gage at Calva (Item 112), 900 acre-feet on San Carlos River upstream from the gage near Peridot, and 400 acre-feet on San Carlos River downstream from gage near Peridot for this river section item); all in Arizona.

119. Stream depletion by evaporation from San Carlos Reservoir (see Table 8); all in Arizona.

120. Stream depletion by average annual accretion of surface storage in San Carlos Reservoir (see Table 11); all in Arizona.

121. Item 115 plus Items 116 and 117 minus Items 118, 119, and 120.

122. The estimated channel losses of 21,500 acre-feet a year in this section were prorated between New Mexico and Arizona on the basis of the respective volumes conveyed (see Table 14 for total).

123. Item 121 minus Item 122 (see Appendix A, Sheet 33A of Table 6 for total).

124. Average annual historical flow of the San Pedro River at the gage at Palominas, Arizona (see Appendix A, Sheet 34 of Table 6 for total). The flow was prorated between Arizona and Mexico on the basis of their respective drainage areas with consideration for upstream depletions of 1,100 acre-feet a year in Mexico.

125. The total estimated inflow to this stream section was computed as the differential needed to balance the measured flow of the San Pedro River at Charleston adjusted for depletions and channel losses in the section. The total unmeasured inflow was prorated between Arizona and Mexico on the basis of their respective drainage areas.

Item No.

126. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-9-G in Table 12); all in Arizona.

127. Item 124 plus Item 125 minus Item 126.

128. Estimated channel losses of 10,800 acre-feet a year were prorated between Arizona and Mexico on the basis of the respective volumes conveyed (see Table 14 for total).

129. Item 127 minus Item 128 (see Appendix A, Sheet 35 of Table 6 for total).

130. The estimated inflow to this stream section was computed as the differential needed to balance the measured flow of the San Pedro River near Mammoth adjusted for depletions and channel losses in the section; all in Arizona.

131. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-10-G in Table 12); all in Arizona.

132. Item 129 plus Item 130 minus Item 131.

133. Estimated channel losses of 45,600 acre-feet a year in this stream section were prorated between Arizona and Mexico on the basis of the respective volumes conveyed (see Table 14 for total).

134. Item 132 minus Item 133 (see Appendix A, Sheet 36 of Table 6 for total).

135. The estimated inflow to this stream section was computed as the differential needed to balance the measured flow of the Gila River at Kelvin adjusted for depletions and channel losses in the section; all in Arizona.

136. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-11-G plus A-12-G in Table 12); all in Arizona.

137. Item 123 plus Items 134 and 135 minus Item 136.

Item No.

138. Estimated channel losses of 22,200 acre-feet a year were prorated among Arizona, New Mexico, and Mexico on the basis of the respective volumes conveyed from Mammoth to the mouth of the San Pedro River and from Coolidge Dam to Kelvin on the Gila River. (See Table 14 for total. San Pedro River from Mammoth to mouth, 9,700 acre-feet plus Gila River from Coolidge Dam to Kelvin, 12,500 acre-feet).

139. Item 137 minus Item 138 (see Appendix A, Sheet 38A of Table 6 for total).

140. Average annual historical flow of the Santa Cruz River at the gage near Nogales, Arizona (see Appendix A, Sheet 39 of Table 6 for total). The flow was prorated between Arizona and Mexico on the basis of their respective drainage areas with consideration for upstream depletions of 600 acre-feet a year in Arizona and 5,400 acre-feet a year in Mexico.

141. It was estimated that the ground water stored in this river section prior to 1914 was depleted an average 20,800 acre-feet a year during the 1914-1945 period (see Upper Santa Cruz River in Table 4).

142. The total estimated inflow to this river section was computed as the differential needed to balance the measured flow of the Santa Cruz River at Rillito adjusted for consumptive use, channel losses, and change in ground-water storage in the section. The contribution from Mexico was estimated by applying the runoff rate of the undepleted flow near Nogales to the drainage area in Mexico in this section. The balance of the total estimated inflow was apportioned to Arizona.

143. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-14-G plus A-15-G in Table 12); all in Arizona.

144. Item 140 plus Items 141 and 142 minus Item 143.

145. The estimated channel losses of 24,700 acre-feet a year in this stream section were prorated between Arizona and Mexico on the basis of the respective volumes conveyed (see Table 14 for total).

146. Item 144 minus Item 145 (see Appendix A, Sheet 42 of Table 6 for total).

147. Average annual historical flow of the Salt River at the gage near Roosevelt (see Appendix A, Sheet 43A of Table 6); all in Arizona.

Item No.

160. It was estimated that the ground water stored in this river section prior to 1914 was depleted an average 133,600 acre-feet a year during the 1914-1945 period (see Table 4, Pinal County and Maricopa County upstream from Gillespie Dam).

161. The estimated inflow to this river section was computed as the differential needed to balance the measured flow of the Gila River at Gillespie Dam adjusted for consumptive use, channel losses, reservoir depletions, ground-water depletions, and the water imported for use in Phoenix. All in Arizona.

162. Evaporation depletion by Lake Pleasant (see Table 8); all in Arizona.

163. Stream depletion by the average annual accretion of surface storage in Lake Pleasant (see Table 11); all in Arizona.

164. Stream depletion by Picacho Reservoir in Pinal County (see Table 8); all in Arizona.

165. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-16-G plus A-26-G in Table 12); all in Arizona.

166. Item 139 plus Items 146, 158, 159, 152, 160 and 161 minus Items 162, 163, 164, and 165.

167. The estimated channel losses of 368,000 acre-feet a year in this stream system were prorated among Arizona, New Mexico, and Mexico on the basis of the respective volumes conveyed (see Table 14 for total).

168. Item 166 minus Item 167.

169. Average annual diversions by Gillespie Canal during the 1914-1945 period for use downstream (see Appendix A, Sheet 51 of Table 6).

170. Average annual diversions by Enterprise Canal during the 1914-1945 period for use downstream (see Appendix A, Sheet 52 of Table 6).

171. Item 168 minus Items 169 and 170. This is the average annual historical flow of the Gila River at the gage below Gillespie Dam (see Appendix A, Sheet 53A of Table 6 for total).

172. It was estimated that the ground water stored in this river section prior to 1914 was depleted an average 21,900 acre-feet a year during the 1914-1945 period (see Table 4, Gillespie Dam to Dome).

Item No.

173. The estimated inflow to this river section was computed as the differential needed to balance the measured flow of the Gila River near Dome adjusted for consumptive use, channel losses, and change in ground-water storage in this section. The unmeasured inflow was prorated between Arizona and Mexico on the basis of their respective drainage areas.

174. Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-27-G in Table 12); all in Arizona.

175. Item 168 plus Items 172 and 173 minus Item 174.

176. Estimated channel losses of 257,900 acre-feet a year in this river section were prorated among Arizona, New Mexico, and Mexico on the basis of the respective volumes conveyed (see Table 14 for total).

177. Item 175 minus Item 176 (see Appendix A, Sheet 54A of Table 6 for total).

178. Average annual historical flow of the Bill Williams River at the gage at Planet (see Appendix A, Sheet 21 of Table 6); all in Arizona.

179. The total estimated inflow to this river section was computed as the differential needed to balance the historical flow of the Colorado River within the Limitrophe Section at the International Boundary adjusted for consumptive use, channel losses, reservoir depletions, and transbasin exports in the section. The derivation of the historic flow of the Colorado River within the Limitrophe Section is described under Items 188 through 192. The unmeasured inflow was prorated between Arizona and California on the basis of their respective drainage areas.

180. Consumptive use of irrigation water by crops and noncropped areas as determined for each state in this stream section. (See Tables 12 and 13. For Arizona: the sum of A-6-C, A-7-C, A-8-C, and A-9-C in Table 12 plus 100 acre-feet for Arizona's share of All-American Canal depletions as discussed in footnote 2/ to Table 13. For California: the sum of C-1-C and C-2-C in Table 12 plus 300 acre-feet for California's share of All-American Canal depletions as discussed in footnote 2/ to Table 13).

181. The sum of 1914-1945 average diversions by the Colorado River Aqueduct, All-American Canal, and Alamo Canal system for use in California outside of the natural drainage area of the Colorado River (see Appendix A, Table 6, Sheet 22 for Colorado River Aqueduct, Sheet 59 for All-American below Pilot Knob Wasteway, and Sheet 65A for diversions for use in California by Alamo Canal system).

182. Average annual stream depletions by evaporation at Havasu Lake and the diversion reservoirs at Headgate

Item No.

183. Stream depletion by the average annual accretion of surface storage in Havasu Lake (see Table 11, Havasu Lake); apportioned to undistributed stream flow.

184. Stream depletion by the average annual accretion of bank storage in Havasu Lake (see Table 11, Havasu Lake); apportioned to undistributed stream flow.

185. Item 76 plus Items 177, 178, and 179 minus Items 180, 181, 182, 183, and 184. Computations for California give historic inflow to this section of 14,200 acre-feet annually with depletions by California of 2,571,200 acre-feet a year. The 2,557,000 acre-feet needed to balance the California water account was taken from undistributed stream flow.

186. Channel losses from water surface evaporation and river bottom growth from Topock to the California-Baja California boundary and phreatophytic growth along the Arizona boundary of the Limitrophe Section (see Table 14 for total. Topock to Yuma, 741,900 acre-feet plus Yuma to International Boundary, 42,500 acre-feet). The losses were prorated among the various contributors on the basis of the respective volumes conveyed as shown in Item 185.

187. Item 185 minus Item 186.

188. The record for this constructed station is tabulated on Sheets 72 and 72A of Table 6 in Appendix A. It was prepared by combining the record of the flow of the Colorado River at the Yuma gaging station with records and estimates of downstream return flows by drains and wasteways in the United States and deducting diversions from the Colorado River downstream from Yuma gaging Station for use in the United States.

189. The contribution from the intermediate drainage area in this stream section was estimated by applying the unit rate of runoff determined for the entire river section from Topock to the Limitrophe Section in Item 179. This unit runoff rate has been determined by algebraic solution of the hydrologic equation of the entire section downstream from Topock with consideration for channel losses between Yuma and the International Boundary.

The contribution from the drainage area in Arizona downstream from the California-Baja California boundary was considered to have been included in the measured return flows within the Limitrophe Section.

190. Item 188 plus Item 189.

191. Channel losses from water surface evaporation and river bottom growth from Yuma to the California-Baja California boundary and phreatophytic growth along the Arizona boundary of the Limitrophe Section (see Table 14, Yuma to International Boundary).

Table 23 (Continued) Sheet 1 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
LITTLE COLORADO RIVER FROM HEADWATERS TO GAGE ABOVE ZUNI RIVER NEAR HUNT, ARIZONA									
Consumptive use upstream from St. Johns	(1)	17.0	0	0	0	0	0	0	17.0
Reservoir evaporation depletion above St. Johns	(2)	3.3	0	0	0	0	0	0	3.3
Less replacement of native vegetation	(3)	.3	0	0	0	0	0	0	.3
Net depletions upstream from St. Johns	(4)	20.0	0	0	0	0	0	0	20.0
Little Colorado River at St.Johns,Ariz.	1	4.8	0	0	1.8	0	0	0	6.6
Undepleted Little Colo.R.at St. Johns	(5)	24.8	0	0	1.8	0	0	0	26.6
Estimated inflow,St.Johns to Zuni River	2	5.9	0	0	4.6	0	0	0	10.5
Undepleted volumes conveyed to Zuni River	(6)	30.7	0	0	6.4	0	0	0	37.1
Historic channel losses,St.Johns to Zuni R.	6	4.0	0	0	3.0	0	0	0	7.0
Virgin channel losses,St.Johns to Zuni R.	(7)	$ 3.0	0	0	¢ 3.0	0	0	0	6.0
Replacement of native vegetation	(8)	1.3	0	0	0	0	0	0	1.3
Increased losses from native growth change	(9)	2.3	0	0	0	0	0	0	2.3
Undepleted Little Colorado River above Zuni River near Hunt, Arizona	(10)	27.7	0	0	3.4	0	0	0	31.1
ZUNI RIVER FROM HEADWATERS TO NEW MEXICO-ARIZONA STATE LINE									
Consumptive use upstream from Black Rock	(11)	0	0	0	1.0	0	0	0	1.0
Reservoir evaporation depletion above Black Rock	(12)	0	0	0	4.1	0	0	0	4.1
Net depletions upstream from Black Rock	(13)	0	0	0	5.1	0	0	0	5.1
Zuni River at Black Rock, New Mexico	8	0	0	0	18.4	0	0	0	18.4
Undepleted Zuni River at Black Rock	(14)	0	0	0	23.5	0	0	0	23.5
Estimated inflow,Black Rock to State line	9	0	0	0	2.1	0	0	0	2.1
Undepleted volumes conveyed to State line	(15)	0	0	0	25.6	0	0	0	25.6
Historic channel losses to State line	13	0	0	0	3.5	0	0	0	3.5
Virgin channel losses to State line	(16)	0	0	0	$ 7.8	0	0	0	7.8
Replacement of native vegetation	(17)	0	0	0	1.6	0	0	0	1.6
Decreased losses from native growth change	(18)	0	0	0	2.7	0	0	0	2.7

Table 23 (Continued) Sheet 2 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
ZUNI RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO MOUTH NEAR HUNT, ARIZONA									
Estimated inflow, State line to mouth	15	3.8	0	0	3.6	0	0	0	7.4
Undepleted volumes conveyed to mouth	(20)	3.8	0	0	21.4	0	0	0	25.2
Virgin channel losses, State line to mouth	(21)	$ .9	0	0	¢ 3.9	0	0	0	4.8
Undepleted Zuni River at mouth	(22)	2.9	0	0	17.5	0	0	0	20.4
LITTLE COLORADO RIVER FROM GAGE ABOVE ZUNI RIVER TO GAGE NEAR HUNT, ARIZONA									
Estimated inflow, excluding Zuni River	19	.1	0	0	0	0	0	0	.1
Undepleted volumes conveyed to lower gage	(23)	30.7	0	0	20.9	0	0	0	51.6
Virgin channel losses	(24)	$ .1	0	0	¢ .3	0	0	0	.4
Undepleted Little Colorado River near Hunt	(25)	30.6	0	0	20.6	0	0	0	51.2
LITTLE COLORADO RIVER FROM GAGE NEAR HUNT TO GAGE NEAR WOODRUFF, ARIZONA									
Consumptive use in Silver Creek Basin	(26)	8.3	0	0	0	0	0	0	8.3
Reservoir evaporation depletion, Silver Creek	(27)	.8	0	0	0	0	0	0	.8
Less replacement of native vegetation	(28)	.6	0	0	0	0	0	0	.6
Net depletions in Silver Creek Basin	(29)	8.5	0	0	0	0	0	0	8.5
Silver Creek near Woodruff, Arizona	23	23.1	0	0	0	0	0	0	23.1
Undepleted Silver Creek near Woodruff	(30)	31.6	0	0	0	0	0	0	31.6
Estimated inflow, Hunt to Woodruff	24	16.3	0	0	0	0	0	0	16.3
Undepleted volumes conveyed to Woodruff	(31)	78.5	0	0	20.6	0	0	0	99.1
Virgin channel losses, Hunt to Woodruff	(32)	$ 2.5	0	0	¢ .9	0	0	0	3.4
Undepleted Little Colorado River near Woodruff, Arizona	(33)	76.0	0	0	19.7	0	0	0	95.7

Table 23 (Continued) Sheet 3 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
PUERCO RIVER FROM HEADWATERS TO NEW MEXICO-ARIZONA STATE LINE									
Consumptive use upstream from Gallup, New M.	(34)	0	0	0	3.3	0	0	0	3.3
Less replacement of native vegetation	(35)	0	0	0	.2	0	0	0	.2
Less decreased losses from growth change	(36)	0	0	0	1.7	0	0	0	1.7
Net depletions upstream from Gallup, N.M.	(37)	0	0	0	1.4	0	0	0	1.4
Puerco River at Gallup, New Mexico	29	0	0	0	7.2	0	0	0	7.2
Undepleted Puerco River at Gallup	(38)	0	0	0	8.6	0	0	0	8.6
Estimated inflow, Gallup to State line	30	0	0	0	6.5	0	0	0	6.5
Undepleted volumes conveyed to State line	(39)	0	0	0	15.1	0	0	0	15.1
Virgin channel losses, Gallup to State line	(40)	0	0	0	$ .2	0	0	0	.2
Undepleted Puerco R. at N.M.-Ariz. State line	(41)	0	0	0	14.9	0	0	0	14.9
PUERCO RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE NEAR ADAMANA, ARIZONA									
Estimated inflow, State line to Adamana	34	30.5	0	0	13.0	0	0	0	43.5
Undepleted volumes conveyed to Adamana	(42)	30.5	0	0	27.9	0	0	0	58.4
Historic channel losses	37	0.5	0	0	0.5	0	0	0	1.0
Virgin channel losses	(43)	$ .8	0	0	¢ .5	0	0	0	1.3
Replacement of native vegetation	(44)	.3	0	0	0	0	0	0	.3
Undepleted Puerco River near Adamana, Ariz.	(45)	29.7	0	0	27.4	0	0	0	57.1
PUERCO RIVER FROM GAGE NEAR ADAMANA TO MOUTH									
Estimated inflow, Adamana to mouth	39	3.3	0	0	0	0	0	0	3.3
Undepleted volumes conveyed to mouth	(46)	33.0	0	0	27.4	0	0	0	60.4
Virgin channel losses, Adamana to mouth	(47)	$ 1.1	0	0	¢ .8	0	0	0	1.9
Undepleted Puerco River at mouth	(48)	31.9	0	0	26.6	0	0	0	58.5

Table 23 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet
Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
LITTLE COLORADO RIVER FROM GAGE NEAR WOODRUFF TO GRAND FALLS, ARIZONA									
Chevelon Fork near Winslow, Arizona	43	45.3	0	0	0	0	0	0	45.3
Clear Creek near Winslow, Arizona	44	77.0	0	0	0	0	0	0	77.0
Estimated inflow, Woodruff to Grand Falls	45	78.7	0	0	0	0	0	0	78.7
Undepleted volumes conveyed to Grand Falls	(49)	308.9	0	0	46.3	0	0	0	355.2
Historic channel losses	49	45.2	0	0	6.8	0	0	0	52.0
Virgin channel losses	(50)	$ 40.5	0	0	¢ 6.8	0	0	0	47.3
Salvage of channel evaporation	(51)	.1	0	0	0	0	0	0	.1
Replacement of native vegetation	(52)	.4	0	0	0	0	0	0	.4
Increased losses from native growth change	(53)	5.2	0	0	0	0	0	0	5.2
Undepleted Little Colorado River at Grand Falls, Arizona	(54)	268.4	0	0	39.5	0	0	0	307.9
LITTLE COLORADO RIVER FROM GRAND FALLS TO MOUTH									
Consumptive use in Moenkopi Wash Basin	(55)	1.5	0	0	0	0	0	0	1.5
Less replacement of native vegetation	(56)	.2	0	0	0	0	0	0	.2
Net depletions in Moenkopi Wash Basin	(57)	1.3	0	0	0	0	0	0	1.3
Moenkopi Wash near Tuba, Arizona	51	15.7	0	0	0	0	0	0	15.7
Undepleted Moenkopi Wash near Tuba	(58)	17.0	0	0	0	0	0	0	17.0
Estimated inflow, Grand Falls to mouth	52	153.4	0	0	0	0	0	0	153.4
Undepleted volumes conveyed to mouth	(59)	438.8	0	0	39.5	0	0	0	478.3
Historic channel losses	54	7.2	0	0	.6	0	0	0	7.8
Virgin channel losses	(60)	$ 7.3	0	0	¢ .6	0	0	0	7.9
Salvage of channel evaporation	(61)	.1	0	0	0	0	0	0	.1
Undepleted Little Colorado River at mouth	(62)	431.5	0	0	38.9	0	0	0	470.4

Table 23 (Continued) Sheet 5 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
UNDEPLETED CONTRIBUTION OF COLORADO RIVER AT LEE FERRY, ARIZONA									
Undepleted Colorado River at Lee Ferry	(63)	-	-	-	-	-	0	15,638.5	15,638.5
COLORADO RIVER FROM LEE FERRY TO GAGE NEAR GRAND CANYON, ARIZONA									
Estimated inflow, Lee Ferry to Grand Canyon	57	23.0	0	0	0	0	0	0	23.0
Undepleted volumes conveyed to Grand Canyon	(64)	454.5	0	0	38.9	0	0	15,638.5	16,131.9
Historic channel losses	59	.6	0	0	0	0	0	20.3	20.9
Virgin channel losses	(65)	$ .6	0	0	0	0	0	¢ 20.5	21.1
Salvage of channel evaporation	(66)	0	0	0	0	0	0	.2	.2
Undepleted Colorado River near Grand Canyon	(67)	453.9	0	0	38.9	0	0	15,618.0	16,110.8
COLORADO RIVER FROM GAGE NEAR GRAND CANYON TO GAGE BELOW HOOVER DAM									
Bright Angel Creek near Grand Canyon	61	29.3	0	0	0	0	0	0	29.3
Virgin River at Littlefield, Arizona	62	45.3	0	6.1	0	180.3	0	0	231.7
Consumptive use upstream from Littlefield	(68)	1.6	0	0	0	35.4	0	0	37.0
Reservoir evaporation depletions above Littlefield	(69)	0	0	0	0	1.6	0	0	1.6
Transbasin exports upstream from Littlefield	(70)	0	0	0	0	1.2	0	0	1.2
Less replacement of native vegetation	(71)	1.0	0	0	0	3.7	0	0	4.7
Net depletions upstream from Littlefield	(72)	.6	0	0	0	34.5	0	0	35.1
Undepleted Virgin River at Littlefield	(73)	45.9	0	6.1	0	214.8	0	0	266.8
Estimated inflow, Grand Canyon to Hoover Dam	63	355.8	0	135.4	0	17.1	0	0	508.3
Undepleted volumes conveyed to Hoover Dam	(74)	884.9	0	141.5	38.9	231.9	0	15,618.0	16,915.2
Historic channel losses	70	7.2	0	1.0	.3	1.7	0	110.9	121.1
Virgin channel losses	(75)	$ 8.0	0	$15.6	¢ .3	¢ 1.7	0	¢ 113.1	138.7
Salvage of channel evaporation	(76)	.1	0	0	0	0	0	2.2	2.3

Table 23 (Continued) Sheet 6 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
COLORADO RIVER FROM GAGE NEAR GRAND CANYON TO GAGE BELOW HOOVER DAM (Continued)									
Replacement of native vegetation	(77)	1.2	0	15.5	0	0	0	0	16.7
Increased losses from native growth change	(78)	.5	0	.9	0	0	0	0	1.4
Undepleted Colorado River below Hoover Dam	(79)	876.9	0	125.9	38.6	230.2	0	15,504.9	16,776.5
COLORADO RIVER FROM GAGE BELOW HOOVER DAM TO GAGE NEAR TOPOCK, ARIZONA									
Estimated inflow, Hoover Dam to Topock	72	13.4	4.1	8.1	0	0	0	0	25.6
Undepleted volumes conveyed to Topock	(80)	890.3	4.1	134.0	38.6	230.2	0	15,504.9	16,802.1
Historic channel losses	75	23.3	0	3.3	.9	5.3	0	350.8	383.6
Virgin channel losses	(81)	$11.6	0	$ 2.2	¢1.0	¢5.6	0	¢359.3	379.7
Salvage of channel evaporation	(82)	1.1	0	.2	.1	.3	0	19.8	21.5
Replacement of native vegetation	(83)	0	0	.2	0	0	0	0	.2
Increased losses from native growth change	(84)	12.8	11.3	1.5	0	0	0	0	25.6
Undepleted Colorado River near Topock	(85)	878.7	4.1	131.8	37.6	224.6	0	15,145.6	16,422.4
GILA RIVER FROM HEADWATERS IN NEW MEXICO TO NEW MEXICO-ARIZONA STATE LINE									
Consumptive use upstream from Virden	(86)	0	0	0	11.2	0	0	0	11.2
Less replacement of native vegetation	(87)	0	0	0	8.9	0	0	0	8.9
Net depletions upstream from Virden	(88)	0	0	0	2.3	0	0	0	2.3
Gila River below Blue Creek, near Virden	77	0	0	0	155.0	0	0	0	155.0
Undepleted Gila River near Virden	(89)	0	0	0	157.3	0	0	0	157.3
Estimated inflow, Virden to State line	78	0	0	0	4.9	0	0	0	4.9
Undepleted volumes conveyed to State line	(90)	0	0	0	162.2	0	0	0	162.2
Historic channel losses	81	0	0	0	2.9	0	0	0	2.9
Virgin channel losses	(91)	0	0	0	$ 5.8	0	0	0	5.8
Replacement of native vegetation	(92)	0	0	0	2.9	0	0	0	2.9
Undepleted Gila River at New Mex.-Ariz. State line	(93)	0	0	0	156.4	0	0	0	156.4

Table 23 (Continued) Sheet 7 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE NEAR CLIFTON, ARIZONA									
Estimated inflow, State line to Clifton	83	17.7	0	0	4.9	0	0	0	22.6
Undepleted volumes conveyed to Clifton	(94)	17.7	0	0	161.3	0	0	0	179.0
Historic channel losses	86	.3	0	0	5.0	0	0	0	5.3
Virgin channel losses	(95)	$ 5.0	0	0	¢ 5.0	0	0	0	10.0
Replacement of native vegetation	(96)	4.3	0	0	0	0	0	0	4.3
Decreased losses from native growth change	(97)	.4	0	0	0	0	0	0	.4
Undepleted Gila River near Clifton	(98)	12.7	0	0	156.3	0	0	0	169.0
SAN FRANCISCO RIVER FROM HEADWATERS TO NEW MEXICO-ARIZONA STATE LINE									
Consumptive use above Glenwood, New Mexico	(99)	0	0	0	4.5	0	0	0	4.5
Reservoir evaporation depletion above Glenwood	(100)	0	0	0	.1	0	0	0	.1
Less replacement of native vegetation	(101)	0	0	0	2.2	0	0	0	2.2
Net depletions upstream from Glenwood	(102)	0	0	0	2.4	0	0	0	2.4
San Francisco River near Glenwood, New Mex.	88	3.7	0	0	61.0	0	0	0	64.7
Undepleted San Francisco River near Glenwood	(103)	3.7	0	0	63.4	0	0	0	67.1
Estimated inflow, Glenwood to State line	89	0	0	0	10.2	0	0	0	10.2
Undepleted volumes conveyed to State line	(104)	3.7	0	0	73.6	0	0	0	77.3
Virgin channel losses	(105)	0	0	0	$ .6	0	0	0	.6
Undepleted San Francisco River at New Mexico-Arizona State line	(106)	3.7	0	0	73.0	0	0	0	76.7

Table 23 (Continued) Sheet 8 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
SAN FRANCISCO RIVER FROM NEW MEXICO-ARIZONA STATE LINE TO GAGE AT CLIFTON, ARIZONA									
Estimated inflow, State line to Clifton	93	87.8	0	0	5.8	0	0	0	93.6
Undepleted volumes conveyed to Clifton	(107)	91.5	0	0	78.8	0	0	0	170.3
Historic channel losses	96	.6	0	0	.6	0	0	0	1.2
Virgin channel losses	(108)	$ .9	0	0	¢ .6	0	0	0	1.5
Replacement of native vegetation	(109)	.3	0	0	0	0	0	0	.3
Undepleted San Francisco River at Clifton	(110)	90.6	0	0	78.2	0	0	0	168.8
GILA RIVER FROM GAGE NEAR CLIFTON, ARIZONA, TO HEAD OF SAFFORD VALLEY, ARIZONA									
Estimated inflow, Clifton to Safford Valley	99	62.9	0	0	0	0	0	0	62.9
Undepleted volumes conveyed, Clifton to head of Safford Valley	(111)	166.2	0	0	234.5	0	0	0	400.7
Historic channel losses	102	0.4	0	0	0.6	0	0	0	1.0
Virgin channel losses	(112)	$ .9	0	0	¢ .6	0	0	0	1.5
Replacement of native vegetation	(113)	.5	0	0	0	0	0	0	.5
Undepleted Gila River at head of Safford Valley, Arizona	(114)	165.3	0	0	233.9	0	0	0	399.2
SAN SIMON CREEK FROM HEADWATERS IN ARIZONA THROUGH NEW MEXICO TO GAGE NEAR SOLOMON, ARIZONA									
Consumptive use upstream from State line	(115)	.1	0	0	0	0	0	0	.1
San Simon Creek at N.Mex.-Ariz.State line	104	2.1	0	0	1.3	0	0	0	3.4
Undepleted San Simon Creek at State line	(116)	2.2	0	0	1.3	0	0	0	3.5
Estimated inflow, State line to Solomon	105	11.5	0	0	0	0	0	0	11.5
Undepleted volumes conveyed to Solomon	(117)	13.7	0	0	1.3	0	0	0	15.0
Virgin channel losses	(118)	$ .5	0	0	¢ .1	0	0	0	.6
Undepleted San Simon Creek near Solomon	(119)	13.2	0	0	1.0	0	0	0	14.4

Table 23 (Continued) Sheet 9 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM HEAD OF SAFFORD VALLEY TO GAGE AT CALVA, ARIZONA									
Estimated inflow, head of valley to Calva	110	20.3	0	0	0	0	0	0	20.3
Undepleted volumes conveyed to Calva	(120)	198.8	0	0	235.1	0	0	0	433.9
Historic channel losses	114	15.8	0	0	30.1	0	0	0	45.9
Virgin channel losses	(121)	$21.3	0	0	¢ 30.1	0	0	0	51.4
Replacement of native vegetation	(122)	3.3	0	0	0	0	0	0	3.3
Decreased losses from native growth change	(123)	2.2	0	0	0	0	0	0	2.2
Undepleted Gila River at Calva, Arizona	(124)	177.5	0	0	205.0	0	0	0	382.5
GILA RIVER FROM CALVA TO GAGE BELOW COOLIDGE DAM, ARIZONA									
Consumptive use on San Carlos River upstream from Peridot	(125)	0.9	0	0	0	0	0	0	0.9
San Carlos River near Peridot, Arizona	116	50.5	0	0	0	0	0	0	50.5
Undepleted San Carlos River near Peridot	(126)	51.4	0	0	0	0	0	0	51.4
Estimated inflow, Calva to Coolidge Dam	117	13.7	0	0	0	0	0	0	13.7
Undepleted volumes conveyed to dam	(127)	242.6	0	0	205.0	0	0	0	447.6
Historic channel losses	122	9.4	0	0	12.1	0	0	0	21.5
Virgin channel losses	(128)	$ 9.7	0	0	¢ 12.1	0	0	0	21.8
Replacement of native vegetation	(129)	.3	0	0	0	0	0	0	.3
Undepleted Gila River below Coolidge Dam	(130)	232.9	0	0	192.9	0	0	0	425.8

Table 23 (Continued) Sheet 10 of 14

LOWER COLORADO RIVER BASIN

Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet

Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
SAN PEDRO RIVER FROM HEADWATERS IN MEXICO TO GAGE AT CHARLESTON, ARIZONA									
Consumptive use above Palominas, Arizona	(131)	0	0	0	0	0	1.4	0	1.4
Less replacement of native vegetation	(132)	0	0	0	0	0	.3	0	.3
Net depletions upstream from Palominas	(133)	0	0	0	0	0	1.1	0	1.1
San Pedro River at Palominas, Arizona	124	3.9	0	0	0	0	26.1	0	30.0
Undepleted San Pedro River at Palominas	(134)	3.9	0	0	0	0	27.2	0	31.1
Estimated inflow, Palominas to Charleston	125	32.6	0	0	0	0	3.6	0	36.2
Undepleted volumes conveyed to Charleston	(135)	36.5	0	0	0	0	30.8	0	67.3
Historic channel losses	128	5.9	0	0	0	0	4.9	0	10.8
Virgin channel losses	(136)	$ 6.8	0	0	0	0	¢ 4.9	0	11.7
Replacement of native vegetation	(137)	.6	0	0	0	0	0	0	.6
Decreased losses from native growth change	(138)	.3	0	0	0	0	0	0	.3
Undepleted San Pedro River at Charleston	(139)	29.7	0	0	0	0	25.9	0	55.6
SAN PEDRO RIVER FROM CHARLESTON TO GAGE NEAR MAMMOTH, ARIZONA									
Estimated inflow, Charleston to Mammoth	130	62.3	0	0	0	0	0	0	62.3
Undepleted volumes conveyed to Mammoth	(140)	92.0	0	0	0	0	25.9	0	117.9
Historic channel losses	133	35.0	0	0	0	0	10.6	0	45.6
Virgin channel losses	(141)	$33.7	0	0	0	0	¢10.6	0	44.3
Replacement of native vegetation	(142)	4.6	0	0	0	0	0	0	4.6
Increased losses from native growth change	(143)	5.9	0	0	0	0	0	0	5.9
Undepleted San Pedro River near Mammoth	(144)	58.3	0	0	0	0	15.3	0	73.6

Table 23 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet
Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM COOLIDGE DAM TO GAGE AT KELVIN, ARIZONA									
Estimated inflow, Coolidge Dam to Kelvin	135	75.2	0	0	0	0	0	0	75.2
Undepleted volumes conveyed to Kelvin	(145)	366.4	0	0	192.9	0	15.3	0	574.6
Historic channel losses	138	15.2	0	0	5.2	0	1.8	0	22.2
Virgin channel losses	(146)	$20.8	0	0	¢ 5.2	0	¢ 1.8	0	27.8
Salvage of channel evaporation	(147)	.1	0	0	0	0	0	0	.1
Replacement of native vegetation	(148)	4.2	0	0	0	0	0	0	4.2
Decreased losses from native growth change	(149)	1.3	0	0	0	0	0	0	1.3
Undepleted Gila River at Kelvin, Arizona	(150)	345.6	0	0	187.7	0	13.5	0	546.8
SANTA CRUZ RIVER FROM HEADWATERS IN ARIZONA THROUGH MEXICO TO GAGE NEAR NOGALES, ARIZONA									
Consumptive use upstream from Nogales	(151)	.8	0	0	0	0	8.2	0	9.0
Less replacement of native vegetation	(152)	.2	0	0	0	0	2.8	0	3.0
Net depletions upstream from Nogales	(153)	.6	0	0	0	0	5.4	0	6.0
Santa Cruz River near Nogales, Arizona	140	6.6	0	0	0	0	8.6	0	15.2
Undepleted Santa Cruz River near Nogales	(154)	7.2	0	0	0	0	14.0	0	21.2
SANTA CRUZ RIVER FROM GAGE NEAR NOGALES TO GAGE AT RILLITO, ARIZONA									
Estimated inflow, Nogales to Rillito	142	83.2	0	0	0	0	1.8	0	85.0
Undepleted volumes conveyed to Rillito	(155)	90.4	0	0	0	0	15.8	0	106.2
Historic channel losses	145	20.0	0	0	0	0	4.7	0	24.7
Virgin channel losses	(156)	$56.4	0	0	0	0	¢ 5.6	0	62.0
Salvage of channel evaporation	(157)	4.5	0	0	0	0	.9	0	5.4
Replacement of native vegetation	(158)	23.6	0	0	0	0	0	0	23.6
Decreased losses from native growth change	(159)	8.3	0	0	0	0	0	0	8.3
Undepleted Santa Cruz River at Rillito	(160)	34.0	0	0	0	0	10.2	0	44.2

Table 23 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet
Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
SALT RIVER FROM HEADWATERS TO GRANITE REEF DAM, ARIZONA									
Consumptive use, Salt River to Roosevelt gage	(161)	3.7	0	0	0	0	0	0	3.7
Small reservoir evaporation depletions	(162)	.6	0	0	0	0	0	0	.6
Water exported from Black River	98	.2	0	0	0	0	0	0	.2
Less replacement of native vegetation	(163)	.7	0	0	0	0	0	0	.7
Net depletions, Salt River to Roosevelt gage	(164)	3.8	0	0	0	0	0	0	3.8
Salt River near Roosevelt, Arizona	147	706.5	0	0	0	0	0	0	706.5
Undepleted Salt River near Roosevelt	(165)	710.3	0	0	0	0	0	0	710.3
Consumptive use, Tonto Creek to Roosevelt gage	(166)	1.4	0	0	0	0	0	0	1.4
Less replacement of native vegetation	(167)	.9	0	0	0	0	0	0	.9
Net depletions, Tonto Creek to Roosevelt gage	(168)	.5	0	0	0	0	0	0	.5
Tonto Creek near Roosevelt, Arizona	148	107.9	0	0	0	0	0	0	107.9
Undepleted Tonto Creek near Roosevelt	(169)	108.4	0	0	0	0	0	0	108.4
Consumptive use, Verde River to Bartlett Dam	(170)	25.3	0	0	0	0	0	0	25.3
Small reservoir evaporation depletions	(171)	1.3	0	0	0	0	0	0	1.3
Bartlett Reservoir evaporation depletion	(172)	.6	0	0	0	0	0	0	.6
Accretion of surface storage, Bartlett Res.	(173)	.1	0	0	0	0	0	0	.1
Less replacement of native vegetation	(174)	5.4	0	0	0	0	0	0	5.4
Net depletions, Verde River to Bartlett Dam	(175)	21.9	0	0	0	0	0	0	21.9
Verde River below Bartlett Dam, Arizona	149	522.4	0	0	0	0	0	0	522.4
Undepleted Verde River below Bartlett Dam	(176)	544.3	0	0	0	0	0	0	544.3
Estimated inflow to Granite Reef Dam	150	100.2	0	0	0	0	0	0	100.2
Undepleted volumes conveyed to Granite Reef	(177)	1,463.2	0	0	0	0	0	0	1,463.2

Table 23 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet
Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
SALT RIVER FROM HEADWATERS TO GRANITE REEF DAM, ARIZONA (Continued)									
Virgin channel losses	(178)	$ 39.4	0	0	0	0	0	0	39.4
Replacement of native vegetation	(179)	.3	0	0	0	0	0	0	.3
Increased channel evaporation losses	(180)	.2	0	0	0	0	0	0	.2
Increased losses from native growth change	(181)	.2	0	0	0	0	0	0	.2
Undepleted Salt River at Granite Reef Dam	(182)	1,423.8	0	0	0	0	0	0	1,423.8
AGUA FRIA RIVER FROM HEADWATERS TO LAKE PLEASANT, ARIZONA									
Consumptive use above Lake Pleasant	(183)	1.2	0	0	0	0	0	0	1.2
Agua Fria River at Lake Pleasant Dam	159	128.3	0	0	0	0	0	0	128.3
Undepleted Agua Fria River at Lake Pleasant Dam (inflow to lake)	(184)	129.5	0	0	0	0	0	0	129.5
GILA RIVER FROM GAGE AT KELVIN TO GILLESPIE DAM, ARIZONA									
Estimated inflow to Gillespie Dam	161	94.7	0	0	0	0	0	0	94.7
Undepleted volumes conveyed to Gillespie Dam	(185)	2,027.6	0	0	187.7	0	23.7	0	2,239.0
Historic channel losses	167	300.1	0	0	61.7	0	6.2	0	368.0
Virgin channel losses	(186)	$ 376.9	0	0	¢ 63.0	0	¢ 6.3	0	446.2
Salvage of channel evaporation	(187)	10.2	0	0	1.3	0	.1	0	11.6
Replacement of native vegetation	(188)	99.8	0	0	0	0	0	0	99.8
Increased losses from native growth change	(189)	33.2	0	0	0	0	0	0	33.2
Undepleted Gila River at Gillespie Dam	(190)	1,650.7	0	0	124.7	0	17.4	0	1,792.8
GILA RIVER FROM GILLESPIE DAM TO GAGE NEAR DOME, ARIZONA									
Estimated inflow, Gillespie Dam to Dome	173	29.7	0	0	0	0	.2	0	29.9
Undepleted volumes conveyed to Dome	(191)	1,680.4	0	0	124.7	0	17.6	0	1,822.7
Historic channel losses	176	210.7	0	0	43.1	0	4.4	0	[illegible]

Table 23 (Continued)
LOWER COLORADO RIVER BASIN
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period, Unit: 1,000 Acre-feet
Item numbers not in parentheses are taken from Table 22, based on historic runoff

River section	Item	Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
GILA RIVER FROM GILLESPIE DAM TO GAGE NEAR DOME, ARIZONA (Continued)									
Virgin channel losses	(192)	370.2	0	0	¢ 44.3	0	¢ 4.6	0	419.1
Salvage of channel evaporation	(193)	16.2	0	0	1.2	0	.2	0	17.6
Replacement of native vegetation	(194)	12.9	0	0	0	0	0	0	12.9
Decreased losses from native growth change	(195)	130.7	0	0	0	0	0	0	130.7
Undepleted Gila River near Dome	(196)	1,310.2	0	0	80.4	0	13.0	0	1,403.6
COLORADO RIVER FROM GAGE NEAR TOPOCK TO LIMITROPHE SECTION AT INTERNATIONAL BOUNDARY									
Consumptive use, Bill Williams River	(197)	9.7	0	0	0	0	0	0	9.7
Less replacement of native vegetation	(198)	5.9	0	0	0	0	0	0	5.9
Net depletions, Bill Williams River	(199)	3.8	0	0	0	0	0	0	3.8
Bill Williams River at Planet, Arizona	178	135.2	0	0	0	0	0	0	135.2
Undepleted Bill Williams River at Planet	(200)	139.0	0	0	0	0	0	0	139.0
Estimated inflow, Topock to Limitrophe Section	179	19.4	12.1	0	0	0	0	0	31.5
Undepleted volumes conveyed to Limitrophe Section	(201)	2,347.3	16.2	131.8	118.0	224.6	13.0	15,145.6	17,996.5
Historic channel losses	186	80.3	0	8.2	7.6	12.9	.6	674.8	784.4
Virgin channel losses	(202)	$ 171.3	$ .1	¢ 8.9	¢ 8.1	¢14.2	¢ .6	¢ 820.7	1,023.9
Salvage of channel evaporation	(203)	9.5	.1	.7	.5	1.3	0	85.5	97.6
Replacement of native vegetation	(204)	87.1	65.9	0	0	0	0	0	153.0
Increased losses from native growth change	(205)	5.6	5.5	0	0	0	0	0	11.1
Undepleted Colorado River within Limitrophe Section at International Boundary	(206	2,176.0	16.1	122.9	109.9	210.4	12.4	14,324.9	16,972.6

$. Losses within state.
¢. Losses out of state.

Notes Accompanying Table 23
Analysis of Contributions by States Based on Mean Virgin Runoff for the 1914-1945 Period
Item numbers not in parentheses are taken from Table 22, based on historic runoff

Item No.

(1) Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-1-LC plus A-2-LC in Table 12); all in Arizona.

(2). Stream depletion by small reservoirs in this river section (see Table 8); all in Arizona.

(3). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this section (see Table 14); all in Arizona. These uses are deductible from the consumptive use by crops and noncropped areas in determining net stream depletions at sites of use.

(4). Item (1) plus Item (2) minus Item (3).

(5). Item (4) plus Item 1.

(6). Item (5) plus Item 2.

(7). Channel losses in this section were estimated to be 6,000 acre-feet a year under virgin flow conditions with evaporation from the water surface the same as for historical conditions (see Table 14). Losses apportioned to New Mexico were thus considered the same as for historical conditions and the remainder of the virgin losses were apportioned to Arizona.

(8). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this section (see Table 14); all in Arizona. These uses are deductible from the consumptive use by crops and noncropped areas in determining net stream depletions at sites of use.

(9). It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation as compared with virgin conditions in this stream section (see Table 14). As these changes occurred in Arizona, the increased losses were assigned to Arizona and represent additional man-made depletions for the section.

(10). Item (6) minus Item (7).

Item No.

(11). Consumptive use of irrigation water by crops and noncropped areas in this stream section; all in New Mexico. (As discussed for Item 10 in the notes accompanying Table 22, the total of 5,200 acre-feet listed for NM-2-LC in Table 12 was distributed as 1,000 acre-feet upstream from Blackrock and 4,200 acre-feet downstream from Blackrock on Zuni River to the New Mexico-Arizona State line.)

(12). Stream depletion by small reservoirs in this river section (see Table 8) all in New Mexico.

(13). Item (11) plus Item (12).

(14). Item (13) plus Item 8.

(15). Item (14) plus Item 9.

(16). Channel losses in this section were estimated to be 7,800 acre-feet a year for virgin conditions with the evaporation from the water surface the same as for historical conditions (see Table 14); all in New Mexico.

(17). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section (see Table 14); all in New Mexico.

(18). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation as compared with virgin conditions in this stream section (see Table 14). As these changes occurred in New Mexico, the decreased losses were credited to New Mexico.

(19). Item (15) minus Item (16).

(20). Item (19) plus Item 15.

(21). It was estimated that channel losses under virgin conditions were the same as under historical conditions for this section as shown in Item 17 with the same distribution (see Table 14 for total).

(22). Item (20) minus Item (21).

(23). Item (10) plus Items (22) and 19.

(24). It was estimated that channel losses under virgin conditions were the same as under historical conditions for this section as shown in Item 21 with the same distribution (see Table 14 for total).

Item No.

(25). Item (23) minus Item (24).

(26). Consumptive use of irrigation water by crops and noncropped areas in this section (A-4-LC in Table 12); all in Arizona.

(27). Stream depletion by small reservoirs in this river section (see Table 8); all in Arizona.

(28). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section (see Table 14); all in Arizona.

(29). Item (26) plus Item (27) minus Item (28).

(30). Item (29) plus Item 23.

(31). Item (25) plus Items (30) and 24.

(32). It was estimated that channel losses under virgin conditions were the same as for historical conditions in this river section as shown in Item 27 with the same distribution (see Table 14 for total).

(33). Item (31) minus Item (32).

(34). Consumptive use of irrigation water by crops and noncropped areas in this stream section (NM-3-LC in Table 12); all in New Mexico.

(35). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section upstream from Gallup (see Table 14); all in New Mexico.

(36). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation as compared with virgin conditions in this stream section upstream from Gallup (see Table 14). As these changes occurred in New Mexico, the decreased losses were credited to New Mexico.

(37). Item (34) minus Items (35) and (36).

(38). Item (37) plus Item 29.

(39). Item (38) plus Item 30.

Item No.

(40). It was estimated that channel losses under virgin conditions were the same as for historical conditions in this river section as shown in Item 32 (see Table 14); all in New Mexico.

(41). Item (39) minus Item (40).

(42). Item (41) plus Item 34.

(43). Channel losses in this river section were estimated to be 1,300 acre-feet a year under virgin flow conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were thus considered the same as for historical conditions and the remainder of the losses were apportioned to Arizona.

(44). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section (see Table 14); all in Arizona.

(45). Item (42) minus Item (43).

(46). Item (45) plus Item 39.

(47). It was estimated that channel losses under virgin conditions were the same as for historical conditions in this river section as shown in Item 41 with the same distribution (see Table 14 for total).

(48). Item (46) minus Item (47).

(49). Item (33) plus Items (48), 43, 44, and 45.

(50). Channel losses in this river section were estimated to be 47,300 acre-feet a year under virgin flow conditions (see Table 14 for total). The estimated water surface evaporation was 100 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited to Arizona on the basis of proportional volumes conveyed. Virgin losses apportioned to New Mexico were thus considered the same as for historical conditions and the remainder of the losses were apportioned to Arizona.

(51). This salvage was discussed under Item (50) (see Table 14).

Item No.

(52). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section (see Table 14); all in Arizona.

(53). It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation as compared with virgin conditions in this stream section (see Table 14). As these changes occurred in Arizona, the increased losses were charged to Arizona.

(54). Item (49) minus Item (50).

(55). Consumptive use of irrigation water by crops and noncropped areas in this stream section (A-9-LC in Table 12); all in Arizona.

(56). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section (see Table 14, Moenkopi Wash above Tuba); all in Arizona.

(57). Item (55) minus Item (56).

(58). Item (57) plus Item 51.

(59). Item (54) plus Items (58) and 52.

(60). Channel losses in this river section were estimated to be 7,900 acre-feet a year under virgin flow conditions (see Table 14 for total). The estimated water surface evaporation was 100 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited to Arizona on the basis of proportional volumes conveyed. Virgin losses apportioned to New Mexico were thus considered the same as for historical conditions and the remainder of the losses were charged to Arizona.

(61). This salvage was discussed under Item (60) (see Table 14).

(62). Item (59) minus Item (60).

(63). Average annual undepleted flow of the Colorado River at Lee Ferry as given in the final report of the Engineering Advisory Committee to Upper Colorado River Basin Compact Commission, dated November 29, 1948.

Item No.

(64). Item (62) plus Items (63) and 57.

(65). Channel losses in this river section were estimated to be 21,100 acre-feet a year under virgin flow conditions (see Table 14 for total). The phreatophyte losses were considered the same for historic and virgin conditions and the salvaged water surface evaporation of 200 acre-feet a year was prorated on the basis of the respective volumes conveyed. Arizona was thus charged with annual losses of 600 acre-feet and 20,500 acre-feet a year was apportioned to the undistributed stream flow.

(66). This salvage was discussed under Item (65) (see Table 14).

(67). Item (64) minus Item (65).

(68). Consumptive use of irrigation water by crops and noncropped areas in Arizona and Utah in this river section. (See Table 12. For Arizona: A-1-V plus 1,400 acre-feet of A-2-V distributed as upstream from the gage on Virgin River at Littlefield, Arizona. See note for Item 64 of Table 22. For Utah: U-1-V.)

(69). Stream depletion by small reservoirs in this river section (see Table 8); all in Utah.

(70). Diversions of water from the headwaters of the Virgin River system for use outside of the drainage area of the Colorado River Basin (refer to Section III C 5 (f) (1) (a); all in Utah.

(71). Uses by native vegetation in cropped and noncropped areas in Arizona and Utah in this river section under virgin conditions (see Table 14, Virgin River upstream from Littlefield for total).

(72). Item (68) plus Items (69) and (70) minus Item (71).

(73). Item 62 plus Item (72).

(74). Item (67) plus Items 61, (73), and 63.

Item No.

(75). Channel losses in this river section were estimated to be 138,700 acre-feet a year under virgin flow conditions (see Table 14: Grand Wash, 100 acre-feet; Grand Canyon to Hoover Dam on Colorado River, 82,100 acre-feet; Littlefield to mouth on Virgin River, 42,900 acre-feet; Meadow Valley Wash, 4,200 acre-feet; and Muddy River, 9,400 acre-feet). The estimated water surface evaporation was 2,300 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was apportioned on the basis of the respective volumes conveyed. Uses by native vegetation in cropped and noncropped areas under virgin conditions in Arizona and Nevada in the section downstream from the Littlefield and Grand Canyon gages to the gage below Hoover Dam were added to the respective historic channel losses apportioned to Arizona and Nevada in determining the virgin channel losses apportioned to these states. It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation (channel losses) in Arizona by 500 acre-feet annually and the uses in Nevada by 900 acre-feet a year. These quantities were deducted from the historic channel losses assigned to Arizona and Nevada in determining the virgin channel losses apportioned to these states. Thus, Item (75) is Item 70 plus Items (76) and (77) minus Item (78).

(76). This salvage was discussed under Item (75) (see Table 14, Grand Canyon to Hoover Dam on Colorado River for total).

(77). Uses by native vegetation in cropped and noncropped areas in Arizona and Nevada in this stream section under virgin conditions. (See Table 14: Grand Wash, 100 acre-feet in Arizona; Littlefield to mouth of Virgin River, 1,100 acre feet in Arizona and 5,000 acre-feet in Nevada; Meadow Valley Wash, 4,200 acre-feet in Nevada; and Muddy River, 6,300 acre-feet in Nevada.)

(78). These increased channel losses from growth changes attributable to the influence of man in Arizona and Nevada represent additional man-made depletions for the section. (See Table 14: Littlefield to mouth of Virgin River, 500 acre-feet increased losses in Arizona and 4,000 increased losses in Nevada; Muddy River, 3,100 decreased losses in Nevada. Net increased losses are thus 500 acre-feet for Arizona and 900 acre-feet for Nevada.)

(79). Item (74) minus Item (75).

(80). Item (79) plus Item 72.

(81). As outlined in Item (75) for that river section, this item is Item 75 plus Items (82) and (83) minus Item (84) (see Table 14, Hoover Dam to Topock, for total). However, because no historic losses were apportioned to California, the increased losses from native growth change in California were deducted from historic losses for undistributed stream flow in determining apportionments of virgin channel

Item No.

(82). The estimated water surface evaporation from the channel in this stream section was 21,500 acre-feet a year less for historical conditions as compared with virgin conditions and this salvage was prorated among the contributors on the basis of the respective volumes conveyed under virgin conditions (see Table 14, Hoover Dam to Topock, for total).

(83). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Nevada.

(84). It was estimated that growth changes attributable to the influence of man increased the uses by river bottom growth by 25,600 acre-feet a year as compared with virgin conditions in this stream section (see Table 14). These increased losses were apportioned equally between Arizona on the one side and California and Nevada in their respective boundary sections.

(85). Item (80) minus Item (81).

(86). Consumptive use of irrigation water by crops and noncropped areas in this stream section (NM-1-G in Table 12); all in New Mexico.

(87). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14, Gila River upstream from Virden); all in New Mexico.

(88). Item (86) minus Item (87).

(89). Item (88) plus Item 77.

(90). Item (89) plus Item 78.

(91). Channel losses were estimated to be 5,800 acre-feet a year in this stream section under virgin conditions (see Table 14, Virden to New Mexico-Arizona State line); all in New Mexico.

(92). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14, Virden to New Mexico-Arizona State line); all in New Mexico.

(93). Item (90) minus Item (91).

(94). Item (93) plus Item 83.

Item No.

(95). Channel losses in this river section were estimated to be 10,000 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were thus considered the same as for historical conditions and the remainder of the virgin losses were apportioned to Arizona.

(96). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Arizona.

(97). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation as compared with virgin conditions in this stream section (see Table 14). As these changes occurred in Arizona, the decreased losses of 400 acre-feet a year were credited to Arizona.

(98). Item (94) minus Item (95).

(99). Consumptive use of irrigation water by crops and noncropped areas in this river section (NM-3-G in Table 12); all in New Mexico.

(100). Stream depletion by small reservoirs in this river section (see Table 8); all apportioned to New Mexico.

(101). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this stream section upstream from Glenwood (see Table 14); all in New Mexico.

(102). Item (99) plus Item (100) minus Item (101).

(103). Item (102) plus Item 88.

(104). Item (103) plus Item 89.

(105). It was estimated that channel losses under virgin conditions were the same as under historical conditions for this river section as shown in Item 91 (see Table 14, Glenwood to State line); all in New Mexico.

(106). Item (104) minus Item (105).

Item No.

(107). Item (106) plus Item 93.

(108). Channel losses in this river section were estimated to be 1,500 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were thus considered to be the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(109). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Arizona.

(110). Item (107) minus Item (108).

(111). Item (98) plus Items (110) and 99.

(112). Channel losses in this river section were estimated to be 1,500 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were thus considered to be the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(113). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Arizona.

(114). Item (111) minus Item (112).

(115). Consumptive use of irrigation water by crops and noncropped areas in this stream section. These depletions are on the headwaters of the San Simon Creek system in Arizona (A-5-G in Table 12). The stream heads in Arizona, curves through a portion of southwestern New Mexico, and then reenters Arizona.

(116). Item (115) plus Item 104.

(117). Item (116) plus Item 105.

Item No.

(118). It was estimated that channel losses under virgin conditions were the same as for historical conditions in this stream section as shown in Item 108 with the same distribution (see Table 14 for total, New Mexico-Arizona State line to Solomon).

(119). Item (117) minus Item (118).

(120). Item (114) plus Items (119) and 110.

(121). Channel losses in this river section under virgin conditions were estimated to be 51,400 acre-feet a year with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were thus considered to be the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(122). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Arizona.

(123). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation as compared with virgin conditions in this river section (see Table 14). As these changes occurred in Arizona, the decreased losses of 2,200 acre-feet a year were credited to Arizona.

(124). Item (120) minus Item (121).

(125). Consumptive use of irrigation water by crops and noncropped areas in this stream section; all in Arizona. (See A-8-G in Table 12. As discussed in the notes for Item 118 of Table 22, the total of 1,800 acre-feet for this area was distributed as 500 acre-feet on Gila River upstream from gage at Calva (Item 112), 400 acre-feet on San Carlos River downstream from gage near Peridot (Item 118), and 900 acre feet for this river section on San Carlos River upstream from gage near Peridot.)

(126). Item (125) plus Item 116.

(127). Item (124) plus Items (126) and 117.

(128). Channel losses in this river section were estimated to be 21,800 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to New Mexico were considered the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

Item No.

(129). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14); all in Arizona.

(130). Item (127) minus Item (128).

(131). Consumptive use of irrigation water by crops and noncropped areas in this stream section (M-1-G in Table 12); all in Mexico.

(132). Uses by native vegetation in cropped and noncropped areas in this stream section under virgin conditions (see Table 14, San Pedro River in Mexico); all in Mexico.

(133). Item (131) minus Item (132).

(134). Item (133) plus Item 124.

(135). Item (134) plus Item 125.

(136). Channel losses in this river section were estimated to be 11,700 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14, Palominas to Charleston for total). Losses apportioned to Mexico were thus considered the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(137). Uses by native vegetation in cropped and noncropped areas between Palominas and Charleston under virgin conditions (see Table 14); all in Arizona.

(138). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation between Palominas and Charleston as compared with virgin conditions (see Table 14). As these changes occurred in Arizona, the decreased losses of 300 acre-feet a year were credited to Arizona.

(139). Item (135) minus Item (136).

(140). Item (139) plus Item 130.

Item No.

(141). Channel losses in this river section were estimated to be 44,300 acre-feet a year under virgin conditions with evaporation from the water surface the same as for historical conditions (see Table 14 for total). Losses apportioned to Mexico were thus considered the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(142). Uses by native vegetation in cropped and noncropped areas under virgin conditions in this river section (see Table 14); all in Arizona.

(143). It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation in this river section as compared with virgin conditions (see Table 14). As these changes occurred in Arizona, the increased losses of 5,900 acre-feet a year were charged to Arizona.

(144). Item (140) minus Item (141).

(145). Item (130) plus Items (144) and 135.

(146). Channel losses in this river section were estimated to be 27,800 acre-feet a year under virgin conditions. (See Table 14: San Pedro River from Mammoth to mouth, 13,500 acre-feet plus Gila River from Coolidge Dam to Kelvin, 14,300 acre-feet.) The estimated water surface evaporation from the channel was 100 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited to Arizona on the basis of proportional volumes conveyed. Virgin losses in this stream section apportioned to Mexico and New Mexico were thus considered the same as for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(147). This salvage was discussed under Item (146) (see Table 14, Gila River from Coolidge Dam to Kelvin).

(148). Uses by native vegetation in cropped and noncropped areas in this river section under virgin conditions (see Table 14: San Pedro River from Mammoth to mouth, 2,100 acre-feet plus Gila River from Coolidge Dam to Kelvin, 2,100 acre-feet); all in Arizona.

(149). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation in this stream section as compared with virgin conditions. (See Table 14: San Pedro River from Mammoth to mouth, decreased losses of 1,700 acre-feet; Gila River from Coolidge Dam to Kelvin, increased losses of 400 acre-feet; net decreased losses for this river section are thus 1,300 acre-feet.) As these changes occurred in Arizona, the decreased channel losses of 1,300 acre-feet a year were credited to Arizona.

Item No.

(150). Item (145) minus Item (146).

(151). Consumptive use of irrigation water by crops and noncropped areas in Arizona and Mexico in this stream section (see Table 12, San Rafael Ranch in Arizona, A-13-G, and Santa Cruz River in Mexico, M-2-G). The Santa Cruz River heads in Arizona, curves through northern Sonora, Mexico, and reenters Arizona near Nogales.

(152). Uses by native vegetation in cropped and noncropped areas in Arizona and Mexico in this river section under virgin conditions (see Table 14, Santa Cruz River upstream from Nogales gage).

(153). Item (151) minus Item (152).

(154). Item (153) plus Item 140.

(155). Item (154) plus Item 142.

(156). Channel losses in this river section were estimated to be 62,000 acre-feet a year under virgin conditions (see Table 14 for total). The estimated water surface evaporation from the channel was 5,400 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited as 4,500 acre-feet to Arizona and 900 acre-feet to Mexico on the basis of the respective undepleted volumes conveyed. Virgin channel losses apportioned to Mexico were considered as 900 acre-feet a year greater than for historical conditions or 5,600 acre-feet a year and the remainder of the virgin channel losses were apportioned to Arizona.

(157). This salvage was discussed under Item (156) (see Table 14 for total).

(158). Uses by native vegetation in cropped and noncropped areas in this river section under virgin conditions (see Table 14); all in Arizona.

(159). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation in this stream section as compared with virgin conditions (see Table 14). As these changes occurred in Arizona, the decreased channel losses of 8,300 acre-feet a year were credited to Arizona.

Item No.

(160). Item (155) minus Item (156).

(161). Consumptive use of irrigation water by crops and noncropped areas upstream from the gage on the Salt River near Roosevelt (see Table 12, the sum of A-17-G, A-18-G, A-19-G, and A-20-G); all in Arizona.

(162). Stream depletion by small reservoirs upstream from the gage on the Salt River near Roosevelt (see Table 8, Upper Salt River small reservoirs); all in Arizona.

(163). Uses by native vegetation in the cropped and noncropped areas upstream from the gage on the Salt River near Roosevelt under virgin conditions (see Table 14, Salt River above Roosevelt gage); all in Arizona.

(164). Item (161) plus Items (162) and 98 minus Item (163).

(165). Item (164) plus Item 147.

(166). Consumptive use of irrigation water by crops and noncropped areas upstream from the gage on Tonto Creek near Roosevelt (A-21-G in Table 12); all in Arizona.

(167). Uses by native vegetation in the cropped and noncropped areas upstream from the gage on Tonto Creek near Roosevelt under virgin conditions (see Table 14, Tonto Creek above Roosevelt gage); all in Arizona.

(168). Item (166) minus Item (167).

(169). Item (168) plus Item 148.

(170). Consumptive use of irrigation water by crops and noncropped areas upstream from the gage on the Verde River below Bartlett Dam (A-22-G plus A-23-G in Table 12); all in Arizona.

(171). Stream depletion by small reservoirs upstream from the gage on the Verde River below Bartlett Dam (see Table 8, Upper Verde River small reservoirs); all in Arizona.

Item No.

(172). Average annual evaporation depletion by Bartlett Reservoir (See Table 8); all in Arizona.

(173). Stream depletion by the average annual accretion of surface storage in Bartlett Reservoir (see Table 11); all in Arizona.

(174). Uses by native vegetation in the cropped and noncropped areas upstream from the gage on the Verde River below Bartlett Dam under virgin conditions (see Table 14, Verde River above Bartlett Dam); all in Arizona.

(175). Item (170) plus Items (171), (172), and (173) minus Item (174).

(176). Item (175) plus Item 149.

(177). Item (165) plus Items (169), (176), and 150.

(178). Channel losses in this river section were estimated to be 39,400 acre-feet a year under virgin conditions (see Table 14, Verde River from Bartlett Dam to mouth, 8,600 acre-feet plus Salt River from above Roosevelt Lake to Granite Reef Dam, 30,800 acre-feet); all in Arizona.

(179). Uses by native vegetation in the cropped and noncropped areas between the upstream gages and Granite Reef Dam under virgin conditions (see Table 14, Verde River from Bartlett Dam to mouth); all in Arizona.

(180). It was estimated that water surface evaporation from the channel in this river section was 200 acre-feet a year more for historical conditions as compared with virgin conditions. (See Table 14: Verde River from Bartlett Dam to mouth, decreased losses of 400 acre-feet; Salt River from above Roosevelt Lake to Granite Reef Dam, increased losses of 600 acre-feet; net increased losses for this river section are thus 200 acre-feet.) The increase was caused by the pool above Granite Reef Diversion Dam. The increased losses were charged to Arizona.

(181). It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation in this river section as compared with virgin conditions (see Table 14, Salt River from above Roosevelt Lake to Granite Reef Dam). As these changes occurred in Arizona, the increased channel losses of 200 acre-feet a year were charged to Arizona.

Item No.

(182). Item (177) minus (178).

(183). Consumptive use of irrigation water by crops and noncropped areas in the Agua Fria River Basin upstream from Lake Pleasant (A-25-G in Table 12).

(184). Item (183) plus Item 159.

(185). Item (150) plus Items (160), (182), (184), and 161.

(186). Channel losses in this river section were estimated to be 446,200 acre-feet a year under virgin conditions (see Table 14 for total). The estimated water surface evaporation from the channel was 11,600 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited as 10,200 acre-feet to Arizona, 1,300 acre-feet to New Mexico, and 100 acre-feet to Mexico on the basis of the respective undepleted volumes conveyed. Virgin channel losses apportioned to Mexico were considered as 100 acre-feet a year greater than for historical conditions or 6,300 acre-feet a year, those for New Mexico were considered as 1,300 acre-feet a year greater than for historical conditions or 63,000 acre-feet a year, and the remainder of the virgin channel losses were apportioned to Arizona.

(187). This salvage has been discussed under Item (186) (see Table 14 for total).

(188). Uses by native vegetation in cropped and noncropped areas in this river section under virgin conditions (see Table 14); all in Arizona.

(189). It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation in this river section as compared with virgin conditions (see Table 14). As these changes occurred in Arizona, the increased channel losses of 33,200 acre-feet a year were charged to Arizona.

(190). Item (185) minus Item (186).

(191). Item (190) plus Item 173.

Item No.

(192). Channel losses in this river section were estimated to be 419,100 acre-feet a year under virgin conditions (see Table 14 for total). The estimated water surface evaporation from the channel was 17,600 acre-feet a year less for historical conditions as compared with virgin conditions and the salvage was credited as 16,200 acre-feet to Arizona, 1,200 acre-feet to New Mexico, and 200 acre-feet to Mexico on the basis of the respective undepleted volumes conveyed. Virgin channel losses apportioned to Mexico were considered as 200 acre-feet a year greater than for historical conditions, those for New Mexico were 1,200 acre-feet a year greater than for historical conditions and the remainder of the virgin channel losses were apportioned to Arizona.

(193). This salvage was discussed under Item (192) (see Table 14 for total).

(194). Uses by native vegetation in the cropped and noncropped areas in this river section under virgin conditions (see Table 14); all in Arizona.

(195). It was estimated that growth changes attributable to the influence of man decreased the uses by native vegetation in this river section as compared with virgin conditions (see Table 14). As these changes occurred in Arizona, the decreased channel losses of 130,700 acre-feet a year were credited to Arizona.

(196). Item (191) minus Item (192).

(197). Consumptive use of irrigation water by crops and noncropped areas upstream from the gage on the Bill Williams River at Planet (A-1-BW plus A-2-BW in Table 12); all in Arizona.

(198). Uses by native vegetation in the cropped and noncropped areas upstream from the gage on the Bill Williams River at Planet under virgin conditions (see Table 14, Big Sandy River, 3,700 acre-feet plus Santa Maria River, 2,200 acre-feet); all in Arizona.

(199). Item (197) minus Item (198).

(200). Item (199) plus Item 178.

(201). Item (85) plus Items (196), (200), and 179.

Item No.

(202). Channel losses in this river section were estimated to be 1,023,900 acre-feet a year under virgin conditions. (See Table 14 for total. Topock to Yuma, 903,100 acre-feet plus Yuma to International Boundary, 120,800 acre-feet.)

The water surface evaporation was estimated to be 97,600 acre-feet a year less for historical conditions as compared with virgin conditions. This total reduction of evaporation loss consisted of 2,900 acre-feet on the Gila River from Dome to the mouth, 81,600 acre-feet on the Colorado River from Topock to Laguna Dam, and 13,100 acre-feet from Laguna Dam to the California-Baja California International Boundary. The salvages were apportioned among the various contributors on the basis of the respective undepleted volumes conveyed in the respective stream sections.

The annual uses by native vegetation in the cropped and noncropped areas under virgin conditions were determined to be 65,900 acre-feet in California and 87,100 acre-feet in Arizona between Topock and the Arizona-Sonora International Boundary. It was estimated that growth changes attributable to the influence of man increased the uses by native vegetation in this river section by 11,100 acre-feet a year over uses under virgin conditions. These increased losses were divided as 5,600 acre-feet chargeable to Arizona and 5,500 acre-feet to California.

The apportionments of virgin channel losses in Item (202) were determined as Items 186 plus Items (203) and (204) minus Item (205). However, because depletions by California were 2,557,000 acre-feet a year in excess of contributions by California and no historic losses were apportioned to California, the quantities listed for California in Items (204) and (205) were assigned to undistributed stream flow and California's apportionment was considered to be the credited salvage of water surface evaporation.

(203). This salvage was discussed under Item (202) (See Table 14 for total. Topock to Yuma, 95,300 acre-feet plus Yuma to International Boundary, 2,300 acre-feet).

(204). This replacement salvage was discussed under Item (202) (See Table 14 for total. Topock to Yuma, 75,600 acre-feet plus Yuma to International Boundary, 77,400 acre-feet).

(205). These increased losses were discussed under Item (202) (See Table 14 for total. Topock to Yuma, 9,700 acre-feet plus Yuma to International Boundary, 1,400 acre-feet).

(206). Item (201) minus Item (202).

APPENDIX A

TABLES

OF

CLIMATOLOGICAL DATA

AND

STREAM FLOW

Table 1

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

ARIZONA

October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts		
						Yrs. of Record	Last in Spring	First in Autumn
Agua Caliente	Gila	Maricopa	32°58'	113°20'	516	10	Feb 25	Nov 26
Alpine	San Francisco	Apache	33°51'	109°08'	8000	26	June 22	Sept 13
Ashdale Ranger Station	Verde	Maricopa	33°58'	111°52'	3300	22	Apr 1	Nov 13
Ashfork	Verde	Yavapai	35°13'	112°29'	5140	30	May 8	Oct 16
Aztec	Gila	Yuma	32°48'	113°27'	492	8	Feb 26	Dec 9
Bagdad	Bill Williams	Yavapai	34°36'	113°12'	3900	20	Mar 28	Nov 14
Bartlett Dam	Verde	Maricopa	33°49'	111°38'	1650	5	1/	1/
Benson	San Pedro	Cochise	31°57'	110°17'	3550	31	Apr 7	Nov 3
Betatakin	Little Colorado	Navajo	36°40'	110°31'	7200	6	May 13	Oct 7
Bisbee	San Pedro	Cochise	31°27'	109°55'	5350	30	Mar 27	Nov 22
Blue	San Francisco	Greenlee	33°40'	109°06'	6500	15	May 8	Oct 16
Bowie	San Simon	Cochise	32°20'	109°29'	3756	24	Mar 30	Nov 6
Buckeye	Gila	Maricopa	33°22'	112°35'	888	31	Mar 11	Nov 18
Canelo Ranger Station	San Pedro	Santa Cruz	31°33'	110°31'	5000	2/ 27	May 2	Oct 18
Canille	San Pedro	Santa Cruz	31°31'	110°30'	5225	2/ 27	May 2	Oct 18
Casa Grande	Santa Cruz	Pinal	32°53'	111°45'	1390	25	Mar 4	Nov 23
Cedar Glade	Verde	Yavapai	34°58'	112°22'	4610	21	Apr 24	Oct 18
Childs	Verde	Yavapai	34°21'	111°42'	2650	30	Mar 26	Nov 13
Chinle	San Juan	Apache	36°09'	109°32'	5538	24	May 11	Oct 8
Clemenceau	Verde	Yavapai	34°44'	112°02'	3460	3/ 28	Apr 2	Nov 3
Clifton	San Francisco	Greenlee	33°03'	109°17'	3465	32	Feb 27	Nov 25
Copper Mine Trading Post	Colorado	Coconino	36°38'	111°22'	6380	6	Apr 29	Oct 20
Cordes	Agua Fria	Yavapai	34°18'	112°10'	3773	20	Apr 13	Nov 17

1/ Not estimated.
2/ Records at Canille combined with records at Canelo Ranger Station.
3/ Combined with records at Montezuma Castle and Cornville.

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

ARIZONA (Continued) October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts: Yrs. of Record	Killing Frosts: Last in Spring		Killing Frosts: First in Autumn	
Cornville	Verde	Yavapai	34°42'	112°02'	3300	1/ 28	Apr	2	Nov	3
Douglas (Smelter)	Yaqui	Cochise	31°21'	109°35'	3973	32	Apr	6	Nov	8
Dudleyville	San Pedro	Pinal	32°56'	110°45'	2204	11	Apr	1	Nov	11
Elgin	San Pedro	Santa Cruz	31°40'	110°32'	4900	16	Apr	21	Oct	26
Fairbank	San Pedro	Cochise	31°43'	110°12'	3862	25	Apr	8	Nov	3
Flagstaff	Little Colorado	Coconino	35°12'	111°40'	6903	32	June	1	Oct	2
Florence	Gila	Pinal	33°02'	111°23'	1500	26	Mar	15	Nov	19
Fort Apache	Salt	Navajo	33°46'	109°57'	5300	2/ 24	May	3	Oct	17
Fort Defiance	Little Colorado	Apache	35°46'	109°05'	6750	3/ 28	May	22	Oct	2
Fredonia	Kanab Creek	Coconino	36°57'	112°32'	5000	9	May	23	Oct	7
Ganado	Little Colorado	Apache	35°43'	109°34'	6350	17	May	7	Oct	4
Gila Bend	Gila	Maricopa	32°57'	112°43'	737	30	Feb	23	Nov	29
Globe	Salt	Gila	33°23'	110°48'	3410	32	Apr	1	Nov	11
Grand Canyon	Colorado	Coconino	36°03'	112°08'	6930	32	May	17	Oct	9
Granite Reef Dam	Salt	Maricopa	33°31'	111°42'	1325	31	Feb	13	Dec	3
Henry's Camp	Salt	Apache	33°34'	109°54'	6925	24	May	19	Oct	12
Hereford	San Pedro	Cochise	31°26'	110°02'	4180	7	Mar	29	Oct	30
Holbrook	Little Colorado	Navajo	34°54'	110°10'	5069	32	Apr	27	Oct	21
Inner Canyon	Colorado	Coconino	36°06'	112°06'	2490	9	Jan	29	Dec	22
Intake	Salt	Gila	33°37'	110°55'	2220	13	Mar	10	Nov	26
Jeddito	Little Colorado	Navajo	35°46'	110°08'	6700	14	May	19	Oct	6
Jerome	Verde	Yavapai	34°45'	112°07'	5250	31	Apr	10	Nov	18
Kayenta	San Juan	Navajo	36°44'	110°16'	5675	24	Apr	29	Oct	15

1/ Combined with records at Montezuma Castle and Clemenceau.
2/ Combined with records at Whiteriver.
3/ Combined with records at St. Michaels.

Table 1

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

ARIZONA (Continued) October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts		
						Yrs. of Record	Last in Spring	First in Autumn
Keams Canyon	Little Colorado	Navajo	35°49'	110°12'	6205	7	May 13	Oct 15
Kingman	Colorado	Mohave	35°11'	114°03'	3333	30	Apr 3	Nov 7
Klondyke	San Pedro	Graham	32°50'	110°20'	3225	1/	Apr 1	Nov 11
Lees Ferry	Colorado	Coconino	36°52'	111°36'	3141	20	Mar 26	Nov 7
Leupp	Little Colorado	Coconino	35°17'	110°58'	4700	16	May 6	Oct 17
Lewis Springs	San Pedro	Cochise	31°34'	110°10'	4029	20	Apr 10	Oct 21
Litchfield Park	Agua Fria	Maricopa	33°30'	112°22'	1030	28	Mar 6	Nov 25
Maricopa	Santa Cruz	Pinal	32°57'	112°00'	1242	31	Mar 6	Nov 22
Marinette	Agua Fria	Maricopa	33°38'	112°14'	1150	27	Mar 8	Nov 25
Mesa Experiment Farm	Salt	Maricopa	33°25'	111°52'	1245	31	Mar 12	Nov 21
Moccasin	Kanab Creek	Mohave	36°55'	112°48'	4500	12	May 12	Oct 2
Mohawk	Gila	Yuma	32°44'	113°46'	538	29	Jan 19	Dec 18
Montezuma Castle	Verde	Yavapai	34°37'	111°50'	3180	2/ 28	Apr 2	Nov 3
Mormon Flat	Salt	Maricopa	33°33'	111°27'	1815	20	Feb 3	Dec 27
Naco	San Pedro	Cochise	31°20'	109°57'	4579	20	Mar 18	Nov 17
Natural Bridge	Verde	Gila	34°19'	111°27'	4607	31	Apr 9	Nov 12
Nogales	Santa Cruz	Santa Cruz	31°21'	110°55'	3800	32	Mar 31	Nov 18
Oracle	San Pedro	Pinal	32°36'	110°47'	4600	28	Apr 1	Nov 11
Paradise	San Simon	Cochise	31°57'	109°13'	5436	24	Apr 19	Oct 25
Parker	Colorado	Yuma	34°09'	114°17'	385	32	Feb 27	Nov 15
Patagonia	Santa Cruz	Santa Cruz	31°33'	110°45'	4044	17	Apr 15	Oct 26
Payson Ranger Station	Verde	Gila	34°14'	111°20'	4900	29	May 25	Oct 10
Phoenix WB City	Salt	Maricopa	33°28'	112°04'	1083	32	Jan 31	Dec 5
Pinal Ranch	Gila	Pinal	33°20'	111°00'	4520	29	Apr 27	Oct 18

1/ Estimated to be same as Globe, Arizona.
2/ Combined with records at Clemenceau and Cornville.

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

ARIZONA (Continued) October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts: Yrs. of Record	Killing Frosts: Last in Spring	Killing Frosts: First in Autumn
Pinedale	Little Colorado	Navajo	34°18'	110°15'	6500	29	June 1	Oct 9
Portal	San Simon	Cochise	31°54'	109°10'	5000	18	Apr 28	Oct 24
Prescott	Verde	Yavapai	34°33'	112°28'	5354	32	May 13	Oct 12
Roosevelt	Salt	Gila	33°40'	111°09'	2230	31	Feb 4	Dec 13
Sacaton	Gila	Pinal	33°05'	111°45'	1280	32	Mar 10	Nov 15
Safford	Gila	Graham	32°50'	109°43'	2900	1/ 32	Apr 5	Nov 4
Saint Johns	Little Colorado	Apache	34°31'	109°22'	5560	31	May 4	Oct 12
St. Michaels	Little Colorado	Apache	35°39'	109°06'	6950	2/ 28	May 22	Oct 2
Salome	Desert (Gila)	Yuma	33°44'	113°32'	1700	32	Mar 8	Nov 22
San Carlos Reservoir	Gila	Gila	33°10'	110°31'	2532	24	Mar 16	Nov 17
San Rafael Ranch	Santa Cruz	Santa Cruz	31°22'	110°37'	4741	16	Apr 11	Oct 29
San Simon	San Simon	Cochise	32°19'	109°16'	3609	23	Apr 3	Nov 8
Seligman	Verde	Yavapai	35°19'	112°53'	5219	31	May 15	Oct 10
Sierra Ancha	Salt	Gila	33°48'	110°58'	5100	10	Apr 24	Nov 8
Snowflake	Little Colorado	Navajo	34°30'	110°04'	5644	30	May 21	Oct 5
Springerville	Little Colorado	Apache	34°08'	109°17'	6964	32	May 26	Oct 3
Stewart Mountain	Salt	Maricopa	33°34'	111°32'	1422	6	3/	3/
Supai	Colorado	Coconino	36°10'	112°42'	3200	16	Mar 8	Nov 7
Superior	Queen Creek	Pinal	33°18'	111°06'	2995	10	Apr 3	Nov 11
Thatcher	Gila	Graham	32°51'	109°46'	2800	1/ 32	Apr 5	Nov 4
Tombstone	San Pedro	Cochise	31°43'	110°04'	4540	31	Mar 30	Nov 18
Tuba City	Little Colorado	Coconino	36°08'	111°15'	4936	29	Apr 22	Oct 20
Tucson (U. of A.)	Santa Cruz	Pima	32°15'	110°58'	2423	32	Mar 18	Nov 18

1/ Records at Thatcher combined with records at Safford.
2/ Combined with records at Fort Defiance.
3/ Not estimated.

Table 1

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

ARIZONA (Continued) October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts: Yrs. of Record	Killing Frosts: Last in Spring	Killing Frosts: First in Autumn
Walnut Grove	Hassayampa	Yavapai	34°16'	112°26'	3764	17	Apr 24	Oct 31
Wellton	Gila	Yuma	32°40'	114°08'	258	21	Mar 3	Nov 17
Whiteriver	Salt	Navajo	33°50'	109°57'	5200	1/ 24	May 3	Oct 17
Wickenburg	Hassayampa	Maricopa	33°58'	112°44'	2072	31	Apr 2	Nov 15
Wikieup	Bill Williams	Mohave	34°44'	113°37'	2125	14	Mar 25	Nov 5
Willcox	Desert	Cochise	32°15'	109°50'	4200	31	May 2	Oct 24
Williams	Colorado	Coconino	35°15'	112°11'	6750	32	June 4	Sept 26
Winslow	Little Colorado	Navajo	35°01'	110°44'	4880	31	Apr 30	Oct 19
Young	Salt	Gila	34°07'	110°57'	5100	20	May 2	Oct 19
Yuma Citrus Station	Colorado	Yuma	32°37'	114°38'	191	25	Jan 18	Dec 17
Yuma Date Orchard	Colorado	Yuma	32°43'	114°41'	125	2/ 32	Feb 22	Nov 25
Yuma Valley	Colorado	Yuma	32°37'	114°38'	110	2/ 32	Feb 22	Nov 25
Yuma WB City	Colorado	Yuma	32°44'	114°36'	138	32	Jan 11	Dec 27
CALIFORNIA								
Blythe	Colorado	Riverside	33°36'	114°36'	268	32	Feb 20	Nov 21
Needles Airport	Colorado	San Bernardino	34°46'	114°38'	913	29	Feb 6	Dec 5
NEVADA								
Boulder City	Colorado	Clark	35°59'	114°51'	2525	12	Feb 16	Dec 13
Caliente	Muddy	Lincoln	37°37'	114°31'	4402	9	Apr 30	Oct 10
Las Vegas	Colorado	Clark	36°10'	115°09'	2006	30	Mar 8	Nov 18
Logandale	Muddy	Clark	36°36'	114°29'	1400	24	Mar 16	Nov 12
Overton	Muddy	Clark	36°33'	114°27'	1275	6	Mar 1	Nov 15

1/ Combined with records at Fort Apache.
2/ Records at Yuma Valley combined with records at Yuma Date Orchard.

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

NEVADA (Continued) October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts: Yrs. of Record	Killing Frosts: Last in Spring	Killing Frosts: First in Autumn
Pioche	Muddy	Lincoln	37°56'	114°28'	6110	9	May 12	Oct 22
Searchlight	Colorado	Clark	35°28'	114°55'	3540	27	Mar 15	Nov 28
NEW MEXICO								
Alma	San Francisco	Catron	33°22'	108°53'	4800	13	May 1	Oct 19
Birmingham Ranch	St.Augustine Plains	Catron	33°48'	108°20'	6800	1/ 27	May 22	Oct 4
Black Rock	Little Colorado	McKinley	35°06'	108°47'	6455	32	May 13	Oct 13
Cliff	Gila	Grant	32°52'	108°31'	4800	11	May 2	Oct 9
Crownpoint	San Juan	McKinley	35°40'	108°13'	6978	28	May 1	Oct 18
Datil	St.Augustine Plains	Catron	34°09'	107°51'	7100	27	May 31	Sept 25
Fort Bayard	Mimbres Valley	Grant	32°48'	108°09'	6152	31	Apr 23	Oct 31
Fort Wingate	Little Colorado	McKinley	35°28'	108°32'	7000	6	May 6	Oct 8
Gamerco	Little Colorado	McKinley	35°36'	108°46'	6735	26	May 9	Oct 10
Glenwood	San Francisco	Catron	33°19'	108°53'	4717	2	May 4	Oct 21
Hood Ranger Station	San Francisco	Catron	33°43'	108°47'	5832	9	May 20	Oct 8
Horse Springs	St.Augustine Plains	Catron	33°56'	108°10'	7070	1/ 27	May 22	Oct 4
Jewett Ranger Station	San Francisco	Catron	33°59'	108°38'	7400	9	June 5	Sept 17
Luna Ranger Station	San Francisco	Catron	33°50'	108°56'	7050	30	June 18	Sept 22
McGaffey Ranger Station	Little Colorado	McKinley	35°22'	108°31'	8000	27	June 2	Sept 24
Mogollon	San Francisco	Catron	33°24'	108°47'	6600	3	May 5	Oct 5
Navajo Experiment Station	San Juan	McKinley	35°50'	108°51'	6455	9	May 10	Oct 9
Quemado	Little Colorado	Catron	34°21'	108°30'	6879	14	June 2	Oct 1
Ramah	Little Colorado	McKinley	35°08'	108°30'	7200	5	June 1	Sept 20
Red Rock	Gila	Grant	32°42'	108°44'	4150	8	Apr 28	Oct 15
Rodeo	San Simon	Hidalgo	31°51'	109°02'	4118	30	Apr 7	Nov 8

1/ Records at Horse Springs combined with records at Birmingham Ranch.

LOWER COLORADO RIVER BASIN

Selected Weather Bureau Stations and Average Killing Frosts

UTAH

October 1, 1913 - September 30, 1945

Station	Drainage	County	Latitude	Longitude	Elev.	Killing Frosts		
						Yrs. of Record	Last in Spring	First in Autumn
Alton	Kanab Creek	Kane	37°26'	112°29'	7150	31	June 3	Sept 27
Cedar City	Sevier	Iron	37°41'	113°05'	5805	29	May 12	Oct 5
Gunlock Power House	Virgin	Washington	37°17'	113°43'	3600	6	Apr 20	Nov 1
Hurricane	Virgin	Washington	37°10'	113°17'	3800	0	1/	1/
Kanab Power House	Kanab Creek	Kane	37°03'	112°32'	4925	27	May 3	Oct 14
Leeds	Virgin	Washington	37°14'	113°21'	3400	22	Apr 7	Nov 3
Modena	Sevier	Iron	37°48'	113°54'	5462	32	May 15	Oct 5
New Harmony	Virgin	Washington	37°29'	113°18'	5280	0	2/	2/
Orderville	Virgin	Kane	37°16'	112°38'	5250	0	3/	3/
St. George	Virgin	Washington	37°07'	113°35'	2880	32	Mar 31	Oct 27
Springdale	Virgin	Washington	37°12'	113°00'	3981	4/ 28	Apr 11	Oct 27
Zion National Park	Virgin	Washington	37°13'	112°58'	4000	4/ 28	Apr 11	Oct 27

1/ Not estimated.
2/ Not estimated.
3/ Not estimated.
4/ Records at Zion National Park combined with records at Springdale.

Supplemental Data 5/

CALIFORNIA

Imperial	Salton Sea	Imperial	32°51'	115°34'	-69	18	Jan 29	Dec 9
Indio	Salton Sea	Riverside	33°43'	116°14'	20	32	Feb 6	Dec 12

5/ Killing frosts for period of record to 1936, inclusive, from 1941 Yearbook of Agriculture, "Climate and Man."

Table 2

LOWER COLORADO RIVER BASIN

Average Temperature in Degrees Fahrenheit

October 1, 1913 - September 30, 1945

ARIZONA

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean Annual
Agua Caliente	9	52.4	57.1	62.0	70.0	76.9	85.8	93.0	90.6	84.7	71.2	61.1	54.0	71.6
Alpine	18	26.6	30.2	35.0	41.0	48.2	56.8	60.7	59.4	53.7	45.0	36.0	28.8	43.5
Ashdale Ranger Station	6	43.4	45.6	50.1	56.3	64.6	73.0	79.9	79.0	73.9	61.2	51.7	44.1	60.2
Ashfork	29	35.9	39.6	44.6	51.0	58.7	68.2	74.3	72.5	66.2	55.7	45.5	38.2	54.2
Aztec	6	52.0	57.4	62.2	70.7	78.6	88.0	94.8	93.9	86.8	74.2	60.7	53.2	72.7
Bagdad	17	45.9	48.9	53.9	59.8	67.7	76.5	83.4	82.0	76.0	65.3	55.1	48.2	63.6
Bartlett Dam	5	51.3	54.0	59.1	65.9	74.9	84.4	89.4	88.0	83.0	71.4	60.4	52.2	69.5
Benson	31	45.8	49.8	54.1	60.4	68.6	77.4	81.2	78.9	74.0	63.9	53.1	46.4	62.8
Betatakin	6	27.3	30.5	37.3	45.8	55.7	66.3	71.2	69.0	62.4	50.5	38.9	31.3	48.9
Bisbee	31	46.3	49.6	53.9	60.4	68.2	76.8	77.2	75.2	71.9	63.9	53.9	47.1	62.0
Bowie	23	46.1	51.1	56.0	63.2	72.2	82.4	84.2	82.4	77.0	67.1	54.7	47.0	65.3
Buckeye	31	50.1	54.7	59.7	66.7	75.0	83.5	90.7	89.4	83.1	70.2	58.0	51.1	69.4
Canelo Ranger Station 1/	20	40.8	44.2	46.3	54.4	61.2	70.2	73.3	71.7	67.6	58.5	48.1	41.9	56.5
Casa Grande	23	49.6	54.2	59.4	67.0	75.6	84.6	90.8	88.5	82.8	70.6	58.5	51.1	69.4
Childs	28	45.2	49.3	54.3	61.0	69.3	78.3	83.6	81.0	75.6	64.9	54.3	46.6	63.6
Chinle	23	27.2	35.1	41.9	49.8	58.7	69.2	75.1	72.6	64.1	52.2	39.4	31.1	51.4
Clifton	32	45.8	52.1	58.2	65.4	74.2	83.6	85.9	84.5	79.5	69.0	55.2	46.7	66.7
Copper Mine Trading Post	6	30.1	34.9	42.2	50.4	59.0	69.1	73.3	72.1	65.4	54.0	40.4	32.0	51.9
Cordes	13	42.8	46.7	51.3	57.2	64.9	73.9	79.7	78.1	72.5	62.2	52.3	45.5	60.6
Douglas (Smelter)	32	45.1	49.4	54.0	60.9	68.5	77.5	80.0	78.0	74.1	64.2	52.9	46.2	62.6
Dudleyville	12	46.5	50.7	55.8	61.0	68.7	77.5	82.4	80.0	74.9	63.7	53.1	47.2	63.5
Flagstaff	32	27.1	30.7	36.2	42.9	50.5	59.4	65.9	64.1	57.7	47.0	37.2	29.8	45.7
Florence	26	51.2	55.1	59.5	66.2	74.2	83.5	90.0	87.7	82.7	71.0	59.5	52.9	69.5
Fort Defiance 2/	28	26.8	32.2	38.3	45.9	54.4	63.9	69.5	67.6	60.7	49.6	38.6	29.4	48.1
Fredonia	9	32.3	36.8	43.4	50.0	57.6	67.0	73.1	72.0	64.2	53.4	42.1	33.8	52.1

1/ Combined with Canille.
2/ Combined with St. Michaels.

LOWER COLORADO RIVER BASIN

Average Temperature in Degrees Fahrenheit October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean Annual
Ganado	15	27.4	33.0	39.3	46.6	55.3	64.7	70.7	69.5	62.4	51.5	39.4	29.9	49.1
Gila Bend	29	52.8	57.0	62.4	69.1	77.1	86.4	93.0	90.8	85.5	73.4	61.3	53.9	71.9
Globe	32	43.2	47.7	53.0	59.6	68.0	77.7	82.4	80.3	74.9	63.6	51.7	44.4	62.2
Grand Canyon	32	29.5	32.5	38.4	45.9	55.0	64.6	69.8	67.5	61.5	50.3	39.4	31.9	48.9
Granite Reef Dam	30	52.3	55.7	60.1	66.7	74.5	82.9	89.9	88.1	83.1	71.7	60.6	53.4	69.9
Henry's Camp	23	34.0	38.1	42.4	48.4	56.8	65.6	70.5	69.2	63.6	53.6	42.6	35.8	51.7
Holbrook	30	32.7	40.3	45.8	53.6	61.6	71.3	77.1	75.2	68.4	55.9	43.5	34.6	55.0
Inner Canyon	10	45.3	52.2	58.3	66.8	75.6	86.4	90.9	88.0	81.8	69.2	55.8	45.5	68.0
Jeddito	14	30.0	35.5	40.6	48.1	56.8	66.3	72.3	70.7	63.9	52.8	41.4	32.7	50.9
Jerome	30	41.6	44.4	49.6	56.9	65.5	75.2	79.0	76.4	71.9	62.2	51.7	43.9	59.9
Kayenta	26	28.1	36.3	43.5	51.7	61.2	70.9	75.9	73.7	66.1	54.2	40.9	31.3	52.8
Keams Canyon	6	30.3	36.1	41.4	49.3	58.2	68.7	73.1	70.6	64.9	53.4	41.7	31.8	51.6
Kingman	30	43.1	46.4	51.6	58.4	66.3	75.2	82.1	80.0	74.1	62.4	51.5	43.9	61.3
Lees Ferry	19	35.6	43.8	52.6	60.9	70.8	80.7	86.9	84.0	76.1	62.2	47.6	38.0	61.6
Leupp	17	31.5	39.1	45.1	53.0	60.6	70.2	76.7	74.8	67.3	55.4	41.4	33.3	54.0
Litchfield Park	28	50.3	54.7	59.9	66.8	74.8	83.9	90.4	88.1	82.5	69.9	58.7	52.0	69.3
Maricopa	31	49.0	53.9	59.1	66.7	75.7	85.2	92.0	90.2	83.4	70.4	57.8	50.4	69.5
Marinette	25	50.0	54.7	59.8	66.7	74.3	83.8	90.2	87.6	81.9	70.0	57.9	51.4	69.0
Mesa Experiment Farm	31	49.4	53.5	58.2	64.6	72.8	81.8	87.4	85.5	80.0	68.8	57.7	50.7	67.5
Moccasin	5	31.5	37.9	43.0	50.2	58.3	67.3	74.8	73.0	62.4	53.2	41.7	34.3	52.3
Mohawk	29	53.6	58.7	65.1	71.4	78.9	88.6	94.5	92.6	87.5	75.9	63.0	55.2	73.8
Montezuma Castle 1/	29	43.1	47.4	52.8	59.8	67.2	75.6	82.1	80.2	74.2	63.4	52.1	44.7	61.9
Mormon Flat	21	52.7	55.5	61.2	69.2	78.3	87.1	92.3	89.6	85.6	74.3	62.4	54.4	71.9
Natural Bridge	31	40.8	44.0	48.5	54.9	62.5	71.7	76.3	74.3	69.4	59.5	49.4	42.6	57.8
Nogales	32	46.6	49.8	54.1	60.5	68.0	77.2	80.2	77.7	74.0	64.5	54.7	48.0	62.9
Oracle	27	46.0	48.4	52.5	58.7	67.4	76.9	79.7	77.6	73.9	64.7	54.9	47.2	62.3

1/ Combined with Clemenceau and Cornville.

LOWER COLORADO RIVER BASIN

Average Temperature in Degrees Fahrenheit

October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean Annual
Paradise	24	37.1	41.9	46.8	53.5	61.5	70.3	72.7	70.1	65.2	56.0	44.4	37.7	54.8
Parker	32	49.3	55.1	60.7	67.7	75.9	84.6	91.8	90.3	82.9	69.5	57.5	50.2	69.6
Payson Ranger Station	26	35.7	38.9	43.6	49.2	56.5	65.6	73.0	71.0	65.1	53.4	43.3	37.6	52.7
Phoenix WB City	32	51.9	56.1	61.1	68.0	76.5	85.4	91.0	89.0	83.7	71.7	60.1	53.1	70.6
Pinedale	29	29.7	34.8	39.6	46.2	53.8	62.9	69.3	67.4	61.5	50.6	39.3	31.5	48.9
Portal	8	39.1	43.3	47.4	54.2	60.7	69.9	72.8	71.3	66.9	56.8	45.0	39.0	55.5
Prescott	32	34.4	38.6	43.5	50.5	58.1	67.3	73.3	71.0	65.1	53.7	43.5	36.4	53.0
Roosevelt	31	47.6	51.6	57.5	64.9	74.4	83.7	88.2	86.1	80.9	69.4	57.5	49.0	67.6
Sacaton	32	49.2	53.8	58.8	65.8	74.0	82.9	88.5	86.6	81.4	69.5	57.7	50.6	68.2
Safford 1/	32	43.9	48.9	53.9	61.0	69.6	79.0	83.6	80.9	75.0	63.6	51.9	44.9	63.0
Saint Johns	31	31.5	37.6	43.1	51.3	59.0	68.0	73.1	71.3	64.7	53.5	41.4	33.1	52.3
Salome	32	49.3	52.3	57.5	63.8	71.7	81.1	88.4	87.0	80.8	69.1	57.6	50.7	67.4
San Carlos Reservoir	25	45.4	50.1	55.2	61.9	70.4	80.4	85.6	83.6	79.0	66.2	53.9	46.5	64.9
San Simon	7	41.9	46.6	51.7	58.1	67.1	77.1	80.7	77.8	73.3	63.0	50.9	45.2	61.1
Seligman	27	34.7	38.5	43.2	50.2	57.6	66.4	72.4	70.4	64.5	54.2	44.0	36.4	52.7
Sierra Ancha	10	42.4	46.2	49.6	56.2	64.1	74.0	78.1	76.2	72.2	62.7	51.8	43.9	59.8
Snowflake	31	31.3	37.3	42.3	50.1	57.4	66.7	72.9	71.1	63.7	52.5	41.0	33.1	51.6
Springerville	30	31.1	35.1	39.7	46.5	54.5	63.4	66.8	64.6	59.7	50.7	40.7	33.2	48.8
Supai	15	40.7	47.2	53.9	62.3	70.3	77.5	82.7	80.4	73.8	62.9	49.7	42.4	62.0
Tombstone	31	46.7	50.0	54.6	61.3	69.4	78.2	79.4	77.1	74.0	65.4	54.8	47.6	63.2
Tuba City	28	32.4	39.8	46.8	53.9	62.7	72.0	77.6	75.9	68.5	56.7	43.5	33.9	55.3
Tucson (U. of A.)	32	49.6	53.2	57.6	64.1	72.3	81.5	86.2	84.0	79.6	68.7	57.7	51.0	67.1
Wellton	21	51.0	56.1	61.7	68.1	75.4	83.8	91.3	90.5	84.2	71.3	58.3	51.7	70.3
Whiteriver 2/	23	36.5	40.5	45.6	52.3	60.2	69.3	73.4	71.7	66.7	56.3	45.2	38.2	54.7
Wickenburg	29	46.7	50.1	54.7	60.9	69.1	78.7	85.9	83.9	77.3	66.5	55.5	48.6	64.8

1/ Combined with Thatcher.
2/ Combined with Fort Apache.

LOWER COLORADO RIVER BASIN

Average Temperature in Degrees Fahrenheit October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean Annual
Willcox	30	41.2	45.0	49.4	56.0	63.4	72.6	77.2	75.4	70.1	59.6	48.7	42.3	58.4
Williams	32	29.6	32.5	37.8	45.4	53.7	62.5	67.6	65.7	59.5	48.7	39.1	32.1	47.9
Winslow	31	31.8	39.5	45.5	53.4	62.0	71.3	77.3	75.1	68.2	55.7	42.7	34.1	54.7
Yuma Citrus Station	25	53.7	58.1	63.4	69.4	76.6	84.9	91.2	91.0	84.8	73.9	62.0	55.2	72.0
Yuma Valley 1/	31	52.0	56.0	61.3	67.1	73.6	80.9	88.2	87.8	81.9	70.4	59.4	52.7	69.3
Yuma WB City	32	54.6	59.1	64.6	70.3	77.3	85.2	91.8	90.6	85.0	73.6	62.5	55.7	72.5

CALIFORNIA

Blythe	32	51.5	56.5	62.6	69.2	76.4	84.4	91.6	90.2	83.3	71.0	59.1	51.9	70.6
Needles Airport	29	51.0	56.3	62.6	70.3	78.8	87.3	94.2	91.8	84.0	71.4	58.8	52.2	71.6

NEVADA

Boulder City	14	45.2	49.7	56.1	64.3	72.6	82.5	88.7	86.8	79.7	68.1	55.5	47.4	66.4
Caliente	16	30.5	36.9	44.0	51.2	59.5	68.3	76.3	73.7	64.7	52.2	40.9	33.1	52.6
Las Vegas	30	45.9	51.2	57.2	64.5	72.3	80.8	86.8	85.0	77.7	66.4	54.4	47.4	65.8
Logandale	24	45.6	51.0	57.5	64.5	72.8	80.5	87.5	85.4	77.8	67.0	54.2	46.5	65.9
Overton	6	45.4	51.5	58.2	69.9	76.4	84.3	91.5	90.2	81.3	68.1	54.3	46.3	68.1
Pioche	8	29.7	33.3	40.0	47.7	56.8	67.3	74.0	71.5	63.5	51.3	40.9	31.8	50.7
Searchlight	29	44.3	48.2	53.9	60.9	68.9	78.2	83.9	81.7	76.0	65.1	54.3	45.6	63.4

NEW MEXICO

Alma	12	38.1	42.0	47.0	53.0	60.2	69.9	74.3	72.4	66.8	56.4	45.6	39.6	55.4
Birmingham Ranch 2/	30	27.7	32.3	38.0	44.7	53.6	62.6	66.5	65.0	59.2	49.0	37.6	28.9	47.1
Black Rock	32	28.8	34.5	40.4	47.5	55.7	65.1	70.4	68.8	62.5	51.4	39.6	31.4	49.7
Cliff	7	38.0	41.5	46.5	53.8	61.2	70.8	76.1	74.4	68.3	57.5	45.5	39.7	56.1

1/ Combined with Yuma Date Orchard.
2/ Combined with Horse Springs.

LOWER COLORADO RIVER BASIN

Average Temperature in Degrees Fahrenheit October 1, 1913 - September 30, 1945

NEW MEXICO (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean Annual
Crownpoint	30	29.6	35.1	40.8	48.1	57.4	67.5	71.4	69.7	63.5	52.2	40.4	31.9	50.6
Datil	16	28.6	32.7	37.2	44.8	52.6	62.2	65.9	64.3	58.5	48.0	37.5	30.8	46.9
Fort Bayard	31	38.2	41.9	45.9	52.2	60.4	69.8	72.1	70.6	65.8	56.6	45.8	39.6	54.9
Fort Wingate	5	29.1	33.4	39.4	46.9	56.5	65.8	70.2	68.8	62.5	51.3	41.0	30.8	49.6
Gamerco	26	27.0	32.6	38.7	46.3	54.9	64.5	69.9	68.3	61.1	49.0	37.5	29.0	48.2
Glenwood	2	40.1	43.6	49.1	56.1	62.7	70.7	78.2	76.1	69.8	59.6	48.5	40.8	57.9
Luna Ranger Station	22	28.0	32.3	37.0	42.8	50.4	59.5	64.3	62.5	57.4	46.9	36.1	29.6	45.6
McGaffey Ranger Station	19	22.7	27.1	33.2	40.9	50.2	59.3	64.6	63.0	56.5	44.4	34.1	25.9	43.5
Mogollon	7	35.3	38.1	42.8	48.9	56.8	66.3	69.4	67.8	63.3	53.5	42.8	36.1	51.8
Navajo Experiment Station	9	28.5	34.1	40.1	47.5	56.1	66.3	71.6	69.9	62.8	51.0	39.5	30.9	49.9
Quemado	17	29.6	33.0	37.5	44.6	53.0	61.9	67.0	64.7	59.6	49.2	37.8	31.4	47.4
Rodeo	9	42.4	47.2	52.0	58.0	66.1	76.2	79.4	77.6	72.7	62.8	50.9	44.5	60.8

UTAH

Alton	30	26.1	28.9	34.1	42.1	49.9	58.5	64.7	63.2	56.4	46.8	36.8	28.8	44.7
Cedar City	30	29.7	34.0	40.0	48.1	56.6	66.8	73.4	71.6	63.8	52.2	40.7	31.9	50.7
Kanab Power House	28	33.6	38.2	44.8	52.0	60.1	68.7	75.5	73.7	66.8	55.8	44.5	35.5	54.1
Leeds	23	36.2	41.8	49.1	56.1	64.6	73.7	79.9	77.8	70.6	58.9	47.3	38.6	57.9
Modena	32	25.6	31.8	38.6	46.1	54.2	63.7	71.4	69.4	60.8	49.1	37.1	28.3	48.0
St. George	31	38.5	44.8	51.8	59.3	67.6	76.5	83.9	81.7	73.5	61.0	47.8	39.8	60.5
Zion National Park 1/	30	39.3	44.2	49.8	56.8	65.7	76.4	82.3	79.7	73.5	62.5	49.6	40.9	60.1

1/ Combined with Springdale

Supplemental Data

CALIFORNIA Period of Record to 1945, Inclusive

Imperial	24	53.8	58.2	64.6	70.7	77.6	85.3	91.8	91.2	84.1	73.7	61.8	54.9	72.3
Indio	66	53.7	59.0	65.1	72.2	79.2	87.6	93.2	91.9	85.6	75.0	63.0	55.5	73.4

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches

October 1, 1913 - September 30, 1945

ARIZONA

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Agua Caliente	9	1.06	0.46	0.10	0.16	0.02	0.04	0.56	0.95	0.85	0.35	0.23	0.35	5.13
Alpine	26	1.36	1.97	1.41	1.06	0.73	0.76	3.86	3.61	2.47	1.76	1.18	1.64	21.81
Ashdale Ranger Station	28	2.55	2.92	2.19	1.37	0.37	0.28	2.23	2.75	1.77	1.15	1.45	3.00	22.03
Ashfork	31	1.13	1.35	1.11	1.08	0.43	0.54	1.94	2.14	1.49	0.80	0.61	1.31	13.93
Aztec	8	0.74	0.48	0.50	0.21	0.03	0.08	0.49	1.18	0.57	0.21	0.36	0.54	5.39
Bagdad	20	1.83	2.17	1.34	0.76	0.58	0.68	1.44	1.98	1.49	0.69	1.00	1.83	15.79
Bartlett Dam	6	1.29	1.80	1.10	0.87	0.20	0.68	1.90	1.28	0.97	0.67	1.10	1.86	13.72
Benson	32	0.64	0.83	0.47	0.21	0.12	0.39	2.54	2.97	1.57	0.56	0.72	0.90	11.92
Betatakin	6	0.96	1.48	1.14	0.69	0.87	0.33	2.11	1.54	1.07	1.32	0.84	1.31	13.66
Bisbee	32	1.17	1.24	0.91	0.51	0.24	0.78	4.28	4.37	2.40	1.04	1.13	1.63	19.70
Blue	17	1.23	1.25	0.99	0.88	0.70	0.73	3.83	3.30	2.33	1.47	1.38	1.39	19.48
Bowie	31	0.66	0.73	0.62	0.28	0.21	0.24	1.97	1.92	1.03	0.63	0.74	0.96	9.99
Buckeye	32	0.86	0.81	0.72	0.35	0.13	0.11	0.90	1.09	0.78	0.45	0.54	1.13	7.87
Canelo Ranger Station 1/	30	1.26	1.41	0.89	0.48	0.23	0.95	4.63	4.40	1.74	0.73	1.07	1.54	19.33
Casa Grande	27	0.79	0.84	0.71	0.36	0.14	0.17	1.27	1.26	0.91	0.28	0.76	1.26	8.75
Cedar Glade	30	1.39	1.65	1.03	0.87	0.45	0.37	1.57	2.29	1.51	1.00	0.73	1.63	14.49
Childs	30	2.00	2.12	1.54	1.22	0.44	0.41	1.96	2.54	1.76	1.06	1.20	2.15	18.40
Chinle	23	0.64	0.57	0.58	0.62	0.53	0.39	1.47	1.58	1.12	0.91	0.55	0.65	9.61
Clifton	32	0.80	0.95	0.69	0.38	0.37	0.42	2.26	2.60	1.88	0.83	0.78	1.19	13.15
Copper Mine Trading Post	7	0.39	0.48	0.66	0.57	0.40	0.14	1.25	1.40	0.92	0.81	0.52	0.84	8.38
Cordes	20	1.37	1.84	1.25	0.99	0.23	0.21	1.58	1.73	1.70	0.77	0.95	1.70	14.32
Douglas (Smelter)	32	0.64	0.62	0.44	0.27	0.21	0.51	3.24	2.84	1.42	0.77	0.74	0.96	12.66
Dudleyville	12	1.52	1.21	0.95	0.95	0.37	0.29	2.26	2.71	1.40	0.46	0.92	1.83	14.87
Elgin	32	1.00	1.13	0.57	0.31	0.22	0.72	3.71	3.88	1.75	0.59	0.80	1.17	15.85
Fairbank	31	0.56	0.59	0.42	0.25	0.12	0.57	3.17	2.73	1.33	0.48	0.64	0.72	11.58
Flagstaff	32	1.92	1.85	1.67	1.35	0.60	0.49	2.93	2.53	1.75	1.49	1.10	1.80	19.48

1/ Combined with Canille.

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Florence	28	1.03	1.05	0.93	0.48	0.19	0.15	1.20	1.67	0.92	0.40	0.86	1.41	10.29
Fort Defiance 1/	28	0.84	0.88	0.79	0.68	0.51	0.53	2.10	2.27	1.41	0.95	0.74	1.04	12.74
Fredonia	9	0.96	1.20	1.01	0.73	0.75	0.27	1.16	1.70	1.19	0.70	0.57	1.07	11.31
Ganado	16	0.71	0.89	0.91	0.95	0.64	0.42	1.90	1.85	1.56	0.93	0.60	0.96	12.32
Gila Bend	30	0.59	0.51	0.65	0.26	0.13	0.09	0.72	1.07	0.59	0.37	0.46	0.84	6.28
Globe	32	1.71	1.63	1.23	0.74	0.38	0.44	2.72	2.59	1.41	0.87	1.11	1.88	16.71
Grand Canyon	32	1.39	1.83	1.38	0.96	0.69	0.41	1.67	2.00	1.61	1.02	0.88	1.50	15.34
Granite Reef Dam	31	1.11	1.10	0.97	0.48	0.19	0.12	0.75	1.00	0.85	0.47	0.79	1.38	9.21
Henry's Camp	23	2.14	2.65	2.18	1.45	0.86	0.88	3.94	4.05	2.46	1.21	1.51	2.22	25.55
Hereford	19	0.58	0.57	0.57	0.21	0.11	0.83	3.60	3.71	1.50	0.50	0.53	0.86	13.57
Holbrook	31	0.51	0.60	0.56	0.51	0.31	0.49	1.53	1.32	1.17	0.59	0.56	0.58	8.73
Inner Canyon	10	0.84	1.23	0.82	0.53	0.46	0.23	1.24	1.08	0.92	0.56	0.59	1.09	9.59
Intake	31	1.38	1.49	1.12	0.71	0.30	0.24	1.84	2.02	1.16	0.72	1.03	1.75	13.76
Jeddito	14	1.06	1.01	0.85	0.88	0.62	0.36	1.51	1.92	1.20	1.04	0.90	1.23	12.58
Jerome	31	1.92	2.06	1.47	1.17	0.51	0.42	2.43	2.72	1.62	1.17	1.09	1.87	18.45
Kayenta	26	0.59	0.62	0.69	0.53	0.36	0.32	1.23	1.38	0.80	0.92	0.57	0.66	8.67
Keams Canyon	8	1.15	1.08	1.08	0.95	0.53	0.18	2.01	2.23	0.83	0.95	0.56	2.12	13.67
Kingman	31	1.15	1.76	0.98	0.65	0.28	0.17	0.96	1.32	1.17	0.65	0.60	1.56	11.25
Klondyke	5	1.53	1.51	1.24	0.67	0.41	0.66	2.67	2.44	1.22	0.62	0.98	1.76	15.71
Lees Ferry	22	0.33	0.62	0.47	0.46	0.34	0.15	0.60	1.08	0.42	0.57	0.38	0.65	6.07
Leupp	18	0.38	0.43	0.27	0.62	0.20	0.26	1.04	1.26	1.19	0.55	0.42	0.53	7.15
Lewis Springs	20	0.47	0.53	0.29	0.14	0.09	0.49	2.76	2.70	1.10	0.43	0.63	0.66	10.29
Litchfield Park	28	0.93	1.02	0.78	0.44	0.18	0.09	0.87	1.37	0.85	0.37	0.70	1.26	8.86
Maricopa	31	0.64	0.70	0.63	0.32	0.16	0.11	1.19	1.53	0.98	0.34	0.63	1.06	8.29
Marinette	26	0.82	0.88	0.71	0.43	0.11	0.13	0.88	1.05	0.79	0.39	0.58	1.32	8.09
Mesa Experiment Farm	32	0.82	0.94	0.79	0.41	0.17	0.07	0.77	0.98	0.89	0.37	0.68	1.22	8.11

1/ Combined with St. Michaels.

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches

October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Moccasin	11	1.33	1.68	1.09	1.08	0.39	0.26	1.35	0.78	1.08	0.69	0.79	1.33	11.85
Mohawk	31	0.51	0.50	0.40	0.21	0.02	0.08	0.36	0.93	0.47	0.28	0.25	0.74	4.75
Montezuma Castle 1/	29	1.18	1.30	0.96	0.88	0.30	0.22	1.29	1.73	1.66	0.67	0.78	1.24	12.21
Mormon Flat	21	1.50	1.79	1.44	0.78	0.25	0.34	1.28	2.23	1.16	0.58	1.07	1.85	14.27
Naco	21	0.77	0.68	0.45	0.30	0.12	0.56	3.61	2.88	1.63	0.68	0.86	1.16	13.70
Natural Bridge	32	2.51	3.41	2.55	1.81	0.59	0.52	2.84	3.24	2.34	1.59	1.83	2.97	26.20
Nogales	32	1.11	0.99	0.79	0.32	0.15	0.53	3.77	4.10	1.61	0.59	0.85	1.30	16.11
Oracle	30	2.05	1.92	1.68	0.94	0.31	0.50	2.81	2.93	1.62	0.91	1.66	2.34	19.67
Paradise	24	1.17	1.37	1.20	0.73	0.41	0.58	3.94	3.61	2.20	1.06	1.17	1.57	19.01
Parker	32	0.75	0.74	0.62	0.30	0.04	0.04	0.35	0.57	0.65	0.32	0.31	0.88	5.57
Patagonia	23	1.33	1.11	0.85	0.38	0.17	0.62	4.00	3.74	1.75	0.59	0.92	1.50	16.96
Payson Ranger Station	30	2.15	2.55	1.97	1.34	0.45	0.56	2.59	2.93	2.14	1.32	1.72	2.18	21.90
Phoenix WB City	32	0.77	0.87	0.77	0.42	0.16	0.06	0.75	0.95	0.89	0.42	0.63	1.07	7.76
Pinal Ranch	32	3.25	3.35	2.52	1.22	0.50	0.44	2.65	3.44	2.26	1.37	1.92	3.47	26.39
Pinedale	32	1.52	1.63	1.44	1.22	0.53	0.61	3.04	2.75	1.84	1.71	1.52	1.79	19.60
Portal	30	1.08	1.25	0.91	0.54	0.36	0.61	3.47	3.85	2.24	1.12	1.55	1.54	18.52
Prescott	32	2.02	2.48	1.74	1.28	0.50	0.34	2.47	3.28	2.03	1.11	1.16	2.01	20.42
Roosevelt	32	2.00	2.24	1.71	1.00	0.38	0.41	1.53	1.98	1.27	0.89	1.32	2.27	17.00
Sacaton	32	0.85	0.89	0.89	0.42	0.23	0.08	1.45	1.62	0.98	0.37	0.73	1.27	9.78
Safford 2/	32	0.64	0.70	0.58	0.31	0.20	0.31	1.58	1.77	1.21	0.59	0.65	0.84	9.38
Saint Johns	31	0.76	0.75	0.84	0.63	0.59	0.59	2.23	2.11	1.35	0.73	0.61	0.81	12.00
Salome	32	0.99	1.22	0.77	0.37	0.05	0.14	1.06	1.19	0.71	0.46	0.48	1.15	8.59
San Carlos Reservoir	27	1.29	1.49	1.15	0.59	0.31	0.33	1.81	1.67	1.04	0.59	1.12	1.62	13.01
San Rafael Ranch	22	1.30	1.12	0.93	0.36	0.11	0.75	4.56	3.80	1.88	0.73	0.97	1.38	17.89
San Simon	27	0.60	0.66	0.56	0.30	0.20	0.25	1.91	1.78	0.86	0.57	0.55	0.92	9.16

1/ Combined with Clemenceau and Cornville.
2/ Combined with Thatcher.

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches October 1, 1913 - September 30, 1945

ARIZONA (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Seligman	29	0.97	1.10	0.80	0.57	0.30	0.27	2.03	2.11	1.25	0.75	0.50	1.01	11.66
Sierra Ancha	10	3.09	3.64	2.79	1.54	0.97	0.18	3.95	3.40	2.04	1.50	2.38	3.22	28.70
Snowflake	30	0.82	0.76	0.82	0.78	0.60	0.56	2.42	2.63	1.54	1.01	0.71	0.78	13.43
Springerville	32	0.62	0.56	0.59	0.49	0.50	0.52	2.89	3.17	1.56	0.71	0.57	0.58	12.76
Stewart Mountain	6	1.01	1.45	1.15	0.77	0.24	0.28	1.37	2.33	1.41	0.45	1.02	1.58	13.06
Supai	15	0.78	1.20	0.66	0.63	0.32	0.21	0.81	1.21	1.52	0.70	0.68	0.91	9.63
Superior	25	2.30	2.31	1.79	0.93	0.37	0.27	2.25	2.63	1.50	1.11	1.55	2.32	19.33
Tombstone	32	0.80	0.74	0.51	0.31	0.19	0.50	3.61	3.54	1.73	0.70	0.75	1.04	14.42
Tuba City	29	0.60	0.54	0.42	0.52	0.29	0.29	0.92	0.88	0.88	0.64	0.44	0.61	7.03
Tucson (U. of A.)	32	0.84	0.92	0.73	0.37	0.26	0.32	1.84	2.20	1.41	0.49	0.90	1.13	11.41
Walnut Grove	32	1.99	2.39	1.46	1.11	0.36	0.38	2.25	2.64	1.86	1.10	1.13	2.13	18.80
Wellton	21	0.65	0.48	0.41	0.13	0.04	0.02	0.35	0.73	0.55	0.28	0.22	0.64	4.50
Whiteriver 1/	24	1.63	1.58	1.61	0.86	0.48	0.51	2.83	2.72	1.96	1.02	1.25	1.38	17.83
Wickenburg	31	1.40	1.39	0.80	0.62	0.16	0.11	1.33	1.87	1.13	0.62	0.73	1.55	11.71
Wikieup	19	1.18	2.05	0.97	0.62	0.20	0.38	1.23	1.46	1.12	0.47	0.70	1.59	11.97
Willcox	30	0.88	1.01	0.66	0.27	0.27	0.36	2.39	2.53	1.44	0.71	0.92	1.14	12.58
Williams	32	2.10	2.70	2.08	1.82	0.67	0.47	2.96	3.20	1.84	1.48	1.19	2.32	22.83
Winslow	31	0.46	0.51	0.42	0.60	0.33	0.26	1.43	1.56	0.98	0.62	0.49	0.61	8.27
Young	27	2.22	2.19	1.99	1.39	0.60	0.58	3.64	3.04	2.00	1.27	1.36	2.20	22.48
Yuma Citrus Station	25	0.47	0.39	0.26	0.14	0.01	0.01	0.24	0.61	0.55	0.34	0.17	0.53	3.72
Yuma Valley 2/	31	0.46	0.36	0.26	0.13	0	0	0.20	0.46	0.64	0.28	0.16	0.51	3.46
Yuma WB City	32	0.44	0.33	0.31	0.12	0.01	0.01	0.18	0.58	0.67	0.32	0.16	0.53	3.66

CALIFORNIA

Blythe	32	0.49	0.54	0.38	0.13	0.02	0.07	0.17	0.49	0.58	0.23	0.30	0.77	4.17
Needles Airport	32	0.59	0.72	0.41	0.29	0.09	0.09	0.29	0.66	0.54	0.34	0.31	0.86	5.19

1/ Combined with Fort Apache.
2/ Combined with Yuma Date Orchard.

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches October 1, 1913 - September 30, 1945

NEVADA

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Boulder City	14	1.01	0.67	0.52	0.44	0.35	0.05	0.73	0.48	0.54	0.35	0.30	0.53	5.97
Caliente	19	0.93	1.05	0.90	0.75	0.55	0.28	1.03	1.13	0.62	0.69	0.61	0.75	9.29
Las Vegas	32	0.64	0.64	0.46	0.28	0.21	0.17	0.57	0.57	0.38	0.28	0.25	0.58	5.03
Logandale	24	0.79	0.67	0.47	0.37	0.14	0.15	0.40	0.57	0.21	0.36	0.37	0.65	5.15
Overton	6	0.52	0.84	0.53	0.34	0.33	0.04	0.21	0.68	0.41	0.42	0.24	0.74	5.30
Pioche	9	1.77	1.73	1.56	1.03	1.15	0.30	1.07	1.32	1.04	0.97	0.83	1.13	13.90
Searchlight	30	1.03	1.10	0.78	0.53	0.20	0.15	0.97	1.35	0.65	0.41	0.35	0.77	8.29

NEW MEXICO

Alma	13	0.77	0.84	0.81	0.81	0.68	0.72	2.27	2.46	2.04	1.07	0.93	0.84	14.24
Birmingham Ranch 1/	31	0.66	0.59	0.62	0.59	0.49	0.45	2.48	2.27	1.55	0.80	0.70	0.88	12.08
Black Rock	32	0.85	0.91	0.94	0.75	0.62	0.44	2.33	1.84	1.41	0.94	0.69	0.93	12.65
Cliff	22	1.04	0.96	0.70	0.53	0.40	0.58	2.79	3.04	1.93	1.15	0.87	1.13	15.12
Crownpoint	32	0.59	0.63	0.58	0.60	0.65	0.62	2.07	1.93	1.39	0.82	0.50	0.62	11.00
Datil	30	0.64	0.53	0.55	0.61	0.70	0.86	2.69	2.61	1.72	0.89	0.52	0.73	13.05
Fort Bayard	32	0.76	1.02	0.81	0.53	0.57	0.74	3.33	3.71	2.31	1.13	0.89	1.14	16.94
Fort Wingate	6	0.61	0.84	1.02	0.79	0.94	0.60	2.81	2.29	1.64	1.05	0.54	0.86	13.99
Gamerco	28	0.72	0.74	0.87	0.76	0.68	0.39	1.85	1.95	1.44	1.04	0.67	0.83	11.94
Glenwood	6	0.82	0.96	1.38	0.76	0.79	0.73	1.85	3.10	2.71	1.53	1.04	1.38	17.05
Hood Ranger Station	29	1.03	0.99	1.17	0.87	0.50	0.61	2.44	2.55	1.81	1.17	0.93	1.07	15.14
Jewett Ranger Station	22	1.36	0.95	0.85	0.79	0.59	0.54	2.59	3.05	1.96	0.94	0.69	1.01	15.32
Luna Ranger Station	32	1.18	0.98	0.96	0.71	0.58	0.70	3.14	2.76	1.97	1.21	0.91	1.25	16.35
McGaffey Ranger Station	30	1.47	1.53	1.53	1.20	0.81	0.58	2.59	2.37	1.75	1.18	0.95	1.47	17.43
Mogollon	9	1.15	1.80	1.93	1.10	0.94	0.67	3.09	3.77	2.47	1.83	1.50	1.64	21.89
Navajo Experiment Station	9	0.60	0.59	0.83	0.60	0.86	0.41	1.78	2.30	1.67	0.81	0.48	0.90	11.83
Quemado	22	0.83	0.59	0.64	0.65	0.64	0.62	2.55	2.66	1.47	0.72	0.58	0.81	12.76

1/ Combined with Horse Springs.

LOWER COLORADO RIVER BASIN

Average Precipitation in Inches October 1, 1913 - September 30, 1945

NEW MEXICO (Continued)

Station	Years of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Ramah	18	0.85	1.11	1.13	1.08	0.74	0.45	2.17	2.35	1.28	1.09	0.60	0.94	13.79
Red Rock	31	0.78	0.88	0.63	0.47	0.36	0.48	2.26	2.09	1.52	0.98	0.72	1.01	12.18
Rodeo	32	0.68	0.57	0.60	0.27	0.30	0.36	2.29	2.29	1.69	0.85	0.73	0.97	11.60

UTAH

Alton	30	1.77	1.85	1.61	1.29	0.77	0.64	1.57	1.64	1.62	1.26	0.84	1.62	16.48
Cedar City	32	0.94	1.13	1.41	1.24	0.88	0.46	1.44	1.28	0.82	1.24	1.01	0.99	12.84
Gunlock Power House	16	1.47	1.50	1.50	0.98	0.61	0.22	1.40	1.15	0.73	0.82	0.50	1.18	12.06
Hurricane	17	1.33	1.52	1.08	0.87	0.53	0.37	0.54	0.80	0.98	0.87	0.81	1.09	10.79
Kanab Power House	30	1.49	1.64	1.32	0.99	0.62	0.26	1.22	1.29	1.25	0.87	0.73	1.46	13.14
Leeds	26	1.86	1.93	1.52	1.13	0.55	0.26	0.67	0.88	0.80	0.88	0.80	1.79	13.07
Modena	32	0.89	0.92	1.07	0.90	0.77	0.42	1.25	1.50	0.81	0.87	0.57	0.73	10.70
New Harmony	14	2.32	2.99	2.09	1.23	0.71	0.64	1.16	1.08	1.35	1.45	1.10	2.23	18.35
Orderville	32	1.93	1.95	1.51	1.23	0.72	0.33	1.26	1.34	1.31	1.00	0.85	1.57	15.00
St. George	32	1.18	1.17	0.94	0.63	0.36	0.22	0.61	0.79	0.58	0.68	0.55	0.99	8.70
Zion National Park 1/	30	1.56	1.84	1.71	1.50	0.76	0.30	1.09	1.35	1.26	1.00	0.88	1.38	14.63

1/ Combined with Springdale.

Supplemental Data

CALIFORNIA Period of Record to 1945, Inclusive

Imperial	26	0.28	0.86	0.17	0.17	0.03	0	0.11	0.26	0.60	0.24	0.13	0.81	3.66
Indio	67	0.68	0.51	0.26	0.10	0.04	0.01	0.07	0.21	0.33	0.20	0.18	0.56	3.15

Table 4 Sheet 1 of 1

LOWER COLORADO RIVER BASIN

Average Evaporation In Inches 1/ October 1, 1913 - September 30, 1945

ARIZONA

Station 2/	Yrs. of Record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Bartlett Dam	5	3.71	3.90	6.60	9.57	13.92	16.76	16.72	14.29	12.26	8.82	5.93	3.63	116.11
Davis Dam 3/	3	3.42	4.44	7.24	10.09	11.92	12.96	13.21	12.12	9.58	6.22	5.88	4.00	101.08
Lake Mead (Ariz.-Nev.)	10	2.96	4.15	7.31	10.89	15.08	18.04	18.02	15.85	12.22	8.43	4.97	3.04	120.96
Lees Ferry	15	1.84	2.82	5.99	8.45	11.62	13.77	13.71	11.55	9.22	6.08	3.18	1.78	90.01
Mesa Experiment Farm	29	2.79	3.55	5.67	7.54	10.12	11.22	11.05	9.18	7.32	5.27	3.55	2.55	79.81
Roosevelt	29	1.87	2.67	4.88	7.04	10.15	12.41	12.09	10.17	7.99	5.30	2.87	1.81	79.25
Sacaton 4/	3	2.76	4.01	6.52	9.12	12.36	14.02	13.21	11.11	8.93	7.12	4.93	3.13	97.22
Safford	5	1.86	2.94	5.11	7.51	9.42	10.51	9.72	7.95	6.36	4.29	2.62	1.57	69.86
San Carlos Reservoir	15	2.49	3.24	6.35	9.16	12.75	15.01	14.70	12.39	10.26	7.15	3.86	2.15	99.51
Sierra Ancha	9	1.95	2.30	4.31	6.61	8.81	10.46	10.07	8.65	7.52	5.73	3.41	2.04	71.86
Tucson (U of A)	15	2.43	3.14	6.01	8.55	11.22	12.67	11.79	9.54	8.13	6.09	3.56	2.06	85.19
Willcox	16	3.91	4.68	7.23	9.96	10.67	11.29	9.78	8.28	7.40	6.09	4.59	3.37	87.25
Yuma Citrus Station	25	4.00	5.05	8.19	10.66	13.87	15.32	16.55	14.44	11.53	8.28	5.41	3.86	117.16
Yuma Evaporation Station	13	3.24	4.04	6.14	7.76	8.85	9.66	10.29	9.76	7.62	5.45	3.52	2.90	79.23
Yuma Valley	9	4.01	4.90	7.88	10.13	12.51	13.33	14.02	11.83	9.37	7.17	4.78	3.50	103.43
NEVADA														
Boulder City	10	3.41	4.34	7.54	11.13	14.87	17.66	17.35	15.35	11.91	8.29	5.05	3.26	120.16
NEW MEXICO														
Navajo Experiment Station	5/ 6			4.17	8.42	11.91	13.43	12.74	10.53	7.66	6.28	4.19		79.33

1/ Estimated 32 year averages obtained by temperature correlation with the recorded evaporation from standard land pans of the Weather Bureau. Pans are 48 inches in diameter and 10 inches deep.

2/ Locations and elevations of the stations are shown on Table 5.

3/ Same as recorded average listed on Sheet 1 of Table 5. Comparison with records of adjacent stations indicates that recorded evaporation would be comparable with 32 year average.

4/ Correlated with average of the evaporation at Roosevelt and Mesa Experiment Farm.

5/ Records obtained during part of the year. See Sheet 13 of Table 5 for recorded evaporation.

LOWER COLORADO RIVER BASIN

Evaporation in Inches

BARTLETT DAM, ARIZONA

Lat. 33°49'
Long. 111°38'

Standard Land Pan

Elev. 1650

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1940									17.20	18.20	15.77	11.01	62.18
1941	8.99	5.65	3.90	3.28	2.91	5.64	6.51	11.47	14.43	15.36	13.42	11.67	103.23
1942	7.36	5.87	3.44	4.71	4.62	7.58	9.47	15.24	17.62	17.42	14.85	12.74	120.92
1943	9.16	6.77	3.31	3.31	5.07	7.39	11.29	14.98	16.77	16.11	11.09	12.40	117.65
1944	8.79	7.75	4.23	4.02	3.06	5.82	8.52	12.16	15.70	16.83	16.08	11.89	114.85
1945	10.74	4.36	4.32	3.87	4.23	5.82	11.10	15.49	17.38	17.04	15.33	14.63	124.31
Mean	9.01	6.08	3.84	3.84	3.98	6.45	9.38	13.87	16.52	16.83	14.42	12.39	116.61

DAVIS DAM, ARIZONA

Lat. 35°11'
Long. 114°34'

Standard Land Pan

Elev. 528

1948						7.87	9.77	12.35	12.24	13.81	11.89	9.93	77.86
1949	4.89	5.40	4.02		3.88	6.09	9.19	11.45	13.77	13.81	12.79	9.65	94.94
1950	7.54	6.36	3.99	3.42	4.99	7.76	11.30	11.95	12.87	12.02	11.69	9.17	103.06
Mean	6.22	5.88	4.00	3.42	4.44	7.24	10.09	11.92	12.96	13.21	12.12	9.58	101.08

SACATON, ARIZONA

Lat. 33°05'
Long. 111°45'

Standard Land Pan

Elev. 1280

1948				4.09	3.98	6.39	10.31	13.55	15.13	15.24	13.10	11.75	93.54
1949	9.02	5.43	3.18	2.40	3.62	7.29	9.99	13.23	15.29	13.68	14.45	10.59	108.17
1950	7.38	6.08	3.61	3.67	4.73	7.44	11.32	13.57	14.26	13.31	11.84	9.19	106.40
Mean	8.20	5.75	3.40	3.39	4.11	7.04	10.54	13.45	14.89	14.08	13.13	10.51	108.49

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

LAKE MEAD, ARIZONA AND NEVADA 1/

Average of Four Land Pans

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1936				3.68	4.40	8.65	12.73	16.94	19.99	18.58	16.19	14.19	115.35
1937	8.10	5.22	3.13	2.64	3.77	6.10	11.14	16.02	18.35	17.30	17.18	12.88	121.83
1938	9.21	5.18	3.92	3.81	4.11	6.36	10.79	12.58	16.64	17.62	16.72	12.84	119.78
1939	8.71	6.11	3.11	2.98	4.21	7.30	10.94	14.98	19.36	20.12	15.81	9.56	123.19
1940	8.79	4.12	3.27	2.54	4.63	9.09	11.48	17.56	19.74	21.98	19.05	11.72	133.97
1941	8.76	5.28	2.88	2.28	3.06	6.13	8.98	14.17	16.69	15.69	13.61	12.38	109.91
1942	6.58	3.85	2.73	3.39	4.48	7.48	11.79	16.04	17.62	18.35	15.23	12.66	120.20
1943	8.48	5.89	3.70	4.04	4.37	7.51	10.57	16.80	18.43	17.49	15.74	11.93	124.95
1944	8.67	4.81	2.81	2.79	3.34	8.03	9.88	15.21	17.65	18.81	16.73	12.71	121.44
1945	8.63	4.37	2.91	1.93	4.32	6.36	11.12	15.13	15.90	15.46	13.37	12.08	111.58
Mean	8.44	4.98	3.16	3.01	4.07	7.30	10.94	15.54	18.04	18.14	15.96	12.30	121.88

Average of Three Floating Pans

1936				3.31	3.61	5.49	8.37	10.51	11.89	10.81	11.85	11.59	77.43
1937	7.68	5.40	4.94	4.89	3.40	4.34	7.64	10.06	12.49	12.70	14.22	12.01	99.77
1938	10.38	8.27	6.53	5.66	5.93	6.66	8.64	10.02	13.07	13.01	13.26	10.71	112.14
1939	9.64	8.72	4.18	4.02	5.49	5.59	7.37	10.26	13.19	14.40	12.63	9.62	105.11
1940	10.15	6.06	4.76	3.41	3.90	5.47	7.07	10.74	12.56	15.61	12.94	9.14	101.81
1941	8.05	6.62	4.46	2.82	2.27	4.86	5.78	8.38	11.78	12.69	12.70	11.82	92.23
1942	7.28	5.11	3.98	4.04	4.40	5.53	7.47	11.50	13.20	13.22	12.64	11.30	99.67
1943	8.42	6.69	4.31	4.61	3.25	4.77	7.01	10.61	11.93	12.40	12.92	9.89	96.81
1944	9.51	5.91	4.00	3.06	3.23	5.49	6.77	9.29	11.68	13.43	12.68	10.90	95.95
1945	8.55	4.83	3.83	2.52	3.44	4.18	6.95	10.63	10.69	11.35	10.39	10.28	87.64
Mean	8.85	6.40	4.55	3.83	3.89	5.24	7.31	10.20	12.25	12.96	12.62	10.73	98.83

1/ From records of Bureau of Reclamation published in report of Office of River Control for 1945.

LOWER COLORADO RIVER BASIN

Evaporation in Inches

LEES FERRY, ARIZONA

Lat. 36°50'
Long. 111°38'

Standard Land Pan

Elev. 3143

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1922	5.85	3.02	1.76	1.74	3.04	5.39	7.56	11.21	12.73	14.68	10.16	9.67	86.81
1923	7.61	3.04	2.15	2.45	2.98	6.02	7.66	12.31	13.17	12.38	9.55	7.50	86.82
1924	6.31	2.58	1.83	3.19	3.32	5.64	7.89	11.13	14.36	12.30	12.76	9.99	91.30
1925	5.72	3.24			3.28	6.21	8.48	12.57	12.69	14.56	10.20	7.78	84.73
1926					4.22	6.10	6.21	11.27	15.54	14.57	13.95	9.32	81.18
1927	5.95	3.62			2.18	5.01	8.98	14.10	13.77	14.46	11.19	8.83	88.09
1928	5.56	2.67		1.67	2.79	5.52	8.73	10.27	13.30	13.47	11.47	9.71	85.16
1929	6.07	2.43				6.01	7.66	11.23	13.83	11.56	9.96	8.15	76.90
1930	5.72	2.92	2.11	1.34	2.91	6.06	8.53	10.26	14.53	12.25	10.50	9.31	86.44
1931	6.21	3.00	1.80	1.35	2.36	6.54	9.21	12.26	13.87	15.01	11.00	9.45	92.06
1932	6.50	3.89		1.92	2.16	6.89	9.58	11.85	13.08	14.11	12.66	9.60	92.24
1933	5.89	3.69	1.74		2.43	6.46	8.43	11.24	15.09	14.32	12.55	10.78	92.62
1934	5.43	3.67	1.65	2.47	3.36	7.40	10.04	13.09	13.63	15.74	13.76	9.83	100.07
1935	7.07	3.72	1.56	1.17	2.91	5.40	8.59	10.01	14.26	14.20	11.97	8.66	89.52
1936	6.41	2.95	1.32	1.89	2.93	6.47	9.14	11.95	13.73	13.56	11.37	9.03	90.75
1937	5.42	2.86	1.85	0.74	1.80	4.91	8.62	11.47	12.22	12.43			62.32
1938					2.64	5.07	8.98						16.69
Mean	6.11	3.15	1.78	1.81	2.83	5.95	8.49	11.64	13.74	13.73	11.54	9.17	89.94

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

MESA EXPERIMENT FARM, ARIZONA

Lat. 33°25'
Long. 111°52'

Standard Land Pan

Elev. 1245

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1917		3.19	2.12	1.79	2.88	4.06	6.52	7.48	8.48	9.57	9.13	6.92	62.14
1918	4.28	3.36	2.58	2.65	3.51	5.37	8.65	10.93		10.38	8.04	6.47	66.22
1919	4.70	3.04	2.84	3.30	3.18	6.30	8.38	10.94	11.37	9.32	7.82	6.95	78.14
1920	4.68	3.52	2.86	2.15	2.39	5.56	8.87	11.38	12.04	11.31	9.23	7.91	81.90
1921	6.11	3.38	2.98	3.07	5.22	7.95	8.81	11.17	12.82	12.08	8.60	6.74	88.93
1922	5.21	3.40	2.83	2.78	3.81	5.38	8.66	11.48	11.99	10.44	7.51	5.74	79.25
1923	4.35	3.50	2.03	3.50	4.14	6.93	8.61	11.56	12.17	9.78	7.56	6.15	80.28
1924	4.58	2.77	2.33	3.36	4.84	5.90	7.61	11.85	12.33	10.33	8.10	6.40	80.40
1925	6.32	3.70	2.53	2.68	3.24	4.68	5.33	8.53	10.10	11.09	9.11	5.62	72.93
1926	3.56	3.11	2.86	2.55	3.54	5.27	5.40	7.41	9.24	11.15	7.80	4.96	66.85
1927	3.48	3.77	2.38	3.08	2.64	4.18	4.95	8.90	10.18	11.05	8.20	5.01	67.82
1928	4.06	2.75	2.53	3.13	3.66	6.66	8.37	11.48	12.20	12.22	9.99	8.33	85.38
1929	4.97	3.62	3.24	2.58	3.82	6.02	7.63	9.95	10.88	9.54	9.28	7.01	78.54
1930	5.86	4.09	3.64	2.68	4.35	6.10	7.03	8.84	10.46	10.02	8.82	7.36	79.25
1931	5.55	3.94	2.93	3.27	3.51	5.86	7.14	10.05	10.02	11.95	9.52	7.77	81.51
1932	5.52		2.52	2.60		5.54	6.56	9.08	9.98	10.38	9.29	7.73	69.20
1933	5.12	4.10			3.77	5.81	6.83	8.59	10.14	11.14	10.01	8.43	73.94
1934	5.82	3.85	2.27	3.52	3.78	6.60	7.75	10.29	10.72	11.52	9.46	7.31	82.89
1935	5.67	3.04	2.49	2.30	4.07	3.80	6.45	9.29	11.50	10.95	8.28	7.07	74.91
1936	5.22	2.60	2.40	2.48	2.98	5.88	8.35	11.21	12.32	12.08	9.97	9.08	84.57
1937	6.63	4.94	2.41	2.38	3.86	5.26	8.42	9.37	11.34	11.96	10.67	8.13	85.37
1938	5.98	3.26	2.77	2.99	2.59	4.80	8.63	10.54	11.23	10.43	9.49	7.93	80.64
1939	4.78	4.13	2.33	2.87	3.46	6.41	8.80	11.44	11.84	12.38	10.36	7.27	86.07
1940	6.42	3.90	2.47	3.31	3.72	6.72	8.22	11.47	12.28	12.08	11.37	7.37	89.33
1941	5.29	3.54	2.09	2.10	2.37	4.58	6.27	9.65	11.04	11.02	9.13	7.53	74.61
1942	4.41	3.50	1.72	2.79	3.19	5.99	6.53	10.32	11.52	11.53	9.17	8.18	78.85
1943	6.21	3.87	2.73	2.74	4.66	5.80	8.09	10.80	11.76	11.44	9.27	8.62	85.99
1944	6.31	4.30	2.66	3.09	2.68	5.56	7.29	9.70	11.54	11.44	10.32	8.75	83.64
1945	6.75	2.94	2.59	2.27	3.44	4.89	8.30	11.02	11.90	12.59	10.70	9.72	87.11
Mean	5.28	3.54	2.58	2.79	3.55	5.65	7.53	10.16	11.19	11.08	9.18	7.33	79.86

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

ROOSEVELT, ARIZONA

Lat. 33°40'
Long. 111°09'

Standard Land Pan

Elev. 2230

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1916			2.60	2.31	3.40	5.32	8.56	12.38	14.77	13.38	11.54	9.63	83.89
1917	5.86	4.20	2.93	1.83	3.29	6.74	7.74	10.12	13.23	13.48	12.09	9.57	91.08
1918	7.12	3.95	2.48	2.88	2.94	4.22	7.86	8.30		11.57	10.25	10.26	71.83
1919	6.24	4.30	2.69	2.71	2.68	5.51	8.68			10.54	9.52	6.75	59.62
1920	4.67		1.88	2.08	2.54	4.88	7.16	10.60	12.40	13.21	10.18	8.53	78.13
1921	5.72	2.77	2.40	2.31	3.52	6.61	8.38	11.83	13.72	12.50	9.42	7.84	87.02
1922	5.64	2.71	2.31	2.12	2.87	4.93	7.04	10.33	12.79	13.25	10.91	9.71	84.61
1923	7.34	3.53	1.78	2.16	2.93	5.52	7.66	11.98	13.28	12.22	9.70	7.58	85.68
1924	5.78	2.88	1.61	2.24	3.74	4.95	6.24		13.12	12.66	12.71	10.28	76.21
1925	6.28	3.51	2.67		3.50	5.38	7.60	10.91	11.66	12.72	10.50	7.79	82.52
1926	4.20	2.24	2.04		3.04	4.52	4.84	8.87	11.15	11.21	10.31	7.65	70.07
1927	4.74	2.78	1.50	1.83		4.54	5.49	8.70	9.12	10.01	8.35	6.88	63.94
1928	3.93	2.31	1.99	1.60	2.52	4.51	7.70	9.81	12.14	11.75	9.96	7.94	76.16
1929	4.49	2.58	1.61	1.62	2.58	5.56	7.15	11.12	13.09	11.49	9.43	6.42	77.14
1930	5.83	2.56	1.99	1.88	3.15	4.68	6.55	8.62	12.68	10.33	8.40	7.07	73.74
1931	5.52	3.43	1.93	2.17	2.52	5.93	8.28	10.47	11.30	12.78	8.75	7.62	80.70
1932	5.23	2.46	1.31	1.56	2.27	5.20	6.55	9.87	11.41	11.45	9.22	7.66	74.19
1933	4.28	2.42	1.71	1.76	2.43	4.57	5.93	8.51	10.84	11.51	9.26	6.26	69.48
1934	3.98	2.47	1.02	1.58	2.26	4.99	7.60	10.16	10.43	10.94	7.48	4.61	67.52
1935	3.44	1.82	1.07	1.21	2.35	3.23	5.78	7.21	10.79	10.14	6.94	5.54	59.52
1936	4.21	1.75	0.92	1.72	2.41	4.56	6.38	8.79	11.32	10.75	8.71	6.62	68.14
1937	4.64	2.61	1.40	1.82	2.01	3.54	5.66	8.87	10.28	9.87	8.06	5.83	64.59
1938	3.65	2.37	1.27	1.57	1.74	3.82	5.83	8.34	9.75	9.24	11.69	8.26	67.53
1939	6.28	3.53	1.81	1.65	2.11	4.79	8.46	12.09	15.25	15.85	11.41	8.56	91.79
1940	6.44	2.72	1.92	1.83	2.92	6.18	8.06	12.13	15.23	15.06	12.25	8.18	92.92
1941	5.64	2.44	1.43	1.57	1.76	3.92	4.83	7.92	11.75	12.12	10.81	8.69	72.88
1942	4.70	2.98	1.76	1.75	2.64	4.65	7.16	11.66	14.34	13.97	11.89	9.38	86.88
1943	6.16	3.33	1.49	1.49	2.65	5.00	8.06	12.26	13.93	13.37	11.45	9.52	88.71
1944	5.88	3.17	1.71	1.68	2.45	4.57	6.71	10.42	13.19	13.03	12.59	8.73	84.13
1945	5.94	2.28	1.32	1.49	2.31	3.61	6.85	11.66	14.05	12.75	11.38	10.31	83.95
Mean	5.30	2.86	1.82	1.87	2.67	4.88	7.03	10.14	12.39	12.11	10.17	7.99	79.23

LOWER COLORADO RIVER BASIN

Evaporation in Inches

SAFFORD, ARIZONA

Lat. 32°50'
Long. 109°43'

Standard Land Pan

Elev. 2900

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1941	4.93	2.48	1.48	1.73	2.21	4.10	5.63	7.75	9.20	9.47	7.59	6.44	63.01
1942	4.04	2.37	1.80	2.22	2.79	5.30	7.21	9.65	10.66	10.16	8.55	6.16	70.91
1943	4.71	3.21	1.65	1.65	3.33	5.18	7.66	9.83	9.74	8.72	7.31	6.28	69.27
1944	4.64	3.31	1.78	1.97	2.84	5.37	7.89	8.89	10.59	9.62	8.89	6.17	71.96
1945	3.52	1.93	1.40	2.10	3.77	5.27	9.09	11.49	11.85	11.12	8.05	7.10	76.69
Mean	4.37	2.66	1.62	1.93	2.99	5.04	7.50	9.52	10.41	9.82	8.08	6.43	70.37

SIERRA ANCHA, ARIZONA

Lat. 33°48'
Long. 110°58'

Standard Land Pan

Elev. 5100

1936												7.34	7.34
1937	5.76	3.34	2.03	0.97	2.29	4.01	7.80	9.61	9.70	9.81	9.96	7.72	73.00
1938	6.62	3.98	2.02	2.36	2.11	3.74	7.30	8.92	10.83	10.16	9.66	8.35	76.05
1939	6.29	3.81	2.57	1.92	1.50	4.57	7.29	9.57	11.49	11.02	8.43	6.71	75.17
1940	6.54	3.60	2.38	1.83	2.65	5.38	6.24	9.24	10.64	11.31	8.45	6.59	74.85
1941	5.12	2.67	2.11	1.58	1.82	3.67	4.41	7.25	8.76	8.64	7.89	7.17	61.09
1942	4.07	3.29	1.87	2.27	2.40	4.74	5.95	9.31	10.86	10.20	8.44	8.18	71.58
1943	5.10	3.69	1.94	1.94	2.81	4.55	7.34	9.42	10.46	10.03	7.67	7.95	72.90
1944	5.56	4.07	1.90	2.13	2.26	4.01	6.27	8.13	9.20	9.67	9.18	6.81	69.19
1945	6.43	2.17	2.31	2.45	2.42	3.65	6.85	9.61	11.42	10.45	9.20	8.92	75.88
Mean	5.72	3.40	2.13	1.94	2.25	4.26	6.61	9.01	10.37	10.14	8.76	7.57	72.16

LOWER COLORADO RIVER BASIN

Evaporation in Inches

SAN CARLOS RESERVOIR, ARIZONA 1/

Lat. 33°10'
Long. 111°31'

Standard Land Pan

Elev. 2532

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1930											10.36	9.50	19.86
1931	7.54	4.39	2.61	2.43	2.74	7.04	8.39	12.32	13.68	14.30	10.40	8.49	94.33
1932	6.92	2.86	2.13	2.13	2.75	6.41	9.19	13.17	14.90	12.45	12.95	12.27	98.13
1933	7.72	4.91	2.61	2.52	3.27	7.68	9.03	12.68	14.37	14.43	14.05	11.02	104.29
1934	7.41	4.40	2.57	3.64	4.36	8.47	10.18	14.53	15.29	16.72	12.88	11.38	111.83
1935	8.08	4.62	2.91	2.22	3.67	5.16	8.52	10.83	15.16	15.15	10.46	9.04	95.82
1936	8.12	3.71	2.29	2.69	3.55	6.78	10.02	13.50	16.17	14.99	12.76	9.96	104.54
1937	7.62	4.33	2.17	1.96	2.91	5.76	10.65	14.10	15.26	16.23	14.97	10.97	106.93
1938	8.05	4.57	2.17	3.28	2.88	6.56	10.52	14.37	16.80	15.42	13.85	10.36	108.83
1939	8.45	4.96	3.11	3.44	3.12	6.73	9.85	14.32	17.45	17.06	13.02	11.19	112.70
1940	7.87	3.50	2.00	2.06	3.53	6.55	9.56	13.40	15.75	15.59	13.08	9.05	101.94
1941	6.58	3.34	1.41	1.94	2.30	4.99	6.03	10.57	13.99	13.01	11.50	9.54	85.20
1942	5.37	3.05	1.29	2.54	2.89	5.79	8.30	12.67	15.22	14.57	12.00	9.96	93.65
1943	6.77	4.11	2.01	1.96	3.71	6.30	10.18	14.44	14.88	15.05	11.17	10.42	101.00
1944	7.11	3.83	2.00	2.47	2.88	6.55	9.35	12.52	13.50	13.83	13.27	10.40	97.71
1945	6.80	2.77	1.87	2.55	3.68	5.22	10.01	13.59	16.00	14.82	12.67	11.95	101.93
Mean	7.36	3.96	2.21	2.52	3.22	6.40	9.32	13.13	15.23	14.91	12.46	10.34	101.06

1/ Unpublished data in files of Weather Bureau, Phoenix office.

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

TUCSON, UNIVERSITY OF ARIZONA, ARIZONA

Lat. 32°15'
Long. 110°58'

Standard Land Pan

Elev. 2423

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1931				3.24	2.73	7.06	9.25	11.50	12.01	12.26	9.06	7.42	74.53
1932	6.40	3.07	2.50	2.36	3.49	6.68	9.08	12.19	13.03	10.95	10.15	10.73	90.63
1933	6.34	4.95	2.23	2.61	3.37	6.99	9.01	11.48	12.93	11.79	11.40	8.52	91.62
1934	6.87	4.73	2.62	3.90	4.23	8.08	10.34	13.04	13.80	12.62	10.34	9.73	100.30
1935	7.65	3.92	2.79	2.95	4.45	5.01	8.58	10.54	13.62	13.13	8.65	8.08	89.37
1936	7.59	3.56	2.64	2.55	3.34	6.38	9.09	12.07	13.26	12.84	9.55	8.37	91.24
1937	6.87	5.62	2.45	1.98	4.13	6.34	8.80	10.26	10.61	11.88	10.82	8.33	88.09
1938	6.49	3.91	2.40	3.14	3.11	5.80	8.69	12.12	13.23	11.04	9.78	8.28	87.99
1939	7.24	4.48	2.60	3.13	3.06	6.48	8.75	10.79	13.18	12.19	10.24	8.41	90.55
1940	7.15	4.21	2.48	2.67	3.42	7.06	9.21	12.19	11.98	12.65	10.52	7.17	90.71
1941	6.14	3.07	1.47	1.69	2.63	4.83	6.64	9.38	12.25	10.90	7.95	7.29	74.24
1942	4.37	2.08	1.23	2.08	2.27	5.66	7.29	11.22	12.75	11.45	9.04	7.63	77.07
1943	5.00	2.63	1.67	1.67	3.30	6.07	8.86	11.61	12.04	11.71	7.97	8.47	81.00
1944	4.27	2.42	1.23	1.34	1.58	4.72	8.06	10.28	12.03	11.11	9.26	6.71	73.01
1945	3.60	1.27	1.01	1.06	1.79	3.54	8.19	11.22	12.68	11.52	8.65	7.08	71.61
Mean	6.14	3.57	2.09	2.42	3.13	6.05	8.66	11.33	12.63	11.87	9.56	8.15	85.60

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

WILLCOX, ARIZONA

Lat. 32°15'
Long. 109°50'

Standard Land Pan

Elev. 4200

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1917				2.58	4.16	8.02	10.55	11.58	13.94	11.68	10.01	8.64	81.16
1918	7.96	6.26	4.23	3.57	5.27	7.15	11.09	12.01	9.80	10.24	8.85	8.42	94.85
1919	6.83	4.93	2.80	3.96	3.67	8.05	9.60	10.41	11.42	8.60	8.67	6.60	85.54
1920	5.36	4.06	3.34	2.84	3.76	6.43	8.92	10.92	10.76	11.40	9.45	7.85	85.09
1921	5.68	3.45	3.56	3.59	5.52	8.81	10.10	11.90	12.98	9.98	6.54	6.30	88.41
1922	7.01	4.28	3.72	3.15	4.59	5.00		6.85					34.60
1923					3.79	7.27	10.42	13.84	12.49	10.21	7.20	7.60	72.82
1924	7.31	3.77	2.59	4.50	4.97	6.96	8.86	11.88	13.87	11.07	12.74	11.62	100.14
1925	8.72	6.41	3.96	5.56	6.63	9.33	11.28	11.79	12.51	11.94	8.75	7.79	104.67
1926	4.94	4.17	3.11	2.78	4.99	5.84							25.83
1927							11.64	11.64	9.48	7.47	6.06	4.75	51.04
1928	4.53	6.02	2.91	5.06	4.35	7.21	11.73	7.72	11.08	8.22	5.93	7.02	81.78
1929	3.76	2.69				6.36	9.79	11.10			7.38	6.83	47.91
1930	4.20			3.14	4.32	5.68	7.37	8.17	8.39	7.17	7.96	6.49	62.89
1931	5.59	4.32	2.59	5.12	4.10	7.15	6.79	8.13	8.84	8.83	6.95	5.69	74.10
1932	5.23	3.83			4.49	6.82	8.86	10.83	12.19	8.40	7.84	7.88	76.37
1933	5.87	5.99	3.53		4.79	8.07	10.17	11.68	9.94	10.04	7.93	6.90	84.91
1934	5.87	4.53	3.00	4.49	4.42	7.92	9.97	10.06	11.07	10.19	8.11	6.78	86.41
1935	6.07	4.19	2.78	3.11	5.15	6.14	9.74	8.61	9.46	9.69	7.42	6.57	78.93
1936	6.32	3.31	3.57										13.20
Mean	5.96	4.51	3.26	3.82	4.65	7.12	9.82	10.51	11.14	9.70	8.11	7.28	85.88

LOWER COLORADO RIVER BASIN

Evaporation in Inches

YUMA CITRUS STATION, ARIZONA

Lat. 32°37'
Long. 114°38'

Standard Land Pan

Elev. 191

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1921				4.36	7.40	10.58	12.63	14.91	18.18	18.91	16.62	13.32	116.91
1922	8.83	5.53	4.29	3.83	5.48	7.66	10.82	13.85	15.39	17.82	13.27	11.40	118.17
1923	8.73	5.39	3.54	4.46	5.35	7.88	9.58	14.29	14.12	15.87	14.81	10.83	114.85
1924	8.60	4.97	3.01	4.55	6.27	7.47	10.45	14.52	17.65	20.36	18.14	13.56	129.55
1925	9.84	6.65	4.19	4.62	5.89	8.24	10.86	14.09	15.23	16.19	15.03	11.56	122.39
1926	5.92	4.71	3.57	3.45	5.14	7.80	9.37	13.07	14.74	16.38	13.69	10.97	108.81
1927	8.32	5.41	2.96	3.51	4.12	7.47	9.88	14.76	15.09	15.84	13.90	11.40	112.66
1928	8.22	4.71	3.80	4.34	4.92	8.56	11.56	14.45	17.05	17.44	14.93	12.51	122.49
1929	8.25	5.79	4.51	3.98	5.48	8.69	11.02	15.39	16.42	16.74	13.87	10.25	120.39
1930	9.05	6.23	4.91	3.66	5.77	8.10	10.76	13.36	15.87	16.24	14.03	12.06	120.04
1931	8.92	6.49	4.93	4.90	3.65	9.58	11.06	14.26	15.01	16.11	12.90	10.95	118.76
1932	8.07	4.92	3.74	4.43	4.54	9.30	11.35	14.73	15.27	16.54	15.81	13.08	121.78
1933	8.04	5.98	3.32	3.60	5.10	8.98	10.55	13.76	15.61	18.41	15.83	12.46	121.64
1934	8.83	6.45	4.37	5.12	5.05	10.00	11.93	15.54	14.37	17.45	14.07	12.32	125.50
1935	9.19	5.32	3.81	3.54	5.44	7.63	11.28	13.73	16.86	16.11	13.99	11.85	118.75
1936	8.93	4.91	3.53	3.81	4.92	8.75	11.30	13.78	15.17	15.40	14.75	12.26	117.51
1937	8.47	5.89	3.99	3.15	5.30	7.72	11.10	13.24	14.30	15.91	15.06	12.31	116.44
1938	8.63	5.28	4.12	4.81	4.37	7.42	11.28	13.26	14.93	15.69	14.55	11.45	115.79
1939	7.53	6.26	3.66	3.67	4.57	7.42	10.96	13.87	15.00	15.80	14.32	9.38	112.44
1940	8.71	4.60	4.80	4.02	4.71	8.66	10.53	13.46	15.16	15.71	15.08	10.28	115.72
1941	7.77	5.26	3.86	2.55	4.12	6.64	8.41	13.21	13.70	15.60	12.58	10.44	104.14
1942	7.29	5.52	3.67	4.56	4.76	7.80	9.58	13.20	14.46	16.49	13.90	11.26	112.49
1943	8.11	5.16	4.28	4.28	5.18	8.09	10.42	14.32	13.77	16.11	13.86	10.57	114.09
1944	8.21	5.60	2.83	3.78	3.61	7.68	9.32	12.51	13.40	15.42	14.26	11.45	108.07
1945	7.42	3.32	3.87	3.10	5.03	6.65	10.25	13.96	14.28	15.72	13.17	11.70	108.47
Mean	8.33	5.43	3.90	4.00	5.06	8.19	10.65	13.98	15.24	16.57	14.50	11.58	117.42

LOWER COLORADO RIVER BASIN

Evaporation in Inches

YUMA EVAPORATION STATION, ARIZONA

Lat. 32°45'
Long. 114°36'

Standard Land Pan

Elev. 127

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1917				3.08	4.52	6.79	6.80	8.48		9.32	11.51	7.79	58.29
1918	5.21	3.30	2.85	3.47	4.49	5.30	9.29	10.15	13.84	11.88	9.99	7.99	87.76
1919	5.38	4.20	3.03	4.30	4.51	6.64	9.15	7.79	9.08	10.55	7.57	5.66	77.86
1920	5.23	3.16	2.99	2.74	2.98	5.23	6.78	7.31	8.12	9.55	9.25	7.50	70.84
1921	5.43	2.75	2.66	2.52	4.10	5.75	7.16	7.63	8.82	11.18		6.58	64.58
1922	3.64	2.43		2.71	3.32	5.38	7.63	8.38	9.13	10.31	8.97	8.33	70.23
1923	5.64	3.18	1.97	2.79	3.72	5.68	6.35	8.03	8.21	10.27			55.84
1924	6.50	3.07	2.38	3.18	4.10	5.44	6.77	8.35	9.53	10.15	11.66	9.13	80.26
1925	6.63	4.28	3.02	2.94	3.28	5.43	6.39	7.65	7.88	9.95	12.28	9.61	79.34
1926	5.11	4.24	3.16	3.18	3.88	5.59	6.20	8.59	8.69	9.39	8.43	6.54	73.00
1927	5.15	3.36	2.51	2.66	3.80	6.28	7.96	10.43	10.65	9.61	8.68	7.11	78.20
1928	4.76	2.68	2.69	4.09	4.82	6.89	9.76	11.03	12.08	10.67	9.00	8.02	86.49
1929	5.75	4.45	4.03	3.96	4.85	7.76	8.88	10.94	10.43	10.52	9.31	6.93	87.81
1930	5.51	4.19											9.70
Mean	5.38	3.48	2.84	3.20	4.03	6.01	7.62	8.83	9.71	10.26	9.70	7.60	78.66

Table 5

LOWER COLORADO RIVER BASIN

Evaporation in Inches

YUMA VALLEY, ARIZONA

Lat. 32°37'
Long. 114°38'

Standard Land Pan

Elev. 110

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1931											10.51	9.07	19.58
1932	6.72	4.47	3.51	4.92	4.57	9.31	10.43	14.24	13.58	14.81	13.44	10.05	110.05
1933	6.82	4.74	2.95	3.35	4.90	7.99	9.42	11.12	12.29	14.62	12.49	10.21	100.90
1934	7.38	5.11	3.55	4.36	4.64	7.75	9.38	11.93	11.63	14.33	12.10	9.55	101.71
1935	7.62	4.45	3.52	3.16	4.90	7.12	9.25	12.46	14.24	12.55	9.30	7.88	96.45
1936	7.31	4.12	3.17	3.62	4.75	8.06	10.54	13.20	14.17	13.39	12.08	9.87	104.28
1937	6.71	5.14	3.53	3.40	5.52	7.78	11.04	12.68	14.21	14.93	12.50	10.25	107.69
1938	7.27	4.69	4.16	4.71	4.22	7.38	11.32	12.49	13.16	13.25	11.66	9.67	103.98
1939	6.86	5.67	3.47	3.87	4.78	7.66	10.40	13.43	13.66	15.05	13.68	8.43	106.96
1940	8.04	4.02	3.83	3.77	4.59	7.87	9.77	11.94					53.83
Mean	7.19	4.71	3.52	3.91	4.76	7.88	10.17	12.61	13.37	14.12	11.97	9.44	103.65

LOWER COLORADO RIVER BASIN

Evaporation in Inches

BOULDER CITY, NEVADA

Lat. 35°59'
Long. 114°51'

Standard Land Pan

Elev. 2525

Year Ending Sept. 30	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total
1935											16.54	11.75	28.29
1936	10.22	5.48	3.75	4.56	4.73	9.46	13.24	17.82	20.04	18.37	15.63	13.99	137.29
1937	8.06	5.93	3.53	3.30	4.30	6.84	11.98	17.36	18.23	17.73	18.43	13.39	129.08
1938	9.83	5.47	4.33	4.59	4.42	6.91	11.96	13.39	17.11	17.40	15.50	12.11	123.02
1939	7.85	5.47	3.46	3.43	4.02	7.37	10.93	15.08	19.01	18.39	14.18	8.53	117.72
1940	8.23	3.67	3.47	2.70	4.83	9.10	10.60	15.70	17.31	19.85	17.72	11.19	124.37
1941	7.65	5.05	2.29	2.35	2.89	6.03	8.30	14.19	16.25	15.37	13.03	11.56	104.96
1942	6.43	4.11	2.65	3.71	4.71	7.86	11.13	14.77	18.75	17.41	14.14	12.59	118.26
1943	8.17	5.71	3.63	4.09	4.66	7.32	13.21	15.80	17.52	16.96	14.49	12.18	123.74
1944	8.01	4.93	3.04	3.24	3.21	7.94	9.78	13.94	16.68	18.63	17.64	12.90	119.94
1945	8.60	4.47	3.58	2.66	4.79	6.45	10.78	15.10	15.72	14.64	12.71	11.94	111.44
Mean	8.30	5.03	3.37	3.46	4.26	7.53	11.19	15.32	17.66	17.47	15.46	12.01	121.06

NAVAJO EXPERIMENT STATION, NEW MEXICO

Lat. 35°50'
Long. 108°51'

Standard Land Pan

Elev. 6455

1936											9.29	7.04	16.33
1937	6.18					4.07	10.43	12.57	11.50	11.08	12.46	7.33	75.62
1938	6.22	4.41					9.81	11.36	12.57	12.29	11.78	6.63	75.07
1939	6.90						11.76	12.69	16.30	14.52	11.34	7.71	81.22
1940	7.48	4.55					8.20	14.01	14.29	12.99	10.88	6.54	78.94
1941	5.72						4.57	10.78	9.76	10.19	8.15	7.49	56.66
1942	5.38						6.36	11.85	16.07	15.35	10.52	10.72	76.25
1943	7.04												7.04
Mean	6.42	4.48				4.07	8.52	12.21	13.41	12.74	10.63	7.64	(80.12)

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER AT LEE FERRY, ARIZONA (Compact Point)

Location: One mile downstream from mouth of Paria River.

Drainage Area: 109,458 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	648.5	536.9	329.2	365.0	401.9	876.8	1539.1	4449.1	5887.4	2626.1	1055.9	618.9	19,334.8	
1915	947.5	524.6	332.0	302.8	394.6	521.9	1439.5	2296.2	3248.9	1603.4	465.0	424.0	12,500.4	
1916	515.0	409.7	342.6	391.5	423.5	1389.7	1759.9	3525.6	4228.7	2068.0	1600.7	669.9	17,324.8	
1917	1393.1	493.7	368.2	261.6	353.6	507.1	1529.9	3678.4	7274.9	4245.0	1132.0	655.6	21,893.1	
1918	467.0	447.0	402.7	351.9	375.0	657.1	877.0	2499.6	4725.0	1716.6	553.8	576.9	13,649.6	
1919	538.6	494.9	408.5	287.4	313.9	651.4	1357.4	2930.2	1997.2	949.8	540.7	388.4	10,858.4	
1920	360.2	404.7	391.7	405.2	600.3	683.6	969.0	5679.2	6446.1	2402.6	925.0	471.1	19,738.7	
1921	516.5	595.7	403.2	409.9	455.6	943.6	898.2	3938.1	7952.3	2212.1	1637.9	751.7	20,714.8	
1922	429.8	436.5	449.3	350.3	439.5	908.1	1159.4	4448.7	5125.4	1440.4	708.5	426.5	16,302.4	
1923	291.1	400.1	397.6	373.8	340.7	449.4	1276.3	3609.6	4560.3	2326.3	1352.1	884.0	16,261.3	
1924	727.4	647.6	422.5	310.1	506.0	506.9	1636.3	3055.3	3126.2	998.4	298.5	245.9	12,481.1	
1925	357.4	391.1	273.4	259.2	402.0	603.1	1293.7	2125.2	2386.2	1438.4	736.7	1074.7	11,341.1	
1926	1017.6	608.1	445.4	359.2	351.5	640.3	1581.4	3356.7	3432.1	1382.8	536.2	297.2	14,008.5	
1927	428.5	333.8	378.1	335.7	388.7	604.4	1213.4	3863.1	3644.1	2407.9	930.0	2059.2	16,586.9	
1928	936.1	735.3	441.0	468.0	461.6	753.2	984.2	4340.5	3703.1	1528.9	626.4	345.0	15,323.3	
1929	606.0	568.2	342.4	329.4	344.2	921.1	1674.5	4070.2	4805.2	2013.1	1901.7	1647.4	19,223.4	1/
1930	922.3	559.3	436.4	295.7	482.9	569.7	1705.3	1976.4	3067.3	1064.1	1468.0	522.7	13,070.1	
1931	549.6	424.5	287.6	262.7	366.4	427.2	564.4	1156.6	1384.3	448.2	246.8	269.2	6,387.5	
1932	500.4	351.9	250.6	271.7	563.6	675.1	1638.1	3975.5	3617.2	2015.0	940.4	486.8	15,286.3	
1933	335.5	378.4	272.1	270.8	253.9	499.8	495.9	1435.5	3972.2	1116.1	339.6	375.6	9,745.4	
1934	375.3	297.4	318.5	307.7	302.1	333.7	453.7	1099.2	510.5	131.5	133.1	133.7	4,396.4	
1935	152.3	179.7	228.8	255.2	274.4	339.8	654.5	1402.8	4003.2	1471.9	522.2	427.3	9,912.1	
1936	347.2	319.7	265.6	261.7	317.1	459.0	1324.5	3591.2	2649.2	1013.6	873.8	547.7	11,970.3	
1937	348.5	443.1	315.3	197.8	414.5	704.5	1514.8	3475.5	2352.3	1321.5	402.9	406.2	11,896.9	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER AT LEE FERRY, ARIZONA (Continued)

Location: One mile downstream from mouth of Paria River.

Drainage Area: 109,458 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	453.6	377.5	383.8	318.9	347.6	794.9	1611.2	3356.7	4667.1	1722.5	503.1	903.1	15,440.0	↑
1939	563.6	469.9	401.8	341.5	294.2	802.1	1154.5	2490.2	1665.3	418.4	221.2	571.0	9,393.7	|
1940	324.3	308.4	281.0	257.5	297.4	432.0	680.8	2022.3	1487.8	391.9	181.1	417.1	7,081.6	|
1941	686.9	402.6	359.3	350.4	427.1	672.7	1096.1	4976.3	4004.5	1668.5	798.6	609.0	16,052.0	1/
1942	1802.8	904.7	577.1	408.2	397.6	632.2	2845.5	3209.4	4202.2	1318.0	455.8	275.9	17,029.4	
1943	335.7	369.6	358.6	331.4	334.4	518.2	1450.8	2158.2	2729.2	1429.3	798.1	449.5	11,263.0	|
1944	382.3	457.3	396.3	279.5	345.7	514.0	1028.8	3252.1	4136.5	1782.2	417.7	229.0	13,221.4	|
1945	341.9	384.5	321.2	326.5	353.1	439.1	756.0	2805.3	2761.2	1668.7	1015.2	372.7	11,545.4	↓
14-45 Mean	581.3	457.4	361.9	321.8	385.1	638.5	1255.1	3132.8	3742.3	1573.2	760.0	579.2	13,788.6	

Subsequent Records

1946	510.2	444.4	337.4	366.9	320.4	496.9	1014.0	1732.2	1993.2	732.2	486.5	310.4	8,744.7	2/
1947	405.9	468.4	446.1	278.1	358.0	655.2	780.6	3121.4	3275.2	1926.3	1214.6	584.6	13,514.4	2/
1948	821.0	586.4	468.0	407.6	461.0	646.5	1704.0	3507.3	3339.8	979.9	535.3	230.4	13,687.2	2/

1/ From "Final Report, Engineering Advisory Committee to Upper Colorado River Basin Compact Commission," November 29, 1948; Appendix A, page 30.

2/ Geological Survey annual Water-Supply Papers; computed as sum of Colorado River at Lees Ferry and Paria River at Lees Ferry.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER AT ST. JOHNS, ARIZONA

Location: Lat. 34°30', long. 109°22', in SE¼NW¼ sec. 27, T. 13 N., R. 28 E., at former highway bridge at east side of St. Johns, 400 feet upstream from steel and concrete bridge on highway from St. Johns to Sanders.

Drainage Area: 941 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													4.9	
1915													9.1	
1916													11.3	
1917													5.3	
1918													2.8	
1919													11.4	
1920													10.9	
1921													5.7	*
1922													6.0	
1923													6.1	
1924													4.8	
1925													5.3	
1926													5.8	
1927													14.0	
1928													2.4	
1929									0	0.4	1.7	0.7	*19.4	
1930	0.8	0.7	0.5	0.8	0.6	0.5	0.2	0	0	0.7	0.4	0	5.2	
1931	0.1	0.2	0.4	0.3	0.3	0.3	0.1	0.1	0	1.0	0.1	0.2	3.1	
1932	0.4	0.5	0.5	0.5	0.4	0.4	9.4	0.9	0.2	1.6	0.7	0.2	15.7	
1933	0.2	0.4	0.6	0.6	0.5	0.4	0.3	0	0.5	0.5	0.3	0.7	5.0	1/
1934													*3.8	
1935													*5.5	
1936	0.3	0.4	0.5	0.4	0.1	0.1	0.3	0.2	0.2	0.1	0.7	1.0	4.3	
1937	0.3	0.5	0.3	0.1	0.5	0.5	0.4	0.2	0.1	0.2	0.2	0.2	3.5	
1938	0.3	0.4	0.5	0.5	0.4	0.5	0.1	0.2	0	0.1	0.2	0.9	4.1	
1939	0.1	0.4	0.5	0.5	0.4	0.2	0.1	0	0.1	0.2	0	0	2.5	2/
1940	0	0.1	0.3	0.5	0.2	0							*5.9	3/
1941													15.1	
1942													3.2	
1943													1.2	*
1944													1.3	
1945													6.4	
14-45 Mean	0.4	0.5	0.6	0.5	0.5	0.5	1.7	0.2	0.2	0.6	0.4	0.5	6.6	*

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 879.

3/ Geological Survey Water-Supply Paper 899.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER ABOVE ZUNI RIVER, NEAR HUNT, ARIZONA

Location: Lat. 34°38', long. 109°40', in SW¼NW¼ sec. 2, T. 14 N., R. 25 E., 500 feet upstream from Zuni River and 3 miles northwest of Hunt.

Drainage Area: 3,685 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													5.7	
1915													12.0	
1916													15.3	
1917													6.3	
1918													2.6	
1919													15.5	
1920													14.7	
1921													6.8	
1922													7.3	
1923													7.5	
1924													5.6	
1925													6.2	*
1926													6.9	
1927													19.4	
1928													1.9	
1929													27.5	
1930													5.2	
1931													11.5	
1932													14.0	
1933													6.5	
1934													4.0	
1935													6.5	
1936													7.0	
1937													4.4	
1938													2.1	
1939													1.2	
1940						0	0	0	0	0.5	2.9	3.0	*7.2	
1941	0.8	0.4	0.6	0.9	0.6	1.8	0.6	9.1	0.5	0.3	0.1	0.1	15.8	
1942	0.9	0.4	0.5	0.5	0.3	0.3	0.1	0.1	0	0	0	0	3.1	1/
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	
1944	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0.2	
1945	0	0	0	0	0	0	0	0	0	0	7.6	0.2	7.8	
14-45 Mean	0.4	0.2	0.4	0.5	0.7	0.5	0.3	0.6	0.2	0.5	2.0	1.8	8.1	*

Subsequent Records

1946	0.1	0.1	0.1	0.4	0.6	0.2	0.1	0	0	0.1	3.2	2.2	7.1	1/
1947	0.4	0.4	0.4	0.5	0.2	0.1	0	0	0	0	2.0	0.7	4.7	1/
1948	0.1	0.1	0.4	0.3	0.5	0.6	0.1	0	0	0	0.1	0.1	2.3	1/

* Estimated.

1/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ZUNI RIVER AT BLACKROCK, NEW MEXICO

Location: Lat. 35°06', long. 108°47', in sec. 18, T. 10 N., R. 18 W., at dam forming Blackrock Reservoir on Zuni River, at Blackrock on Zuni Indian Reservation, 4 miles northeast of Zuni and 4½ miles downstream from Nutria Creek.

Drainage Area: 692 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	2.2	0.1	0.1	1.7	2.9	5.2	0.8	1.2	0.2	7.2	0.8	0.5	22.9	
1915	0.5	0	0.1	0	4.6	26.7	13.7	5.1	1.9	1.4	0.8	1.0	55.8	
1916	0	0	0	5.0	8.6	20.2	4.8	0.1	0	1.4	1.3	1.3	42.7	
1917	22.1	0	0	0	0.7	1.2	0.4	0.1	0.1	0	0.6	0.5	25.7	
1918	0.1	0	0	0	0.9	1.2	0	0	0.6	0.9	0.8	0.3	4.8	
1919	0.5	0	0.1	0.1	0.1	6.1	1.0	0	0	22.4	14.7	0.7	45.7	
1920	0.4	0	1.0	2.6	2.8	0.5	1.5	0	1.0	0.3	0.6	0.4	11.1	
1921	0	0	0	0.2	0.5	0.1	0	0.2	0.2	5.1	0.2	0.3	6.8	1/
1922	0	0	0	0	0.3	0	0.2	0.2	0	0.2	1.1	0.3	2.3	
1923	0.2	0	0.2	0.2	0.8	1.4	0.1	0	0	0.5	5.7	8.6	17.7	
1924	0	0.7	2.4	0	0.7	0.2	5.9	0.5	0	0.2	1.2	0.2	12.0	
1925	0	0	0	0	0.1	0.3	0	0.2	0.1	1.6	1.8	1.1	5.2	
1926	0.1	0	0	0	0.2	0.7	0.7	0.6	0	0.6	0.7	1.4	5.0	
1927	0	0	0.1	0.5	1.8	7.3	0	0.4	0	0.8	1.0	4.2	16.1	
1928	0	0	0	0	4.5	34.0	14.6	0.3	0	1.8	0.4	0	55.6	
1929	0	0	0	0	0.2	1.9	2.1	0.2	0	0	2.3	0.3	7.0	
1930	8.0	0.1	0	0	0.1	5.3	0	0	0.7	1.0	0.2	0	15.4	
1931													19.9	
1932													27.4	
1933													9.8	
1934													24.5	
1935													16.9	
1936													17.7	
1937													17.8	
1938													7.3	2/
1939													3.8	
1940													19.3	
1941													44.1	
1942													10.2	
1943													9.0	
1944													6.5	
1945													3.9	
14-45 Mean	1.8	0.1	0.2	0.5	1.5	5.9	2.4	0.5	0.2	2.4	1.8	1.1	18.4	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Estimated.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER NEAR HUNT, ARIZONA

Location: Lat. 34°39', long. 109°42', in NE¼NW¼ sec. 4, T. 14 N., R. 25 E., at bridge on U. S. Highway 260, 2 miles downstream from Zuni River and 5 miles northwest of Hunt.

Drainage Area: 6,281 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													16.6	
1915													28.6	
1916													40.7	
1917													19.0	
1918													6.5	
1919													67.5	
1920													36.2	*
1921													18.7	
1922													25.3	
1923													24.5	
1924													16.7	
1925													16.5	
1926													20.0	
1927													44.9	
1928													4.8	
1929								0	0	13.0	26.7	23.3	*81.0	
1930	3.6	0.3	0.6	0.8	0.6	0.8	0.3	0.1	0.1	2.0	4.5	0.3	14.0	
1931	0.2	0.3	0.1	0.1	0.6	0.2	0	0	0	3.8	12.7	9.6	27.6	1/
1932	5.2	0.5	0.5	0.5	8.6	11.5	10.1	0.9	0.1	1.9	7.7	1.2	48.7	
1933	0.7	0.6	0.3	0.3	0.7	0.4	0	0	0.4	4.2	3.0	5.4	16.0	
1934	3.6												*9.6	
1935													20.3	
1936													16.3	
1937													16.6	*
1938													3.8	
1939													1.9	
1940							0	0	0	2.8	6.2	6.3	*16.6	
1941	0.9	0.5	0.9	2.0	1.4	13.7	18.7	14.7	0.5	1.2	1.0	1.7	57.2	
1942	2.4	0.4	0.5	0.6	0.4	0.3	1.4	0.1	0	0	0.6	0	6.7	2/
1943	0.1	0	0.1	0.1	0.1	0	0	0	0	0.1	0.4	0.2	1.1	
1944	0.1	0	0.1	0	0	0.1	0	0	0	0.1	0	0.9	1.3	
1945	0.1	0	0.1	0	0	0	0	0	0	0.5	13.2	0.3	14.2	
14-45 Mean	1.2	0.3	0.6	0.8	1.3	2.8	3.6	0.9	0.2	2.4	4.9	4.1	23.1	*

Subsequent Records

1946	0.1	0.1	0.3	0.6	0.9	0.2	0.1	0	0	0.5	12.5	4.7	20.0	2/
1947	0.5	0.5	0.5	0.6	0.2	0.1	0	0	0	0	7.7	2.0	12.1	2/
1948	1.8	0.1	0.4	0.4	0.7	0.7	1.0	0	0	0.2	0.7	0.3	6.3	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers except (*).

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SILVER CREEK NEAR WOODRUFF, ARIZONA

Location: Lat. 34°44', long. 110°02', in NW¼NE¼ sec. 5, T. 15 N., R. 22 E., half a mile upstream from mouth and 3 miles south of Woodruff.
Drainage Area: 942 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													19.0	
1915													29.1	
1916													77.3	
1917													19.4	
1918													11.2	
1919													49.3	
1920													47.8	*
1921													16.0	
1922													26.8	
1923													23.6	
1924													16.6	
1925													14.3	
1926													13.0	
1927													36.6	
1928													12.7	
1929								0	0	13.0	4.3	6.5	*31.9	
1930	0.7	0.5	0.3	0.5	1.7	5.8	0.7	0.1	0	3.9	7.0	0.4	21.6	
1931	0.3	0.6	0.7	0.9	3.9	1.3	0.4	0.4	0.3	3.1	3.9	3.2	19.0	
1932	1.0	1.1	1.2	1.4	37.8	12.7	0.6	0.2	0.1	2.2	0.9	0.3	59.5	
1933	1.1	0.8	0.7	0.7	1.3	5.4	0	0.2	0.5	5.4	3.2	4.5	23.8	1/
1934	4.7												*13.3	
1935													*17.9	
1936	1.0	0.6	0.8	0.8	2.3	1.0	1.0	0.1	0.1	3.5	3.2	1.5	15.9	
1937	0.6	0.5	0.4	0.4	9.7	9.4	0.3	0.2	0.3	0.5	0.5	0.3	23.1	
1938	0.1	0.1	0.2	0.1	0.1	2.8	0.1	0	0	0.1	2.8	1.2	7.6	
1939	0.1	0.1	0.1	0.3	0.4	1.7	0.8	0	0	0.1	1.7	0.5	5.8	
1940	0.2	0.4	0.2	0.4	0.5	0.2	0.1	0	0.1	6.8	3.0	3.7	15.6	
1941	0.9	0.3	1.8	3.9	3.5	16.2	3.8	0.2	0.2	0.8	1.6	2.1	35.3	
1942	1.9	0.2	0.6	1.1	0.3	0.8	0.3	0.1	0	0	0.4	0.1	5.8	2/
1943	0.5	0.3	0.4	0.3	0.4	1.3	0.3	0.1	0	0.8	3.7	1.0	9.1	
1944	0.5	0.2	0.5	0.7	0.7	4.5	0.8	0.1	0	0.5	0.7	0.5	9.7	
1945	0.2	0.2	0.4	0.4	0.4	3.4	0.1	0	0	2.3	5.3	0.2	12.9	
14-45 Mean	0.9	0.5	1.1	1.6	4.8	5.1	0.8	0.2	0.2	3.2	2.7	2.0	23.1	*

Subsequent Records

1946	0.5	0.2	0.3	0.4	0.3	0.2	0	0	0	2.2	4.2	6.1	14.4	2/
1947	1.1	0.5	0.5	0.5	0.3	0.1	0	0.1	0					2/
1948							0.7	0.1	0.2	0.8	2.0	0.2		2/

* Estimated.
1/ Geological Survey Water-Supply Paper 1049 except (*).
2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER NEAR WOODRUFF, ARIZONA

Location: Lat. 34°48', long. 110°03', in SE¼NE¼ sec. 7, T. 16 N., R. 22 E., 1.5 miles northwest of Woodruff and 5.5 miles downstream from Silver Creek.

Drainage Area: 8,101 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													45.0	*
1915													69.0	*
1916													165.9	*
1917	15.6	2.5	2.8	2.8	3.8	3.6	4.7	0.4	0.3	1.8	4.5	5.3	48.1	1/
1918	1.0	0.8	0.7	0.5	1.6	4.2	*0	*0	*0.3	*4.7	*5.3	*5.1	24.2	1/
1919	*1.9	*0.8	*0.7	0.9	4.6	27.3	21.5	1.3	0	49.8	19.9	10.5	139.2	1/
1920	2.1	4.4	23.5										*103.0	1/
1921													45.6	
1922													64.6	
1923													60.8	
1924													43.6	*
1925													40.7	
1926													41.4	
1927													99.8	
1928													22.9	
1929								0	0	31.0	37.4	37.5	*132.6	
1930	4.8	0.8	0.9	1.2	2.1	6.4	0.8	0.1	0	8.0	16.8	0.6	42.5	
1931	0.4	1.9	1.2	1.4	4.6	1.4	0.7	0.9	0.4	10.9	28.4	12.0	64.2	
1932	7.2	1.8	2.4	1.7	47.6	24.6	10.6	1.3	0.1	5.6	12.6	1.7	117.2	
1933	1.7	1.2	1.0	0.8	2.7	5.7	0.1	0.2	0.9	12.6	8.8	15.9	51.6	1/
1934	8.8	1.8	1.8	*0.7	*0	*0	*0	*0	*0.4	*3.8	*8.8	*2.8	28.9	
1935													*48.4	
1936	1.2	0.9	1.4	1.5	2.8	1.4	1.2	0.9	0.1	8.6	13.1	9.6	42.7	
1937	1.8	0.9	0.8	0.5	14.8	14.3	6.5	0.2	0.3	3.2	1.8	1.1	46.2	
1938	0.4	0.5	0.5	0.4	0.4	3.6	0.2	0	0.5	0.2	4.4	4.0	15.1	
1939	0.2	0.3	0.4	0.7	0.8	2.0	1.3	0	0	0.8	2.5	1.2	10.2	
1940	0.2	0.5	0.3	0.7	1.0	0.3	0.2	0	0.2	14.6	14.5	13.6	46.1	
1941	2.3	1.2	3.2	10.4	6.6	37.5	21.7	15.5	0.8	3.3	4.9	8.0	115.4	
1942	6.2	0.8	0.9	1.3	0.5	1.2	2.0	0.2	0	0	1.3	0.1	14.5	2/
1943	2.0	0.4	0.6	0.4	0.5	1.5	0.3	0	0	2.1	10.3	2.2	20.3	
1944	0.9	0.3	0.5	0.8	0.8	4.9	0.9	0.1	0	0.7	1.1	3.7	14.7	
1945	0.7	0.5	0.5	0.4	0.5	4.2	0.2	0	0	8.4	19.9	0.5	35.8	
14-45 Mean	2.6	1.0	1.9	3.8	6.4	8.9	4.3	1.2	0.4	8.2	11.2	8.2	58.1	*

Subsequent Records

1946	0.5	0.3	0.6	1.0	1.1	0.5	0	0	0	7.0	22.8	16.0	49.8	2/
1947	1.5	0.8	0.7	0.6	0.6	0.3	0.1	0.3	0	1.1	20.5	3.6	30.1	2/
1948	14.1	0.7	0.9	0.7	1.6	2.1	2.0	0.1	0.2	1.6	5.1	1.7	30.8	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

PUERCO RIVER AT GALLUP, NEW MEXICO

Location: Lat. 35°32', long. 108°44', in SW¼NW¼ sec. 15, T. 15 N., R. 18 W., 1,500 feet upstream from Second Street Bridge in Gallup and half a mile upstream from mouth of Little Puerco Wash.

Drainage Area: 558 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													6.0	
1915													6.8	
1916													14.2	
1917													10.4	
1918													4.6	
1919													6.2	
1920													10.4	
1921													6.2	
1922													7.8	
1923													7.3	
1924													6.4	
1925													5.7	*
1926													5.2	
1927													10.8	
1928													4.5	
1929													18.0	
1930													7.2	
1931													4.6	
1932													8.6	
1933													4.0	
1934													4.9	
1935													7.3	
1936													7.8	
1937													8.4	
1938													6.6	
1939													6.3	
1940								0	0.2	0.5	0.9	2.3	*4.7	
1941	0.2	0	0.2	0.3	0.8	2.9	3.5	1.2	0.1	0.8	0.8	3.6	14.4	
1942	1.4	0	0	0.1	0	1.0	0.2	0	0	0.1	0.1	0	2.9	1/
1943	0	0	0	0	0	0.3	0	0	0	1.6	3.4	0.4	5.7	
1944	0.2	0	0	0	0	0.2	0	0	0	0	0.3	0.8	1.5	
1945	0.1	0	0	0	1.5	0.3	0.7	0	0	1.2	2.5	0.1	6.4	
14-45 Mean	0.2	0	0.1	0.2	0.7	0.9	0.9	0.1	0.1	0.7	2.0	1.3	7.2	*

Subsequent Records

1946	0.1	0	0	0.1	1.2	0	0	0	0					1/

* Estimated.

1/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

PUERCO RIVER NEAR ADAMANA, ARIZONA

Location: Lat. 34°58'45", long. 109°47'40", in NE¼ sec. 9, T. 18 N., R. 24 E., at highway bridge in Petrified Forest National Monument, a quarter of a mile downstream from Dead Wash and 1½ miles east of Adamana.

Drainage Area: 2,757 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													42.2	
1915													56.4	
1916													188.8	
1917													59.2	
1918													30.7	
1919													44.1	
1920													106.6	
1921													43.1	
1922													59.9	
1923													54.8	
1924													40.0	
1925													36.3	*
1926													27.1	
1927													87.8	
1928													27.4	
1929													116.8	
1930													53.8	
1931													31.9	
1932													92.6	
1933													21.7	
1934													38.9	
1935													41.4	
1936													52.2	
1937													75.8	
1938													44.8	
1939													28.2	
1940						0	0	0	0.2	0.9	11.9	11.9	*27.5	
1941	3.0	0.5	2.1	5.2	16.3	27.1	8.5	26.3	2.4	3.1	13.3	25.8	133.6	
1942	38.3	1.1	0.6	0.7	0.5	7.1	6.8	1.1	0	0	0.9	0.2	57.3	
1943	0	0	0	0.1	0.2	0.4	0	0	0	0.9	8.4	2.0	12.0	1/
1944	0.4	0.1	0	0.1	0.2	1.7	0.3	0	0	0.2	0.6	5.5	9.1	
1945	0.4	0.3	0.2	0	4.0	1.0	3.3	0.7	0	2.1	9.5	0.4	21.9	
14-45 Mean	2.8	1.1	0.9	4.3	7.5	7.9	3.7	1.7	1.3	1.8	13.9	8.2	55.1	*

Subsequent Records

1946	0.1	0	0.2	0.2	2.4	0.1	0	0	0	2.0	32.4	7.4	44.8	1/
1947	0	0	0	0	0	0	0	0	0	0.1	44.6	3.8	48.5	1/
1948	20.1	0	0	0	2.4	7.7	5.3	0	1.4	5.5	4.8	3.3	50.5	1/

* Estimated.

1/ Geological Survey annual Water-Supply Papers except (*).

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

CHEVELON FORK NEAR WINSLOW, ARIZONA

Location: Lat. 34°56', long. 110°31', in SE¼SW¼ sec. 27, T. 18 N., R. 17 E., 3 miles upstream from mouth and 12 miles southeast of Winslow.

Drainage Area: 1,008 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													35.1	*
1915													61.3	*
1916	*0.2	*0.1	*0.2	58.3	25.4	38.7	7.4	0.4	0.2	0.2	0.4	1.9	133.4	
1917	1.3	0.2	0.2	0.2	0.5	8.8	36.3	8.3	0.2	0.5	0.8	0.4	57.7	
1918	0.3	0.3	0.3	0.3	4.6	12.4	0.3	0.2	0.4	0.3	0.2	0.2	19.8	1/
1919	0.3	0.2	0.2	0.2	0.9	6.4	19.4	0.6	0.2	1.5	1.5	0.3	31.7	
1920	5.1	9.2	12.4										*86.9	
1921													23.6	
1922													55.0	
1923													46.5	
1924													47.1	*
1925													26.5	
1926													43.7	
1927													50.5	
1928													23.8	
1929	*0.3	*0.8	*0.1	*0.3	*1.1	*14.9	26.7	0.9	0.2	0.9	2.4	0.2	48.8	
1930	0.3	0.2	0.2	0.2	1.3	8.5	8.6	0.9	0.2	0.3	1.2	0.3	22.2	
1931	0.2	0.3	0.8	0.3	2.9	14.0	5.6	1.9	0.2	0.5	0.4	0.2	27.3	
1932	0.2	2.6	2.9	2.5	16.5	29.9	15.2	1.4	0.3	0.3	0.4	0.3	72.5	
1933	0.3	0.2	0.3	0.2	0.4	11.6	5.2	4.6	0.3	0.5	0.3	0.6	24.5	1/
1934	0.4	0.2	0.2	0.3	0								*24.2	
1935													*63.0	
1936	0.2	0.2	0.3	0.2	0.2	11.2	18.0	0.4	0.2	0.6	1.0	1.0	33.5	
1937	0.2	0.2	0.2	0.4	18.8	23.0	24.7	0.6	0.2	0.5	0.5	0.3	69.6	
1938	0.2	0.2	0.2	0.4	0.2	30.7	1.0	0.3	0.3	0.3	0.4	0.2	34.4	
1939	0.2	0.2	0.2	0.2	0.2	14.0	8.6	0.3	0.2	0.2	0.8	0.5	25.6	
1940	0.2	0.4	0.3	0.3	4.0	6.4	3.3	0.3	0.2	0.6	0.8	0.4	17.2	
1941	0.3	2.5	8.1	5.8	16.6	22.9	21.3	13.0	0.2	0.2	0.4	0.3	91.6	
1942	0.3	0.7	1.3	3.6	3.0	7.2	13.5	1.9	0.2	0.2	0.2	0.1	32.2	2/
1943	0.2	0.2	0.7	1.0	5.7	22.0	2.8	0.2	0.2	0.2	0.7	0.4	34.3	
1944	0.2	0.2	0.3	0.3	0.4	6.1	27.4	4.8	0.4	0.3	0.2	0.9	41.5	
1945	0.3	0.2	0.3	0.3	2.6	6.9	27.5	2.7	0.3	0.3	1.2	0.3	42.9	
14-45 Mean	0.5	0.9	1.7	2.8	5.6	16.0	13.4	2.4	0.2	0.4	0.8	0.6	45.3	*

Subsequent Records

1946	0.2	0.2	0.3	0.3	0.3	3.6	2.1	0.4	0.3	0.5	1.0	4.0	13.2	2/
1947	0.3	8.2	2.6	2.0	4.1	3.4	0.3	0.3	0.2	0.3	1.5	0.3	23.5	2/
1948	0.7	0.2	0.6	2.2	2.3	5.2	17.1	0.3	0.2	0.4	0.9	0.2	30.3	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-Feet

CLEAR CREEK NEAR WINSLOW, ARIZONA

Location: Lat. 34°58', long. 110°38', in SE¼ sec. 9, T. 18 N., R. 16 E., 1.5 miles upstream from mouth and 5 miles southeast of Winslow.

Drainage Area: 607 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													56.4	
1915													116.6	
1916													203.9	
1917													113.3	
1918													28.8	
1919													50.9	
1920													136.9	
1921													36.5	*
1922													96.0	
1923													78.3	
1924													75.7	
1925													36.1	
1926													108.5	
1927													81.6	
1928													36.8	
1929	*0.1	*0.9	*0	*0	*0.4	*22.6	75.8	2.1	0	0.2	0.3	0	102.4	
1930	0	0	0	0	0.2	7.9	17.6	2.4	0	0	0.9	0	29.0	
1931	0	0.2	1.3	0	2.6	20.5	13.9	5.9	0	0	0.2	0	44.6	
1932	0	2.1	2.6	2.6	28.8	51.4	54.0	7.4	0	0	0	0	148.9	
1933	0	0.1	0.1	0	0	12.1	15.6	9.2	0	0.4	0.1	0	37.6	1/
1934	0.2	0	0	0									*39.2	
1935													*105.7	
1936	0	0	0	0	0	12.2	33.4	1.2	0	0	0	0	46.8	
1937	0	0	0	0	25.2	40.1	48.7	3.4	0	0	0	0	117.4	
1938	0	0	0	0	0	59.6	4.9	0.1	0	0	0.1	0	64.7	
1939	0	0	0	0	0	12.9	17.1	0	0	0	0	0	30.0	
1940	0	0	0.1	0.2	3.1	10.8	6.7	0.2	0	0	0.8	0	21.9	
1941	3.3	4.0	10.9	8.4	26.1	39.6	43.0	39.2	0.2	0	0	0	174.7	
1942	0.	2.6	1.6	2.4	3.6	9.0	29.7	4.5	0	0	0	0	53.4	2/
1943	0	0	0	0	4.4	29.5	9.5	0.1	0	0	0.1	0	43.6	
1944	0	0	0	0	0	6.2	44.5	21.7	0.1	0	0	0	72.5	
1945	0	0.1	0	0	0.8	8.7	46.9	18.7	0	0	0	0	75.2	
14-45 Mean	0.3	1.0	2.0	3.2	7.6	24.3	30.1	7.9	0	0.1	0.2	0.3	77.0	*

Subsequent Records

1946	0	0	0	0	0	2.6	4.0	0	0	0.6	0.5	4.1	11.8	2/
1947	0.1	10.4	4.1	2.0	4.9	6.4	1.1	0	0	0	1.1	0.4	30.5	2/
1948	0.1	0	0	1.1	2.2	5.9	40.6	1.0	0	0	0	0	50.9	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER AT GRAND FALLS, ARIZONA

Location: Lat. 35°26', long. 111°12', in T. 24 N., R. 11 E., unsurveyed, at Grand Falls on Navajo Indian Reservation, 30 miles northeast of Flagstaff and 96 miles upstream from mouth.

Drainage Area: 21,178 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	5.0	3.8	0.8	1.2	30.3	54.4	36.0	0.7	0.3	11.5	29.0	17.2	190.2	
1915	6.6	5.8	12.8	15.3	60.7	52.5	50.9	75.4	0.4	19.3	23.7	15.4	338.8	
1916	4.4	1.2	0.1	436.2	166.1	178.1	26.7	0.5	0.1	3.1	16.5	26.4	859.4	
1917	14.6	1.5	0.1	0	0	23.5	141.2	49.1	0	22.1	36.7	15.1	303.9	
1918	5.2	1.8	0.3	0	24.0	42.2	0	0	0.8	5.4	9.4	14.6	103.7	
1919	4.8	1.4	0.1	0	0	10.8	74.2	1.5	0	88.8	65.0	14.9	261.5	1/
1920	51.8	20.0	41.9	11.1	89.4	81.6	75.5	11.7	0.3	14.9	48.0	14.8	461.0	
1921	6.0	3.9	0	0	0	42.2	21.4	0	0.2	33.1	48.3	15.5	170.6	
1922	6.3	1.6	4.1	8.4	33.3	122.7	52.6	9.3	0.2	23.3	32.7	14.4	308.9	
1923	4.3	1.6	6.5	0	14.0	119.6	34.1	2.8	0.1	29.7	36.3	22.6	271.6	
1924	4.2	6.4	44.1	9.1	0	48.9	49.2	4.5	0.2	13.9	27.0	14.3	221.8	
1925	4.3	1.2	1.9	0	0	40.2	25.6	0.3	0.2	17.4	33.3	26.0	150.4	
1926	6.2	3.9	2.4	0.9	0.5	18.7	83.9	10.9	0	0.7	5.5	47.9	181.5	
1927	2.4	1.1	1.0	3.0	61.0	75.0	50.5	6.0	3770	20.7	20.8	115.3	393.8	
1928	0.6	0	0.2	0.5	17.2	50.5	7.6	0.1	0	2.5	5.2	3.2	87.6	
1929	0.1	7.3	0.9	0.5	1.4	42.4	155.3	2.4	0	96.9	110.3	93.3	510.8	
1930	12.1	0.5	0.5	0.7	1.4	22.3	27.0	1.0	0	50.5	67.7	5.6	189.3	
1931	0	1.0	4.4	1.1	12.5	29.3	13.9	12.4	0	23.2	51.3	15.9	165.0	
1932	14.1	17.1	7.1	9.4	153.7	146.8	77.7	9.4	0	3.3	24.2	3.1	465.9	2/
1933	1.9	0.2	0.1	0.2	7.4	25.3	18.0	10.6	0	18.3	19.6	27.6	129.2	
1934	31.1	1.0	1.2	0.7	0.8	1.7	1.5	0	1.5	2.1	20.9	8.5	71.0	
1935	0.1	0	0	19.1	27.4	38.0	72.6	2.8	0	0.7	32.8	21.8	215.3	
1936	1.7	0.1	0.8	0.6	4.0	22.7	49.3	0.8	0	3.8	45.6	35.6	165.0	
1937	0.3	4.9	0.2	0	115.8	110.9	89.1	2.5	0	6.0	2.8	6.9	339.4	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

LITTLE COLORADO RIVER AT GRAND FALLS, ARIZONA (Continued)

Location: Lat. 35°26', long. 111°12', in T. 24 N. R. 11 E., unsurveyed, at Grand Falls on Navajo Indian Reservation, 30 miles northeast of Flagstaff and 96 miles upstream from mouth.

Drainage Area: 21,178 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	6.3	0.1	0.5	0.1	1.3	128.1	4.4	0	0	0.2	11.2	18.0	170.2	2/
1939	0	0	0	0.4	1.6	34.2	40.1	0	0	0	2.8	4.1	83.2	↑
1940	0	0	0.2	0.8	5.4	13.5	6.7	0	0	12.2	42.0	51.4	132.2	
1941	21.6	8.6	28.8	56.7	74.9	136.7	107.6	86.4	4.0	3.8	26.8	31.0	586.9	-
1942	53.8	3.1	3.0	6.7	6.4	19.0	50.6	6.0	0	0	0.4	0	149.0	3/
1943	0.7	0.6	0	0.3	6.7	53.1	12.8	0	0	0	16.7	12.1	103.0	
1944	0.7	0	0.1	0.2	0.4	22.7	71.8	24.7	0	0	0	8.5	129.1	!
1945	2.2	1.0	1.1	0.5	4.9	16.8	67.3	19.6	0	9.6	35.8	0.7	159.5	↓
14-45 Mean	8.5	3.2	5.2	18.2	28.8	57.0	49.8	11.0	1.4	16.8	29.6	22.6	252.1	
Subsequent Records														
1946	0	0	0.4	4.3	2.5	4.0	3.2	0	0	9.6	52.0	40.4	116.4	3/
1947	0.7	14.5	4.9	3.5	8.4	6.6	0.8	0.4	0	0	74.5	12.7	127.0	3/
1948	57.0	0.7	1.0	3.5	7.9	19.9	68.3	1.0	0.1	5.0	16.2	1.7	182.3	3/

1/ Estimated.
2/ Geological Survey Water-Supply Paper 1049.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

MOENKOPI WASH NEAR TUBA, ARIZONA

Location: Lat. 36°02', long. 111°24', in T. 31 N., R. 9 E., unsurveyed, on Navajo Indian Reservation, at bridge on U. S. Highway 89, 9 miles upstream from mouth, 11 miles north of Cameron, and 11 miles southwest of Tuba.

Drainage Area: 2,486 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	1.9	0.4	0.3	0.4	0.3	0.2	0.1	0	0.2	16.5	8.2	2.1	30.6	
1915	3.8	0.3	0.5	0.4	0.3	0.2	0.4	0	0	6.7	0.6	2.1	15.3	
1916	0.1	0.3	0.6	0.5	0.3	0.3	0.1	0	0	3.3	4.8	2.4	12.7	
1917	6.6	0.3	0.3	0.4	0.3	0.2	0.5	0.1	0	1.1	6.6	3.0	19.4	
1918	0.2	0.3	0.2	0.5	0.3	0.2	0	0	0	3.4	2.0	2.1	9.2	
1919	2.1	0.4	0.5	0.3	0.3	0.2	0	0	0	3.9	1.9	2.6	12.2	1/
1920	1.4	0.5	0.2	0.3	0.4	0.2	0	0	0.1	2.8	8.1	2.8	16.8	
1921	3.6	0.3	0.2	0.3	0.3	0.2	0	0.1	0.2	6.7	7.9	1.7	21.5	
1922	1.4	0.3	0.7	0.3	0.3	0.2	0	0	0.3	1.4	3.3	1.9	10.1	
1923	0.8	0.5	0.2	0.4	0.3	0.2	0.3	0	0	6.7	7.1	6.1	22.6	
1924	1.3	0.6	0.9	0.3	0.3	0.2	0	0	0	0	0	1.9	5.5	
1925	0.4	0.3	0.5	0.3	0.3	0.2	0.1	0	0	3.4	2.1	3.7	11.3	
1926	*5.6	*0.3	*0.3	*0.3	*0.3	*0.2	*0.7	*0.1	*0	0.1	0.5	1.9	10.3	
1927	0.3	0.4	0.4	0.4	0.3	0.3	0	0	1.6	0.2	0.8	5.1	9.8	
1928	0.1	0.5	0.4	0.6	0.3	0.3	0	0.2	0	0.2	1.6	0.3	4.5	
1929	0.9	0.7	0.4	0.2	0.1	0.2	0.1	0	0	8.5	18.0	12.0	41.1	
1930	0.4	0.3	0.3	0.4	0.3	0.1	0.1	0	0	12.1	30.6	1.4	46.0	
1931	0.3	0.3	0.2	0.4	0.4	0.2	0.1	0.3	0	1.1	0.9	1.3	5.5	
1932	1.0	0.4	0.3	0.3	2.9	0.2	0	0	0	0.7	1.6	0.4	7.8	2/
1933	0.5	0.3	0.2	0.2	0.4	0.2	0.1	0	0	5.1	2.0	1.0	10.0	
1934	5.2	0.5	0.3	0.3	0.2	0.1	0.3	0.3	0	0.7	8.4	0.2	16.5	
1935	0.2	0.3	0.3	0.7	0.3	0.3	0.1	0	0	0.2	4.0	1.7	8.1	
1936	0.4	0.4	0.4	0.4	0.5	0.2	0	0	0	1.6	12.7	8.1	24.7	
1937	0.6	0.5	0.4	0.2	1.4	0.4	0.1	0	0.1	6.6	0.4	12.3	23.0	
1938	1.4	0.2	0.3	0.3	0.3	1.6	0	0	0.1	0.1	2.0	2.2	8.5	
1939	0.2	0.2	0.3	0.3	0.3	0.1	0.1	0	0	0	0.3	5.2	7.0	
1940	0.2	0.3	0.3	0.2	0.3	0.1	0	0	0	0	5.3	17.0	23.7	
1941	5.1	0.3	0.7	0.6	0.9	0.4	0.9	0	0	0.2	4.8	7.2	21.1	
1942	15.2	0.4	0.2	0.4	0.3	0.1	0.1	0	0	0.1	0.6	0	17.4	3/
1943	0.2	0.2	1.2	0.5	0.4	0.3	0	0	0	0.5	5.6	0.8	9.7	
1944	0.5	0.2	0.2	0.3	0.3	0.4	0.1	0	0	0	0.2	0.2	2.4	
1945	0.2	0.2	0.3	0.3	0.2	0.2	0	0	0	4.5	9.6	0.1	15.6	
14-45 Mean	1.9	0.4	0.4	0.4	0.4	0.3	0.1	0	0.1	3.1	5.1	3.5	15.7	

Subsequent Records

1946	0.8	0.2	0.6	0.3	0.2	0.1	0	0	0	1.5	7.0	0.4	11.1	3/
1947	0.1	0.5	0.3	0.2	0.2	0.1	0	0	0	0	7.1	0.6	9.1	3/
1948	9.4	0.2	0.5	0.3	0.3	0.2	0	0	0.7	1.9	1.0	0.1	14.6	3/

1/ Estimated.
2/ Geological Survey Water-Supply Paper 1049 except (*), estimated.
3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER NEAR GRAND CANYON, ARIZONA

Location: Lat. 36°05'55", long. 112°05'30", at Kaibab Bridge, a quarter of a mile upstream from Bright Angel Creek, 11 miles by trail northeast of Grand Canyon, Coconino County, 26 miles downstream from Little Colorado River, and 267 miles upstream from Hoover Dam.

Drainage Area: 137,772 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	676.9	569.8	355.0	387.6	444.3	923.6	1540.0	4381.0	5895.0	2693.0	1110.0	671.3	19,647.5	
1915	980.3	558.8	370.8	338.7	466.9	577.0	1460.0	2344.0	3264.0	1665.0	513.1	474.0	13,012.6	
1916	540.7	432.2	368.7	857.4	598.6	1542.0	1741.0	3476.0	4241.0	2112.0	1633.0	731.9	18,274.5	
1917	1438.0	521.5	395.5	281.1	367.2	534.4	1632.0	3673.0	7278.0	4312.0	1191.0	706.9	22,330.6	
1918	493.4	472.4	432.1	373.2	411.8	698.3	877.0	2469.0	4736.0	1762.0	588.1	626.5	13,939.8	*
1919	566.7	522.8	438.4	307.3	328.3	662.3	1404.0	2893.0	2016.0	1076.0	630.0	438.3	11,283.1	
1920	434.3	447.0	464.5	438.5	696.8	762.3	1036.0	5598.0	6452.0	2458.0	999.2	521.3	20,307.9	
1921	547.3	632.2	432.3	432.0	467.2	976.6	917.2	3880.0	7953.0	2290.0	1704.0	802.3	21,034.1	
1922	458.4	439.8	486.0	379.9	484.1	1020.0	1195.0	4389.0	5135.0	1500.0	765.3	475.3	16,727.8	
1923	319.7	423.6	437.9	400.7	369.4	499.1	1306.0	3568.0	4643.0	2326.0	1440.0	1311.0	17,044.4	
1924	752.7	766.3	593.6	369.4	529.2	532.1	1664.0	2994.0	3154.0	1049.0	334.7	275.6	13,014.6	
1925	378.1	407.1	300.3	269.9	426.2	661.3	1310.0	2102.0	2396.0	1487.0	802.5	1196.0	11,736.4	
1926	1046.0	620.8	460.4	371.5	362.4	654.5	1651.0	3379.0	3479.0	1428.0	580.1	387.3	14,420.0	
1927	468.5	371.8	415.7	361.3	462.9	677.8	1284.0	3872.0	3661.0	2527.0	992.9	266.0	17,260.9	
1928	965.0	778.7	486.4	498.2	501.2	780.0	986.8	4270.0	3766.0	1553.0	667.2	374.8	15,627.3	
1929	614.8	589.4	365.8	349.6	361.2	950.5	1770.0	3901.0	4725.0	2116.0	1995.0	1695.0	19,433.3	1/
1930	946.3	583.5	459.8	317.6	480.7	612.4	1670.0	1999.0	3076.0	1155.0	1592.0	530.4	13,422.7	
1931	565.9	445.8	312.8	280.0	385.4	451.9	575.2	1165.0	1411.0	503.9	324.6	299.1	6,720.6	
1932	534.8	390.1	273.3	306.7	731.0	848.0	1724.0	3969.0	3620.0	2067.0	961.0	540.7	15,965.6	
1933	354.5	395.8	299.0	283.5	276.7	529.3	520.6	1390.0	3973.0	1181.0	386.6	418.6	10,008.6	
1934	432.3	309.4	339.6	329.3	316.9	348.9	452.4	1103.0	545.6	146.4	166.0	166.5	4,656.3	
1935	171.9	195.8	243.3	288.1	306.2	378.2	731.4	1361.0	3992.0	1514.0	580.1	454.1	10,216.1	
1936	385.5	335.4	289.9	278.6	331.7	503.8	1312.0	3583.0	2708.0	1045.0	924.0	624.2	12,321.1	
1937	362.5	458.5	338.2	217.6	531.1	821.4	1565.0	3471.0	2402.0	1367.0	422.8	452.5	12,409.6	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER NEAR GRAND CANYON, ARIZONA (Continued)

Location: Lat. 36°05'55", long. 112°05'30", at Kaibab Bridge, a quarter of a mile upstream from Bright Angel Creek, 11 miles by trail northeast of Grand Canyon, Coconino County, 26 miles downstream from Little Colorado River, and 267 miles upstream from Hoover Dam.

Drainage Area: 137,772 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	486.1	397.0	407.4	338.1	358.2	901.2	1539.0	3288.0	4679.0	1753.0	543.2	937.6	15,627.8	1/
1939	592.8	499.0	432.1	360.7	317.7	818.4	1210.9	2407.9	1671.9	468.0	244.1	594.9	9,618.4	↑
1940	353.8	331.8	309.4	282.1	325.0	467.6	692.6	1987.2	1518.7	432.9	255.0	479.0	7,435.1	
1941	757.1	430.2	408.0	433.7	514.6	837.9	1209.0	4976.0	4100.0	1753.0	860.7	658.6	16,938.8	
1942	1904.0	952.9	594.5	429.5	435.1	653.2	2763.0	3163.0	4241.0	1345.0	486.0	293.7	17,260.9	2/
1943	356.2	385.8	373.1	347.3	350.9	579.5	1417.0	2161.0	2676.0	1459.0	833.5	494.2	11,433.5	
1944	408.4	476.6	419.7	297.6	362.8	550.8	1099.0	3206.0	4144.0	1854.0	455.6	251.0	13,525.5	
1945	361.5	401.1	344.7	356.2	380.6	471.5	804.4	2803.0	2754.0	1732.0	1071.0	393.5	11,873.5	
14-45 Mean	614.2	485.7	395.3	361.3	427.6	694.6	1283.1	3100.7	3759.6	1629.1	814.1	638.8	14,204.1	↓

Subsequent Records

1946	524.5	465.4	358.8	383.8	332.6	514.2	1016.0	1775.0	1995.0	784.4	567.2	372.4	9,089.3	2/
1947	418.8	492.3	468.0	303.1	371.1	653.4	785.3	3088.0	3233.0	1953.0	1329.0	640.3	13,735.3	2/
1948	894.1	608.4	490.5	427.4	458.3	668.7	1732.0	3392.0	3358.0	1009.0	586.9	242.4	13,867.7	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 918.

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

BRIGHT ANGEL CREEK NEAR GRAND CANYON, ARIZONA

Location: Lat. 36°05'55", long. 112°05'40", 1,000 feet upstream from mouth and 11 miles by trail from Grand Canyon, Coconino County.

Drainage Area: 100 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	1.4	1.4	1.5	1.4	1.6	1.9	5.4	6.8	2.1	1.5	1.4	1.4	27.8	
1915	1.2	1.2	1.3	1.3	1.4	1.7	4.8	5.9	1.8	1.3	1.3	1.2	24.4	
1916	1.4	1.4	1.4	1.4	1.5	1.9	5.4	6.7	2.1	1.5	1.5	1.4	27.6	
1917	1.3	1.2	1.3	1.3	1.4	1.7	4.9	6.1	1.9	1.4	1.3	1.3	25.1	
1918	1.4	1.4	1.5	1.4	1.5	1.9	5.5	6.8	2.1	1.5	1.5	1.4	27.9	1/
1919	1.6	1.6	1.6	1.6	1.7	2.1	6.1	7.6	2.4	1.7	1.6	1.6	31.2	
1920	1.5	1.5	1.6	1.6	1.7	2.1	5.9	7.3	2.3	1.7	1.6	1.5	30.3	
1921	1.3	1.3	1.3	1.3	1.4	1.7	5.0	6.2	1.9	1.4	1.3	1.3	25.4	
1922	1.6	1.6	1.7	1.7	1.8	2.2	6.4	7.9	2.5	1.8	1.7	1.6	32.5	
1923	1.7	1.7	1.7	1.7	1.9	2.3	6.6	8.2	2.6	1.8	1.8	1.7	33.7	
1924	1.8	2.0	2.0	2.0	1.8	1.8	3.2	3.1	1.7	1.7	1.4	1.6	24.1	
1925	1.4	1.3	1.5	1.4	1.4	1.6	3.0	2.4	1.5	1.4	1.4	1.4	19.7	
1926	1.2	1.3	1.4	1.2	1.2	1.6	8.7	8.5	2.0	1.6	1.3	1.4	31.4	
1927	1.3	1.3	1.5	1.4	2.4	1.8	6.4	10.4	2.2	1.6	1.6	1.8	33.7	
1928	1.6	1.7	1.6	1.6	1.6	3.0	6.9	5.4	1.8	1.5	1.5	1.4	29.6	
1929	1.4	1.4	1.5	1.5	1.3	1.5	3.4	4.6	1.6	1.5	1.4	1.3	22.4	
1930	1.3	1.3	1.3	1.4	1.3	1.4	3.6	3.3	1.6	1.4	1.3	1.3	20.5	
1931	1.3	1.3	1.4	1.4	1.3	1.4	2.1	1.8	1.2	1.2	1.2	1.2	16.8	2/
1932	1.2	1.2	1.3	1.3	2.6	2.2	10.6	14.2	3.2	1.7	1.5	1.4	42.4	
1933	1.4	1.4	1.4	1.4	1.2	1.4	1.6	2.1	1.5	1.2	1.2	1.0	16.8	
1934	1.1	1.0	1.2	1.2	1.1	1.3	1.2	1.2	1.0	1.0	1.2	1.1	13.6	
1935	1.1	1.2	1.3	1.2	1.1	1.5	7.0	9.3	3.8	1.6	1.4	1.2	31.7	
1936	1.1	1.2	1.2	1.2	1.4	1.5	7.2	4.5	1.4	1.5	1.7	1.3	25.2	
1937	1.2	1.2	1.2	1.2	2.5	2.0	8.5	15.7	3.2	2.1	1.5	1.6	41.9	
1938	1.5	1.5	1.6	1.6	1.6	3.6	12.9	11.6	3.1	2.0	1.8	1.6	44.4	
1939	1.6	1.6	1.6	1.6	1.4	1.8	5.6	3.6	1.6	1.4	1.4	2.7	25.9	
1940	1.7	1.5	1.5	1.7	1.9	3.1	9.0	5.1	1.9	1.4	1.4	1.5	31.7	
1941	1.6	1.5	1.8	1.9	2.8	3.9	5.2	30.8	7.8	2.7	2.5	1.9	64.4	
1942	2.1	1.8	2.0	1.9	1.7	1.8	6.7	4.2	1.9	1.8	1.7	1.7	29.3	3/
1943	1.8	1.6	1.6	1.6	1.5	2.4	10.1	7.1	1.7	1.5	1.5	1.4	33.8	
1944	1.6	1.4	1.6	1.6	1.6	1.8	2.3	7.5	2.5	1.6	1.3	1.4	26.2	
1945	1.4	1.4	1.5	1.4	1.4	1.5	3.5	8.2	1.8	1.7	1.6	1.4	26.8	
14-45 Mean	1.4	1.4	1.5	1.5	1.6	2.0	5.8	7.3	2.2	1.6	1.5	1.5	29.3	

Subsequent Records

1946	1.5	1.3	1.5	1.4	1.2	1.6	5.2	3.8	1.5	1.6	1.4	1.2	23.2	3/
1947	1.4	1.4	1.5	1.5	1.3	1.8	2.6	1.8	1.3	1.2	1.5	1.2	18.5	3/
1948	1.3	1.3	1.3	1.3	1.2	1.3	3.0	3.3	1.4	1.3	1.7	1.1	19.5	3/

1/ Estimated.
2/ Geological Survey Water-Supply Paper 1049.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

VIRGIN RIVER AT VIRGIN, UTAH

Location: Lat. 37°13', long. 113°11', in SE¼SE¼ sec. 22, T. 41 S., R. 12 W., at east side of Virgin, 0.5 mile downstream from North Creek.

Drainage Area: 934 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	8.7	11.2	10.4	17.2	15.9	19.3	48.1	40.0	14.7	17.1	7.1	6.2	215.9	
1915	*9.2	*8.4	*8.1	*7.2	10.0	14.5	29.8	54.4	18.1	7.1	5.6	20.5	192.9	
1916	10.5	13.4	13.8	15.8	13.1	48.0	52.1	39.1	15.9	22.3	27.1	11.5	282.6	
1917	18.5	8.6	7.8	9.9	11.2	10.4	23.7	38.3	16.4	*15.8	*15.4	4.9	180.9	
1918	7.5	8.8	9.5	7.8	6.2	38.5	20.3	27.7	7.7	11.7	7.7	13.5	166.9	
1919	11.8	9.8	11.1	8.6	7.8	14.0	22.9	13.6	6.5	*5.7	*7.7	*11.9	131.4	
1920	9.1	10.5	12.1	11.6	14.3	14.8	23.5	41.6	11.8	2.6	*16.6	5.1	173.6	
1921	10.1	13.6	15.8	13.1	9.8	16.8	21.3	23.7	*9.6	*11.0	*12.3	*12.2	169.3	
1922	13.9	12.7	32.4	20.3	19.1	26.8	38.0	84.8	27.1	*23.2	*19.5	*13.9	331.7	
1923	*10.2	*9.6	*11.3	*11.1	*10.1	*13.0	34.9	40.2	9.8	*13.9	*16.0	6.1	186.2	
1924	7.5	9.9	9.0	10.7	5.9	5.6	11.6	11.3	4.4	7.3	4.8	12.2	100.2	
1925	6.3	8.1	9.3	10.9	9.9	8.9	14.3	10.2	*6.5	*7.1	*8.4	*11.4	111.3	
1926	4.3	4.9	7.2	7.6	5.0	5.8	39.0	26.6	6.2	5.9	5.4	5.3	123.2	1/
1927	5.7	11.8	9.6	10.1	13.4	14.7	25.1	22.3	7.0	6.6	12.1	21.4	159.8	
1928	18.1	7.8	7.6	7.3	14.1	15.7	18.3	12.8	4.1	1.9	2.7	3.6	114.0	
1929	3.8	6.0	6.0	6.0	7.2	10.9	16.8	20.7	5.4	12.1	18.5	21.2	134.6	
1930	7.4	6.0	5.5	5.5	6.1	7.5	13.3	27.5	5.9	5.0	14.3	8.3	112.3	
1931	7.2	12.1	7.7	6.7	38.4	8.3	8.2	6.0	4.4	4.9	7.2	4.1	85.2	
1932	3.9	6.6	4.8	4.4	30.8	15.5	38.1	63.6	19.7	20.0	12.9	5.0	225.3	
1933	6.8	7.2	9.6	9.5	7.9	10.3	10.9	20.0	10.8	6.8	6.0	7.9	113.7	
1934	4.7	6.0	7.1	9.4	8.0	9.6	8.7	5.6	3.5	4.1	6.5	5.3	78.5	
1935	6.3	6.7	9.5	9.3	9.7	11.0	28.5	31.6	11.3	6.1	7.0	4.5	141.5	
1936	6.1	8.0	8.3	7.5	14.1	11.5	29.1	10.3	5.0	14.0	8.0	5.8	118.7	
1937	8.4	6.9	6.3	6.1	13.7	21.8	39.2	67.7	15.5	13.1	5.8	7.7	212.2	
1938	6.2	7.5	11.2	9.8	9.5	34.1	48.2	43.3	10.9	5.8	8.1	8.4	203.0	
1939	7.1	7.2	9.3	9.4	7.9	12.1	20.3	9.6	4.7	4.2	4.4	25.0	121.2	
1940	8.2	6.8	6.8	12.1	14.1	14.0	20.0	12.3	4.9	4.2	4.2	16.0	123.6	
1941	6.4	6.7	11.5	9.1	15.0	25.7	37.5	87.0	20.1	12.8	8.5	6.6	246.9	
1942	15.9	11.7	11.2	11.2	9.7	14.2	40.5	30.2	9.4	6.6	8.4	4.7	173.7	2/
1943	8.0	8.5	7.8	9.1	11.9	19.0	27.3	14.5	5.9	4.9	7.5	5.4	129.8	
1944	7.7	6.6	8.5	9.1	9.6	13.8	19.4	42.1	11.4	5.1	4.7	4.3	142.3	
1945	5.2	8.6	7.5	7.9	9.4	12.3	18.4	25.5	6.5	4.5	8.5	5.9	120.2	
14-45 Mean	8.5	8.7	9.8	9.7	11.2	16.2	26.2	31.4	10.0	9.2	9.7	9.6	160.2	

Subsequent Records

1946	9.3	8.3	8.0	7.4	6.3	10.7	11.7	7.2	3.7	4.6	5.8	3.8	86.8	2/
1947	11.1	9.6	9.9	9.1	7.9	12.9	16.8	16.4	5.7	4.1	8.7	5.0	117.2	2/
1948	6.8	6.7	8.5	7.5	7.2	7.8	15.9	13.6	5.6	3.6	5.2	3.6	92.0	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

VIRGIN RIVER AT LITTLEFIELD, ARIZONA

Location: Lat. 36°53', long. 113°56', in SW¼SW¼ sec. 4, T. 40 N., R. 15 W., three-eighths of a mile downstream from Beaverdam Wash, and three-eighths of a mile upstream from Littlefield.

Drainage Area: 5,092 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	13.6	19.6	15.4	25.7	34.3	39.5	62.3	42.9	12.4	20.3	12.9	8.4	307.3	
1915	14.8	13.4	13.1	12.4	18.4	25.1	35.7	60.5	15.5	7.5	4.6	37.9	258.9	
1916	17.9	24.5	18.9	23.8	26.7	124.5	68.1	41.7	13.5	26.9	122.0	19.2	527.7	
1917	36.6	13.9	12.8	15.9	21.7	12.9	26.7	40.8	13.9	18.6	58.3	5.7	277.8	
1918	10.8	14.3	14.6	13.1	8.3	96.4	21.8	27.8	6.0	13.4	16.1	23.5	266.1	
1919	20.9	16.5	16.1	14.2	12.6	23.6	25.6	10.5	5.0	5.8	16.2	20.1	187.1	
1920	14.6	18.0	17.1	18.2	29.9	26.1	26.5	44.9	9.8	3.1	64.8	6.1	279.1	
1921	17.0	25.1	20.9	20.2	18.0	31.9	23.2	22.9	7.7	12.5	41.2	20.8	261.4	1/
1922	25.7	23.1	37.7	29.8	43.0	61.5	47.5	97.8	23.7	28.0	80.2	24.3	522.3	
1923	17.0	16.1	16.4	17.6	18.8	20.8	43.0	43.1	7.9	16.2	61.6	8.1	286.6	
1924	10.8	16.9	13.9	17.0	7.4	3.1	9.1	7.7	3.1	7.8	3.1	20.7	120.6	
1925	8.0	12.9	14.3	17.2	18.3	8.4	13.0	6.3	4.9	7.5	20.2	19.0	150.0	
1926	3.2	5.7	12.2	12.9	5.2	3.1	49.0	26.5	4.6	6.0	3.5	6.6	138.5	
1927	6.5	21.0	14.6	16.2	27.5	25.8	28.7	21.1	5.4	6.9	40.5	39.8	254.0	
1928	35.6	12.2	12.6	12.5	29.4	28.8	18.8	9.5	3.0	3.1	3.1	3.0	171.6	
1929	3.1	8.1	11.0	10.7	10.9	14.6	16.7	19.2	3.9	13.9	74.9	39.5	226.5	
1930	5.3	7.6	9.0	13.8	14.5	9.9	8.5	28.1	6.7	6.7	52.5	25.5	188.1	
1931	16.0	18.4	13.1	14.5	17.2	7.9	5.5	4.2	3.3	3.9	9.0	6.3	119.3	
1932	5.4	16.9	11.8	9.6	76.3	41.6	45.9	63.3	20.5	23.4	60.0	7.2	381.9	
1933	10.6	10.0	16.0	14.2	13.3	12.3	9.2	17.7	6.9	7.5	4.8	5.0	127.5	
1934	5.6	7.7	12.3	12.5	10.2	7.2	3.7	3.4	3.3	4.1	3.9	4.1	78.0	2/
1935	5.1	6.8	13.0	14.3	13.6	15.1	34.8	31.7	8.2	4.7	12.3	5.3	164.9	
1936	4.0	7.3	11.0	8.7	17.6	12.6	17.7	9.0	4.0	18.7	11.9	8.5	131.0	
1937	11.8	12.3	11.8	9.4	29.1	41.6	47.0	46.3	8.9	7.8	4.3	10.0	240.3	
1938	5.8	8.4	15.5	17.2	17.9	84.9	56.8	44.2	6.6	4.6	11.2	5.5	278.6	
1939	7.4	11.3	14.2	15.5	13.0	14.9	15.2	8.7	3.6	3.6	3.6	43.9	154.9	
1940	9.0	7.8	9.8	20.3	39.6	17.6	14.3	5.6	3.3	3.3	6.7	36.4	173.7	
1941	9.1	10.2	13.0	14.9	30.8	62.1	62.2	130.5	19.3	22.0	20.4	5.5	400.0	
1942	22.8	18.9	17.4	19.7	15.5	20.2	49.9	28.3	5.1	4.2	8.9	4.0	214.9	3/
1943	9.1	10.3	11.3	17.9	20.8	36.3	34.1	11.6	4.0	4.2	12.6	5.9	178.1	
1944	8.7	10.1	12.9	13.3	15.0	25.7	25.2	48.9	10.6	4.0	4.1	4.2	182.7	
1945	5.0	12.9	11.6	11.3	17.6	20.4	19.6	24.8	4.7	4.6	25.8	8.0	166.3	
14-45 Mean	12.4	13.7	14.5	15.8	21.6	30.5	30.2	32.2	8.1	10.1	27.4	15.2	231.7	

Subsequent Records

1946	19.8	10.4	14.1	13.1	9.7	10.6	11.6	4.6	4.0	6.2	13.3	3.9	121.3	3/
1947	37.0	32.8	22.1	15.1	12.3	13.4	15.8	16.7	4.3	4.7	13.9	4.2	192.3	3/
1948	8.1	9.2	13.8	10.6	12.2	12.7	20.0	10.2	4.1	4.2	5.4	5.9	116.4	3/

1/ Estimated.
2/ Geological Survey Water-Supply Paper 1049.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS FROM LAKE MEAD TO HENDERSON, NEVADA, AREA

Location: Diversion by pumping from Lake Mead 6 miles above Hoover Dam to Henderson, Nevada, area (10 miles northwest of Boulder City, Nevada) for municipal and industrial use began April 7, 1942.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1942													1.3	1/
1943	0.4	0.5	0.6	1.0	1.3	1.7	0.9	1.2	1.3	1.9	2.0	1.8	14.6	2/
1944	1.4	1.4	1.3	1.2	0.9	1.0	1.2	1.2	1.2	1.5	1.4	1.2	14.9	2/
1945	1.0	0.6	0.4	0.5	0.4	0.5	0.5	0.7	0.8	0.8	0.7	0.5	7.4	2/
14-45 Mean	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2	

Subsequent Records

1946	0.4	0.3	0.2	0.2	0.2	0.2	0.3	0.5	0.5	0.7	0.7	0.7	4.9	2/
1947	0.6	0.4	0.3	0.4	0.3	0.4	0.5	0.7	0.7	0.7	0.8	0.6	6.4	2/
1948	0.5	0.4	0.2	0.3	0.2	0.3	0.3	0.4	0.5	0.7	0.6	0.6	5.0	2/

1/ Diversion of 1,335 acre-feet for period April 7 to September 30,1942 published in Geological Survey Water-Supply Paper 979. Monthly distribution not available.

2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER BELOW HOOVER DAM, ARIZONA-NEVADA

Location: Lat. 36°00'15", long. 114°44'35", in SW¼NE¼ sec. 10, T. 30 N., R. 23 W. Gila and Salt River meridian, or NW¼NE¼ sec 32, T. 22 S., R. 65 E., Mount Diablo Meridian, 1 mile downstream from Hoover Dam.

Drainage Area: 167,750 square miles at Hoover Dam.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	722.4	559.5	448.0	526.6	584.4	1032.0	1622.0	4174.0	6594.0	3049.0	1467.0	728.4	21,507.3	
1915	915.0	679.3	499.3	469.5	890.9	750.8	1659.0	3219.0	2990.0	1903.0	801.8	401.8	15,179.4	
1916	549.1	442.5	407.1	685.0	[illegible]	1543.0	1813.0	4187.0	3647.0	2216.0	1811.0	771.5	18,895.2	
1917	1420.0	741.4	463.7	454.5	412.2	564.1	1327.0	3503.0	5411.0	5384.0	1495.0	652.8	21,828.7	
1918	571.1	497.0	461.0	460.9	346.0	871.6	920.9	2263.0	3788.0	2597.0	802.8	535.1	14,114.4	
1919	578.9	544.7	479.0	266.4	392.2	592.0	1387.0	2796.0	2210.0	1277.0	729.1	403.8	11,656.1	
1920	428.3	486.8	666.4	733.2	1952.0	1006.0	1307.0	3557.0	7683.0	2585.0	1223.0	593.2	22,220.9	
1921	516.5	688.1	484.2	473.7	471.9	943.0	998.4	3363.0	6630.0	2730.0	1959.0	1161.0	20,418.8	
1922	619.9	532.3	629.3	522.6	564.3	926.9	1311.0	4327.0	5865.0	1948.0	879.8	611.8	18,737.9	17
1923	386.4	425.1	460.0	390.3	362.6	533.8	1297.0	3633.0	5153.0	2554.0	1556.0	1347.0	18,098.2	
1924	876.4	904.8	657.2	564.2	556.4	616.7	1751.0	3040.0	3242.0	1272.0	412.7	336.9	14,230.3	
1925	408.7	459.3	398.1	281.2	440.9	645.0	1335.0	2032.0	2415.0	1633.0	785.2	1213.0	12,046.4	
1926	1095.0	650.1	470.9	399.3	362.7	594.3	1579.0	3348.0	3696.0	1506.0	610.1	329.3	14,640.7	
1927	500.7	343.1	427.0	377.5	532.9	682.0	1224.0	3845.0	3524.0	2746.0	1041.0	2181.0	17,424.2	
1928	1079.0	803.4	499.5	490.1	499.6	663.8	1013.0	4023.0	3931.0	1668.0	706.7	401.5	15,778.6	
1929	591.1	591.1	405.0	362.4	365.0	891.5	1723.0	3576.0	4805.0	2104.0	2276.0	1670.0	19,360.1	
1930	1014.0	601.6	493.3	355.5	415.1	621.8	1510.0	2022.0	3031.0	1235.0	1733.0	603.7	13,635.6	
1931	617.6	507.0	363.8	308.1	424.4	448.4	554.8	1124.0	1464.0	580.4	365.9	260.3	7,018.7	
1932	592.7	432.7	294.7	363.9	848.4	865.9	1761.0	3789.0	3607.0	2331.0	862.6	755.2	16,504.1	
1933	387.1	420.2	361.7	308.8	310.6	561.7	523.2	1265.0	3947.0	1401.0	462.1	411.8	10,360.2	
1934	482.7	330.2	405.8	378.1	355.4	393.5	439.8	1111.0	631.3	171.1	161.8	197.1	5,057.8	
1935	191.1	209.4	273.2	326.2	212.1	433.2	434.2	567.1	983.8	705.3	626.1	594.4	5,556.1	24
1936	604.6	572.2	299.8	297.6	325.5	559.7	588.0	559.4	610.4	696.2	612.5	555.8	6,281.7	
1937	453.7	360.4	315.3	292.6	312.1	514.2	554.2	547.1	587.4	669.0	664.1	556.3	5,826.4	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER BELOW HOOVER DAM, ARIZONA-NEVADA (Continued)

Location: Lat. 36°00'15", long. 114°44'35", in SW¼NE¼ sec. 10, T. 30 N., R. 23 W., Gila and Salt River meridian, or NW¼NE¼ sec. 32, T. 22 S., R. 65 E., Mount Diablo meridian, 1 mile downstream from Hoover Dam.

Drainage Area: 167,750 square miles at Hoover Dam.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1938	506.1	413.3	401.5	390.2	361.5	465.3	579.0	554.3	623.8	680.3	636.1	556.2	6,167.6	2/
1939	773.9	745.2	398.6	770.8	1282.4	623.8	629.2	599.2	632.7	691.8	717.8	607.9	8,473.3	
1940	676.1	710.8	702.4	681.8	464.7	634.5	622.5	575.3	582.3	673.0	675.8	695.2	7,694.4	
1941	796.3	775.7	795.9	589.2	500.1	552.0	518.1	1435.0	1810.0	950.9	1429.0	1576.0	11,728.2	
1942	1641.0	1817.0	2071.0	2011.0	1550.0	1425.0	1301.0	1343.0	1561.0	1285.0	846.4	1025.0	17,876.4	3/
1943	1163.0	1095.0	1157.0	1109.0	823.1	970.5	915.4	1029.0	1040.0	1109.0	1042.0	1042.0	12,495.0	
1944	1179.0	1179.0	1277.0	1303.0	1269.0	1307.0	1170.0	1216.0	1097.0	1111.0	1211.0	1132.0	14,451.0	
1945	1226.0	1186.0	1199.0	1239.0	1100.0	1250.0	1042.0	1068.0	1014.0	860.7	884.6	869.2	12,938.5	
14-45 Mean	736.4	647.0	583.3	568.2	628.5	765.1	1106.6	2302.8	2962.7	1635.1	984.0	774.3	13,694.0	
Subsequent Records														
1946	1080.0	1042.0	1062.0	1116.0	1047.0	1004.0	872.3	902.7	816.9	837.6	750.9	758.6	11,290.0	3/
1947	856.5	762.1	859.3	983.5	886.1	955.8	858.6	951.3	918.5	925.3	865.0	843.0	10,665.0	3/
1948	828.1	880.1	1063.0	1169.0	1138.0	1150.0	1202.0	1142.0	1076.0	1156.0	967.7	981.1	12,753.0	3/

1/ Estimated.

2/ Geological Survey Water-Supply Paper 918. Published as Colorado River near Willow Beach, Arizona, for site 9 miles downstream from October 1933 to November 1939.

3/ Geological Survey annual Water-Supply Papers. Published as Colorado River below Boulder Dam until 1946.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER NEAR TOPOCK, ARIZONA

Location: Lat. 34°41'15", long. 114°27'45", in NW¼ sec. 13, T. 15 N., R. 21 W., Gila and Salt River meridian, in Mohave Canyon, 3 miles downstream from Topock, 39.5 miles upstream from Parker Dam, and 49 miles downstream from Davis Dam.

Drainage Area: 172,257 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	691.6	543.0	439.2	506.0	572.3	1012.0	1557.0	3989.0	6629.0	3060.0	1406.0	698.9	21,104.0	
1915	878.9	658.1	489.8	450.3	882.6	735.2	1593.0	3077.0	2978.0	1893.0	767.9	384.7	14,788.5	
1916	523.1	430.5	398.8	660.4	813.8	1516.0	1740.0	4002.0	3643.0	2212.0	1736.0	740.3	18,415.9	
1917	1370.0	717.7	454.7	435.7	398.0	551.3	1275.0	3349.0	5430.0	5437.0	1433.0	626.1	21,477.5	
1918	544.5	482.9	452.0	441.9	330.9	854.3	887.2	2164.0	3786.0	2599.0	768.9	512.9	13,824.5	1/
1919	552.1	528.7	469.8	252.3	377.7	578.7	1333.0	2673.0	2187.0	1256.0	698.2	386.6	11,293.1	
1920	405.6	473.1	654.9	707.3	1957.0	986.7	1256.0	3400.0	7732.0	2587.0	1172.0	568.8	21,900.4	
1921	491.4	666.5	474.9	454.4	458.4	924.6	961.3	3215.0	6665.0	2735.0	1878.0	1115.0	20,039.5	
1922	591.9	516.8	618.2	502.1	551.9	908.8	1260.0	4136.0	5890.0	1939.0	842.8	586.7	18,344.2	
1923	364.9	413.8	451.0	373.1	347.7	521.4	1247.0	3473.0	5169.0	2556.0	1492.0	1294.0	17,702.9	
1924	841.4	874.7	645.8	542.6	543.9	603.1	1681.0	2906.0	3233.0	1251.0	394.6	322.2	13,839.3	
1925	386.6	446.7	389.9	266.8	427.0	631.0	1283.0	1944.0	2395.0	1618.0	752.0	1165.0	11,705.0	
1926	1054.0	630.0	461.8	381.9	347.8	581.0	1516.0	3201.0	3693.0	1489.0	584.0	314.9	14,254.4	
1927	476.0	335.0	418.4	360.6	520.1	667.4	1177.0	3675.0	3519.0	2751.0	997.7	2096.0	16,993.2	
1928	1038.0	777.3	490.0	470.4	486.4	649.5	975.1	3845.0	3931.0	1654.0	676.7	384.4	15,377.8	
1929	563.9	573.3	396.7	345.9	350.2	873.9	1654.0	3418.0	4816.0	2098.0	2182.0	1605.0	18,876.9	
1930	975.3	583.4	483.9	338.8	400.9	608.1	1450.0	1934.0	3019.0	1213.0	1661.0	578.9	13,246.3	2/
1931	589.7	492.5	356.0	293.0	410.3	437.2	537.3	1076.0	1432.0	546.5	349.7	248.5	6,768.7	
1932	565.5	421.1	287.8	347.4	839.5	848.7	1690.0	3622.0	3603.0	2329.0	826.3	724.6	16,104.9	
1933	365.6	409.1	353.9	293.7	295.1	548.9	507.1	1211.0	3947.0	1382.0	442.0	394.3	10,149.7	
1934	464.5	316.8	392.4	364.5	345.1	381.7	413.6	1078.0	641.6	150.7	135.9	185.1	4,869.9	
1935	170.0	192.1	257.6	313.3	198.4	409.7	409.7	518.6	932.2	674.1	584.3	564.6	5,224.6	
1936	579.0	560.4	295.8	288.4	316.4	540.7	567.9	534.3	564.8	660.1	583.2	534.2	6,025.2	
1937	438.0	347.5	299.4	286.6	285.7	494.4	529.5	527.6	554.9	642.2	639.7	531.2	5,576.7	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER NEAR TOPOCK, ARIZONA (Continued)

Location: Lat. 34°41'15", long. 114°27'45", in NW¼ sec. 13, T. 15 N., R. 21 W., Gila and Salt River meridian, in Mohave Canyon, 3 miles downstream from Topock, 39.5 miles upstream from Parker Dam, and 49 miles downstream from Davis Dam.

Drainage Area: 172,257 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	484.2	403.4	388.5	372.3	346.5	450.9	565.2	538.5	590.5	660.7	624.2	542.4	5,967.3	2/
1939	740.7	752.5	395.5	659.4	1280.4	646.5	618.2	570.8	595.6	650.8	672.4	605.6	8,188.4	↑
1940	642.6	684.4	687.1	682.6	469.5	594.1	626.0	556.7	540.2	641.0	655.0	680.8	7,460.0	
1941	774.3	762.8	807.3	596.9	496.8	568.9	510.7	1314.0	1831.0	954.4	1344.0	1521.0	11,482.1	
1942	1586.0	1750.0	2041.0	1953.0	1577.0	1410.0	1185.0	1298.0	1505.0	1315.0	818.2	955.2	17,393.4	3/
1943	1148.0	1069.0	1122.0	1068.0	793.2	921.3	890.0	980.4	965.8	1051.0	988.2	997.7	11,994.6	
1944	1151.0	1128.0	1222.0	1251.0	1232.0	1248.0	1148.0	1146.0	1064.0	1053.0	1144.0	1094.0	13,881.0	
1945	1164.0	1136.0	1192.0	1183.0	1064.0	1239.0	1003.0	980.6	934.2	835.8	824.5	813.8	12,369.9	↓
14-45 Mean	706.6	627.4	571.5	545.1	616.1	748.2	1064.0	2198.5	2950.5	1621.7	939.8	742.9	13,332.3	

Subsequent Records

1946	990.5	995.9	1073.0	1054.0	1017.0	993.5	844.4	879.5	778.7	784.5	729.8	723.5	10,864.3	3/
1947	811.5	774.0	842.8	970.1	897.1	963.8	811.3	956.8	892.0	871.9	870.1	794.4	10,455.8	3/
1948	814.2	807.4	1057.0	1188.0	1166.0	1126.0	1191.0	1154.0	1003.0	1137.0	966.7	962.8	12,573.1	3/

1/ Estimated. The Geological Survey does not consider that the accuracy of records prior to 1924 warrant detailed comparison with records at other stations on the Colorado River.

2/ Geological Survey Water-Supply Paper 918.

3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

BILL WILLIAMS RIVER AT PLANET, ARIZONA

Location: Lat. 34°16', long. 113°59', in NE¼ sec. 36, T. 11 N., R. 17 W., 1 mile west of Planet and 6 miles upstream from water line of Havasu Lake at elevation 450 feet above mean sea level.

Drainage Area: 5,144 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	1.1	1.0	1.0	12.2	50.4	3.7	1.5	1.4	1.5	1.5	1.5	1.4	78.2	*
1915	2.0	1.6	1.8	23.3	59.5	6.5	1.9	7.5	5.7	2.2	1.8	2.0	115.8	*
1916	*1.1	*1.3	*1.2	110.8	81.7	52.1	14.4	3.6	2.6	2.8	10.6	30.2	312.4	
1917	1.4	1.3	4.6	5.8	44.5	28.3	7.9	2.0	1.4	1.5	5.7	16.4	120.8	
1918	1.1	1.0	3.6	4.6	34.9	22.2	6.2	1.5	1.1	1.2	4.5	12.9	94.8	
1919	2.4	2.1	7.7	9.8	74.4	47.4	13.1	3.3	2.4	2.5	9.6	27.5	202.2	
1920	3.1	2.7	9.6	12.3	93.4	59.5	16.5	4.1	3.0	3.2	12.1	34.5	254.0	
1921	1.0	0.9	3.1	4.0	30.5	19.5	5.4	1.3	1.0	1.0	4.0	11.3	83.0	
1922	2.5	2.2	7.9	10.2	77.2	49.2	13.6	3.4	2.5	2.6	10.0	28.5	209.8	1/
1923	2.0	1.7	6.2	8.0	60.4	38.5	10.7	2.6	2.0	2.0	7.8	22.3	164.2	
1924	0.6	0.6	2.0	2.5	19.3	12.3	3.4	0.8	0.6	0.7	2.5	7.1	52.4	
1925	1.4	1.2	4.4	5.6	42.4	27.0	7.5	1.8	1.4	1.4	5.5	15.6	115.2	
1926	1.7	1.5	5.3	6.7	51.3	32.7	9.1	2.2	1.7	1.7	6.6	18.9	139.4	
1927	5.2	4.6	16.4	20.9	159.0	101.4	28.1	7.0	5.1	5.4	20.6	58.7	432.4	
1928	0.3	0.2	0.8	1.0	7.8	5.0	1.4	0.3	0.3	0.3	1.0	2.9	22.3	
1929	1.2	1.3	1.1	1.1	1.1	1.2	1.0	1.1	1.0	0.9	3.5	16.7	31.2	
1930	1.0	1.1	1.3	1.0	1.0	7.6	0.9	1.1	1.0	0.9	2.1	14.0	33.0	
1931	1.0	1.3	1.0	1.0	22.1	1.1	2.0	1.4	1.0	1.1	64.2	11.7	108.9	
1932	1.4	1.2	13.8	4.9	269.3	22.1	1.4	1.1	1.0	1.1	1.4	0.9	319.6	
1933	1.2	1.3	1.4	1.2	1.1	1.6	0.9	1.3	0.9	0.8	0.8	0.8	13.3	*
1934	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.6	0.6	3.2	1.1	11.6	
1935	0.6	0.6	2.0	9.8	60.8	25.5	1.4	1.4	1.3	1.2	2.4	3.2	110.2	
1936	1.1	1.1	1.1	1.1	1.2	1.0	0.9	0.8	0.8	4.9	6.5	1.3	21.8	
1937	0.9	1.0	1.9	2.5	209.1	27.4	3.1	1.3	1.2	1.3	1.2	2.1	253.0	
1938	1.7	1.1	1.2	1.1	1.1	100.5	1.2	1.0	1.1	1.1	0.9	0.9	112.9	
1939	0.9	1.0	2.1	1.0	1.5	1.1	0.9	0.8	0.8	0.8	1.0	219.6	231.5	
1940	2.8	1.5	1.5	1.9	12.6	2.1	1.9	1.5	1.3	1.3	1.2	1.2	30.8	
1941	1.9	1.2	40.6	27.4	65.4	170.6	109.0	5.9	1.0	1.4	4.1	8.3	436.8	
1942	1.4	1.4	3.3	8.5	2.7	2.3	1.4	1.4	1.1	1.3	1.1	0.9	26.8	2/
1943	1.1	1.1	1.1	1.2	0.9	2.9	1.2	0.9	0.9	0.9	1.1	0.9	14.2	
1944	1.3	1.0	1.0	1.0	23.0	78.1	2.3	1.5	1.3	1.3	1.2	1.4	114.4	
1945	1.2	1.2	1.4	1.3	1.1	43.6	3.8	1.5	1.2	1.2	1.6	1.0	60.1	
14-45 Mean	1.5	1.3	4.8	9.5	48.8	31.1	8.6	2.1	1.6	1.6	6.3	18.0	135.2	

Subsequent Records

1946	1.0	1.1	1.6	1.1	1.0	1.0	1.3	0.8	0.7	0.9	1.0	0.8	12.3	2/
1947	0.5	0.7	9.7	2.0	1.0	0.9	0.6	0.5	0.4	0.4	1.0	0.9	18.6	1/
1948	0.4	0.6	0.6	0.6	0.7	0.7	0.6	0.5	0.4	0.5	1.4	0.3	7.3	1/

* Geological Survey Water-Supply Paper 1049.

1/ Estimated except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS TO COLORADO RIVER AQUEDUCT 1/

Location: Diversion by pumping from Havasu Lake at pumping plant of Metropolitan Water District of Southern California, lat. 34°19', long. 114°09', in SW¼ sec. 28, T. 3 N., R. 27 E., San Bernardino Meridian, 1.8 miles upstream from Parker Dam.
Diversions began January 7, 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1939				5.9	24.3	6.9	7.0	11.1	11.8	12.2	25.7	16.6	121.5	
1940	13.0	24.7	13.2	-13.5	-1.8	23.0	8.0	10.6	11.5	13.5	6.3	12.7	121.2	
1941	14.3	11.1	0	4.8	0.2	2.3	3.7	2.7	3.9	1.3	3.5	4.8	52.6	
1942	0.4	1.7	1.5	2.9	0	0	2.8	4.1	0	0	0	0	13.4	2/
1943	13.6	7.7	0	2.7	0	0.4	3.8	7.9	11.4	1.8	1.9	1.2	52.4	
1944	1.5	2.0	0	2.2	4.6	9.8	0	1.3	2.0	1.2	7.3	5.4	37.3	
1945	5.3	5.9	6.7	0	1.9	0	8.4	9.3	3.5	1.2	13.7	9.7	65.6	
14-45 Mean	1.5	1.6	0.7	0.2	0.9	1.3	1.0	1.5	1.4	1.0	1.8	1.6	14.5	

Subsequent Records

1946	8.6	2.0	0	3.1	3.4	4.6	1.7	12.6	10.6	1.1	0	17.4	65.1	2/
1947	25.9	0	0	0	0	0.4	4.7	15.0	25.1	18.3	0	0	89.4	2/
1948	7.4	2.4	12.0	10.8	12.9	12.6	25.9	26.3	17.2	13.4	14.2	25.4	180.5	2/

1/ Records are those of flow diverted to Colorado River Aqueduct by pumping from Havasu Lake less flow returned to Havasu Lake from Gene Reservoir and flow returned to Colorado River from Copper Basin Reservoir. Return surface flows greater than diversions account for the negative quantities listed for some months.

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER NEAR RED ROCK, NEW MEXICO

Location: Lat. 32°43'30", long. 108°40'30", in W½ sec. 23, T. 18 S., R. 18 W., 4 miles northeast of Red Rock and 14 miles downstream from Mangas Creek.

Drainage Area: 2,857 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	11.9	14.5	9.6	10.7	13.3	16.4	11.9	8.0	4.9	48.7	27.2	16.8	193.9	1/
1915	29.7	24.2	78.5	52.0	34.3	77.5	81.2	33.8	13.4	28.9	22.7	12.1	488.3	
1916	9.3	6.8	8.2	55.5	35.0	32.0	17.1	14.5	5.2	19.0	34.0	50.6	287.2	
1917	50.0	9.9	9.2	18.2	19.6	32.9	24.0	13.5	6.6	4.9	4.7	3.6	197.1	
1918	3.5	3.4	4.0	5.1	5.2	14.0	4.3	4.2	3.3	2.5	5.2	2.8	57.5	
1919	6.3	6.3	9.7	8.0	15.6	43.9	59.1	22.7	8.5	31.3	17.1	10.3	238.8	
1920	6.5	7.9	12.4	15.8	56.4	24.2	17.5	20.3	9.9	4.2	11.0	6.5	192.6	
1921	4.3	10.1	4.7	5.4	2.8	6.4	4.0	4.9	5.6	15.8	35.4	9.2	108.6	
1922	2.1	4.0	3.5	5.7	6.2	5.2	4.0	3.0	2.5	7.7	3.0	3.7	50.6	2/
1923	3.2	3.3	6.3	4.6	5.5	18.5	11.9	7.1	2.3	9.8	37.7	32.9	143.1	
1924	6.3	7.6	18.8	22.1	12.8	14.8	45.7	23.6	6.4	3.5	2.4	2.4	166.4	
1925	3.6	4.1	4.4	4.3	3.6	3.7	2.5	2.5	3.4	6.1	10.1	16.4	64.7	
1926	8.6	6.3	5.9	5.8	4.2	18.2	40.4	25.0	4.0	9.0	8.0	7.0	142.4	
1927	12.5	10.9	17.2	10.3	15.8	21.8	12.0	8.7	6.7	9.2	10.7	7.1	142.9	
1928	5.3	5.6	6.0	5.7	7.3	17.1	14.3	7.6	3.3	2.8	6.2	4.7	85.9	
1929	4.5	6.2	7.3	6.2	4.1	4.4	4.0	2.1	1.7	5.0	35.3	8.8	89.6	
1930	7.4	6.7	6.1	5.9	5.2	20.9	20.1	6.7	3.2	16.4	25.4	9.1	133.1	
1931	4.8	5.7	5.5	4.9	17.2	18.5	25.4	22.8	4.1	8.1	20.4	19.7	157.1	
1932	8.8	7.1	7.3	8.2	34.8	45.0	21.8	12.7	5.0	9.6	16.9	4.6	181.8	
1933	5.3	5.4	6.1	5.7	11.4	29.3	9.9	7.0	7.3	6.3	6.9	7.1	107.7	
1934	9.3	6.4	7.6	5.6	4.7	4.0	3.3	1.7	0.9	1.8	12.6	5.4	63.3	1/
1935	3.7	4.6	5.2	8.7	14.2	14.2	10.0	5.8	3.2	1.4	17.4	12.9	91.1	
1936	5.5	5.4	6.3	6.0	15.5	15.5	14.2	6.7	2.2	4.7	3.2	9.5	94.7	
1937	5.3	5.4	6.1	6.8	63.1	66.7	30.8	13.1	5.1	5.0	4.1	9.9	221.4	
1938	5.9	5.0	5.6	5.5	4.8	23.7	8.2	5.2	1.8	8.8	3.4	17.3	95.2	
1939	4.2	5.1	5.9	6.0	5.5	19.0	12.4	4.0	1.3	3.1	7.9	8.4	82.8	
1940	24.6	5.8	6.1	7.5	39.5	23.3	10.9	6.4	3.6	3.3	10.4	5.6	147.0	
1941	4.8	6.3	31.2	52.3	55.5	73.5	47.9	45.5	10.1	7.4	13.3	104.4	452.2	
1942	38.7	12.9	19.0	14.7	9.8	15.5	17.1	8.7	2.9	3.3	9.0	14.6	166.2	3/
1943	5.6	5.3	7.1	6.1	6.3	19.4	6.1	3.2	2.0	6.5	5.8	3.6	77.0	
1944	5.3	5.1	5.4	4.7	4.8	5.6	5.2	3.9	1.7	6.7	19.7	6.5	74.6	
1945	6.1	7.0	7.6	9.3	13.2	19.5	20.5	11.8	2.8	4.3	13.0	1.4	116.5	
14-45 Mean	9.8	7.2	10.7	12.3	17.1	23.9	19.3	11.5	4.5	9.5	14.1	13.6	153.5	

Subsequent Records

1946	5.6	4.2	4.8	5.8	5.0	4.6	2.7	1.9	0.7	2.3	6.9	8.8	53.3	3/
1947	4.8	7.5	6.4	6.2	4.6	3.9	3.1	2.5	1.7	1.1	11.5	5.2	58.5	3/
1948	2.4	3.9	4.5	4.3	5.7	19.4	18.0	4.8	2.9	2.6	3.7	2.3	74.5	3/

1/ Geological Survey Water-Supply Paper 1049 through December 1914.
2/ Records and estimates in reports of State Engineer of New Mexico.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER BELOW BLUE CREEK, NEAR VIRDEN, NEW MEXICO

Location: Lat. 32°39', long. 108°51', in SE¼SW¼ sec. 18, T. 19 S., R. 19 W., at head of canyon, 1¼ miles downstream from Blue Creek, 10 miles east of Virden, and 16 miles upstream from State line.

Drainage Area: 3,218 square miles, excluding Animas River Basin.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	*13.2	*14.1	*9.9	*11.0	*12.9	*15.4	*10.9	6.7	7.5	61.8	32.9	16.6	212.9	1/
1915	44.3	22.9	*83.6	*51.4	*31.3	112.5	96.6	39.0	13.6	33.5	23.8	8.7	561.2	1/
1916	10.1	6.9	8.5	54.8	31.9	29.9	15.8	14.4	4.8	22.3	38.5	48.4	286.3	
1917	56.8	9.8	9.6	18.3	18.4	30.7	22.2	13.4	6.3	4.7	4.8	4.5	199.5	
1918	3.5	3.6	4.0	5.5	5.8	13.2	3.8	4.0	2.8	1.7	5.4	3.8	57.1	
1919	6.7	6.4	10.1	8.3	14.9	41.0	55.2	22.7	8.3	37.7	19.1	10.8	241.2	
1920	7.0	7.8	12.9	16.0	50.7	22.6	16.1	20.3	9.8	3.9	12.1	7.3	186.5	
1921	4.4	9.9	4.8	5.7	3.7	6.1	3.4	4.7	5.3	18.3	40.1	9.8	116.2	2/
1922	2.0	4.2	3.4	6.0	6.7	5.0	3.5	2.7	2.0	8.2	2.9	4.7	51.3	
1923	3.2	3.6	6.4	5.0	6.0	17.3	10.9	6.9	1.8	10.8	42.8	31.9	146.6	
1924	6.8	7.6	19.7	22.1	12.5	13.9	42.6	23.7	6.1	3.0	2.1	3.4	163.5	
1925	3.7	4.3	4.4	4.7	4.4	3.5	2.1	2.2	2.9	6.3	11.0	16.5	66.0	
1926	9.4	6.4	6.0	6.1	4.9	17.1	37.7	25.1	3.6	9.8	8.6	7.7	142.4	
1927	*13.9	*10.7	*18.1	*10.5	*15.1	*20.4	*11.0	*8.5	*6.4	10.7	10.9	17.4	153.6	
1928	5.6	5.3	6.3	5.7	6.4	15.2	7.6	10.7	1.9	5.6	11.4	4.9	86.6	
1929	5.0	6.4	5.1	5.3	5.1	5.2	4.1	2.8	0.7	10.4	36.7	11.3	98.1	
1930	10.7	7.2	6.0	5.5	5.0	18.9	16.1	5.7	2.0	13.9	32.9	6.8	130.7	
1931	4.3	5.2	5.3	5.1	18.0	14.8	22.6	24.3	3.2	7.2	24.3	20.1	154.4	
1932	9.7	7.2	7.9	9.0	35.6	45.0	23.3	12.7	3.5	12.4	17.2	4.4	187.9	1/
1933	7.4	5.4	6.4	6.5	14.5	27.8	10.8	7.2	7.5	5.9	7.2	11.4	118.0	
1934	10.1	6.7	8.5	6.3	5.3	4.1	3.9	1.2	0.5	0.9	22.3	7.7	77.5	
1935	4.2	4.7	6.0	9.1	13.9	14.9	9.3	5.1	2.5	0.4	6.9	18.0	95.0	
1936	5.4	6.3	7.4	6.8	15.2	13.7	11.5	5.6	2.0	4.8	2.7	9.8	91.2	
1937	5.1	6.4	6.4	7.4	52.8	61.6	30.9	12.6	5.2	5.5	4.6	9.3	207.8	
1938	5.3	5.1	5.7	6.0	4.9	20.4	8.0	5.0	1.1	7.4	4.2	14.6	87.7	
1939	3.7	5.0	6.4	6.6	5.8	17.0	9.9	3.8	0.7	2.0	7.0	6.6	74.5	
1940	22.2	6.1	6.3	7.8	33.3	23.9	10.4	5.7	2.7	2.4	8.4	6.9	136.1	
1941	4.6	6.3	34.0	51.6	52.9	67.9	44.2	41.7	9.3	7.0	13.1	77.3	409.9	
1942	39.0	12.9	18.2	15.2	10.4	15.2	16.1	8.3	2.5	2.7	8.4	15.0	163.9	3/
1943	5.0	5.4	7.3	6.7	6.0	17.9	5.6	2.4	1.7	6.2	5.1	3.9	73.2	
1944	5.1	4.6	5.6	5.1	5.0	5.2	4.9	3.0	1.0	5.4	22.4	6.5	73.8	
1945	5.8	7.3	8.1	9.9	12.7	18.8	20.8	12.1	2.5	3.1	12.0	0.8	113.9	
14-45 Mean	10.7	7.2	11.2	12.5	16.3	23.6	18.5	11.4	4.1	10.5	15.7	13.3	155.0	

Subsequent Records

1946	7.6	4.3	4.9	5.9	5.1	4.6	2.2	1.0	0.3	1.1	7.1	8.2	52.3	3/
1947	4.1	7.3	6.2	6.3	4.2	3.6	2.5	1.5	1.1	0.5	10.4	5.1	52.8	3/
1948	1.9	3.4	4.2	4.6	5.3	17.7	16.5	4.0	2.1	2.1	3.4	1.4	66.6	3/

1/ Geological Survey Water-Supply Paper 1049 except (*), estimated.
2/ Estimated.
3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER NEAR CLIFTON, ARIZONA

Location: Lat. 32°57'55", long. 109°18'25", in NE¼SE¼ sec. 25, T. 5 S., R. 29 E., at highway bridge on U. S. Highway 666, 6 miles upstream from San Francisco River, and 7 miles south of Clifton.

Drainage Area: 4,037 square miles; 45 square miles less at Guthrie.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	18.9	16.1	14.7	12.2	13.9	14.8	9.1	1.6	4.8	57.4	44.8	18.1	226.4	
1915	42.3	23.0	146.9	52.4	92.5	108.6	100.5	30.9	8.3	34.7	24.2	9.2	673.5	
1916	5.2	6.8	6.8	83.3	61.0	67.9	27.5	18.2	3.3	6.7	26.4	24.0	337.1	1/
1917	82.3	11.3	8.8	66.0	21.4	25.9	20.6	10.3	3.3	2.3	5.7	2.1	260.0	
1918	2.6	3.9	5.0	5.8	5.0	10.9	2.6	1.6	1.7	* 5.1	* 5.1	* 1.3	* 50.6	
1919	4.5	5.7	8.2	12.6	13.5	34.4	45.8	15.4	3.8	41.4	36.2	10.0	231.5	
1920	9.5	9.1	16.8	22.5	52.3	26.4	23.1	12.2	5.9	3.6	12.4	4.9	198.7	
1921	3.7	8.0	6.7	7.0	5.4	5.2	2.4	2.1	2.2	25.0	76.6	12.2	156.5	
1922	5.8	4.9	6.8	8.1	5.5	5.7	4.2	2.3	1.5	2.3	11.3	3.3	61.7	
1923	2.8	4.0	7.0	6.0	5.3	10.2	4.0	2.5	1.2	15.1	83.4	26.1	167.6	*
1924	6.5	17.6	24.9	23.7	9.1	11.1	40.1	12.2	3.0	6.7	5.0	1.4	161.3	
1925	1.9	3.0	5.9	6.0	4.7	4.5	1.5	1.8	3.6	10.9	11.2	48.6	103.6	
1926	13.6	5.8	6.9	8.3	5.6	16.5	46.2	23.2	3.6	7.0	5.4	5.0	147.1	
1927	7.2	7.2	8.9	8.5	16.7	18.6	10.6	5.7	1.9	8.4	15.2	14.8	123.7	
1928	* 3.1	* 3.3	* 6.9	* 6.9	* 6.0	11.9	5.3	7.0	1.4	4.4	10.2	3.8	* 70.2	
1929	4.9	6.5	6.1	4.8	4.5	3.6	1.7	1.6	1.0	19.7	47.3	10.8	112.5	
1930	9.7	6.9	5.8	4.9	3.9	16.4	11.7	3.6	1.3	20.1	39.0	7.1	130.4	2/
1931	2.9	5.1	6.5	6.0	17.3	12.3	19.6	19.0	1.8	6.0	31.5	22.2	150.2	
1932	9.7	6.6	9.0	9.5	32.8	38.8	18.3	7.5	2.1	14.7	16.3	3.8	169.1	
1933	6.3	5.1	6.9	7.4	14.0	24.7	7.3	3.0	5.2	5.8	6.0	13.9	105.6	
1934	13.5	1.4	8.7	5.9	1.4	4.9	3.4	1.6	1.3	18.9	36.0	16.5	113.5	*
1935	* 2.8	* 1.9	* 5.8	*15.2	*18.3	* 16.4	* 4.3	2.2	1.1	1.0	8.3	14.2	* 91.5	2/
1936	3.3	5.4	7.5	6.9	14.6	10.2	6.5	2.1	1.3	3.7	6.2	8.9	76.6	2/
1937	3.3	5.6	6.3	7.4	46.5	55.8	24.4	8.2	3.3	3.2	4.5	11.4	179.9	2/

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER NEAR CLIFTON, ARIZONA (Continued)

Location: Lat. 32°57'55", long. 109°18'25", in NE¼SE¼ sec. 25, T. 5 S., R. 29 E., at highway bridge on U. S. Highway 666, 6 miles upstream from San Francisco River, and 7 miles south of Clifton.

Drainage Area: 4,037 square miles; 45 square miles less at Guthrie.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	5.0	4.5	6.2	6.7	4.0	16.6	4.0	2.5	1.9	6.1	6.3	16.0	79.8	2/
1939	2.6	4.8	6.0	6.0	4.8	12.5	7.7	2.4	1.0	2.0	10.5	8.0	68.3	
1940	22.7	4.3	5.5	7.2	30.5	20.2	7.2	2.9	2.4	3.3	9.0	7.5	122.7	
1941	4.3	7.2	28.9	51.1	53.1	60.7	39.3	38.8	7.0	6.1	12.7	57.9	367.1	
1942	48.8	13.5	18.3	15.3	9.8	12.6	12.1	6.0	2.0	2.0	7.7	14.9	163.0	3/
1943	4.0	5.2	7.4	7.4	5.3	15.0	3.6	1.8	4.2	5.7	7.4	6.0	73.0	
1944	3.7	3.7	5.1	5.7	5.1	3.5	4.6	2.8	1.4	5.3	18.1	6.9	65.9	
1945	4.5	7.7	7.8	10.4	11.6	15.0	16.4	8.1	1.9	2.7	15.1	1.7	102.9	
14-45 Mean	11.3	7.0	13.4	15.8	18.6	22.2	16.7	8.2	2.8	11.2	20.5	12.9	160.6	

Subsequent Records

1946	10.5	3.3	4.1	6.7	5.5	4.1	1.7	1.1	0.9	1.6	7.3	6.1	52.9	3/
1947	2.6	6.4	4.6	6.4	3.5	2.9	1.9	0.9	0.8					3/
1948								2.7	1.2	2.5	2.8	1.0		3/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*). Record obtained at Guthrie, 5½ miles upstream.

2/ Geological Survey Water-Supply Paper 1049 except (*).

3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN FRANCISCO RIVER NEAR GLENWOOD, NEW MEXICO

Location: Lat. 33°15'05", long. 108°52'40", in NE¼NW¼ sec. 23, T. 12 S., R. 20 W., a quarter of a mile upstream from hot springs and 6 miles south of Glenwood.

Drainage Area: 1,664 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914													37.6	
1915													305.2	
1916													177.3	
1917													104.5	
1918													24.5	
1919													98.9	
1920													72.1	*
1921													33.4	
1922													22.0	
1923													42.0	
1924													74.0	
1925													23.4	
1926													58.4	
1927													60.4	
1928	*2.2	2.2	1.9	1.9	2.5	5.0	3.4	2.9	1.0	2.8	4.1	2.3	32.2	1/
1929	2.1	1.9	2.0	1.9	1.8	1.9	2.1	1.4	1.1	2.7	5.5	3.3	27.7	1/
1930	3.0	1.7	1.8	2.2	2.0	7.1	8.1	2.3	1.3	6.7	5.1	3.6	44.9	1/
1931	1.5	1.7	1.4	1.4	5.0	2.3	7.7	7.0	1.5	2.6	8.2	7.3	47.6	
1932	3.4	2.9	3.4	3.0	27.2	*36.9	*16.0	*6.2	1.8	*4.0	*6.4	*2.4	113.6	
1933	2.1	2.0	2.0	1.8	3.9	11.4	4.3	3.3	2.4	3.9	3.8	3.2	44.1	
1934	3.0	3.4	3.0	1.9	1.7	1.2	1.1	1.1	0.7	1.7	9.1	2.8	30.7	2/
1935	1.5	1.5	1.8	4.1	3.8	6.0	3.9	2.6	1.7	1.1	4.4	3.3	35.7	
1936	2.2	1.9	2.2	1.7	3.3	5.2	6.8	2.8	1.2	2.1	2.8	3.8	36.0	
1937	3.8	2.3	2.1	1.9	20.9	22.9	11.6	4.5	1.4	1.7	1.6	2.6	77.3	
1938	2.2	1.7	1.7	1.6	1.4	6.1	2.3	1.7	1.8	2.5	2.1	4.3	29.4	
1939	1.2	1.2	1.5	1.6	1.6	9.2	6.9	1.6	0.8	1.1	3.0	2.2	31.9	
1940	2.5	1.7	1.7	1.7	3.7	5.2	2.4	1.9	1.2	3.4	12.7	6.2	44.3	
1941	2.6	2.5	17.0	18.1	22.7	45.9	31.6	27.9	4.8	3.5	4.8	8.2	189.6	
1942	6.1	4.7	9.6	6.6	4.7	8.8	9.5	3.5	1.6	1.7	4.1	1.8	62.7	3/
1943	2.0	1.9	2.3	2.3	1.9	2.1	1.4	1.6	1.2	2.4	3.1	1.7	23.9	
1944	2.7	2.0	1.9	1.8	1.6	2.1	1.3	1.2	1.1	2.0	3.2	3.9	24.8	
1945	1.8	1.8	2.0	1.9	2.8	7.2	8.4	3.7	1.3	1.5	5.6	1.6	39.6	
14-45 Mean	3.8	2.4	4.6	4.6	7.4	12.2	10.4	4.8	1.8	3.8	5.1	3.8	64.7	*

Subsequent Records

1946	2.1	1.6	1.9	1.6	1.4	1.4	1.0	1.0	0.6	1.8	6.5	5.0	25.9	3/
1947	3.0	2.0	1.9	1.7	1.3	1.1	0.8	1.0	0.8	0.9	4.6	1.4	20.5	3/
1948	1.0	1.3	1.3	1.4	1.8	8.2	9.9	1.4	0.9	1.7	1.3	0.7	30.9	3/

* Estimated.

1/ Records in reports of State Engineer of New Mexico except (*).

2/ Geological Survey Water-Supply Paper 1049 except (*).

3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN FRANCISCO RIVER AT CLIFTON, ARIZONA

Location: Lat. 33°03'00", long. 109°17'45", in SW¼SE¼ sec. 30, T. 4 S., R. 30 E., at Railroad Boulevard Bridge at Clifton, 8½ miles upstream from mouth.

Drainage Area: 2,789 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	August	Sept	Total	Note
1914	3.8	10.5	6.0	4.6	3.7	9.3	4.5	2.7	2.1	30.4	18.0	11.7	107.3	
1915	35.1	17.3	120.0	68.8	69.8	131.4	134.0	31.6	8.1	40.4	14.0	8.2	678.7	
1916	5.6	4.8	5.3	*261.0	116.8	100.0	39.9	22.8	3.6	8.4	21.7	19.6	*609.5	1/
1917	128.8	10.5	7.8	29.2	21.4	24.5	21.0	12.5	4.0	8.5	7.0	4.8	280.0	
1918	3.2	3.7	4.3	4.7	5.7	8.2	4.6	3.4	3.9	* 5.3	* 6.4	* 1.2	* 54.0	
1919	3.6	4.6	7.7	9.6	13.3	41.2	61.6	19.1	4.4	29.9	21.9	8.8	225.7	
1920	6.1	7.1	22.5	18.7	65.4	30.7	31.0	15.2	6.5	4.4	10.1	4.3	222.0	
1921	3.2	6.3	5.0	4.5	2.5	2.4	2.9	3.3	2.8	18.8	42.1	10.8	104.6	
1922	4.2	4.0	5.3	5.4	2.7	3.0	5.4	3.4	2.2	3.5	9.5	3.0	51.6	*
1923	2.6	3.4	5.6	3.6	2.3	9.1	5.1	3.6	1.8	12.2	45.5	23.1	117.9	
1924	4.6	13.4	36.4	19.8	7.5	10.2	53.7	15.3	3.6	6.4	6.3	1.2	178.4	
1925	2.2	2.6	3.7	3.7	1.5	1.7	1.8	2.9	4.2	9.2	9.5	43.0	86.0	
1926	8.3	4.7	5.3	5.7	2.8	17.5	62.0	28.2	4.2	6.7	6.5	4.4	156.3	
1927	* 5.0	* 5.7	* 8.8	* 5.9	* 17.8	* 20.4	* 14.1	* 7.5	* 2.6	* 7.7	10.3	27.1	*132.9	
1928	4.2	4.0	4.8	4.3	7.5	13.3	7.1	6.3	2.2	10.2	13.5	3.3	80.7	
1929	4.6	4.9	4.5	4.4	4.3	4.9	6.2	3.3	1.5	7.2	31.5	13.9	91.2	
1930	5.8	4.7	4.4	4.7	4.4	12.2	12.8	4.4	2.4	13.0	16.3	5.4	90.5	
1931	2.9	3.7	3.9	3.9	17.6	9.3	12.1	13.3	3.0	7.8	20.4	26.0	123.9	
1932	13.1	8.5	12.6	8.7	72.9	67.8	31.2	12.6	3.4	9.1	18.6	5.0	263.5	1/
1933	4.4	4.0	5.2	5.3	14.3	27.5	11.1	7.8	5.7	6.6	5.4	9.3	106.6	
1934	* 6.4	* 7.5	* 7.7	* 4.9	* 5.7	* 5.3	* 4.3	* 3.0	* 1.4	* 3.7	*18.3	* 7.0	* 75.2	
1935	* 2.9	* 3.5	* 4.4	*10.1	* 11.0	* 13.5	* 9.2	7.3	3.5	2.2	8.9	9.3	* 85.8	
1936	3.7	4.5	5.8	4.9	19.9	13.8	17.2	6.3	2.6	4.2	5.4	10.0	98.3	
1937	4.1	5.5	4.9	6.3	59.6	44.8	27.5	10.5	3.6	4.4	3.9	8.1	183.2	

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN FRANCISCO RIVER AT CLIFTON, ARIZONA (Continued)

Location: Lat. 33°03'00", long. 109°17'45", in SW¼SE¼ sec. 30, T. 4 S., R. 30 E., at Railroad Boulevard Bridge at Clifton, 8½ miles upstream from mouth.

Drainage Area: 2,789 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	4.7	3.4	4.2	3.9	3.4	20.7	7.1	4.4	4.2	4.5	6.0	8.4	74.9	1/
1939	2.2	2.7	3.5	3.7	3.8	15.3	16.2	3.6	1.3	2.4	6.1	4.6	65.4	
1940	5.8	3.3	4.0	4.2	14.8	9.8	5.6	4.0	3.1	3.9	17.9	13.0	89.4	
1941	5.2	7.8	44.7	44.7	48.1	80.4	56.4	52.7	9.4	6.9	12.8	20.5	389.6	
1942	14.8	9.1	26.2	15.9	11.4	17.6	20.4	7.1	2.4	2.5	7.4	4.7	139.5	2/
1943	3.5	3.3	4.4	4.8	4.3	11.7	4.8	2.8	2.0	5.1	4.9	5.2	56.8	
1944	4.1	3.5	3.8	3.9	3.6	4.4	3.7	2.8	1.5	3.5	6.2	10.0	51.0	
1945	3.7	5.2	5.8	6.0	7.6	15.5	21.5	9.9	2.5	2.6	11.0	2.7	94.0	
14-45 Mean	9.8	5.9	12.5	18.4	20.2	24.9	22.4	10.4	3.4	9.1	13.9	10.5	161.4	
Subsequent Records														
1946	3.9	2.9	3.8	4.4	3.4	3.3	2.5	2.0	1.1	3.9	9.8	8.4	49.4	2/
1947	4.8	4.0	4.4	4.0	3.3	3.4	2.6	2.1	1.4	1.8	10.1	4.2	46.1	2/
1948	2.3	2.8	2.9	3.1	3.6	12.4	17.9	3.9	3.2	3.0	3.5	2.1	60.7	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

WILLOW CREEK DIVERSION FROM BLACK RIVER, NEAR MORENCI, ARIZONA

Location: Lat. 33°24'45", long. 109°42'45", in SW¼ sec. 23, T. 1 N., R. 25 E., unsurveyed, on San Carlos Indian Reservation, just downstream from end of diversion pipe line, 5.5 miles southeast of pumping plant (on Black River, 2,100 feet downstream from Freezeout Creek), 3 miles northeast of Point of Pines, and 29 miles northwest of Morenci.

The entire flow consists of Black River (head of Salt River) water which is pumped into headwaters of Willow Creek (tributary of Eagle Creek, which is tributary of Gila River) for mining, metallurgical treatment of ores, and domestic supply in vicinity of Morenci.

Diversions began April 21, 1945.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1945							0.05	0.87	1.07	1.06	0.95	1.01	5.01	1/
14-45 Mean													0.2	

Subsequent Records

1946	1.1	1.0	0.2	0	0	0	0	0.2	0.3	1.2	1.2	1.1	6.3	1/
1947	1.1	0.9	0.6	0	0	0.6	1.1	1.1	1.1	1.2	1.1	1.1	9.9	1/
1948	1.1	1.0	0.6	0	0	0.5	0.9	1.1	1.1	1.2	1.1	0.9	9.5	1/

1/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT HEAD OF SAFFORD VALLEY, NEAR SOLOMON, ARIZONA

Location: Combined discharge of Gila River and Brown Canal near Solomon. The Gila River station is at lat. 32°52', long. 109°31', in SE¼NE¼ sec. 31, T. 6 S., R. 28 E., 0.6 mile downstream from intake of Brown Canal, 8 miles northeast of Solomon, and about 13 miles downstream from San Francisco River.

Drainage Area: 7,954 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	*25.1	*30.1	*26.6	*19.0	*22.1	*28.8	*16.0	*4.7	8.9	90.5	78.8	33.4	*384.0	
1915	90.1	46.8	360.6	134.9	213.6	263.5	238.4	66.4	18.4	72.5	43.3	21.0	1,569.5	
1916	11.7	13.1	14.4	623.0	198.0	183.0	74.2	40.3	9.1	17.8	55.9	48.2	1,288.7	
1917	223.0	28.3	19.4	92.1	46.2	62.0	49.6	25.8	8.4	16.7	25.4	8.4	605.3	
1918	7.0	8.5	10.8	12.4	11.1	22.9	10.4	7.1	6.1	11.8	14.1	5.3	127.5	
1919	9.5	12.5	18.8	24.9	33.0	86.1	112.0	38.0	9.2	72.7	69.5	22.1	508.3	
1920	17.4	18.9	50.5	46.6	146.0	65.4	57.5	30.2	13.8	9.4	27.2	12.2	495.1	
1921	8.2	16.8	13.1	12.8	9.6	10.1	7.5	5.9	5.5	45.2	141.5	26.3	302.5	
1922	11.5	11.0	13.5	15.0	9.9	11.3	12.0	6.2	4.1	7.2	25.1	9.2	136.0	
1923	6.5	9.4	14.3	10.6	9.2	23.1	11.5	6.6	3.3	28.7	153.7	53.3	330.2	
1924	12.6	34.9	80.3	49.2	20.4	25.4	98.0	30.3	7.3	14.5	13.9	5.4	392.2	1/
1925	5.1	7.4	10.3	10.8	7.3	8.5	5.5	5.1	8.6	21.5	25.1	97.0	212.2	
1926	24.2	12.7	13.7	15.6	10.1	39.6	112.8	56.6	8.7	15.1	14.5	12.4	336.0	
1927	13.9	15.3	21.2	16.0	42.6	45.2	27.4	14.4	5.0	17.5	30.8	45.8	295.1	
1928	8.7	9.2	13.1	12.4	16.4	27.2	13.4	13.9	4.0	15.4	31.7	7.8	173.2	
1929	10.3	13.4	11.7	11.0	10.0	9.5	9.0	5.5	3.1	30.2	91.9	31.3	236.9	
1930	18.5	12.8	10.7	11.0	9.8	31.6	27.2	9.7	4.6	34.1	65.6	14.9	250.5	
1931	6.4	10.2	12.1	11.2	57.5	25.6	34.8	35.6	5.0	17.3	63.1	54.5	333.3	
1932	25.7	19.1	28.3	22.8	133.1	119.1	54.3	22.2	6.2	27.4	41.8	10.4	510.4	
1933	11.4	10.2	14.3	14.5	31.3	62.5	21.0	12.2	11.6	13.9	14.5	31.5	248.9	
1934	22.0	11.0	19.5	12.0	8.4	13.0	10.0	5.0	3.0	24.0	65.0	27.0	219.9	
1935	6.8	7.2	11.0	28.5	36.0	35.0	16.0	10.7	4.9	3.7	22.1	28.4	210.3	
1936	8.3	10.1	14.1	12.7	58.0	29.9	26.6	9.7	4.2	8.8	14.5	21.3	218.2	
1937	8.5	12.9	13.6	16.1	137.5	112.6	55.1	19.9	7.3	8.0	9.4	21.4	422.3	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT HEAD OF SAFFORD VALLEY, NEAR SOLOMON, ARIZONA (Continued)

Location: Combined discharge of Gila River and Brown Canal near Solomon. The Gila River station is at lat. 32°52', long. 109°31', in SE¼NE¼ sec. 31, T. 6 S., R. 28 E., 0.6 mile downstream from intake of Brown Canal, 8 miles northeast of Solomon, and about 13 miles downstream from San Francisco River.

Drainage Area: 7,954 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	10.3	8.8	12.0	11.9	9.0	41.3	12.1	7.6	5.6	12.0	15.4	25.2	171.2	1/
1939	5.7	8.3	10.3	10.7	9.7	31.2	25.5	6.7	2.5	4.3	19.1	14.3	148.3	↑
1940	29.3	8.4	10.5	12.5	47.9	32.7	14.3	7.4	7.0	8.2	30.7	22.1	231.0	
1941	10.5	16.7	92.6	123.4	125.8	175.8	103.4	103.7	17.6	13.9	27.6	77.0	888.0	
1942	71.9	24.1	52.3	34.9	23.2	35.2	34.3	14.9	4.7	4.7	16.4	24.1	340.7	2/
1943	7.9	9.0	12.3	13.3	10.9	38.8	9.2	5.0	5.7	11.9	15.2	14.4	153.6	
1944	8.6	8.0	9.8	10.2	9.3	8.4	8.3	5.7	3.1	9.5	27.7	29.8	138.4	
1945	9.8	14.4	15.2	17.9	22.8	36.9	43.3	20.0	4.8	5.4	30.5	5.5	226.5	↓
14-45 Mean	23.3	15.0	32.2	45.9	48.0	54.4	42.2	20.4	6.9	21.7	41.3	26.9	378.2	

Subsequent Records

1946	15.7	7.8	9.2	12.2	9.7	8.5	5.5	3.7	2.2	6.9	19.0	16.8	117.2	2/
1947	8.4	12.5	10.7	11.9	7.8	7.2	5.7	3.7	2.7	2.7	27.4	12.9	113.6	2/
1948	4.3	6.4	7.4	7.8	9.0	27.9	33.2	7.8	4.4	6.3	9.0	3.6	127.1	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN SIMON CREEK NEAR SOLOMON, ARIZONA

Location: Lat. 32°48'06", long. 109°38'19", in NW¼NE¼ sec. 25, T. 7 S., R. 26 E., 1 mile southwest of Solomon and 2½ miles upstream from mouth.

Drainage Area: 2,276 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													23.5	
1915													7.9	
1916													17.1	
1917													8.3	
1918													5.3	
1919													16.3	
1920													10.0	
1921													15.1	
1922													6.3	*
1923													14.9	
1924													4.8	
1925													9.1	
1926													13.3	
1927													17.8	
1928													16.0	
1929													17.4	
1930													15.8	
1931									0	0.7	19.0	4.6	*26.4	
1932	4.4	0.5	0.1	0.1	0.8	0.3	0.6	0.7	0	5.9	1.4	0	14.8	
1933													* 8.7	
1934													*10.1	1/
1935								0	0	0.4	14.7	0.6	*16.6	
1936	0	0	0	0	0	0	0	0	0.1	4.1	5.7	3.7	13.6	
1937	0	0	0	0	0	0	0	0	0.2	0.8	0.7	0.9	2.6	
1938	0.5	0	0	0	0	0	0	0	1.1	1.0	2.0	1.0	5.6	
1939	0	0	0	0	0	0	0	0	0	0.1	2.7	0.4	3.2	
1940	2.0	0.3	0	0	0.5	0	0	0	1.2	0.8	3.5	3.7	12.0	
1941	0.1	0.5	0.2	0	0.1	0	0.9	0	0	0.5	7.0	4.1	13.4	
1942	0.6	0	0.4	0	0	0	0	0	0	0.2	4.3	3.0	8.5	2/
1943	0.9	0	0	0	0	0	0	0	0.2	0.9	13.5	0.8	16.3	
1944	0	0	0	0	0	0	0	0	0	1.7	9.7	5.3	16.7	
1945	0.2	0.3	0	0	0	0	0	0	0	1.2	6.4	0.2	8.3	
14-45 Mean	1.2	0.1	0.1	0	0.1	0	0.1	0.1	0.3	1.8	6.3	2.3	12.4	*

Subsequent Records

1946	3.5	0	0	0	0	0	0	0	0	0.2	2.6	0.1	6.4	2/
1947	0	0	0	0	0	0	0	0	0.4	0.2	2.7	0.7	4.0	2/
1948	0	0	0	0	0	0	0	0	0	1.1	3.5	0.1	4.7	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT CALVA, ARIZONA

Location: Lat. 33°11'10", long. 110°13'10", in sec. 5, T. 3 S., R. 21 E., unsurveyed, on San Carlos Indian Reservation, at railroad bridge at head of San Carlos Reservoir, 1½ miles northwest of Calva.

Drainage Area: 11,492 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													282.3	
1915													1,526.7	
1916													1,141.0	
1917													503.2	
1918													75.3	
1919													428.9	
1920													434.6	
1921													252.9	*
1922													46.8	
1923													220.6	
1924													320.0	
1925													118.0	
1926													211.1	
1927													207.1	
1928													92.9	
1929													174.4	
1930	17.6	11.8	10.2	5.0	3.2	18.9	14.7	4.7	0.7	43.5	71.5	8.4	210.2	
1931	1.0	6.5	11.5	7.2	58.9	11.5	20.2	29.8	0.8	3.3	84.6	54.3	289.6	
1932	34.5	16.6	30.2	21.5	134.4	115.2	35.3	8.9	2.0	16.5	23.2	4.0	442.3	
1933	3.8	6.5	12.8	12.4	24.7	50.9	7.0	3.9	1.6	2.0	1.1	22.4	149.1	1/
1934	13.7	7.5	18.6	10.3	4.0	2.4	1.2	0.3	0	14.1	66.9	21.1	160.1	
1935	1.7	2.4	7.4	28.0	36.9	21.0	4.4	2.4	0.5	1.3	18.8	24.7	149.5	
1936	2.3	5.7	12.4	13.1	56.4	19.4	8.9	1.8	0.1	2.1	6.3	21.8	150.3	
1937	2.3	9.1	7.7	17.7	124.6	104.1	29.3	8.4	1.1	1.0	1.5	11.1	317.9	

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT CALVA, ARIZONA (Continued)

Location: Lat. 33°11'10", long. 110°13'10", in sec. 5, T. 3 S., R. 21 E., unsurveyed, on San Carlos Indian Reservation, at railroad bridge at head of San Carlos Reservoir, 1½ miles northwest of Calva.

Drainage Area: 11,492 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	6.8	6.1	9.2	11.7	7.8	37.9	2.4	0.7	1.1	2.2	6.9	13.4	106.2	1/
1939	0.1	3.7	6.1	10.6	10.4	17.3	15.6	3.4	0	0	13.7	10.6	91.5	↑
1940	24.4	4.2	4.4	12.8	45.2	18.9	3.1	2.4	2.8	2.6	22.7	14.8	158.3	
1941	5.4	13.7	75.9	149.0	133.5	176.5	84.1	96.6	8.6	4.9	19.7	36.2	804.1	
1942	112.7	24.8	53.9	35.2	22.9	21.2	13.3	6.5	1.2	1.0	6.5	15.2	314.4	2/
1943	3.2	5.7	9.2	12.2	7.2	34.7	2.4	0.6	0	1.2	16.3	9.8	102.5	
1944	2.2	2.3	4.2	5.8	4.0	2.6	1.6	0.8	0.1	1.2	18.5	37.3	80.6	
1945	7.1	8.6	8.7	15.9	16.1	17.4	24.7	7.5	0.6	1.9	22.9	0.4	131.8	↓
14-45 Mean	18.5	11.1	34.3	47.1	42.3	40.2	28.4	11.3	1.6	14.7	33.3	20.2	303.0	*

Subsequent Records

1946	8.7	0.9	1.5	12.4	9.5	5.1	1.1	0.3	0	1.4	6.9	7.8	55.6	2/
1947	1.4	6.5	2.0	9.5	6.2	3.4	1.0	0.4	0.1	0	10.6	4.6	45.7	2/
1948	0.9	1.1	1.4	4.3	6.3	20.1	16.8	2.1	1.5	2.5	6.1	0.4	63.5	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049.

2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN CARLOS RIVER NEAR PERIDOT, ARIZONA

Location: Lat. 33°19'20", long. 110°26'50", in NW¼ sec. 30, T. 1 S., R. 19 E., unsurveyed, on San Carlos Indian Reservation, at highway bridge, 2 miles downstream from San Carlos and 2 miles upstream from Peridot.

Drainage Area: 1,038 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914							0	0	0.1	0.8	2.9	1.9	*39.5	1/
1915	3.6	3.6				6.0	2.7	2.2	0.2		0.9	0.3	*240.0	1/
1916													212.0	
1917													26.5	
1918													8.0	
1919													92.0	
1920													92.0	
1921													31.5	
1922													19.0	*
1923													16.5	
1924													21.5	
1925													29.5	
1926													56.5	
1927													24.5	
1928													7.5	
1929													28.0	
1930	0.5	0.6	0.9	2.5	0.9	13.6	0.7	0.3	0.1	5.2	11.6	0.2	37.1	
1931	0.3	1.0	0.8	0.7	19.1	0.9	0.5	0.3	0.3	3.8	6.9	2.1	36.7	
1932	0.7	4.3	7.5	2.9	29.3	2.9	0.6	0.4	0.1	1.3	1.8	0.1	51.9	
1933	0.6	0.6	0.9	1.2	4.0	1.9	0.4	0.3	0.1	1.0	0.5	5.3	16.8	
1934	1.3	0.6	0.7	0.8	0.8	0.4	0.3	0.1	0.1	0.2	7.2	1.4	13.9	1/
1935	0.3	0.5	0.9	14.9	36.2	11.7	6.4	0.3	0.1	1.9	12.3	2.1	87.6	
1936	0.3	0.7	0.9	1.3	34.2	3.1	0.9	0.2	0.1	0.4	1.8	0.6	44.5	
1937	0.3	0.5	1.1	4.0	33.2	2.6	0.6	0.3	0.1	0.6	3.0	0.5	46.8	
1938	0.2	0.4	0.8	0.8	0.6	9.2	0.4	0.2	0.1	0.7	1.4	0.9	15.7	
1939	0.1	0.4	0.7	0.8	2.9	1.7	4.1	0.2	0	0.9	6.4	0.2	18.4	
1940	0.4	0.6	0.7	1.3	5.4	0.7	0.3	0.1	0.4	1.2	3.5	1.4	16.0	
1941	0.4	3.2	33.8	31.7	31.8	77.6	10.1	1.0	0.4	1.1	3.4	6.7	201.2	
1942	1.4	1.5	5.4	8.3	1.8	3.2	0.9	0.6	0.3	0.3	0.7	0.9	25.3	2/
1943	0.7	0.8	2.9	8.9	1.7	9.7	0.5	0.3	0.3	0.1	2.2	2.2	30.3	
1944	1.2	0.7	0.9	1.0	1.7	3.2	0.7	0.5	0.2	0.2	0.7	2.2	13.2	
1945	0.6	1.1	1.1	1.4	1.3	7.4	1.3	0.5	0.1	0.4	1.7	0.2	17.1	
14-45 Mean	0.7	1.2	4.4	9.6	14.2	8.1	2.7	0.7	0.2	1.6	4.6	2.5	50.5	*

Subsequent Records

1946	0.4	0.6	0.9	2.4	0.8	0.7	0.5	0.2	0	1.1	3.2	4.3	15.1	2/
1947	0.6	0.8	1.2	0.8	0.6	0.7	0.5	0.4	0.1	0	3.2	2.3	11.2	2/
1948	1.9	0.5	0.6	0.5	0.6	3.0	0.6	0.1	0	1.1	1.3	0.2	10.4	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER BELOW COOLIDGE DAM, ARIZONA

Location: Lat. 33°10'15", long. 110°31'45", in SW¼ sec. 17, T. 3 S., R. 18 E., unsurveyed, 2,200 feet downstream from Coolidge Dam.

Drainage Area: 12,889 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	*25.0	*29.3	*22.8	*18.4	*19.9	*26.6	*13.2	0.5	4.3	59.5	66.3	36.0	321.8	
1915	72.1	50.0	517.8	207.9	285.2	219.7	230.5	69.5	11.5	55.7	30.7	15.9	1,766.5	
1916	4.1	4.3	13.6	776.7	189.1	176.2	64.1	24.8	3.4	5.4	48.5	42.8	1,353.0	
1917	199.2	26.3	21.4	113.7	53.5	47.6	28.7	9.3	2.1	11.5	13.6	2.9	529.8	
1918	1.7	2.8	6.0	12.1	12.4	16.8	2.3	0.9	1.9	4.6	20.3	1.5	83.3	
1919	2.2	5.2	21.5	18.2	36.2	67.6	106.6	25.6	1.7	111.4	100.9	23.9	521.0	
1920	21.1	28.6	98.2	68.7	191.5	55.2	28.5	8.9	2.9	3.0	15.9	4.2	526.7	
1921	3.2	10.6	11.1	12.0	4.8	3.5	2.5	0.8	0.1	62.5	155.7	17.6	284.4	
1922	3.3	3.5	6.8	17.2	5.2	3.7	3.2	0.9	0.3	4.8	15.9	1.1	65.9	
1923	1.3	1.5	8.9	4.2	3.5	11.0	2.1	0.3	0	35.4	122.2	46.7	237.1	
1924	3.8	40.7	105.7	61.6	15.4	16.5	82.0	12.7	0.3	0.6	2.1	0.1	341.5	1/
1925	0.2	0.6	3.4	4.7	2.8	3.1	1.1	0.5	0.8	2.6	18.8	108.9	147.5	
1926	17.4	9.2	15.2	16.1	5.1	29.5	120.5	40.5	1.2	3.5	3.5	5.9	267.6	
1927	7.3	12.5	20.5	13.2	69.5	35.7	6.8	2.8	0.6	5.8	14.1	42.8	231.6	
1928	3.9	3.8	11.9	9.9	13.0	10.9	2.9	1.4	0	6.3	32.7	3.7	100.4	
1929	2.2	4.7	00	0	0	1.4	1.4	0.1	0	0	1.5	5.5	16.8	
1930	9.9	5.4	2.4	0	6.1	9.2	28.9	26.1	36.3	29.3	27.9	38.1	219.6	
1931	11.4	4.6	2.2	2.2	3.3	14.8	33.0	32.8	36.3	47.5	20.7	15.2	224.0	
1932	5.3	2.8	0	0	0.1	18.1	35.6	35.7	36.5	43.2	36.2	42.9	256.4	
1933	13.8	12.4	4.5	3.6	4.0	28.1	40.3	40.2	47.5	52.0	54.5	34.1	335.0	
1934	16.0	13.8	5.6	6.0	9.1	18.4	27.9	27.5	19.7	18.7	4.0	17.9	184.6	
1935	11.4	4.8	3.5	0.4	2.9	4.7	21.5	25.8	34.9	38.8	16.3	19.8	184.6	
1936	14.8	6.8	3.9	1.7	1.5	14.9	28.9	34.3	36.8	33.8	28.1	22.6	228.1	
1937	18.6	9.6	5.0	0.1	3.2	14.6	30.1	40.1	41.0	46.0	44.4	27.0	279.7	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER BELOW COOLIDGE DAM, ARIZONA (Continued)

Location: Lat. 33°10'15", long. 110°31'45", in SW¼ sec. 17, T. 3 S., R. 18 E., unsurveyed, 2,200 feet downstream from Coolidge Dam.

Drainage Area: 12,889 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	24.3	17.2	10.2	11.5	7.9	11.2	23.7	22.1	23.0	11.2	13.6	13.8	189.7	1/
1939	6.5	2.3	4.9	5.8	4.0	13.8	22.5	15.4	6.7	0.3	10.5	9.7	102.4	
1940	11.4	10.7	12.0	8.9	9.6	16.9	18.6	17.8	10.9	8.5	19.0	16.4	160.7	
1941	7.1	4.3	5.3	1.3	0.8	0.6	6.9	31.0	40.4	49.9	35.3	32.8	215.7	
1942	19.0	15.9	5.6	4.5	15.1	21.2	35.9	37.4	46.3	55.6	53.0	42.5	352.0	2/
1943	26.8	19.5	15.5	13.7	18.2	23.8	37.4	43.6	50.7	50.6	29.6	35.7	365.1	
1944	22.3	19.1	11.8	9.7	7.3	12.8	31.0	31.8	35.7	44.0	37.3	34.6	297.4	
1945	22.2	11.9	15.3	5.6	10.1	12.4	20.0	22.7	24.3	29.3	17.2	25.3	216.3	
14-45 Mean	19.0	12.3	31.0	44.7	31.6	30.0	35.6	21.4	17.4	29.1	34.7	24.6	331.4	

Subsequent Records

1946	11.5	7.6	6.9	1.4	6.9	11.3	10.2	10.2	1.2	0.1	1.5	5.8	74.6	2/
1947	4.4	3.7	5.3	6.4	6.1	8.9	11.2	0.3	0	0	3.5	10.1	59.9	2/
1948	4.1	1.6	2.2	4.7	5.5	9.7	14.9	6.9	8.1	3.1	6.3	1.1	68.2	2/

* From "Distribution of Waters of the Gila River", 4th Annual Report (1939) of Gila Water Commissioner to U. S. District Court.

1/ Geological Survey Water-Supply Paper 1049 except (*) in 1914.

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN PEDRO RIVER AT PALOMINAS, ARIZONA

Location: Lat. 31°22'45", long. 110°06'45", in SE¼ sec. 33, T. 23 S., R. 22 E., at highway bridge, 0.7 mile east of Palominas, 4½ miles downstream from international boundary, and 13 miles southwest of Bisbee.

Drainage Area: 741 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													90.9	
1915													87.5	
1916													17.9	
1917													49.4	
1918													10.8	
1919													49.3	
1920													24.6	
1921													53.7	*
1922													18.3	
1923													22.2	
1924													12.7	
1925													23.3	
1926													64.8	
1927													23.5	
1928													7.8	
1929													27.3	
1930									0.8	10.05	12.0	2.1	*29.9	
1931	0.6	0.5	0.6	0.5	3.0	0.7	0.4	0.2	0.1	1.6	16.4	7.2	31.8	
1932	3.6	0.8	1.7	3.1	1.5	1.2	0.6	0.4	0.2	6.1	6.5	0.4	26.1	
1933	0.4	0.5	0.7	1.2	0.8	0.4	0.3	0.2	0.2	3.4	2.1	3.7	13.9	
1934													*17.7	1/
1935								0.1	0.1	1.8	10.0	3.7	*19.9	
1936	0.4	1.2	2.0	0.6	0.5	0.3	0.2	0.1	0.8	4.3	4.3	8.9	23.6	
1937	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.2	1.1	3.6	25.4	4.3	37.5	
1938	1.5	0.3	0.8	0.4	0.4	0.4	0.2	0.1	0.7	5.2	5.0	3.4	18.4	
1939	0.3	0.3	1.5	0.5	0.3	0.2	0.2	0.1	0	5.6	17.3	2.8	29.1	2/
1940	0.3	0.3	0.4	0.4	0.6	0.3	0.2	0.1	0.6	2.9	23.5	1.6	31.2	3/
1941	0.5	0.5	0.7	4.4	1.4	0.9	0.7	0.3	0.1				*22.7	4/
1942													11.4	*
1943													28.6	*
1944													11.8	*
1945													21.1	*
14-45 Mean	1.0	0.7	2.1	1.3	0.8	0.6	0.3	0.2	0.9	6.0	11.6	4.5	30.0	*

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 879.

3/ Geological Survey Water-Supply Paper 899.

4/ Geological Survey Water-Supply Paper 929 except (*).

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN PEDRO RIVER AT CHARLESTON, ARIZONA

Location: Lat. 31°37'40", long. 110°10'30", in NE¼NE¼ sec. 11, T. 21.S., R. 21 E., in Spanish land grant of San Juan de las Boquillas y Nogales, at highway bridge ¼ mile south of Charleston, and 8½ miles upstream from Babocomari River. Prior to Dec. 1, 1942, at site 1½ miles downstream.

Drainage Area: 1,216 sq. mi.; 1,250 sq. mi. prior to Dec. 1, 1942.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0.2	3.5	0.5	0.9	0.6	0.5	0.4	0.3	0.3	8.7	126.2	6.4	148.5	
1915	2.9	2.0	75.6	17.1	12.1	9.8	3.0	1.5	1.2	12.3	5.4	6.4	149.3	
1916	0.8	1.2	1.1	5.3	1.2	0.7	0.4	0.4	0.2	8.5	11.1	3.4	34.3	
1917	4.0	0.3	0.7	1.6	0.9	2.2	1.8	2.3	2.2	34.4	33.9	5.9	90.2	
1918	0.5	0.7	0.7	0.9	0.5	0.6	0.3	0.1	3.2	7.1	5.3	0.4	20.3	
1919	1.0	0.6	1.4	1.0	0.7	0.5	0.2	0.2	0.1	43.2	30.9	13.8	93.6	
1920	3.6	7.6	4.4	8.0	2.9	2.4	1.1	0.5	2.0	0.9	5.7	2.6	41.7	
1921	0.3	0.7	0.7	1.0	0.7	0.9	0.3	0.2	0.4	53.9	40.2	2.4	101.7	
1922	0.7	0.7	0.9	0.9	0.6	0.6	0.3	0.2	0.6	12.6	10.7	7.8	36.6	
1923	0.3	0.5	1.3	1.0	0.4	0.7	0.4	0.2	0.2	14.9	18.3	4.1	42.3	
1924	0.6	1.7	6.3	3.7	0.7	1.4	0.4	0.2	0.2	5.0	4.3	0.6	25.1	
1925	0.3	0.4	0.4	0.6	0.5	0.6	0.6	0.4	9.9	11.2	10.0	2.0	36.9	1/
1926	0.6	1.3	1.0	1.2	0.9	0.9	0.9	0.4	0.1	1.6	1.6	112.3	122.8	
1927	10.2	2.3	1.9	1.6	1.2	1.2	1.2	0.8	0.6	7.9	12.4	2.8	44.1	
1928	1.1	1.2	1.3	1.3	1.3	1.1	0.9	0.8	0.4	2.2	4.3	1.1	17.0	
1929	7.6	1.4	1.2	1.2	1.1	1.0	0.9	0.6	0.4	24.1	10.0	4.5	54.0	
1930	1.9	1.0	1.2	1.6	1.3	1.5	0.9	0.7	1.3	21.1	17.0	4.0	53.5	
1931	1.1	1.2	1.8	1.4	4.6	1.1	0.5	0.5	0.5	4.7	32.6	14.9	64.9	
1932	6.5	1.5	3.6	6.3	1.6	2.2	1.2	0.8	0.6	10.0	10.9	0.7	45.9	
1933	0.9	1.4	1.2	1.7	1.6	1.2	0.7	0.9	0.6	7.9	3.2	6.8	28.1	
1934	2.5	0.9	1.2	1.2	0.9	0.9	0.7	0.4	0.2	6.0	17.0	1.4	33.3	
1935	0.7	0.9	1.4	2.2	1.7	1.5	0.8	0.6	0.3	2.0	25.0	6.9	44.0	
1936	0.9	2.3	3.2	1.5	1.4	1.1	0.9	0.5	1.1	6.4	10.7	14.7	44.7	
1937	1.8	1.2	1.3	1.6	1.1	1.2	0.8	0.7	1.4	5.1	33.7	6.4	55.9	
1938	2.2	0.8	1.4	1.2	1.0	1.0	0.7	0.6	1.0	8.3	10.0	6.4	34.6	
1939	0.8	0.9	2.4	1.1	0.9	0.9	0.6	0.4	0.2	7.7	27.4	6.5	49.8	
1940	1.3	1.0	1.1	1.1	1.8	1.0	0.6	0.5	1.0	8.2	37.9	3.0	58.5	
1941	1.4	1.2	1.6	5.9	2.9	1.5	1.4	0.9	0.5	5.0	13.6	4.8	40.7	
1942	1.6	0.7	1.8	1.3	1.1	1.1	0.8	0.5	0.2	3.3	5.1	6.1	23.6	2/
1943	0.6	0.7	1.0	1.1	0.9	0.8	0.5	0.9	5.3	7.6	26.4	2.0	47.8	
1944	1.3	0.8	1.0	1.1	0.9	1.4	0.7	0.6	0.3	5.4	7.6	3.2	24.3	
1945	0.9	0.9	1.1	1.2	0.9	1.1	0.9	0.5	0.2	3.4	26.0	0.6	37.7	
14-45 Mean	1.9	1.4	3.9	2.5	1.6	1.4	0.8	0.6	1.1	11.3	19.8	8.3	54.6	

Subsequent Records

1946	1.2	0.7	0.9	1.2	1.0	1.0	0.7	0.4	0.3	5.4	17.6	3.1	33.5	2/
1947	0.6	0.7	1.0	1.1	0.9	0.9	0.6	0.5	0.3	1.9	22.3	1.5	32.3	2/
1948	0.4	0.6	0.8	0.8	1.1	0.9	0.6	0.4	0.2	6.8	13.2	7.4	33.2	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey Annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SAN PEDRO RIVER NEAR MAMMOTH, ARIZONA

Location: Lat. 32°44', long. 110°39', in NE¼ sec. 18, T. 8 S., R. 17 E., at bridge on Mammoth-Winkelman highway 1½ miles north of Mammoth.

Drainage Area: 3,607 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													134.4	
1915													157.9	
1916													34.1	
1917													58.7	
1918													26.5	
1919													148.6	
1920													63.3	
1921													149.6	*
1922													34.9	
1923													91.1	
1924													16.5	
1925													23.7	
1926													86.5	
1927													47.5	
1928													34.3	
1929													61.2	
1930													92.1	
1931								0	0.7	2.3	57.3	18.2	*89.7	
1932	12.2	4.2	6.6	7.2	8.8	3.3	0.5	0	0	11.9	11.2	0	65.9	
1933	0	0	0.4	1.0	0.8	0.1	0	0	0	6.1	2.1	4.5	15.0	
1934	2.6	0.1	0.2	0.1	0	0	0	0	0	2.9	18.0	0.9	24.8	1/
1935	0	0	0.3	1.7	1.9	1.2	0	0	0	0.1	29.2	10.6	45.0	
1936	0.2	1.8	3.2	0.9	2.9	0	0	0	0.3	4.1	14.9	9.7	38.0	
1937	0	0.2	0.5	1.0	4.5	0.1	0	0	0	1.2	42.3	13.2	63.0	
1938	0.5	0	0.3	0	0	1.2	0	0	0.4	7.0	14.5	7.1	31.0	
1939	0	0	0.6	0	0.1	0	1.0	0	0	7.5	39.0	7.4	55.6	2/
1940	1.6	0	0	0	0.7	0	0	0	0.6	6.1	51.9	2.5	63.4	3/
1941	0.4	0.3	11.4	8.5	6.9	6.9	0.9	0.2	0				*73.3	4/
1942													19.0	*
1943													39.2	*
1944													32.2	*
1945													35.8	*
14-45 Mean	1.8	0.6	3.2	2.8	2.3	1.0	0.2	0	0.3	10.8	29.8	8.2	61.0	*

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 879.

3/ Geological Survey Water-Supply Paper 899.

4/ Geological Survey Water-Supply Paper 929 except (*).

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ARAVAIPA CREEK NEAR FELDMAN, ARIZONA

Location: Lat. 32°50', long. 110°38', in NW¼ sec. 9, T. 7 S., R. 17 E., 6 miles upstream from mouth and 6 miles east of Feldman.

Drainage Area: 538 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													18.3	
1915													109.3	
1916													19.8	
1917													13.8	
1918													19.4	
1919													35.1	
1920													23.1	
1921													30.3	
1922													16.3	*
1923													16.2	
1924													14.4	
1925													11.5	
1926													24.2	
1927													24.1	
1928													15.2	
1929													16.1	
1930													19.7	
1931								0.5	0.6	2.2	3.0	3.0	*27.7	
1932	1.8	2.9	5.1	1.6	9.0	2.0	1.1	0.8	0.6	2.2	1.6	0.6	29.3	
1933	1.0	0.8	1.7	1.7	1.4	0.9	0.8	0.6	0.5	2.9	0.6	0.8	13.7	
1934	1.3	0.7	0.7	0.6	0.6	0.7	0.5	0.4	0.3	1.7	2.6	0.5	10.6	1/
1935	0.5	0.8	1.3	4.3	10.3	7.3	1.1	0.7	0.3	0.4	8.2	2.1	37.3	
1936	0.7	1.1	1.0	2.1	5.2	1.8	0.9	0.5	0.3	2.2	1.4	2.2	19.4	
1937	0.7	0.7	1.3	4.3	4.8	1.0	0.7	0.5	0.3	0.7	1.7	2.5	19.2	
1938	0.5	0.6	0.9	0.8	1.0	4.0	0.6	0.4	0.3	1.0	1.3	0.9	12.3	
1939	0.4	0.6	0.9	0.7	1.0	0.7	0.5	0.3	0.1	0.5	2.9	0.9	9.5	2/
1940	1.9	0.5	0.9	0.6	2.6	0.6	0.4	0.3	2.4	0.5	2.4	1.5	14.6	3/
1941	0.4	4.4	15.8	5.7	9.9	11.8	2.3	1.3	0.6				*57.9	4/
1942													16.2	*
1943													15.9	*
1944													13.4	*
1945													13.2	*
14-45 Mean	0.9	1.1	4.0	2.3	3.2	2.5	0.8	0.6	0.8	2.4	2.7	1.7	23.0	*

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 879.

3/ Geological Survey Water-Supply Paper 899.

4/ Geological Survey Water-Supply Paper 929 except (*).

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT KELVIN, ARIZONA

Location: Lat. 33°06'15", long. 110°58'45", in NW¼NW¼ sec. 12, T. 4 S., R. 13 E., at Kelvin, 1000 feet downstream from Mineral Creek, 17 miles downstream from San Pedro River, and 19.5 miles upstream from Ashurst-Hayden Dam.

Drainage Area: 18,031 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	12.2	30.2	26.1	20.2	18.0	9.6	2.2	0.4	3.9	120.6	141.7	53.8	438.9	
1915	*75.2	48.2	*760.0	*300.0	*328.0	*233.6	*233.9	72.1	15.3	*94.1	66.7	19.2	2,246.3	
1916	8.1	8.2	21.8	817.5	175.3	165.8	65.9	27.5	6.3	14.3	50.3	53.0	1,414.0	
1917	212.4	30.9	18.0	107.6	49.1	44.5	28.5	15.0	2.7	33.4	37.0	10.7	589.8	
1918	2.6	3.4	6.8	17.4	16.5	49.5	4.4	2.5	3.4	4.5	39.3	1.8	152.1	
1919	2.4	6.2	24.9	29.7	59.6	69.6	113.8	25.3	2.6	212.7	157.5	31.9	736.2	
1920	18.0	33.1	117.8	103.2	231.9	84.9	41.3	13.5	4.4	5.7	32.2	7.5	693.5	
1921	2.4	11.0	11.8	15.0	8.3	4.4	2.7	1.0	0.3	99.1	282.2	23.4	461.6	
1922	6.0	5.4	11.6	22.1	10.8	6.8	5.3	1.5	0.3	*10.0	*36.3	6.4	122.5	
1923	0.5	2.1	12.0	6.5	5.9	14.2	2.2	0.4	0.1	*47.4	*197.1	57.3	345.7	
1924	6.1	40.1	115.5	72.4	17.3	20.1	79.4	15.2	0.7	2.2	8.4	0.4	377.8	
1925	0.2	0.7	4.6	5.6	2.7	3.4	1.3	0.4	5.9	12.3	31.5	109.3	177.9	1/
1926	17.5	11.7	24.2	21.2	7.9	31.0	121.6	37.5	2.0	5.6	8.4	117.1	405.7	
1927	24.2	15.7	23.9	17.1	86.1	50.4	9.6	3.3	1.8	12.4	25.4	54.4	324.3	
1928	5.7	4.6	16.9	15.4	19.2	11.7	3.2	1.3	0.1	9.9	57.2	6.0	151.2	
1929	4.4	5.4	1.6	2.1	2.2	2.4	2.3	0.2	0.1	16.5	29.8	30.7	97.7	
1930	14.2	7.2	5.1	5.3	6.7	27.1	26.7	26.9	35.0	54.7	90.5	43.5	342.9	
1931	12.2	10.8	5.3	5.1	34.4	18.4	32.1	31.4	36.6	54.4	86.5	36.2	363.4	
1932	20.5	12.1	16.7	9.7	25.4	25.9	38.6	33.9	34.8	55.9	48.1	43.9	365.5	
1933	14.2	14.1	12.3	10.3	10.3	29.1	40.4	39.3	46.8	88.6	56.0	41.9	373.3	
1934	19.4	14.5	7.6	7.2	10.1	17.9	25.5	24.8	18.6	25.7	28.4	20.3	220.0	
1935	11.8	7.1	5.2	11.7	24.2	19.8	24.2	25.5	34.2	38.8	90.0	41.8	334.3	
1936	16.3	11.4	8.5	6.7	18.4	20.2	29.9	35.2	34.3	39.4	42.8	38.7	301.8	
1937	20.8	11.2	9.9	10.7	22.3	18.9	30.0	37.8	37.9	46.9	80.6	38.2	365.2	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER AT KELVIN, ARIZONA (Continued)

Location: Lat. 33°06'15", long. 110°58'45", in NW¼NW¼ sec. 12, T. 4 S., R. 13 E., at Kelvin, 1,000 feet downstream from Mineral Creek, 17 miles downstream from San Pedro River, and 19.5 miles upstream from Ashurst-Hayden Dam.

Drainage Area: 18,031 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	27.2	17.9	12.6	13.4	10.0	20.1	24.0	22.8	21.6	15.2	29.6	19.6	234.0	1/
1939	7.1	2.0	7.9	6.6	7.7	13.5	21.0	14.1	5.7	4.2	50.0	16.8	156.6	
1940	13.2	10.6	12.1	8.8	14.7	16.0	17.5	16.8	13.0	12.5	68.2	20.9	224.3	
1941	8.5	10.0	61.4	39.7	34.7	59.7	22.2	37.8	40.8	57.0	58.1	45.9	475.8	
1942	22.8	21.8	17.1	13.7	18.3	25.3	37.0	35.3	41.6	52.5	58.0	47.0	390.4	2/
1943	27.9	21.0	18.0	20.6	20.1	36.8	37.2	42.7	50.7	53.2	57.6	41.7	427.5	
1944	24.3	19.8	13.8	11.6	14.0	16.5	30.5	30.5	33.2	43.5	62.6	39.4	339.7	
1945	24.5	15.1	17.9	12.0	11.2	16.4	20.8	22.5	22.4	30.0	47.8	24.2	264.8	
14-45 Mean	21.3	14.5	44.7	55.2	41.3	37.0	36.7	21.7	17.4	42.0	67.4	35.7	434.9	

Subsequent Records

1946	15.4	7.8	10.1	5.8	8.0	12.1	10.0	8.9	1.5	5.3	19.8	15.3	120.0	2/
1947	4.8	4.9	6.4	7.8	6.3	8.7	10.2	0.8	0.1	0.2	23.5	13.3	87.0	2/
1948	5.8	2.1	2.9	4.5	6.0	10.1	14.3	5.6	5.9	10.0	20.1	4.4	91.7	2/

* Revisions listed in Geological Survey Water-Supply Paper 1119.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SANTA CRUZ RIVER NEAR NOGALES, ARIZONA

Location: Lat. 31°20'40", long. 110°51'05", in NW¼ sec. 18, T. 24 S., R. 15 E., unsurveyed, in Spanish land grant of Buena Vista, 0.75 mile downstream from international boundary and 5.5 miles east of Nogales.

Drainage Area: 542 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0	0.2	0.2	0	0.1	0	0	0	0	3.5	6.4	2.7	13.1	
1915	0.2	0.6	*36.4	12.2	8.4	8.3	4.4	2.7	0.4	5.0	3.6	0.6	*82.8	
1916	0	1.0	1.6	2.7	2.3	1.8	0.8	0.3	0.2	*6.6	1.5	0.4	*19.2	
1917	0.2	0.1	0.7	1.0	0.7	0.3	0.2	0.1	0.1	2.6	4.7	3.2	13.9	
1918	0.4	0.7	0.5	0.8	0.9	0.5	0.1	0	0	0	0.5	0	4.4	
1919	0	0	0	0.1	0.7	0.1	0.1	0	0	4.5	4.8	2.7	13.0	
1920	0.6	1.5	2.4	5.5	1.3	0.6	0.3	0.1	0.2	*0	*0.5	*0	*13.0	
1921								0	0	3.4	15.2	1.9	*23.4	
1922	0.7	0.5	0.8	1.0	0.5	0.4	0	0	0.1	*0.2	*0.2	*0.6	*5.0	
1923													*14.0	
1924													*7.2	1/
1925													*9.0	
1926													*16.6	
1927													*6.9	
1928													*6.7	
1929													*18.9	
1930								0.1	0.5	6.3	4.1	0.1	*13.5	
1931	0.1	0.2	0.3	0.3	7.2	1.4	0.5	0.1	0	2.4	17.8	9.0	39.3	
1932	1.9	1.6	2.0	8.2	2.5	1.5	0.5	0.1	0.1	5.4	7.2	0.8	31.8	
1933	0.3	0.5	1.1	1.7	1.1	0.7	0.3	0.1	0	0.3	0.2	0.6	6.9	
1934	0.8	0.1	0.1										*9.4	
1935										0.8	12.1	4.0	*18.1	
1936	0.6	0.9	1.4	0.8	0.7	0.4	0.2	0	0.4	4.1	4.5	0.8	14.8	
1937	0	0.3	0.4	1.5	0.5	0.4	0.1	0	0	1.0	7.9	4.0	16.1	
1938	0.7	0.4	0.4	0.4	0.3	0.2	0	0	0.1	1.7	2.2	1.8	8.2	
1939	0.1	0	0.2	0.4	0.5	0.2	0.1	0	0	2.6	11.6	2.8	18.5	
1940	1.5	0.5	0.5	0.6	1.5	0.4	0.1	0	0	1.1	3.3	0	9.5	
1941	0.1	0.2	0.4	0.7	1.5	0.7	0.4	0.1	0	1.1	1.5	0.1	6.8	
1942	0	0	0.2	0.3	0.2	0.3	0.1	0	0	2.9	3.7	0.3	8.0	2/
1943	0	0.1	0.1	0.2	0.2	0.1	0.1	0	1.0	2.7	4.7	0.3	9.5	
1944	0.1	0.1	0.2	0.2	0.4	0.4	0.1	0	0	0.3	1.5	0.1	3.4	
1945	0	0.1	0.3	0.5	0.2	0.2	0.1	0	0	0.7	2.6	0	4.7	
14-45 Mean	0.3	0.4	2.0	1.7	1.3	0.8	0.4	0.1	0.1	2.2	4.5	1.4	15.2	*

Subsequent Records

1946	0	0	0.1	0.2	0.2	0.2	0.1	0	0	5.2	7.9	2.4	16.3	2/
1947	0.4	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0	0.6	2.3	0.3	5.3	2/
1948	0	0.1	0	0.1	0.2	0.1	0.1	0	0	0.6	7.0	0.5	8.7	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SANTA CRUZ RIVER AT TUCSON, ARIZONA

Location: Lat. 32°13'15", long. 110°58'50", in NE¼NE¼ sec. 14, T. 14 S., R. 13 E., at Congress Street Bridge in Tucson.

Drainage Area: 2,192 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0	0	0	0	0	0	0	0	0	0.8	1.0	0	1.8	
1915	0.2	0.4	55.0	10.4	11.2	3.1	0	0	0.[illegible]	0.6	0	0	80.9	
1916	0	0	0	24.5	0.6	0	0	0	0	2.7	8.2	1.3	37.3	
1917	0.1	0	0	0	0	0	0	0	0	8.5	10.4	9.3	28.3	
1918	0	0	0	0	0	0	0	0	0.1	0.2	4.6	0	4.9	
1919	0	0	0.1	0	0	0	0	0	0	15.4	9.8	2.2	27.5	
1920	0	0.5	0.5	3.8	0.2	0	0	0	0	0.4	1.8	0.7	7.9	
1921	0	0	0.1	0	0	0	0	0	0	5.2	23.6	3.2	32.1	
1922	0	0	0	0.4	0	0	0	0	0	4.1	5.5	0.9	10.9	
1923	0	0	0	0	0	0	0	0	0	4.4	11.3	0	15.7	
1924	0	2.2	0.5	0.3	0	0.3	0.1	0	0	0.3	0	0	3.7	
1925	0	0	0	0	0	0	0	0	0	1.7	2.7	2.5	6.9	
1926	0.1	0.4	0	0.1	0	0	0.1	0	0	0.2	0.7	18.6	20.2	1/
1927	0.2	0.1	0.2	0	0	0	0	0	0	0.3	1.2	1.1	3.1	
1928	0	0	0	0	0.1	0	0	0	0	0.4	2.2	0.2	2.9	
1929	0	0	0	0	0	0	0	0	0	4.8	8.5	11.0	24.3	
1930	0	0	0	0	0.1	1.3	0	0.1	1.3	2.1	3.0	0.2	8.1	
1931	0	0	0	0	4.6	0	0	0.1	0.1	5.4	24.0	3.0	37.2	
1932	0	1.3	0	3.6	0	0	0	0	0	6.7	3.1	0	14.7	
1933	0.3	0	0	0	0	0	0	0	0	0.9	1.6	4.5	7.3	
1934	0.2	0	0	0	0	0	0	0	0	0.5	6.5	0.3	7.5	
1935	0	0	0.1	0.4	0.3	0	0	0	0	1.2	8.3	10.1	20.4	
1936	0	0.6	0.2	0.1	0.1	0	0	0	0	3.7	3.3	0.8	8.8	
1937	0	0	0	0	0	0	0	0	0	1.8	5.4	1.1	8.3	
1938	0	0	0.1	0	0	0	0	0	0.4	1.0	6.0	0.1	7.6	
1939	0	0	0	0	0	0	0	0	0	2.6	20.8	1.0	24.4	
1940	0	0	0	0	0.3	0	0	0	0.5	1.9	10.1	0.7	13.5	
1941	0	0.1	0.1	0.6	0.1	0	0	0	0	0.7	2.1	1.3	5.0	
1942	0	0	0.1	0.1	0	0	0	0	0	0.8	1.6	0.4	3.0	2/
1943	0	0	0	0	0	0	0	0	0.2	1.9	6.8	2.2	11.1	
1944	0	0	0	0	0	0	0	0	0	0.1	7.6	2.0	9.7	
1945	0.7	0.7	0	0	0	0	0	0	0	5.3	13.8	0.3	20.8	
14-45 Mean	0.1	0.2	1.8	1.4	0.5	0.1	0	0	0.1	2.7	6.7	2.5	16.1	

Subsequent Records

1946	0.5	0	0	0.5	0	0	0	0	0	3.8	7.4	2.6	14.8	2/
1947	2.3	0	0	0	0	0	0	0	0	0.5	2.8	0.9	6.5	2/
1948	0	0	0	0	0	0	0	0	0	1.2	6.6	0.8	8.6	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

RILLITO CREEK NEAR TUCSON, ARIZONA

Location: Lat. 32°18', long. 110°59', in sec. 23, T. 13 S., R. 13 E., at Oracle Road Bridge, 4 miles upstream from mouth and 4 miles north of Tucson. Moved to site 1,800 feet downstream on July 19, 1945.

Drainage Area: 903 square miles; 916 square miles after July 19, 1945.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0	0	0	0	0.8	0	0	0	0	2.5	2.9	2.6	8.8	
1915	0.1	1.4	106.8	21.4	25.4	10.1	1.2	0	0	0	0	0	166.4	
1916	0	0	0	37.1	2.2	3.6	0.1	0	0	0.9	7.8	0.7	52.4	
1917	0	0	0	1.7	0.3	0	0	0	0	5.1	2.9	0.6	10.6	
1918	0	0	0	0	0	7.8	0	4.2	0.5	0.1	0	0	12.6	
1919	0	0	0	0	0.8	0.3	0.7	0	0	30.8	4.1	0.5	37.2	
1920	0	2.4	2.7	4.4	11.6	2.3	0.6	0	0	0	2.0	0	26.0	
1921	0	0	0	0	0	0	0	0	0	26.0	16.1	0.4	42.5	
1922	0	0	0	0.2	0	0	0	0	0.1	0.2	1.9	0.6	3.0	
1923	0	0	0	0	0	0	0	0	0	2.5	4.1	0.1	6.7	
1924	0	0.3	5.2	0.1	0	0	0.2	0	0	0	0	0	5.8	
1925	0	0	0	0	0	0	0	0	0	0.7	1.5	2.5	4.7	
1926	0	0	0	0	0	0.2	0.6	0	0	0.1	0.1	1.0	2.0	1/
1927	0	0	0.1	0.2	1.5	1.3	0	0	0	0	0.2	1.3	4.6	
1928	0	0	0	0	0	0	0	0	0	0.4	0.8	0.1	1.3	
1929	0	0	0	0	0	0	0	0	0	1.8	7.0	18.0	26.8	
1930	0	0	0	0	0	3.3	0	0	0.2	3.2	3.2	0.7	10.6	
1931	0	0	0	0	5.5	0.1	0	0	0	0	6.3	0.1	12.0	
1932	0.1	2.4	1.3	0.4	5.2	1.7	0	0	0	3.6	0.2	0	14.9	
1933	0.4	0	0	0	0.2	0.1	0	0	0	0	0.1	0.7	1.5	
1934	0.3	0	0	0	0	0	0	0	0	0.7	0.9	0.3	2.2	
1935	0	0	0	1.4	3.6	0.8	0	0	0	0.4	7.9	4.1	18.2	
1936	0	0	0	0.3	0.9	0	0	0	0	0.3	2.1	0	3.6	
1937	0	0	0	0	3.0	0.4	0	0	0	0.2	0.8	0.1	4.5	
1938	0	0	0	0	0	1.9	0	0	0.1	0.1	0.5	0	2.6	
1939	0	0	0	0	0	0	0	0	0	1.7	5.1	0	6.8	
1940	0	0	0	0	0.3	0	0	0	0.4	0	7.1	0.5	8.3	
1941	0	0.2	12.8	2.7	4.4	7.0	0	0	0	0.2	1.8	0.6	29.7	
1942	0	0	0.7	0.5	0.3	0.2	0	0	0	0	0.3	0.1	2.1	2/
1943	0	0	0	0	0	0.6	0	0	0	0	1.7	0.3	2.6	
1944	0	0	0	0	0	0	0	0	0	0.7	2.4	0.1	3.2	
1945	0	0.1	0	0	0.1	0.3	0	0	0	0.4	3.0	0	3.9	
14-45 Mean	0	0.2	4.1	2.2	2.1	1.3	0.1	0.1	0	2.6	3.0	1.1	16.8	

Subsequent Records

1946	0.1	0	0	0	0	0	0	0	0	0.4	2.5	0.1	3.1	2/
1947	0.1	0.1	0	0	0	0	0	0	0	0	3.8	0.1	4.1	2/
1948	0	0	0	0	0	0	0	0	0	0.2	0.4	0.3	0.9	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SANTA CRUZ RIVER AT RILLITO, ARIZONA

Location: Lat. 32°24'05", long. 111°08'25", in NE¼SW¼ sec. 8, T. 12 S., R. 12 E., 1 mile southeast of Rillito, 7-3/4 miles downstream from Canada del Oro, and 8-3/4 miles downstream from Rillito Creek.

Drainage Area: 3,523 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													11.4	
1915													178.9	
1916													69.0	
1917													42.7	
1918													11.1	
1919													67.0	
1920													21.3	
1921													77.2	
1922													14.1	
1923													22.5	
1924													6.3	
1925													13.5	*
1926													29.2	
1927													6.5	
1928													4.3	
1929													62.6	
1930													15.7	
1931													45.0	
1932													22.8	
1933													10.7	
1934													9.9	
1935													40.9	
1936													11.7	
1937													11.3	
1938													8.4	
1939													32.0	
1940	0	0	0	0	0.7	0	0	0	0.6	1.5	16.3	1.1	20.2	
1941	0	0.7	10.4	2.3	2.2	2.7	0	0	0	0.6	3.4	2.2	24.5	
1942	0	0	0.3	0.1	0.3	0.2	0.1	0	0	0.5	1.5	0.9	3.9	1/
1943	0	0	0	0	0	0.4	0	0	0.1	1.6	10.2	5.3	17.6	
1944	0	0	0	0	0	0	0	0	0	0.9	11.0	2.4	14.3	
1945	0.4	0.4	0	0	0	0	0	0	0	6.0	17.2	0.1	24.1	
14-45 Mean	0	0.2	4.7	2.5	1.3	0.6	0.1	0.1	0.1	5.3	9.9	4.9	29.7	*

Subsequent Records

1946	0.5	0	0	0.3	0	0	0	0	0	3.8	9.8	2.4	16.8	1/
1947	2.4	0.1	0	0	0	0	0	0	0					1/

* Estimated.

1/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER NEAR ROOSEVELT, ARIZONA

Location: Lat. 33°37', long. 110°55', in NE¼ sec. 9, T. 3 N., R. 14 E., unsurveyed, 100 feet downstream from bridge on Globe-Young highway, a quarter of a mile downstream from Pinal Creek, 1 mile upstream from diversion dam for power canal, 14 miles east of village of Roosevelt, and 17 miles upstream from Roosevelt Dam.

Drainage Area: 4,306 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	13.2	15.2	20.9	23.3	73.3	62.1	63.4	26.6	15.3	36.4	65.1	44.2	459.0	
1915	39.5	29.8	158.3	140.8	187.4	229.1	358.3	227.0	73.1	89.8	37.0	23.0	1,593.1	
1916	19.5	22.3	23.2	983.3	258.1	513.3	256.5	108.9	48.8	28.2	42.6	56.0	2,360.7	
1917	86.6	27.0	19.0	92.9	87.5	73.5	142.9	74.3	28.4	29.5	27.6	17.7	706.9	
1918	14.2	14.7	14.9	16.9	24.8	124.8	40.2	23.1	17.4	22.6	24.1	11.5	349.2	
1919	11.3	14.5	18.2	15.6	54.8	100.3	217.6	75.8	22.5	201.4	99.1	47.8	878.9	
1920	28.9	127.9	282.5	160.3	518.5	172.5	126.4	99.9	38.2	18.7	29.5	17.8	1,621.1	
1921	18.0	29.5	20.1	19.5	20.5	24.3	18.9	17.9	13.3	43.0	221.8	64.1	510.9	
1922	19.7	14.5	19.5	36.4	57.8	122.6	113.7	56.5	23.2	20.3	30.2	14.7	529.1	
1923	11.6	13.6	29.2	16.7	27.8	79.6	72.9	39.3	14.7	22.2	54.2	110.2	492.0	
1924	25.0	59.9	200.5	73.6	30.3	59.4	188.1	67.3	22.9	15.0	16.2	11.7	769.9	1/
1925	10.8	11.7	13.7	12.5	12.6	59.4	38.1	16.0	11.6	15.9	35.2	53.4	290.9	
1926	24.9	17.2	15.2	14.7	14.9	80.2	252.6	120.8	27.6	20.2	20.5	19.4	628.2	
1927	15.4	15.2	23.1	21.5	252.6	141.4	128.4	80.3	31.4	20.8	26.8	36.6	793.5	
1928	13.7	12.7	15.4	13.5	36.1	50.3	39.2	31.2	15.1	18.5	22.2	13.8	281.7	
1929	15.6	15.6	15.5	16.7	15.5	40.7	102.0	26.8	12.1	19.0	67.3	60.8	407.6	
1930	25.7	15.9	13.8	18.2	31.8	107.5	98.7	36.5	16.8	33.4	57.8	15.5	471.6	
1931	9.8	16.6	14.4	11.9	141.6	50.2	77.4	60.5	15.7	19.1	58.0	71.8	547.0	
1932	67.7	38.9	67.2	43.6	341.0	214.5	187.0	73.7	26.0	29.5	50.2	30.0	1,169.3	
1933	17.1	13.0	16.2	16.1	28.0	95.8	68.3	61.2	31.1	29.1	27.9	22.7	426.5	
1934	27.2	16.7	18.0	14.8	13.6	25.3	19.0	12.2	7.2	11.0	46.2	25.2	236.4	
1935	11.1	12.2	12.9	52.8	127.3	158.4	187.4	67.5	39.5	13.9	34.2	30.8	748.0	
1936	13.1	14.4	14.7	13.6	111.3	118.9	193.9	69.7	21.2	14.4	23.6	28.3	637.1	
1937	14.6	17.6	19.6	22.7	238.6	212.4	204.7	75.5	23.0	17.6	16.9	14.6	877.8	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER NEAR ROOSEVELT, ARIZONA (Continued)

Location: Lat. 33°37', long. 110°55', in NE¼ sec. 9, T. 3 N., R. 14 E., unsurveyed, 100 feet downstream from bridge on Globe-Young highway, a quarter of a mile downstream from Pinal Creek, 1 mile upstream from diversion dam for power canal, 14 miles east of village of Roosevelt, and 17 miles upstream from Roosevelt Dam.

Drainage Area: 4,306 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	12.2	11.4	14.3	13.0	13.3	127.7	49.3	27.0	11.4	14.2	36.7	23.5	354.0	1/
1939	9.5	9.7	13.0	13.3	19.2	83.5	113.2	31.6	9.3	7.9	22.2	13.5	345.9	
1940	11.6	13.1	12.3	14.8	33.4	56.0	55.1	26.9	13.2	13.5	20.9	25.8	296.6	
1941	29.2	28.4	184.4	217.1	166.3	512.5	285.3	310.3	81.2	41.1	36.4	33.7	1,925.9	
1942	43.7	27.9	43.0	61.1	34.6	78.8	136.4	57.7	17.5	12.9	24.2	17.0	554.8	2/
1943	15.8	14.3	19.8	55.3	50.6	171.3	98.3	37.3	12.6	10.1	23.6	19.5	528.5	
1944	15.1	12.1	12.9	12.6	20.0	72.7	78.9	40.0	14.9	11.3	16.1	21.9	328.5	
1945	17.3	14.9	15.4	16.8	30.3	100.7	153.2	71.0	15.8	11.9	31.0	11.7	490.0	
14-45 Mean	22.1	22.5	43.2	70.5	96.0	128.7	130.2	67.2	24.1	28.5	42.0	31.5	706.5	

Subsequent Records

1946	16.2	10.1	15.7	16.4	13.6	30.1	34.6	14.7	6.5	10.7	37.4	95.9	301.9	2/
1947	18.0	29.3	30.8	19.9	24.2	35.2	28.7	20.7	7.6	6.3	22.9	40.8	284.4	2/
1948	43.2	15.4	18.2	16.5	21.5	66.1	186.6	49.4	12.5	12.7	16.3	7.1	465.5	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

TONTO CREEK NEAR ROOSEVELT, ARIZONA

Location: Lat. 33°52', long. 111°18', in sec. 14, T. 6 N., R. 10 E., 16 miles upstream from Roosevelt Dam and 16 miles northwest of village of Roosevelt.

Drainage Area: 841 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	0.9	4.3	3.4	7.1	36.1	11.0	2.4	0.9	0.2	1.7	2.3	1.0	71.3	
1915	1.9	1.7	23.2	37.2	64.5	30.6	6.1	16.8	3.5	2.1	1.2	0.7	189.5	
1916	0.4	0.4	2.1	165.5	14.5	11.7	6.4	5.3	2.4	0.8	6.4	6.1	222.0	
1917	4.4	1.2	1.5	15.9	8.1	5.5	54.8	5.0	2.6	3.9	4.6	2.1	109.6	
1918	0.8	1.2	1.7	2.8	6.6	19.6	4.4	0.5	0.3	2.5	5.1	0.6	46.1	
1919	0.1	2.3	6.9	3.3	35.2	20.6	11.3	2.3	0.4	13.9	14.1	2.0	112.4	
1920	2.7	21.5	49.8	28.3	91.4	30.7	22.3	5.9	1.4	0.9	12.5	1.2	268.6	
1921	1.6	4.5	1.7	1.6	2.0	2.1	1.2	0.5	0.2	5.5	12.8	1.7	35.4	
1922	1.9	1.0	8.8	22.3	38.9	60.6	13.3	4.8	0.8	2.9	3.5	0.7	159.5	
1923	0.4	1.0	12.8	2.3	20.8	58.3	6.2	1.8	0.3	4.6	5.6	6.3	120.4	
1924	0.2	8.4	75.0	23.9	3.0	7.1	12.0	2.6	0.4	0.7	0.3	0.5	134.1	
1925	0.4	0.2	5.2	2.6	1.3	9.2	2.8	0.7	0.6	1.5	3.8	8.4	36.7	
1926	5.8	2.6	2.6	1.1	0.8	7.4	103.1	23.2	0.8	1.2	2.6	4.1	155.3	
1927	1.5	0.2	12.2	1.2	84.7	15.6	9.7	3.8	9.7	3.2	5.5	18.0	165.3	1/
1928	0.5	1.0	1.6	2.4	17.3	2.1	0.3	0.9	0.3	1.3	5.8	2.2	35.7	
1929	1.0	2.6	1.3	2.5	7.9	11.4	29.3	1.8	0.7	0.2	4.1	1.4	64.2	
1930	0.1	0.1	0.2	1.6	0.9	15.2	5.6	1.2	0.2	7.3	4.5	0.7	37.6	
1931	0.4	7.7	3.5	0.4	45.3	4.3	10.7	6.8	0.2	0.9	9.7	2.1	92.0	
1932	0.9	15.8	31.8	18.4	114.9	23.8	9.2	2.3	0.5	2.3	4.3	0.8	225.0	
1933	2.8	1.0	3.5	6.9	8.5	10.8	3.2	5.0	0.4	1.5	1.3	2.3	47.2	
1934	2.6	1.0	1.6	1.1	3.2	1.1	0.4	0.3	0.3	0.3	3.9	3.7	19.5	
1935	0.3	2.0	0.9	18.3	20.5	28.3	11.3	2.4	0.4	0.5	5.6	3.4	93.9	
1936	0.6	0.7	1.0	0.7	18.5	13.9	9.6	1.1	0.2	1.0	4.3	2.6	54.2	
1937	0.4	1.4	3.3	13.0	76.8	62.2	11.7	2.3	0.7	2.0	0.8	0.4	175.0	
1938	0.4	0.2	0.3	0.5	1.5	33.1	1.8	0.5	0.5	0.2	2.8	2.9	44.7	
1939	0	0	3.1	2.6	8.1	9.3	5.2	0.6	0.1	0.1	2.1	4.6	35.8	2/
1940	0.2	0.2	0.5	1.2	4.5	1.1	1.3	0.2	0.4	0.5	1.8	1.0	12.9	2/
1941	3.6	1.9	56.8	40.0	53.0	119.0	74.0	36.0	2.5	2.0	3.4	1.2	393.4	3/
1942	1.6	2.6	9.1	18.7	3.1	9.4	6.2	2.3	0.3	0.3	1.1	1.0	55.7	4/
1943	0.5	0.7	2.9	19.0	9.4	34.0	2.7	0.6	0.1	0	1.5	0.5	71.9	4/
1944	0.4	0.4	0.7	1.0	22.0	44.0	15.5	4.2	0.4	0.3	0.1	0.4	89.4	4/
1945	0.3	0.7	1.0	3.2	6.3	46.0	14.5	3.0	0.3	0.5	3.5	0.1	79.4	4/
14-45 Mean	1.2	2.8	10.3	14.6	25.9	23.7	14.6	4.6	1.0	2.1	4.4	2.7	107.9	

Subsequent Records

1946	0.2	0.3	1.9	1.2	0.6	0.9	0.6	0.2	0	0.1	4.4	27.0	37.4	4/
1947	1.0	8.3	18.2	6.3	2.8	2.3	0.7	0.3	0	0	7.9	0.2	48.0	4/
1948	0.4	0.6	5.2	1.1	1.6	7.5	5.5	0.5	0	0.2	1.6	0	24.2	4/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey Water-Supply Papers 879 and 899.
3/ Oct, Nov, and Dec are from W.S.P. 929; other months are estimated.
4/ Estimated.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

VERDE RIVER BELOW BARTLETT DAM, ARIZONA

Location: Lat. 33°48'30", long. 111°40'00", in NE¼ sec. 6, T. 5 N., R. 7 E., 2¼ miles downstream from Bartlett Dam and 3½ miles upstream from Camp Creek. Prior to 1942 at sites 3 to 20 miles downstream.

Drainage Area: 6,159 square miles since Jan. 1, 1942. 6,620 square miles prior to 1925 and 6,180 square miles from 1925 to 1942.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	12.6	20.1	18.8	58.8	169.1	44.1	15.0	9.5	6.8	12.5	14.4	13.7	395.4	
1915	20.1	16.1	40.1	76.3	136.0	149.3	90.7	108.7	12.3	20.1	21.4	13.8	704.9	
1916	10.9	14.8	24.1	434.7	64.0	197.5	41.4	14.2	9.5	12.4	31.2	77.1	931.8	
1917	44.6	19.4	20.9	75.2	83.1	108.2	357.3	77.1	14.0	25.6	44.7	23.1	893.2	
1918	15.2	14.5	16.3	24.2	50.2	283.6	21.1	9.8	8.2	11.8	33.5	11.3	499.7	
1919	11.9	20.6	28.2	21.2	52.9	95.9	79.3	10.6	7.0	130.7	55.7	28.0	542.0	
1920	45.6	169.6	137.1	137.4	515.1	115.8	61.9	18.8	12.4	11.1	28.0	13.5	1,266.3	
1921	14.8	27.6	21.0	19.4	18.6	32.1	14.0	10.3	7.5	18.2	104.2	21.9	309.6	
1922	27.2	17.1	88.3	159.5	152.7	201.6	63.7	15.8	9.7	12.8	20.5	14.3	783.2	
1923	11.4	16.8	75.6	21.3	67.9	135.7	47.2	11.9	6.9	12.2	15.6	114.8	537.3	
1924	16.6	57.6	215.2	61.1	20.6	32.1	97.9	10.6	5.9	11.5	6.4	12.0	547.5	1/
1925	14.0	12.6	26.6	18.4	18.3	25.4	26.9	12.5	7.4	12.5	21.8	67.1	263.5	
1926	47.9	20.3	22.6	18.3	16.3	44.3	263.2	25.1	7.0	11.9	15.3	20.6	512.8	
1927	15.2	12.8	26.6	19.6	393.2	124.8	48.1	12.0	12.0	16.0	29.1	108.8	818.2	
1928	17.1	17.7	26.1	29.5	81.8	61.3	14.3	10.4	6.7	8.1	29.7	11.2	313.9	
1929	16.2	16.3	18.6	19.7	22.9	84.1	127.5	9.2	6.9	10.1	35.7	23.2	390.4	
1930	10.8	12.9	14.4	17.9	24.6	82.5	32.4	10.8	5.9	19.2	38.4	16.8	286.6	
1931	13.8	30.6	21.9	14.1	167.7	39.3	15.0	15.1	5.8	9.9	47.9	22.4	403.5	
1932	13.1	35.7	58.3	29.4	371.2	223.8	46.2	12.2	8.2	13.8	15.2	8.0	835.1	
1933	18.0	12.4	18.1	23.5	20.2	44.6	17.8	21.2	8.8	11.2	10.1	13.8	219.7	
1934	14.3	12.3	15.6	16.0	15.0	13.9	15.3	7.4	6.3	7.6	27.8	12.8	164.3	
1935	10.2	15.9	19.5	64.3	124.2	121.2	59.5	11.3	6.8	7.4	36.4	28.9	505.6	
1936	14.7	14.7	17.1	16.3	49.8	59.6	41.2	9.2	5.5	13.7	26.7	18.9	287.4	
1937	13.0	18.6	17.9	28.4	351.7	250.7	84.5	11.5	8.4	13.3	10.1	11.1	819.2	

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

VERDE RIVER BELOW BARTLETT DAM, ARIZONA (Continued)

Location: Lat. 33°48'30", long. 111°40'00", in NE¼ sec. 6, T. 5 N., R. 7 E., 2¼ miles downstream from Bartlett Dam and 3½ miles upstream from Camp Creek. Prior to 1942 at sites 3 to 20 miles downstream.

Drainage Area: 6,159 square miles since Jan. 1, 1942. 6,620 square miles prior to 1925 and 6,180 square miles from 1925 to 1942.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	12.6	12.8	16.1	16.7	22.6	289.9	13.3	7.9	5.9	8.5	17.8	12.1	436.2	1/
1939	10.0	12.0	23.9	18.3	18.8	49.5	23.6	7.9	5.1	5.1	18.3	57.6	250.1	↑
1940	25.9	16.3	23.9	18.3	31.4	41.1	20.4	9.5	5.4	9.0	17.3	20.4	238.9	|
1941	32.7	26.6	18.6	28.7	187.4	301.4	287.2	39.7	58.7	50.0	48.8	70.3	1,150.1	|
1942	14.1	14.4	6.4	3.6	9.6	49.1	48.4	44.3	51.3	33.8	11.0	7.9	293.9	2/
1943	8.8	12.8	10.6	19.8	24.9	58.4	57.9	44.7	6.8	6.0	3.9	28.2	282.8	|
1944	18.3	13.0	2.1	18.7	13.4	59.6	102.1	43.9	53.6	34.5	47.9	31.4	438.5	|
1945	11.4	1.7	27.2	17.2	25.9	54.4	69.9	47.2	46.1	23.4	26.6	44.9	395.9	↓
14-45 Mean	18.2	23.0	34.9	48.3	103.8	108.6	72.0	22.2	13.4	18.9	28.5	30.6	522.4	

Subsequent Records

1946	13.3	10.1	14.1	15.6	17.5	16.0	36.1	19.6	8.3	4.2	7.5	28.0	190.3	2/
1947	6.0	7.4	28.5	12.9	25.8	35.5	22.7	13.8	8.3	8.0	3.7	19.1	191.7	2/
1948	22.5	12.9	26.2	11.4	6.4	41.4	55.2	15.9	14.4	6.0	8.1	17.4	237.8	2/

1/ Geological Survey Water-Supply Paper 1049. Published as Verde River near McDowell and above Camp Creek, near McDowell, Arizona.

2/ Geological Survey annual Water-Supply Papers. Published as Verde River above Camp Creek, near McDowell, until 1942. Records at the several sites are comparable.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSION FOR CITY OF PHOENIX FROM VERDE RIVER AT McDOWELL, ARIZONA

Location: Lat. 33°34', long. 111°40', in NE¼ sec. 30, T. 3 N., R. 7 E., on canal, 2 miles northwest of mouth of Verde River, 3.9 miles downstream from intake, and 4.5 miles downstream from McDowell.

Water is pumped from infiltration galleries and shallow wells on right bank of Verde River in SE¼ sec. 6, T. 3 N., R. 7 E., three quarters of a mile downstream from McDowell and 6¼ miles upstream from mouth of Verde River. Water is used for municipal supply of Phoenix and is carried 29 miles to that city by pipe line.

Diversions began in February 1922.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1922					0.5	0.5	0.6	0.7	0.7	0.8	0.7	0.7	5.2	
1923	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.9	0.8	0.7	7.7	
1924	0.6	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.8	1.0	0.9	0.7	8.1	
1925	0.6	0.5	0.6	0.6	0.5	0.7	0.7	0.4	0.3	0.8	0.9	0.8	7.4	
1926	0.4	0.6	0.6	0.6	0.6	0.7	0.8	0.7	0.8	1.1	0.9	0.7	8.5	
1927	0.8	0.6	0.6	0.7	0.6	0.7	0.8	0.9	1.0	1.2	1.0	0.9	9.8	
1928	0.9	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.3	1.2	1.0	11.1	
1929	1.0	0.9	0.9	0.9	0.7	1.1	1.1	1.2	1.2	1.3	1.4	1.4	13.1	1/
1930	1.2	1.0	1.1	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.2	13.6	
1931	1.1	1.0	1.0	1.1	1.0	0.9	1.1	1.1	1.3	1.5	1.3	1.2	13.6	
1932	1.3	0.9	0.9	1.1	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.3	14.4	
1933	0.8	0.8	0.7	0.7	0.6	0.9	1.0	1.2	1.6	1.7	1.6	1.2	12.8	
1934	1.0	0.8	0.7	0.8	0.8	1.2	1.4	1.6	1.6	1.9	1.5	1.5	14.8	
1935	1.3	0.9	0.8	0.7	0.7	0.9	1.3	1.4	1.7	1.7	1.3	1.3	14.0	
1936	1.1	0.8	0.8	0.8	0.6	0.9	1.0	1.2	1.4	1.4	1.3	1.2	12.5	
1937	1.0	0.8	0.7	0.7	0.7	0.9	1.2	1.4	1.6	1.8	1.8	1.3	13.9	
1938	1.2	0.9	0.8	0.8	0.8	1.0	1.4	1.5	1.8	1.9	1.8	1.7	15.6	
1939	1.3	1.0	0.8	0.8	0.8	1.2	1.4	1.8	2.0	2.2	1.9	1.3	16.5	2/
1940	1.3	0.9	1.1	1.1	1.1	1.5	1.7	2.0	2.2	2.4	2.3	1.7	19.3	
1941	1.3	1.1	0.9	1.0	1.1	1.2	1.3	1.7	2.1	2.3	2.1	1.7	17.8	
1942	1.2	1.1	0.9	1.0	1.1	1.4	1.5	2.0	2.4	2.5	1.9	1.5	18.5	3/
1943	1.5	1.1	1.1	1.0	1.1	1.5	1.7	2.2	1.8	1.5	1.7	1.6	17.8	
1944	1.2	1.0	1.1	1.2	1.1	1.4	1.6	2.1	2.3	2.4	2.4	2.1	19.9	
1945	1.6	1.2	0.9	1.0	1.3	1.5	1.8	2.3	2.2	2.3	2.0	2.0	20.1	4/
14-45 Mean	0.8	0.6	0.6	0.6	0.6	0.8	0.9	1.0	1.1	1.2	1.1	0.9	10.2	

Subsequent Records

1946	1.5	1.2	1.2	1.2	1.1	1.8	1.8	1.9	2.1	2.2	1.8	1.9	19.7	4/
1947	1.4	1.2	1.4	1.4	1.6	2.0	2.2	1.7	1.9	2.4	1.9	1.8	20.9	4/
1948	2.0	1.5	1.5	1.6	1.5	1.8	2.3	2.6	2.4	2.6	2.5	2.5	24.8	4/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey Water-Supply Paper 879.
3/ Geological Survey Water Supply Paper 1009.
4/ Records furnished by Salt River Valley Water Users' Association.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER AT GRANITE REEF DAM, ARIZONA 1/

Location: Lat. 33°31', long. 111°42', about the center of sec. 13, T. 2 N., R. 6 E., 2.5 miles downstream from former Arizona Dam, and 3.75 miles downstream from Verde River.

Drainage Area: 12,907 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	62.4	40.9	31.2	70.9	176.0	91.9	92.5	101.0	73.1	75.9	97.9	94.8	1,008.5	
1915	50.3	41.7	76.9	98.0	152.0	175.0	222.0	411.0	135.0	138.0	130.0	118.0	1,747.9	
1916	97.8	70.8	54.4	1250.0	616.0	833.0	327.0	164.0	140.5	148.0	124.0	166.0	3,991.5	
1917	107.0	70.6	48.0	105.0	106.0	164.0	406.0	166.0	151.0	162.0	127.0	139.0	1,751.6	
1918	114.0	76.6	58.3	56.4	70.5	309.0	145.0	151.1	149.0	136.0	143.0	152.0	1,560.9	
1919	87.9	53.5	41.2	40.4	74.1	125.0	139.0	129.0	136.0	188.0	150.0	118.0	1,282.1	
1920	83.5	191.0	152.0	186.0	877.0	291.0	228.0	134.0	134.0	152.0	155.0	131.0	2,714.5	
1921	64.2	61.6	46.9	49.3	67.7	114.0	97.7	106.0	111.0	133.0	169.0	119.0	1,139.4	
1922	78.5	55.2	114.0	182.0	172.0	250.0	127.0	128.0	124.0	137.0	137.0	131.0	1,635.7	
1923	68.7	46.0	81.7	53.7	75.3	156.0	121.0	125.0	118.3	116.0	124.0	196.0	1,281.7	
1924	58.2	72.9	244.0	72.0	60.3	78.7	142.0	134.0	155.0	174.0	188.3	157.0	1,536.4	
1925	63.3	39.6	39.9	31.3	47.8	86.2	97.7	87.5	87.1	105.1	81.8	132.0	899.3	2/
1926	52.0	34.8	30.4	23.1	32.7	72.5	275.0	81.6	105.0	112.0	94.9	128.0	1,042.0	
1927	54.4	49.6	49.5	48.3	467.0	151.0	84.6	93.8	96.5	117.0	102.0	177.0	1,490.7	
1928	73.7	52.2	38.1	38.2	106.0	105.4	94.2	105.0	131.0	147.0	116.0	142.0	1,148.8	
1929	50.4	37.0	23.3	25.6	37.1	107.0	163.0	89.1	93.9	90.0	81.5	131.0	928.9	
1930	54.3	37.7	18.9	21.5	31.9	92.6	57.6	59.2	89.0	83.2	86.0	129.0	760.9	
1931	49.3	51.2	24.9	18.4	176.0	64.3	62.6	77.7	87.5	99.5	76.3	105.0	892.7	
1932	73.1	56.4	60.2	33.9	393.0	225.0	91.3	110.0	112.0	110.0	105.0	146.0	1,515.9	
1933	61.2	62.1	31.4	31.2	33.8	81.3	72.1	84.3	99.6	114.2	95.7	121.0	887.9	
1934	88.8	58.3	29.4	49.0	42.4	76.2	84.2	74.9	78.3	95.2	68.7	117.0	862.4	
1935	68.6	40.6	22.5	62.8	127.4	118.8	100.1	86.1	109.0	120.9	88.4	115.6	1,060.8	
1936	80.1	52.7	39.6	40.1	46.9	94.9	109.6	107.5	123.4	123.3	105.9	131.9	1,055.9	
1937	73.7	57.8	35.1	28.8	360.9	253.1	129.8	130.4	123.8	160.4	170.8	150.0	1,674.6	

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER AT GRANITE REEF DAM, ARIZONA (Continued) 1/

Location: Lat. 33°31', long. 111°42', about the center of sec. 13, T. 2 N., R. 6 E., 2.5 miles downstream from former Arizona Dam, and 3.75 miles downstream from Verde River.

Drainage Area: 12,907 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	78.3	48.1	29.3	27.0	36.3	313.4	105.5	106.1	121.6	129.0	121.4	134.6	1,250.6	
1939	72.6	49.3	30.7	19.2	30.3	75.8	84.6	81.0	84.8	92.2	81.0	65.8	767.3	
1940	63.3	43.3	43.1	22.7	30.3	82.3	73.5	64.4	67.9	70.9	47.9	49.1	658.7	
1941	35.8	31.7	33.0	28.6	187.3	302.7	431.4	389.7	154.2	143.8	149.0	160.8	2,048.0	2/
1942	78.4	59.1	36.4	26.9	65.7	93.9	101.2	119.6	136.8	133.2	114.7	115.5	1,081.4	
1943	77.7	53.5	52.3	23.6	46.1	81.1	105.1	117.1	119.9	115.6	67.4	113.7	973.1	
1944	87.9	64.8	34.7	29.0	32.6	66.3	114.3	97.5	122.1	111.5	103.3	131.6	995.6	
1945	92.0	37.1	54.8	18.5	42.9	70.1	98.3	108.8	116.3	101.5	88.9	144.1	973.3	
14-45 Mean	71.9	56.2	53.3	87.9	150.7	162.5	143.2	125.6	115.2	123.0	112.2	130.1	1,331.8	
Subsequent Records														
1946	86.9	71.3	51.8	15.0	55.3	99.5	91.4	95.5	102.3	73.9	74.9	89.4	909.2	2/
1947	73.2	38.3	66.7	35.1	47.6	72.9	72.3	55.8	65.3	58.0	55.4	75.2	715.8	2/
1948	53.2	30.0	43.6	20.0	27.6	64.1	92.9	66.6	71.9	67.0	69.5	86.2	692.6	2/
1949	50.9	35.6	30.4	7.6	27.2	96.4	91.6	76.9	87.3	102.4	95.6	105.0	806.9	2/
1950	54.7	35.4	26.8	20.1	31.5	74.3	93.2	64.0	89.1	82.2	93.7	85.4	750.4	2/
1951	42.9	26.3	30.5	16.1	12.8	63.8	45.0	41.0	71.1	83.6	64.6			2/

1/ These records are computed as the sum of the total diversions by the two canals at Granite Reef Dam and the spills over Granite Reef Dam, and represent the total flow of Salt River immediately upstream from diversions at Granite Reef Dam.

2/ Records furnished by Salt River Valley Water Users' Association.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS FROM SALT RIVER AT GRANITE REEF DAM, ARIZONA 1/

Location: Granite Reef Dam, lat. 33°31', long. 111°42', about the center of sec. 13, T. 2 N., R. 6 E., 2.5 miles downstream from former Arizona Dam, and 3.75 miles downstream from Verde River.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	60.9	35.4	29.1	41.7	51.4	74.0	87.0	98.1	71.5	74.2	95.1	93.2	811.6	
1915	47.0	38.7	27.6	15.2	31.3	90.9	101.2	122.3	120.2	129.1	117.3	113.8	954.6	
1916	94.9	67.9	42.4	39.6	59.1	98.9	118.2	140.7	140.5	145.4	119.4	89.2	1,156.2	
1917	86.4	70.6	43.5	15.9	39.8	107.9	96.9	124.4	150.4	144.3	116.9	136.3	1,133.3	
1918	114.0	76.5	57.5	40.3	48.5	82.9	143.7	151.1	148.6	134.1	128.4	142.3	1,267.9	
1919	87.7	48.1	23.9	23.4	34.6	94.6	119.4	129.0	135.7	106.4	125.4	101.7	1,029.9	
1920	49.0	31.2	14.4	24.6	33.0	75.2	118.8	112.1	133.1	151.8	147.9	130.9	1,022.0	
1921	43.3	28.8	28.6	42.8	67.3	113.5	97.5	105.2	111.0	126.4	88.8	114.4	967.6	
1922	59.8	40.3	31.8	28.0	51.5	82.4	114.1	125.6	122.6	136.1	132.6	129.2	1,054.0	
1923	68.6	44.9	27.3	51.4	53.7	102.4	118.7	124.2	118.3	115.4	122.5	124.4	1,071.8	2/
1924	58.2	14.3	24.5	39.5	59.7	77.6	132.1	132.0	154.6	173.6	188.3	156.8	1,211.2	
1925	62.6	39.6	36.6	31.3	47.8	86.1	96.8	87.5	87.1	105.1	81.7	107.3	869.5	
1926	44.6	34.8	30.4	22.9	32.4	72.3	54.9	81.6	104.6	111.9	94.9	123.4	808.7	
1927	54.4	49.6	22.6	37.4	66.3	121.1	84.2	93.6	95.9	116.3	100.5	116.4	958.3	
1928	73.7	52.2	37.9	37.0	66.2	105.4	94.2	104.9	130.6	146.7	115.6	138.4	1,102.8	
1929	50.4	37.0	23.3	25.5	37.1	100.8	91.8	89.1	93.9	90.0	80.5	129.6	849.0	
1930	54.3	37.7	18.9	20.6	31.9	85.3	57.6	59.2	89.0	82.5	77.8	128.0	742.8	
1931	49.3	49.6	24.9	18.4	47.5	64.3	62.6	77.7	87.5	99.5	74.2	104.6	760.1	
1932	73.1	53.0	43.8	33.1	61.4	136.1	91.3	109.5	111.7	109.6	104.7	145.7	1,073.0	
1933	61.2	62.1	31.4	30.8	33.7	81.3	72.1	84.3	99.6	114.2	95.7	120.5	886.9	
1934	87.3	58.3	29.4	49.0	42.4	76.2	84.2	74.9	78.3	95.2	68.5	116.8	860.5	
1935	68.6	40.6	22.3	51.5	69.8	84.6	91.6	86.1	109.0	120.9	88.3	115.6	948.9	
1936	80.0	52.7	39.6	40.1	39.6	94.9	109.6	107.5	123.4	119.7	102.8	131.9	1,041.8	
1937	73.7	57.8	34.8	27.3	79.4	102.7	127.2	130.3	122.9	159.9	170.3	149.8	1,236.1	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS FROM SALT RIVER AT GRANITE REEF DAM, ARIZONA (Continued) 1/

Location: Granite Reef Dam, lat. 33°31', long. 111°42', about the center of sec. 13, T. 2 N., R. 6 E., 2.5 miles downstream from former Arizona Dam, and 3.75 miles downstream from Verde River.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	78.1	48.0	29.3	27.0	36.3	96.5	105.5	106.1	121.5	128.9	121.2	134.6	1,033.0	2/
1939	72.6	49.3	30.4	19.2	30.3	75.8	84.6	81.0	84.8	91.8	80.0	57.1	756.9	3/
1940	63.3	43.3	43.1	22.7	30.3	82.3	73.5	64.4	67.9	70.9	47.9	48.9	658.5	
1941	35.8	31.7	17.7	26.1	59.6	42.7	103.2	150.5	154.2	142.6	148.2	159.8	1,072.1	
1942	78.4	58.7	36.3	25.6	65.7	93.9	100.9	119.6	136.8	133.0	114.7	115.1	1,078.7	4/
1943	77.7	53.5	52.3	23.6	46.1	80.6	105.0	117.0	119.9	115.6	64.3	113.5	969.1	
1944	87.9	64.8	34.7	28.9	32.1	66.3	114.0	97.3	122.0	111.3	103.3	131.5	994.1	
1945	92.0	37.1	54.1	18.4	42.9	69.7	98.3	108.8	116.3	100.1	88.8	144.1	970.6	5/
14-45 Mean	68.4	47.1	32.6	30.6	47.8	88.1	98.5	106.1	114.5	118.8	106.4	120.8	979.7	
Subsequent Records														
1946	86.7	71.3	51.8	15.0	55.2	99.5	91.3	95.4	102.3	75.8	74.9	87.1	906.3	5/
1947	73.2	38.3	66.4	35.0	47.5	72.9	72.3	55.8	65.3	58.0	55.0	74.9	714.6	5/
1948	53.2	30.0	43.0	20.0	27.5	64.0	92.9	66.6	71.9	66.9	69.3	86.2	691.5	5/

1/ Records show net diversion which was computed as the sum of the diversions near head of the two canals less flow returned to river from the canals by wasteways between the dam and irrigated lands.

2/ Geological Survey Water-Supply Paper 1049.

3/ Geological Survey Water-Supply Paper 879.

4/ Geological Survey Water-Supply Paper 1009.

5/ Computed from records furnished by Salt River Valley Water Users' Association.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER BELOW GRANITE REEF DAM, ARIZONA 1/

The record for this station is computed from records obtained at other stations.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	1.5	5.5	2.1	29.2	124.6	17.9	5.5	2.9	1.6	1.7	2.8	1.6	196.9	
1915	3.3	3.0	49.3	82.8	120.7	84.1	120.8	288.7	14.8	8.9	12.7	4.2	793.3	
1916	2.9	2.9	12.0	1,210.4	556.9	734.1	208.8	23.3	0	2.6	4.6	76.8	2,835.3	
1917	20.6	0	4.5	89.1	66.2	56.1	309.1	41.6	0.6	17.7	10.1	2.7	618.3	
1918	0	0.1	0.8	16.1	22.0	226.1	1.3	0	0.4	1.9	14.6	9.7	293.0	
1919	0.2	5.4	17.3	17.0	39.5	30.4	19.6	0	0.3	81.6	24.6	16.3	252.2	
1920	34.5	159.8	137.6	161.4	844.0	215.8	109.2	21.9	0.9	0.2	7.1	0.1	1,692.5	
1921	20.9	32.8	18.3	6.5	0.4	0.5	0.2	0.8	0	6.6	80.2	4.6	171.8	
1922	18.7	14.9	82.2	154.0	120.5	167.6	12.9	2.4	1.4	0.9	4.4	1.8	581.7	
1923	0.1	1.1	54.4	2.3	21.6	53.6	2.3	0.8	0	0.6	1.5	71.6	209.9	
1924	0	58.6	219.5	32.5	0.6	1.1	9.9	2.0	0.4	0.4	0	0.2	325.2	2/
1925	0.7	0	3.3	0	0	0.1	0.9	0	0	0	0.1	24.7	29.8	
1926	7.4	0	0	0.2	0.3	0.2	220.1	0	0.4	0.1	0	4.6	233.3	
1927	0	0	26.9	10.9	400.7	29.9	0.4	0.2	0.6	0.7	1.5	60.6	532.4	
1928	0	0	0.2	1.2	39.8	0	0	0.1	0.4	0.3	0.4	3.6	46.0	
1929	0	0	0	0.1	0	6.2	71.2	0	0	0	1.0	1.4	79.9	
1930	0	0	0	0.9	0	7.3	0	0	0	0.7	8.2	1.0	18.1	
1931	0	1.6	0	0	128.5	0	0	0	0	0	2.1	0.4	132.6	
1932	0	3.4	16.4	0.8	331.6	88.9	0	0.5	0.3	0.4	0.3	0.3	442.9	
1933	0	0	0	0.4	0.1	0	0	0	0	0	0	0.5	1.0	
1934	1.5	0	0	0	0	0	0	0	0	0	0.2	0.2	1.9	
1935	0	0	0.2	11.3	57.6	34.2	8.5	0	0	0	0.1	0	111.9	
1936	0.1	0	0	0	7.3	0	0	0	0	3.6	3.1	0	14.1	
1937	0	0	0.3	1.5	281.5	150.4	2.6	0.1	0.9	0.5	0.5	0.2	438.5	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

SALT RIVER BELOW GRANITE REEF DAM, ARIZONA (Continued) 1/

The record for this station is computed from records obtained at other stations.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	0.2	0.1	0	0	0	216.9	0	0	0.1	0.1	0.2	0	217.6	
1939	0	0	0.3	0	0	0	0	0	0	0.4	1.0	8.7	10.4	
1940	0	0	0	0	0	0	0	0	0	0	0	0.2	0.2	
1941	0	0	15.3	2.5	127.7	260.0	328.2	239.2	0	1.2	0.8	1.0	975.9	2/
1942	0	0.4	0.1	1.3	0	0	0.3	0	0	0.2	0	0.4	2.7	
1943	0	0	0	0	0	0.5	0.1	0.1	0	0	3.1	0.2	4.0	
1944	0	0	0	0.1	0.5	0	0.3	0.2	0.1	0.2	0	0.1	1.5	
1945	0	0	0.7	0.1	0	0.4	0	0	0	1.4	0.1	0	2.7	
14-45 Mean	3.5	9.1	20.7	57.3	102.9	74.4	44.7	19.5	0.7	4.2	5.8	9.3	352.1	

Subsequent Records

1946	0.2	0	0	0	0.1	0	0.1	0.1	0	0.1	0	2.3	2.9	2/
1947	0	0	0.3	0.1	0.1	0	0	0	0	0	0.4	0.3	1.2	2/
1948	0	0	0.6	0	0.1	0.1	0	0	0	0.1	0.2	0	1.1	2/

1/ This record is computed as the sum of spills over Granite Reef Dam and water returned to the river from the canals by wasteways and sluicing between the dam and irrigated lands. These records represent the total flow of Salt River at Granite Reef Dam less net diversions for irrigation.

2/ Computed from records published by the Geological Survey and records furnished by the Salt River Valley Water Users' Association.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

AGUA FRIA RIVER AT LAKE PLEASANT DAM, ARIZONA

Location: Lat. 33°51', long. 112°16', in NW¼ sec. 21, T. 6 N., R. 1 E., at left upstream end of Lake Pleasant Dam, 24¼ miles upstream from New River.

Drainage Area: 1,459 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	1.0	3.0	0.4	7.8	55.2	1.6	1.3	0.1	0.1	3.2	0.1	3.8	77.6	1/
1915	2.7	0.4	10.1	152.1	48.3	9.2	2.5	9.9	0.6	5.4	6.4	2.4	250.0	
1916	0.2	2.3	15.0	701.8	33.2	31.0	8.9	1.7	0.4	1.5	3.8	7.1	806.9	
1917	12.4	1.0	1.2	22.7	18.9	6.8	92.3	5.8	0.9	63.9	9.0	5.6	240.5	2/
1918	0.5	0.5	0.7	3.7	1.3	13.5	1.2	0.2	0.8	0.9	22.1	0.6	46.0	
1919	0.4	1.8	1.9	0.5	11.2	3.4	1.7	0.6	0.2	22.4	13.7	16.7	74.5	
1920	1.9	180.0	16.4	80.4	128.9	22.4	7.5	4.3	0.7	2.1	11.3	10.1	466.0	
1921	1.0	4.4	2.4	1.8	3.1	1.3	1.5	0.1	0.1	21.0	20.7	8.6	66.0	
1922	34.7	1.0	14.2	94.0	65.1	66.0	6.5	1.8	1.6	2.8	5.1	13.1	305.9	
1923	1.3	1.4	5.3	0.7	4.2	57.1	6.3	3.2	2.3	4.0	4.9	52.3	143.0	
1924	0.1	6.5	74.6	16.8	2.7	6.3	17.3	1.1	0.9	1.0	7.4	7.8	142.5	
1925	2.1	1.5	4.5	1.1	1.1	1.1	1.1	0.8	1.1	6.5	10.4	11.5	42.8	
1926	1.1	1.0	2.2	2.7	4.1	9.1	72.0	17.7	1.2	6.1	24.3	22.7	164.2	1/
1927	6.0	4.0	40.0	1.0	170.0	24.0	23.0	2.0	1.0	0.8	24.1	31.1	327.0	
1928	1.8	0.5	3.7	2.2	9.4	2.0	2.8	2.4	1.5	1.6	9.9	2.0	39.8	
1929	1.6	0.3	0.6	0.6	0.4	0.3	5.3	0.1	0.1	0.6	4.5	8.8	23.2	
1930	0.4	0.2	0.2	1.2	0.6	8.6	2.2	0.4	0.2	4.9	9.4	6.0	34.3	
1931	0.4	6.4	0.6	0.6	56.1	0.9	0.4	0.3	0.2	5.4	29.4	2.2	102.9	
1932	1.7	1.0	6.2	1.7	58.1	9.1	0.6	0.4	0.3	1.0	3.4	0.7	84.2	
1933	2.0	0.3	1.1	9.2	2.6	4.4	1.0	0.8	0.8	1.8	3.1	5.4	32.5	
1934	1.3	0.5	0.3	0.3	0.2	0.4	0.2	0.2	0.2	0.4	8.7	0.9	13.6	
1935	0.2	0.8	2.1	8.3	28.1	14.9	2.1	0.2	0.8	3.5	9.3	8.4	78.7	
1936	0.2	0.4	0.4	0.4	1.6	1.3	0.5	0.3	0.3	5.0	9.7	3.9	24.0	2/
1937	0.6	0.3	1.1	4.3	58.2	41.8	2.1	0.1	1.4	1.3	2.2	1.2	114.6	
1938	0.6	0.5	0.4	0.3	0.2	25.7	0.4	0.1	0	0	0.5	0.4	29.1	
1939	0.3	0.1	5.4	0.4	1.3	1.9	0.6	0	0	0	2.6	17.4	30.0	
1940	0.3	0.5	0.5	0.2	2.5	0.2	1.3	0.5	0.8	0.4	1.3	1.7	10.2	
1941	3.7	0.3	19.0	11.5	17.0	74.2	68.2	3.8	0.8	4.5	4.1	2.0	209.1	
1942	1.5	0.8	4.0	2.9	1.4	2.6	1.1	0.2	0	0.6	3.5	3.3	21.9	3/
1943	1.2	0.7	0.5	1.6	0.3	2.2	0.2	0.1	0.1	0.1	11.6	3.4	22.0	
1944	0.7	0.4	0.3	0.2	12.5	19.8	2.6	0.5	0	1.2	2.0	2.2	42.4	
1945	0.2	0.7	0.9	1.5	5.2	19.9	4.2	0.5	1.0	2.3	4.0	0.2	40.6	
14-45 Mean	2.6	7.0	7.4	35.5	25.1	15.1	10.6	1.9	0.6	5.5	8.8	8.2	128.3	

Subsequent Records

1946	1.4	0.4	0.7	0.3	0.2	0.1	0.1	0	0.1	1.4	4.0	2.3	11.0	3/
1947	0.5	0.7	1.3	0.5	0.2	0.1	0	0.2	0.1	0.1	3.9	0.1	7.7	3/
1948	0	0	0.2	0.1	0.1	0.1	0	0	0	0.2	4.5	0	5.2	3/

1/ Records of Maricopa County Municipal Water Conservation District No. 1.
2/ Geological Survey Water-Supply Paper 1049.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS BY GILLESPIE CANAL AT GILLESPIE DAM, ARIZONA

Location: Lat. 33°13'45", long. 112°45'30", in SE¼NE¼ sec. 28, T. 2 S., R. 5 W., 200 feet downstream from head gates at Gillespie Dam, 20 miles north of Gila Bend.
Canal diverts water from left bank of Gila River just upstream from left end of Gillespie Dam for irrigation in vicinity of Gila Bend.
Diversions began during latter part of 1921.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1921													20.0	
1922													80.0	
1923													80.0	
1924													80.0	
1925													80.0	
1926													101.6	
1927													144.4	*
1928													130.6	
1929													84.3	
1930													81.8	
1931													96.0	
1932													97.9	
1933													75.5	
1934													55.0	
1935									3.0	1.4	4.4	6.9	*76.6	
1936	3.1	5.0	8.3	8.7	7.6	9.0	6.4	3.7	2.2	2.0	8.7	4.5	69.2	1/
1937	2.4	3.5	7.0	10.8	9.3	11.6	11.9	8.7	4.9	4.3	4.7	4.9	84.0	
1938	3.0	4.2	8.1	9.1	9.1	11.6	9.9	7.1	3.9	2.7	4.5	2.1	75.3	
1939	2.1	3.1	6.4	8.8	8.6	8.2	5.7	3.2	1.5	1.0	6.2	9.6	64.4	
1940	4.9	5.4	7.0	8.4	8.3	7.2	5.7	3.3	1.7	1.4	3.5	3.2	60.0	
1941	3.2	4.0	5.5	9.9	9.2	9.4	10.3	10.1	10.2	7.7	9.7	6.7	95.9	
1942	7.0	7.8	8.6	8.7	8.5	9.6	8.9	6.8	4.2	3.3	2.8	1.8	78.0	2/
1943	1.9	3.0	5.4	6.6	8.1	9.8	7.4	4.4	2.3	1.8	8.9	4.9	64.5	
1944	4.3	4.7	8.8	8.6	7.9	9.7	7.9	7.0	3.8	2.4	3.8	3.6	72.5	
1945	2.8	5.2	7.2	11.2	9.1	9.2	7.9	5.6	3.3	2.8	7.1	3.4	74.8	
14-45 Mean	3.0	3.9	6.2	7.8	7.4	8.2	7.0	5.1	3.2	2.4	5.0	4.0	63.2	3/
Subsequent Records														
1946	4.7	4.6	7.8	9.6	8.0	8.4	7.1	5.3	3.2	4.6	4.1	6.0	73.4	2/
1947	8.4	8.1	8.3	9.0	7.7	8.4	6.3	4.7	2.4	1.8	3.3	4.7	73.1	2/
1948	2.7	3.2	5.3	6.0	5.5	6.1	5.0	3.3	2.5	1.9	3.1	1.2	45.8	2/

* Estimates from "Arizona Stream Flow Summary," a report of The Colorado River Commission of Arizona published in March 1940.

1/ Geological Survey Water-Supply Paper 1049 except (*).
2/ Geological Survey annual Water-Supply Papers.
3/ Estimated.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS BY ENTERPRISE CANAL AT GILLESPIE DAM, ARIZONA

Location: Lat. 33°13', long. 112°46', in SW¼NE¼ sec. 28, T. 2 S., R. 5 W., 600 feet downstream from intake at Gillespie Dam.

Canal diverts water from right bank of Gila River at Gillespie Dam for irrigation between dam and Gila Bend.

The Enterprise Canal has diverted water from the Gila River throughout the period, October 1913 through September 1945, and diversions have been made from present heading since construction of Gillespie Dam in 1921.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1935									0.7	0.7	0.8	0.9		1/
1936	0.8	0.8	1.0	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.7	0.6	9.9	
1937	0.7	0.7	0.7	0.9	0.7	0.8	0.7	0.6	0.6	0.6	0.6	0.7	8.3	
1938	0.6	0.5	0.6	0.7	0.8	0.8	0.6	0.7	0.6	0.5	0.5	0.5	7.4	
1939	0.4	0.5	0.3	0.7	0.5	0.6	0.7	0.7	0.7	0.6	0.7	0.5	6.9	2/
1940	0.6	0.5	0.5	0.6	0.5	0.6	0.7	0.6	0.5	0.5	0.7	0.6	6.9	
1941	0.7	0.6	0.5	0.8	0.3	0.6	0.9	0.8	0.7	0.6	0.6	0.5	7.6	
1942	0.5	0.6	0.7	0.7	0.6	0.7	0.8	0.7	0.5	0.5	0.5	0.5	7.3	3/
1943	0.6	0.6	0.6	0.5	0.5	0.8	0.6	0.5	0.6	0.6	0.5	0.5	6.9	
1944	0.7	0.9	0.8	0.8	1.0	0.8	0.6	0.6	0.7	0.5	0.5	0.5	8.4	
1945	0.8	0.8	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.7	0.5	7.3	
14-45 Mean	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.6	7.7	4/

Subsequent Records

1946	0.5	0.7	0.7	0.8	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.7	7.3	3/
1947	0.7	0.8	0.8	0.8	0.6	0.5	0.9	1.0	1.2	1.0	0.9	0.7	9.9	3/
1948	0.8	0.9	0.9	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.8	0.5	8.7	3/

1/ Computed by deducting the sum of recorded diversions by Gillespie Canal plus recorded flows of Gila River below Gillespie Dam from the combined discharge of Gila River below Gillespie Dam and of Gillespie and Enterprise Canals at Gillespie Dam as reported in Geological Survey Water-Supply Paper 1049.

2/ Computed from discharge measurements reported in Geological Survey Water-Supply Paper 879.

3/ Geological Survey annual Water-Supply Papers.

4/ Average for 1914-1945 period estimated to be the same as the mean for the period of record.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER BELOW GILLESPIE DAM, ARIZONA

Location: Lat. 33°13'45", long. 112°45'30", in SE¼NE¼ sec. 28, T. 2 S., R. 5 W., at east end of Gillespie Dam, 8 miles downstream from Hassayampa River and about 165 miles upstream from mouth.

Drainage Area: 49,626 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													650.7	
1915													2,962.4	
1916													4,358.2	
1917													1,296.5	1/
1918													463.1	
1919													992.0	
1920													2,460.9	
1921												*44.4	674.3	
1922	45.0	27.8	95.9	190.7	153.0	218.2	34.6	10.9	15.2	15.6	16.1	42.4	865.4	
1923	16.6	14.2	69.5	44.0	23.5	45.1	1.8	0	0	25.4	171.8	124.3	506.2	
1924	0.8	125.1	359.9	204.7	21.5	7.1	60.6	2.0	0	0	0	0	781.7	
1925	2.3	12.1	23.3	19.1	7.9	3.6	2.4	2.1	0.4	0	4.1	157.8	235.1	
1926	31.9	7.2	14.0	13.5	4.1	7.4	331.3	20.4	0	8.9	1.0	115.0	554.7	
1927	43.7	7.4	87.2	34.1	502.7	92.4	3.0	0	0	0.4	0.4	107.8	879.1	
1928	0.1	0	4.8	5.0	50.8	1.7	0.1	0	0	0	16.3	0.3	79.1	
1929	0	0	2.0	6.4	1.2	2.7	59.1	0	0	0	13.4	26.6	111.4	2/
1930	0.6	0	0	6.3	0.2	19.3	0	0.1	0	1.2	50.1	2.8	80.6	
1931	0	1.1	0	0	140.7	4.2	0	0	0	0	63.0	12.8	221.8	
1932	3.8	11.3	23.7	5.9	312.0	93.4	1.0	0	0	0	1.1	0	452.2	
1933	1.9	0	4.8	7.6	4.7	0.1	0	0	0	0	0	0.5	19.6	
1934	0	0	0.2	0	0	0	0	0	0	0	6.8	1.0	8.0	
1935	0	0	2.2	13.8	54.4	37.2	3.7	0	0	0	7.6	9.7	128.6	
1936	0	0.2	1.0	1.9	10.9	0.9	0	0	0	10.1	2.3	0.5	27.8	
1937	0	0.1	2.2	12.3	238.8	134.2	6.4	0	0	0	3.7	0	397.7	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER BELOW GILLESPIE DAM, ARIZONA (Continued)

Location: Lat. 33°13'45", long. 112°45'30", in SE¼NE¼ sec. 28, T. 2 S., R. 5 W., at east end of Gillespie Dam, 8 miles downstream from Hassayampa River and about 165 miles upstream from mouth.
Drainage Area: 49,626 square miles.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	0	0	0	0.4	0	187.5	0.1	0	0	0	0.3	0	188.3	2/
1939	0	0	2.3	0.1	0	0	0	0	0	0	12.5	22.9	37.8	↑
1940	0	0	0	0	0	0.1	0	0	0	0	6.3	0	6.4	|
1941	0	2.3	3.6	43.1	92.4	344.4	303.9	236.9	2.4	0.6	5.7	0.9	1,036.2	|
1942	0.4	0.3	8.1	5.3	2.0	1.7	0	0	0	0	0	0	17.8	3/
1943	0.2	0.5	0	1.4	0.5	1.8	0	0	0	0	7.2	2.5	14.1	|
1944	0	0	1.8	1.4	5.6	3.4	0.2	0	0	0	1.0	0	13.4	|
1945	0	0	0.8	0	0	0.3	0	0	0	0	6.3	0	7.4	↓
14-45 Mean	18.9	29.0	65.8	129.7	128.4	98.0	63.6	17.1	2.8	16.1	39.4	32.7	641.5	1/

Subsequent Records

1946	1.2	0	0.7	1.4	0	0	0	0	0	0.5	0.1	25.6	29.5	3/
1947	0.7	0.6	2.2	1.1	0.1	0	0	0	0	0	6.9	1.1	12.7	3/
1948	0	0	0	0	0.2	0	0	0	0	0	0.7	0	0.9	3/

1/ Estimated except (*), which is from Geological Survey Water-Supply Paper 1049.
2/ Geological Survey Water-Supply Paper 1049.
3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER NEAR DOME, ARIZONA

Location: Lat. 32°45'40", long. 114°25'10", in SW¼ sec. 4, T. 8 S., R. 21 W., at highway bridge, 3 miles west of Dome and 12 miles upstream from mouth.

Drainage Area: 58,084 square miles. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0	0	0	1.2	118.8	17.6	0	0	0	2.0	29.2	11.0	179.8	
1915	10.4	10.5	357.5	139.6	694.2	314.6	389.6	367.0	16.9	2.4	21.8	0	2,324.5	
1916	0	0	0	2093.0	861.6	746.8	559.3	27.0	2.5	0	0	70.9	4,361.1	
1917	222.3	53.7	27.5	163.8	83.3	132.9	448.3	243.7	0.5	0	82.3	0	1,458.3	
1918	0	0	0	1.6	12.4	243.4	17.2	0.1	0	0	52.2	0	326.9	
1919	0	0	2.8	11.9	24.4	18.9	60.1	3.2	0	42.6	54.3	8.8	227.0	
1920	21.2	188.0	306.6	40.1	424.5	190.5	108.2	14.7	0	0	0	0	1,293.8	
1921	0	9.4	13.6	23.0	8.4	1.0	0	0	0	0	341.2	41.1	437.7	
1922	15.2	5.7	42.9	331.3	82.4	164.3	34.2	2.8	0	0	0	7.0	685.8	
1923	0.1	0	52.1	16.5	5.5	92.2	2.0	0	0	1.0	102.3	57.4	329.1	
1924	2.7	83.2	223.9	317.2	22.3	4.7	30.5	2.0	0	0	0	0	686.5	2/
1925	0	0	0	0	0	0	0	0	0.2	0	0	64.7	64.9	
1926	10.7	0.4	1.8	0.9	0.2	0	228.3	21.2	0	0	0	6.6	270.1	
1927	84.8	0	45.1	36.6	415.5	116.6	8.5	0	0	0	2.0	54.8	763.9	
1928	1.4	0	0	0	22.6	0.3	0	0	0	0	0	0	24.3	
1929	0	0	0	0	0	0	0	0	0	0	0	3.0	3.0	
1930	1.9	0	0	0	0	1.9	0	0	0	0	11.8	0	15.6	
1931	0	0	0	0	78.0	2.1	0	0	0	0	14.5	8.1	102.7	
1932	0	1.4	6.6	1.4	168.5	82.2	6.0	0.2	0	0	0	0	266.3	
1933	1.1	0	0	0	0	0	0	0	0	0	0	0	1.1	
1934	0	0	0	0	0	0	0	0	0	0	0.2	0	0.2	
1935	0	0	0	0	3.3	1.8	0	0	0	0	0	0.8	5.9	
1936	0	0	0	0	0	0	0	0	0	0	0	0	0	
1937	0	0	0	0	71.2	75.8	6.7	0	0	0	0	0	153.7	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

GILA RIVER NEAR DOME, ARIZONA (Continued)

Location: Lat. 32°45'40", long. 114°25'10", in SW¼ sec. 4, T. 8 S., R. 21 W., at highway bridge, 3 miles west of Dome and 12 miles upstream from mouth.

Drainage Area: 58,084 square miles. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	0	0	0	0	0	45.9	0	0	0	0	0	0	45.9	2/
1939	0	0	0	0	0	0	0	0	0	0	0	3.5	3.5	
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	
1941	0	0	0	0.7	0	192.1	181.1	211.2	4.4	0.1	0.1	0	589.7	
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	3/
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	
1944	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945	0	0	0	0	0	0	0	0	0	0	0	0	0	
14-45 Mean	11.6	11.0	33.8	99.3	96.8	76.4	65.0	27.9	0.8	1.5	22.2	10.6	456.9	

Subsequent Records

1946	0	0	0	0	0	0	0	0	0	0	0	0	0	3/
1947	0	0	0	0	0	0	0	0	0	0	0.4	0	0.4	3/
1948	0	0	0	0	0	0	0	0	0	0	0	0	0	3/

1/ Includes 344 square miles in Aubrey Valley Playa, a closed basin, and excludes all other closed basins.

2/ Geological Survey Water-Supply Paper 1049.

3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER AT YUMA, ARIZONA

Location: Lat. 32°43'45", long. 114°37'15", in NW¼NE¼ sec. 35, T. 16 S., R. 22 E., San Bernardino meridian, 1,800 feet downstream from highway bridge at Yuma, 4 miles downstream from Gila River, 19 miles downstream from Imperial Dam, and 7 miles upstream from boundary between California and Mexico.

Drainage Area: 242,818 square miles. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	634.9	471.9	392.9	449.1	645.6	922.9	1364.0	3308.0	6575.0	3168.0	1350.0	591.1	19,873.4	
1915	839.8	610.9	818.2	563.7	1505.0	950.9	1789.0	2941.0	2892.0	1896.0	685.3	270.0	15,761.8	
1916	442.1	355.8	354.0	2814.0	1635.0	2201.0	2119.0	3363.0	3539.0	2258.0	1675.0	736.1	21,492.0	
1917	1636.0	707.1	454.4	561.9	440.3	602.6	1565.0	3030.0	5350.0	5775.0	1442.0	535.9	22,100.2	
1918	465.3	422.3	419.7	405.4	322.7	1008.0	766.6	1787.0	3675.0	2660.0	710.3	406.2	13,048.5	
1919	473.7	479.2	451.4	231.3	398.1	543.3	1224.0	2221.0	2044.0	1243.0	657.1	306.8	10,272.9	
1920	325.1	605.6	944.5	701.6	2188.0	1113.0	1212.0	2842.0	7690.0	2647.0	1080.0	501.4	21,850.2	
1921	399.9	619.4	452.0	427.0	409.0	824.5	814.2	2670.0	6609.0	2816.0	2162.0	1069.0	19,272.0	
1922	551.4	447.9	636.1	800.1	598.2	997.3	1138.0	3437.0	5816.0	1945.0	742.0	524.4	17,633.4	
1923	239.9	326.3	455.3	327.5	321.2	540.0	1077.0	2875.0	5071.0	2617.0	1514.0	1273.0	16,637.2	2/
1924	737.7	824.8	664.4	763.3	465.8	497.5	1326.0	2558.0	3187.0	1116.0	285.3	185.1	12,610.9	
1925	239.9	367.9	354.6	211.7	349.4	530.8	1092.0	1780.0	2498.0	1742.0	649.0	1255.0	11,070.3	
1926	1146.0	676.8	474.0	356.3	288.0	446.4	1406.0	2776.0	3561.0	1417.0	536.6	260.1	13,344.2	
1927	438.1	254.7	459.3	280.3	1083.0	727.4	958.8	2988.0	3451.0	2670.0	913.0	1795.0	16,018.6	
1928	1048.0	743.6	462.6	394.7	445.6	549.1	805.0	3267.0	3826.0	1568.0	538.4	248.7	13,896.7	
1929	398.4	443.9	291.8	226.4	271.0	681.8	1432.0	2724.0	4721.0	2089.0	2115.0	1480.0	16,874.3	
1930	935.9	464.8	360.9	237.8	254.6	477.0	1172.0	1819.0	2726.0	1105.0	1458.0	422.8	11,433.8	
1931	306.3	330.1	222.7	169.2	380.0	277.6	353.5	855.3	1241.0	378.5	257.0	72.0	4,923.2	
1932	403.5	267.8	175.6	216.1	1026.0	773.5	1423.0	2653.0	3671.0	2382.0	666.4	612.2	14,270.1	
1933	249.0	281.8	243.8	178.0	185.1	386.7	349.9	905.1	3390.0	1393.0	297.2	213.8	8,073.4	
1934	308.3	168.8	240.2	213.5	196.9	202.8	203.1	826.7	484.6	17.2	10.1	44.2	2,916.4	
1935	16.2	40.1	128.4	190.4	133.2	264.4	251.2	294.5	724.6	472.5	379.1	364.4	3,259.0	
1936	383.3	392.4	187.6	144.5	169.8	342.0	376.5	345.2	341.6	421.4	379.3	319.7	3,803.3	
1937	262.1	200.8	162.0	177.1	367.0	452.3	364.2	339.6	327.9	413.7	411.7	344.2	3,822.6	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER AT YUMA, ARIZONA (Continued)

Location: Lat. 32°43'45", long. 114°37'15", in NW¼NE¼ sec. 35, T. 16 S., R. 22 E., San Bernardino meridian, 1,800 feet downstream from highway bridge at Yuma, 4 miles downstream from Gila River, 19 miles downstream from Imperial Dam, and 7 miles upstream from boundary between California and Mexico.

Drainage Area: 242,818 square miles. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1938	310.4	251.1	236.1	226.3	229.1	475.0	425.8	377.7	339.5	428.5	426.5	350.1	4,076.1	2/
1939	341.3	274.9	275.8	426.4	1118.9	593.1	438.9	384.7	379.1	423.8	406.2	764.9	5,828.0	↑
1940	543.9	521.5	555.6	566.6	360.9	375.8	466.4	364.2	323.1	395.0	403.5	446.5	5,323.0	
1941	581.2	513.4	640.8	493.2	327.4	695.2	511.5	1062.0	1376.0	692.5	938.8	1198.0	9,030.0	
1942	1233.0	1418.0	1789.0	1615.0	1321.0	1097.0	675.6	1137.0	1074.0	818.6	473.7	374.7	13,026.6	3/
1943	358.3	648.5	891.3	710.1	428.8	457.1	430.2	491.2	537.6	605.1	579.6	569.6	6,707.4	
1944	687.7	781.7	993.1	910.8	929.9	918.9	731.7	674.6	503.9	429.8	467.0	624.2	8,653.3	
1945	712.1	852.9	856.7	946.5	768.2	868.0	561.3	481.0	312.3	193.0	229.3	217.3	6,998.6	↓
14-45 Mean	554.0	492.7	501.4	529.3	611.3	681.0	900.7	1799.3	2758.0	1506.2	776.2	574.3	11,684.4	

Subsequent Records

1946	456.0	646.6	782.9	675.6	683.7	489.3	147.5	266.6	81.0	76.0	114.0	96.5	4,515.7	3/
1947	215.1	405.2	553.7	606.2	542.1	504.9	104.9	333.5	199.9	88.5	276.2	186.4	4,016.6	3/
1948	212.1	444.9	743.8	776.9	782.6	552.0	394.8	579.3	364.1	339.6	270.7	304.7	5,765.5	3/

1/ Includes all closed basins entirely within the drainage boundary.
2/ Geological Survey Water-Supply Paper 918.
3/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ALL-AMERICAN CANAL NEAR IMPERIAL DAM, ARIZONA-CALIFORNIA

Location: Lat. 32°52'15", long. 114°28'50", in SE¼NW¼ sec. 17, T. 15 S., R. 24 E., San Bernardino meridian, 6,000 feet downstream from intake at west end of Imperial Dam. Diversions began in February 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1939					17.5	16.2	0	0	0	0	0	13.4	47.1	1/
1940	0	0	0	0	0	0	0	0	0	0	0	14.7	14.7	
1941	48.1	68.3	49.8	52.4	105.2	104.2	107.6	111.3	127.5	150.9	204.9	237.8	1,368.0	
1942	252.4	235.4	220.7	264.9	272.8	354.9	359.6	345.3	356.4	357.5	319.9	336.5	3,676.3	2/
1943	393.9	325.2	278.2	293.2	292.6	379.7	361.3	340.9	329.5	358.7	319.5	330.4	4,003.1	
1944	393.6	324.8	217.8	286.0	273.3	355.0	377.0	364.8	381.3	476.2	559.9	402.3	4,412.0	
1945	395.7	276.9	274.2	201.5	233.8	244.2	302.6	352.1	477.9	603.6	472.1	507.0	4,341.6	
14-45 Mean	46.4	38.5	32.5	34.3	37.4	45.4	47.1	47.3	52.3	60.8	58.6	57.6	558.2	
Subsequent Records														
1946	434.4	345.3	278.0	313.3	303.3	414.8	587.7	494.9	551.7	618.6	524.7	517.7	5,384.4	2/
1947	465.0	329.7	282.4	307.6	309.9	405.2	606.3	468.3	563.4	629.6	531.0	521.8	5,420.2	2/
1948	514.1	389.5	285.2	314.8	335.2	516.2	588.7	448.0	532.0	643.9	613.2	546.3	5,727.1	2/

1/ Estimated.
2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ALL AMERICAN CANAL ABOVE PILOT KNOB WASTEWAY, CALIFORNIA

Location: Water-stage recorder, lat. 32°45'00", long. 114°42'20" in NW¼SE¼ sec. 24, T. 16 S., R. 21 E., San Bernardino meridian, at bridge on U. S. Highway 80, 1 mile upstream from Pilot Knob Wasteway and 5½ miles northwest of Yuma, Arizona. First flow began February 5, 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1939	-	-	-	-	10.0	9.2	0	0	0	0	0	7.7	26.9	1/
1940	0	0	0	0	0	0	0	0	0	0	0	8.4	8.4	
1941	32.5	52.4	39.8	36.3	88.2	85.6	94.0	93.9	108.3	130.9	98.4	119.9	980.2	
1942	140.1	119.2	102.5	139.4	161.9	232.4	240.5	222.4	236.8	230.9	195.4	215.1	2,236.6	
1943	271.2	205.5	150.0	164.0	177.0	249.3	237.9	213.6	218.0	229.2	194.5	207.7	2,517.9	
1944	265.9	203.1	95.2	163.5	155.8	229.7	257.1	243.6	259.1	353.3	437.9	281.2	2,945.4	
1945	271.2	158.0	147.6	122.8	201.0	238.4	274.5	286.2	434.1	478.1	344.4	383.3	3,339.6	
14-45 Mean	30.7	23.1	16.7	19.6	24.8	32.6	34.5	33.1	39.3	44.4	39.7	38.2	376.7	

Subsequent Records

1946	314.4	229.4	152.7	187.4	190.2	288.2	465.9	376.4	435.3	498.7	398.7	402.0	3,939.3	1/
1947	340.8	212.8	160.9	179.8	194.1	276.3	483.7	335.1	430.4	496.3	396.4	391.0	3,897.6	
1948	378.9	265.5	153.4	193.1	211.7	385.9	453.8	312.6	398.4	502.3	470.2	415.0	4,140.8	

1/ Geological Survey annual Water Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

PILOT KNOB WASTEWAY NEAR PILOT KNOB, CALIFORNIA

Location: Records computed from head, and openings of wasteway gates, rated by current meter measurements made in Alamo Canal, and by differences of measured flow made above and below the wasteway in All-American Canal. Record shows water diverted from All-American Canal to Alamo Canal for use in Mexico or for return to Colorado River through Rockwood gate downstream from station on Colorado River at Yuma.
Pilot Knob Wasteway was completed in summer of 1938 and first flow occurred Feb. 5, 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	1/
1939					10.0	9.2	0	0	0	0	0	2.3	21.5	1009
1940	0	0	0	0	0	0	0	0	0	0	0	0	0	1009
1941	0	0	0	0	0	0	0.8	0	0	0	0	0	0.8	1009
1942	0	0	0	0	0	0	0	0	0	0	0	0	0	1009
1943	0	0	0	0	0	0	0	0	0	0	0	0	0	1009
1944	0	0	0	0	0	0	0	0	0	97.0	234.3	77.1	408.4	1009
1945	0	0	0	0	0	0	0	0	138.7	204.9	160.1	173.3	677.0	1039
14-45 Mean	0	0	0	0	0.3	0.3	0	0	4.4	9.4	12.3	7.9	34.6	

Subsequent Records

1946	28.7	0	0	0	0	20.9	200.7	78.9	136.7	210.7	157.4	158.1	992.1	1059
1947	41.2	18.2	0	0	0	17.7	195.8	56.5	142.0	214.9	169.6	144.1	1000.0	1089
1948	51.5	38.1	0	0	0	106.3	157.3	52.3	151.4	226.8	211.3	142.5	1137.5	1119

1/ Number of Geological Survey Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ALL-AMERICAN CANAL BELOW PILOT KNOB WASTEWAY, CALIFORNIA

Location: Lat. 32°43', long. 114°44', in SW¼ sec. 35, T. 16 S., R. 21 E., San Bernardino meridian, 1.6 miles downstream from Pilot Knob Wasteway, 6.5 miles west of Yuma, and 22 miles downstream from head at Imperial Dam. Flow in the canal at this station began September 11, 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1939								0	0	0	0	3.5	3.5	*
1940	0	0	0	0	0	0	0	0	0	0	0	7.1	7.1	*
1941	*31.0	*52.5	*39.5	*35.5	*86.7	85.6	93.2	93.9	108.3	130.9	98.4	119.9	975.4	
1942	140.1	119.2	102.5	139.4	161.9	232.4	240.5	222.4	236.8	230.9	195.4	215.1	2,236.6	
1943	271.2	205.5	150.0	164.0	177.0	249.3	237.9	213.6	218.0	229.2	194.5	207.7	2,517.9	1/
1944	265.9	203.1	95.2	163.5	155.8	229.7	257.1	243.6	259.1	256.3	203.6	204.1	2,537.0	
1945	271.2	158.0	147.6	122.8	201.0	238.4	274.5	286.2	295.4	273.2	184.3	210.0	2,662.6	
14-45 Mean	30.6	23.1	16.7	19.5	24.5	32.4	34.5	33.1	34.9	35.0	27.4	30.2	341.9	

Subsequent Records

1946	285.7	229.4	152.7	187.4	190.2	267.3	265.2	297.5	298.6	288.0	241.3	243.9	2,947.2	1/
1947	299.6	194.6	160.9	179.8	194.1	258.6	287.9	278.6	288.4	281.4	226.8	246.9	2,897.6	1/
1948	327.4	227.4	153.4	193.1	211.7	279.6	296.5	260.3	247.0	275.5	258.9	272.5	3,003.3	1/

* Geological Survey annual Water-Supply Papers.

1/ Computed by subtracting the recorded flow diverted by Pilot Knob Wasteway from the recorded flow in All-American Canal above Pilot Knob Wasteway except (*).

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

YUMA CANAL AT LAGUNA DAM, ARIZONA-CALIFORNIA

Location: Lat. 32°49', long. 114°30', in NE¼ sec. 25, T. 15 S., R. 23 E., San Bernardino meridian, a short distance downstream from canal head gates at Laguna Dam, 10 miles northeast of Yuma, Arizona. Published as Yuma Main Canal at Laguna Dam, near Yuma, Arizona, in Geological Survey Water-Supply Paper 1049.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	38.1	36.9	30.2	38.1	20.4	36.5	51.2	54.9	44.7	59.2	53.5	56.8	520.5	
1915	60.5	28.5	15.8	19.4	9.0	39.6	49.7	32.4	35.4	57.7	50.4	45.6	444.0	
1916	36.7	36.5	27.3	6.6	6.5	23.2	37.4	39.8	46.7	41.8	50.7	43.6	396.8	
1917	41.2	37.2	15.9	14.8	36.5	48.8	42.4	42.8	51.0	46.0	46.8	41.9	465.3	
1918	38.0	24.1	19.4	13.7	17.8	41.9	48.1	52.0	51.9	61.2	59.6	52.0	479.7	
1919	40.0	15.9	13.3	22.2	28.0	39.3	54.1	48.0	58.4	55.1	46.9	45.7	466.9	
1920	41.6	20.4	18.5	16.8	1.9	48.6	45.6	46.5	53.4	63.5	63.3	36.1	456.2	
1921	42.2	26.9	24.0	24.9	32.5	48.7	51.4	46.6	46.8	53.0	45.1	45.7	487.8	
1922	23.5	40.6	23.2	11.7	37.0	52.6	46.6	53.4	53.7	57.2	58.0	32.3	489.8	
1923	57.5	49.1	37.6	44.2	48.6	51.7	60.4	58.1	64.5	59.1	58.8	52.9	642.5	
1924	65.4	50.5	58.7	32.5	35.6	62.5	68.3	59.7	68.2	73.5	65.2	58.6	698.7	1/
1925	61.8	33.5	46.2	31.8	43.7	68.4	61.6	56.7	64.7	69.6	66.4	54.6	659.0	
1926	46.1	34.1	49.4	46.2	34.6	58.7	56.6	53.0	68.7	75.7	51.4	49.8	624.3	
1927	79.7	78.7	51.7	75.2	78.2	79.9	96.4	115.8	62.3	101.1	111.4	93.8	1,024.2	
1928	37.2	29.0	69.2	95.4	88.4	84.2	102.9	96.8	104.9	111.5	106.0	93.7	1,019.2	
1929	97.9	99.2	101.1	88.8	83.3	106.0	106.4	110.1	109.0	113.5	110.6	90.7	1,216.6	
1930	107.1	102.2	106.6	93.5	91.4	111.6	109.8	115.2	114.9	117.9	117.1	110.1	1,297.4	
1931	114.3	110.8	113.8	102.0	99.0	114.8	110.1	112.0	111.5	112.1	106.2	96.1	1,302.7	
1932	113.6	110.1	105.9	112.2	104.4	114.8	110.6	113.7	111.6	114.3	113.5	108.1	1,332.8	
1933	107.1	108.9	111.0	109.1	97.7	114.3	115.7	119.9	116.1	120.6	115.0	105.6	1,341.0	
1934	119.5	113.6	120.7	120.9	110.4	123.8	120.5	121.7	113.5	72.6	58.1	86.0	1,281.3	
1935	89.7	99.5	109.5	115.6	99.0	117.5	113.3	118.9	113.3	121.0	121.1	116.9	1,335.3	
1936	118.8	113.2	99.3	112.9	108.1	117.8	114.5	117.2	113.9	119.1	117.2	114.2	1,366.2	
1937	114.7	109.9	110.6	92.3	105.5	92.3	114.1	116.0	117.0	114.7	112.9	108.5	1,308.5	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

YUMA CANAL AT LAGUNA DAM, ARIZONA-CALIFORNIA (Continued)

Location: Lat. 32°49', long. 114°30', in NE¼ sec. 25, T. 15 S., R. 23 E., San Bernardino meridian, a short distance downstream from canal head gates at Laguna Dam, 10 miles northeast of Yuma, Arizona. Published as Yuma Main Canal at Laguna Dam, near Yuma, Arizona, in Geological Survey Water-Supply Paper 1049.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	110.3	106.4	109.7	109.9	85.2	35.8	63.6	86.4	109.4	112.8	116.6	111.9	1,158.0	1/
1939	115.1	109.1	113.1	113.8	102.4	115.4	111.0	117.5	115.5	110.7	110.0	35.0	1,269.3	
1940	98.0	104.9	108.4	109.1	103.6	110.0	108.5	111.6	109.9	115.6	113.8	107.6	1,301.0	
1941	110.3	105.7	108.0	107.5	94.9	107.1	105.3	108.5	105.7	111.6	15.9	6.6	1,087.1	
1942	6.0	4.6	4.6	5.0	5.4	7.3	8.1	7.2	7.2	8.0	6.8	7.2	77.4	2/
1943	6.4	5.8	4.9	5.1	5.8	7.9	7.6	7.5	6.9	6.6	5.8	6.6	76.9	
1944	6.6	6.4	5.1	6.1	5.9	7.5	8.0	7.9	6.0	5.8	5.7	5.9	76.9	
1945	6.5	5.9	5.0	5.6	38.4	69.6	70.9	59.4	58.3	6.7	5.5	6.1	337.9	3/
14-45 Mean	67.2	61.2	60.6	59.5	58.1	70.6	74.1	75.2	75.5	77.1	71.4	63.3	813.8	

Subsequent Records

1946	7.7	7.3	5.2	7.5	7.2	8.5	9.1	7.2	7.1	7.3	7.3	7.5	88.9	4/
1947	8.1	6.7	6.9	6.4	7.5	9.4	9.8	7.2	6.3	7.1	6.7	8.7	90.8	5/
1948	5.2	2.6	1.1	3.9	4.0	5.8	5.8	3.6	1.9				33.9	6/

1/ Geological Survey Water-Supply Paper 1049, published as Yuma Main Canal at Laguna Dam near Yuma, Arizona.
2/ Geological Survey Water-Supply Paper 1009.
3/ Geological Survey Water-Supply Paper 1039.
4/ Geological Survey Water-Supply Paper 1059.
5/ Geological Survey Water-Supply Paper 1089.
6/ Geological Survey Water-Supply Paper 1119. Canal heading was sealed and diversion discontinued on June 23, 1948.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

YUMA MAIN CANAL WASTEWAY AT YUMA, ARIZONA

Location: Records computed from canal records upstream and downstream from waste gates, allowing for other factors involved. The wasteway discharges into Colorado River half a mile downstream from station on Colorado River at Yuma.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	
1914	29.5	31.0	24.7	30.6	15.2	24.0	39.3	33.6	22.2	32.2	28.5	30.3	341.1	1/
1915	33.4	15.3	8.9	10.1	5.4	13.8	26.4	14.8	8.5	23.0	20.9	15.9	196.4	
1916	16.1	17.6	13.3	6.0	0	2.9	16.4	13.1	14.3	12.1	16.9	15.1	143.8	
1917	20.2	17.9	11.9	6.8	14.9	17.7	10.1	6.5	11.3	6.5	5.7	4.4	133.9	
1918	15.0	5.4	10.7	5.0	6.4	10.0	14.1	19.7	16.0	15.5	16.9	16.0	150.7	
1919	18.1	7.8	7.1	11.0	11.7	8.6	13.2	13.8	13.2	9.0	15.0	16.1	144.6	
1920	17.7	11.7	10.3	10.7	0.8	14.5	19.0	19.8	14.2	7.0	20.0	10.7	156.4	
1921	13.4	13.0	6.8	10.2	14.6	17.6	12.1	19.0	15.8	12.6	20.8	19.7	175.6	
1922	7.1	20.9	6.5	5.0	20.8	17.3	22.1	22.5	19.0	17.5	18.0	9.2	185.9	
1923	23.6	25.5	19.1	18.6	22.8	16.9	24.4	24.6	26.3	20.2	18.9	24.7	265.6	
1924	31.5	27.8	33.1	16.3	12.8	26.7	31.9	31.2	27.1	25.5	26.6	29.7	320.2	
1925	34.0	19.4	25.9	14.0	20.0	24.6	28.0	26.6	17.6	17.9	19.7	22.7	270.4	1/
1926	27.4	21.0	35.0	31.7	12.8	17.9	28.3	24.3	21.2	27.1	20.4	26.4	293.5	
1927	51.6	50.3	40.5	53.7	48.3	39.8	62.0	74.0	12.8	53.5	58.7	55.3	600.5	
1928	0	0	38.4	75.6	56.9	32.3	63.6	60.0	51.0	50.9	51.7	53.7	534.1	
1929	63.6	82.7	86.0	74.9	59.0	60.3	75.1	68.5	55.6	56.9	62.5	66.7	811.8	
1930	83.6	86.5	91.6	68.7	53.7	66.6	73.2	77.4	62.0	62.4	66.4	65.2	857.3	
1931	70.9	71.4	77.6	74.5	69.7	65.3	75.0	76.8	66.7	65.8	71.9	68.8	854.4	
1932	81.2	80.6	83.5	88.2	80.4	74.7	77.2	77.0	68.3	75.7	74.5	68.4	929.7	
1933	74.7	72.8	81.6	83.1	64.3	65.2	75.7	80.0	71.0	71.9	71.4	66.9	878.6	
1934	83.6	73.9	83.7	85.3	67.9	77.2	79.4	72.7	65.9	42.2	30.9	62.9	825.6	
1935	66.1	83.6	95.7	98.9	73.8	84.3	83.4	81.3	70.0	72.9	80.0	81.4	971.4	
1936	79.2	78.2	73.9	88.1	74.2	77.7	72.0	77.5	64.3	66.4	76.3	70.4	898.2	
1937	78.1	78.3	81.8	67.7	72.3	61.2	74.4	76.7	69.2	68.6	67.4	69.5	865.2	
1938	71.5	78.2	84.9	81.9	59.9	7.1	26.0	48.4	61.6	71.1	73.7	69.8	734.1	
1939	75.1	72.3	84.4	85.6	68.8	73.1	67.3	66.9	62.5	65.7	66.2	27.1	815.0	
1940	54.8	64.6	74.3	73.8	69.2	65.2	61.8	64.4	59.7	63.6	61.8	57.8	771.0	
1941	64.2	68.9	76.3	85.6	69.1	82.9	80.5	81.8	71.5	74.6	80.9	76.9	913.2	
1942	77.4	84.4	93.8	92.4	79.1	87.4	83.0	87.0	82.3	88.2	88.2	78.1	1021.3	2/
1943	81.3	82.9	94.8	92.4	76.8	86.6	82.1	84.4	67.6	91.2	89.9	83.7	1013.7	
1944	84.7	83.3	91.3	89.2	84.6	88.3	82.3	86.4	84.4	88.5	85.4	81.8	1030.2	
1945	85.9	89.0	97.1	52.4	27.9	29.7	49.4	74.6	53.6	87.3	87.0	78.6	812.5	
14-45 Mean	50.5	50.5	54.5	52.7	44.2	44.9	50.9	52.7	44.6	48.2	49.8	47.6	591.1	

Subsequent Records

1946	81.7	77.1	95.2	91.9	80.1	87.7	84.4	84.0	85.4	84.7	82.0	75.7	1009.9	2/
1947	78.6	82.4	95.4	91.5	77.8	90.2	84.1	87.3	86.7	90.8	88.4	80.7	1033.9	2/
1948	82.0	84.5	96.7	79.6	81.8	86.9	81.6	87.3	86.6	91.1	82.5	78.5	1019.1	2/

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

YUMA MAIN CANAL BELOW COLORADO RIVER SIPHON AT YUMA, ARIZONA

Location: Two gages determine head on Colorado River siphon. Water stage recorders on California and Arizona sides of river, a quarter of a mile downstream from highway bridge over Colorado River at Yuma.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													105.3	
1915													173.9	
1916													179.3	
1917													245.3	*
1918													230.8	
1919													215.7	
1920													191.3	
1921													205.3	
1922													193.2	
1923													261.9	
1924				14.8	18.4	29.9	30.1	20.1	30.3	33.8	30.2	20.7	*257.1	
1925	17.4	13.4	13.8	16.8	18.5	30.6	25.6	24.1	33.1	35.6	30.9	24.7	284.5	
1926	14.9	11.0	17.9	16.7	18.5	32.7	22.2	19.3	33.9	34.7	21.5	17.7	261.0	
1927	23.4	21.8	9.7	17.1	24.1	31.7	25.4	26.1	40.0	32.5	39.1	29.3	320.2	
1928	32.2	24.7	26.8	11.9	26.2	39.2	19.5	26.0	35.8	38.2	37.1	26.7	344.3	
1929	21.5	9.4	7.4	10.3	22.6	30.5	19.4	28.8	39.9	41.8	33.1	18.1	282.8	
1930	18.5	11.1	6.2	16.7	25.1	24.7	18.6	20.5	31.1	29.4	29.8	31.6	263.3	
1931	36.1	32.0	27.8	23.3	25.7	40.1	27.9	30.4	37.6	37.4	27.9	21.7	367.9	
1932	26.6	25.0	19.8	19.3	21.5	34.9	28.6	31.6	35.7	31.4	31.3	32.9	338.6	1/
1933	26.6	27.3	22.2	19.4	23.8	36.8	26.4	27.0	33.0	34.7	32.1	27.9	337.2	
1934	22.6	25.7	21.7	20.8	27.1	28.1	22.4	32.1	30.5	24.9	20.4	18.2	294.5	
1935	20.3	12.4	8.4	9.8	19.3	23.0	19.8	25.7	31.9	32.4	25.9	22.6	251.5	
1936	28.0	24.7	16.9	13.8	22.1	25.9	28.4	27.3	35.0	35.7	31.1	33.6	322.5	
1937	29.7	26.3	24.7	20.8	26.1	23.7	29.9	30.8	34.2	36.0	33.9	32.2	348.3	
1938	34.4	26.0	22.4	24.1	21.4	24.2	32.4	31.1	38.4	31.6	30.3	31.3	347.6	
1939	30.0	29.4	22.7	21.8	26.5	32.5	31.9	35.3	36.2	36.9	35.9	20.8	359.9	
1940	35.3	32.0	27.3	28.1	26.4	35.1	35.8	34.4	35.6	35.8	36.3	37.0	399.1	
1941	38.3	34.2	28.1	22.8	28.0	24.5	23.2	25.1	31.4	32.5	28.3	33.6	350.0	
1942	35.4	28.5	22.6	25.4	25.6	29.9	32.2	31.2	30.6	28.8	29.3	36.6	356.1	2/
1943	38.0	35.4	27.5	27.9	30.7	35.0	35.2	34.8	33.3	32.9	33.8	35.2	399.7	
1944	38.0	35.0	28.6	30.1	27.0	31.6	33.9	33.7	31.9	31.0	34.5	34.7	390.0	
1945	35.6	28.5	24.4	20.8	27.6	27.6	34.1	34.7	32.1	33.7	34.4	38.2	371.7	
14-45 Mean	25.0	21.3	17.7	17.1	21.1	26.7	23.9	25.0	29.8	29.4	27.2	24.8	289.0	*

Subsequent Records

1946	37.4	35.0	23.1	28.4	28.4	33.0	32.0	34.3	31.0	35.3	35.5	37.3	390.7	2/
1947	36.4	31.6	25.5	25.4	30.1	32.3	34.6	35.2	31.2	33.1	35.4	39.0	389.8	2/
1948	41.5	34.8	24.6	31.9	31.8	34.8	36.1	34.5	31.4	30.5	38.9	38.5	409.3	2/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey annual Water-Supply Papers.

Table 6

LOWER COLORADO RIVER BASIN

Quantity Pumped in 1000 Acre-feet

WATER PUMPED FOR UNIT B OF YUMA MESA AUXILIARY PROJECT

Location: "B" lift pumping station, about seven miles south of Yuma, Arizona. The water is diverted from the Yuma Main Canal through a supply canal to the pumping plant. Pumping for irrigation started in July 1922.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1922										0.3	0.2	0.1	0.6	
1923	0.1	0.2	0.2	0.3	0.4	0.7	0.8	0.8	0.7	0.7	0.7	0.6	6.2	
1924	0.7	0.4	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.6	0.5	5.5	
1925	0.5	0.3	0.3	0.4	0.4	0.7	0.6	0.5	0.6	0.5	0.4	0.3	5.5	
1926	0.1	0.2	0.3	0.1	0.4	0.4	0.3	0.4	0.5	0.4	0.3	0.2	3.6	
1927	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.4	0.6	0.4	0.5	0.3	3.5	
1928	0.3	0.2	0.2	0.1	0.3	0.3	0.4	0.7	0.7	0.8	0.8	0.6	5.4	
1929	0.5	0.3	0.3	0.3	0.4	0.4	0.5	0.8	0.7	0.8	0.7	0.6	6.3	
1930	0.7	0.4	0.4	0.6	0.5	0.4	0.9	0.9	1.2	1.2	0.8	0.9	8.9	
1931	0.7	0.6	0.4	0.4	0.3	0.7	0.8	0.9	1.0	1.2	0.9	0.8	8.7	
1932	0.6	0.4	0.3	0.4	0.3	0.5	0.7	0.8	1.0	1.0	1.1	0.9	8.0	1/
1933	0.5	0.5	0.3	0.4	0.4	0.6	0.7	0.9	1.0	1.1	1.1	0.9	8.4	
1934	0.5	0.6	0.4	0.6	0.6	0.7	0.9	1.1	1.0	1.1	1.0	0.8	9.3	
1935	0.8	0.6	0.4	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.1	0.9	9.6	
1936	0.9	0.6	0.5	0.5	0.6	0.8	0.8	1.0	1.2	1.3	1.3	1.1	10.6	
1937	0.8	0.7	0.5	0.6	0.4	0.7	0.8	1.1	1.2	1.6	1.5	1.4	11.3	
1938	1.0	0.8	0.6	0.6	0.5	0.7	1.0	1.2	1.5	1.5	1.8	1.3	12.5	
1939	0.9	0.6	0.7	0.5	0.6	0.9	1.1	1.4	1.6	1.9	2.0	0.5	12.7	
1940	1.1	0.8	0.7	0.7	0.7	0.9	1.0	1.6	1.7	2.0	1.9	1.3	14.4	
1941	1.1	0.8	0.4	0.5	0.6	0.8	1.0	1.5	1.7	2.0	1.6	1.4	13.4	
1942	1.0	0.7	0.6	0.6	0.7	0.8	1.2	1.4	1.9	2.1	1.9	1.7	14.6	
1943	1.2	0.8	0.8	0.6	0.9	1.1	1.7	2.2	2.6	2.6	2.6	2.2	19.3	
1944	1.5	1.2	0.7	0.8	0.6	1.0	1.3	1.8	2.4	2.3	2.5	1.8	17.9	
1945	1.3	0.7	0.7	0.7	0.9	1.0	1.4	2.3	2.4	2.6	2.8	2.2	19.0	
14-45 Mean	0.5	0.4	0.3	0.3	0.4	0.5	0.6	0.8	0.9	1.0	0.9	0.7	7.3	

Subsequent Records

1946	1.9	1.2	0.7	1.0	0.8	1.3	2.0	2.6	2.8	3.4	3.3	2.6	23.6	1/
1947	2.3	1.6	1.1	1.6	1.6	2.2	2.7	3.7	3.7	4.0	3.8	3.4	31.7	1/
1948	2.8	1.7	1.6	1.9	1.6	2.1	2.6	3.3	3.9	4.3	4.3	3.8	33.9	1/

1/ Records of Bureau of Reclamation.

LOWER COLORADO RIVER BASIN

Quantity Pumped in 1000 Acre-feet

WATER PUMPED AT YUMA MESA PUMPING PLANT

Location: Pumping plant in NW¼ sec. 1, T. 9 S., R. 22 W., Gila and Salt River base and meridian, about 9 miles southeast of Yuma, Arizona. Water is supplied to the pumping plant by the Gila Gravity Main Canal at a point about 21 canal miles from Imperial Dam and is pumped for use on Yuma Mesa Division of Gila Project. Pumping began November 4, 1943.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1944		0.5	0.4	0.5	0.3	0.9	1.0	1.1	1.3	1.5	1.6	1.2	10.3	1/
1945	1.2	0.8	1.6	1.4	2.4	4.7	5.6	5.4	5.8	7.7	7.2	5.2	49.0	1/
14-45 Mean	0	0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.2	1.9	

Subsequent Records

1946	5.7	5.5	4.1	5.7	5.9	7.8	8.1	10.3	10.7	10.6	12.1	11.2	97.7	1/
1947	11.0	9.1	6.8	7.1	6.8	8.7	9.2	11.6	12.1	12.0	11.6	10.6	116.6	1/
1948	11.9	9.3	6.8	6.8	8.0	11.5	12.1	13.3	11.9	12.7	14.0	12.0	130.3	1/
1949	7.0	5.4	3.6	1.1	4.0	7.6	10.0	11.6	11.8	11.7	10.7	12.1	96.6	1/

1/ Records of Bureau of Reclamation.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS FOR USE IN CALIFORNIA BY ALAMO CANAL AT ANDRADE, CALIFORNIA 1/

Location: Lat. 32°43'10", long. 114°43'30", in SW¼SE¼ sec. 35, T. 16 S., R. 21 E., San Bernardino meridian, at Andrade, 200 feet upstream from international boundary, 800 feet downstream from Hanlon heading, and 1¼ miles downstream from Rockwood gate.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	130.0	70.4	63.2	88.7	80.5	136.3	154.2	180.2	210.8	203.5	177.6	148.3	1,647.7	
1915	140.3	93.4	86.4	96.0	71.5	144.1	160.5	163.0	239.8	184.6	170.6	179.7	1,729.9	
1916	157.3	111.0	105.8	96.6	129.3	152.9	209.4	231.6	267.4	153.2	216.1	176.2	2,006.8	
1917	163.3	116.1	97.6	106.6	121.6	149.0	176.9	213.8	251.6	262.1	145.1	207.2	2,010.9	
1918	200.8	132.4	121.3	133.4	156.2	198.4	241.3	251.7	246.2	238.7	240.5	229.9	2,390.8	
1919	201.2	129.3	119.7	121.4	120.6	173.6	212.8	249.8	256.5	286.5	257.0	186.9	2,315.3	
1920	188.8	145.3	135.1	144.1	141.9	202.6	228.8	258.2	233.1	267.8	253.1	207.7	2,406.5	
1921	207.1	171.1	179.7	144.5	158.1	184.1	185.8	191.1	209.7	217.7	192.1	202.0	2,243.0	
1922	160.4	149.8	133.3	120.3	141.4	184.8	200.4	211.4	213.2	233.1	228.9	211.6	2,188.6	2/
1923	241.9	212.0	135.3	160.5	152.0	209.6	220.6	261.4	257.5	266.1	268.6	253.6	2,639.1	
1924	213.7	207.0	185.0	178.5	173.4	218.8	234.5	265.3	281.5	285.4	178.2	121.9	2,543.2	
1925	180.8	160.4	151.9	133.2	141.6	199.3	229.7	246.2	251.2	258.0	242.3	229.7	2,424.3	
1926	174.6	160.1	148.1	167.2	176.4	212.8	203.6	239.5	244.3	237.8	225.5	193.9	2,383.8	
1927	220.0	194.5	85.6	142.1	141.9	202.0	217.6	255.1	267.0	248.5	235.8	228.8	2,438.9	
1928	232.5	170.0	150.2	134.1	162.2	221.8	246.6	252.3	276.9	260.4	256.7	217.9	2,581.6	
1929	229.1	174.6	158.8	165.8	170.2	236.5	251.5	272.0	270.4	264.1	255.4	237.4	2,685.8	
1930	259.9	214.8	196.2	169.6	157.7	215.4	255.6	265.2	284.4	294.0	254.6	258.9	2,826.3	
1931	262.7	218.9	199.8	185.5	114.9	236.7	238.5	262.0	283.6	213.0	157.5	109.9	2,483.0	
1932	244.2	169.4	158.6	180.1	136.4	224.3	223.2	240.7	247.9	224.3	199.9	201.7	2,450.7	
1933	163.4	175.6	143.9	150.8	156.7	212.4	200.8	219.1	238.4	249.3	193.5	152.6	2,256.5	
1934	231.6	196.3	181.9	174.7	174.2	189.0	171.3	230.7	201.5	33.1	18.8	64.9	1,868.0	
1935	69.3	102.9	166.7	135.5	102.2	207.5	222.7	231.4	228.7	231.3	200.4	198.6	2,097.2	
1936	238.5	192.1	167.1	181.1	153.8	253.5	262.8	252.5	265.2	236.5	230.2	245.0	2,678.3	
1937	262.6	201.8	183.7	171.2	186.0	232.4	270.6	277.1	280.1	282.9	265.1	254.9	2,868.4	

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

DIVERSIONS FOR USE IN CALIFORNIA BY ALAMO CANAL AT ANDRADE, CALIFORNIA (Continued) 1/

Location: Lat. 32°43'10", long. 114°43'30", in SW¼ SE¼ sec. 35, T. 16 S., R. 21 E., San Bernardino meridian, at Andrade, 200 feet upstream from international boundary, 800 feet downstream from Hanlon heading, and 1¼ miles downstream from Rockwood gate.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	288.9	288.1	210.2	203.5	191.0	225.5	266.8	285.9	298.0	276.9	246.7	226.1	2,947.6	2/
1939	288.3	221.9	155.6	141.6	197.6	277.0	275.7	284.4	277.5	247.1	222.0	123.9	2,712.6	
1940	240.8	200.7	190.3	179.6	201.8	255.1	254.5	192.7	228.5	233.7	218.3	219.8	2,615.8	
1941	262.1	176.6	104.6	81.4	115.5	142.2	139.7	157.9	155.5	146.9	112.9	128.3	1,723.6	
1942	107.1	75.8	47.5	23.9									254.3	
14-45 Mean	186.3	149.1	130.1	128.5	129.0	178.0	192.4	207.7	217.7	204.3	183.2	169.3	2,075.6	

1/ These diversions include diversions for use in California from Colorado River at Volcano Lake during the period, August 1916 through September 1921.

2/ Estimated from records and data secured by the Imperial Irrigation District and furnished by the International Boundary and Water Commission. Records of total diversions by Alamo Canal are published by the Geological Survey. The estimates represent the deliveries of water to California from the Alamo Canal system plus a portion of the losses from the Alamo Canal chargeable to California deliveries.

Since February 1942, irrigation water for Imperial Valley in California has been supplied by the All-American Canal.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

CALIFORNIA DRAINAGE CANAL NEAR YUMA, ARIZONA

Location: On California side of river at mouth of Yuma Main Canal Wasteway, half a mile downstream from gaging station on Colorado River at Yuma.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	0.9	0.9	1.0	1.0	0.9	1.1	1.4	1.4	1.3	1.2	1.0	0.9	13.0	
1915	0.8	0.7	0.8	0.9	0.9	1.1	1.2	1.6	1.3	1.2	1.2	1.1	12.8	
1916	0.9	0.8	1.0	2.6	3.0	1.4	1.5	1.7	1.7	1.6	1.4	1.3	18.9	
1917	1.4	1.4	1.2	1.3	1.2	1.3	1.2	1.1	1.4	1.8	1.8	1.5	16.6	
1918	1.3	1.0	1.1	1.2	1.0	1.1	1.4	1.5	1.8	2.2	1.8	1.6	17.0	
1919	1.4	1.5	1.3	1.2	1.3	1.4	1.8	2.2	2.1	1.9	1.4	1.3	18.8	
1920	1.7	1.4	1.3	1.3	1.4	1.8	1.7						*18.0	
1921													*15.0	
1922	1.6	0.9	1.0	0.8	0.6	0.9	1.1	1.4	1.7	0.9	0.8	0.5	12.2	
1923	0.6	0.6	0.8	0.8	0.8	1.0	1.2	1.3	1.5	1.9	1.0	0.7	12.2	
1924	0.6	0.6	0.4	0.6	0.7	0.7	0.8	1.7	1.6	1.3	0.9	0.9	10.8	
1925	0.9	0.7	0.8	1.0	1.1	1.1							*10.9	1/
1926													*10.8	
1927													*10.7	
1928													*10.6	
1929													*10.5	
1930													*10.4	
1931													*10.3	
1932													*10.2	
1933													*10.1	
1934													*10.0	
1935													*11.5	
1936													12.0	
1937				0.9	0.6	2.3	1.2	1.0	0.9	0.8	0.9	0.9	12.5	
1938	1.3	1.1	1.0	0.9	0.8	1.2	1.2	1.1	1.2	1.3	1.4	1.1	13.6	
1939	1.0	1.0	1.2	1.3	1.7	1.9	1.9	1.7	1.6	1.6	1.5	5.0	21.4	
1940	1.6	1.8	2.0	2.0	1.6	1.9	2.0	1.5	1.6	1.9	1.9	2.1	21.9	
1941	2.7	2.5	2.7	3.3	3.0	3.3	3.8	3.1	3.3	4.1	3.7	3.3	38.8	2/
1942	3.5	3.7	3.4	3.0	3.0	3.1	4.0	4.3	3.7	4.2	3.8	3.5	43.2	
1943	3.4	3.5	3.4	3.1	2.8	3.2	3.3	3.1	2.7	2.8	2.4	2.3	36.0	
1944	2.4	2.6	2.8	2.2	2.6	2.8	2.8	3.1	2.8	3.2	2.1	2.7	32.1	
1945	2.6	2.7	2.5	2.8	2.7	3.4	3.6	3.4	3.2	3.2	3.1	2.9	36.1	3/
14-45 Mean	1.3	1.2	1.3	1.3	1.3	1.4	1.6	1.6	1.6	1.7	1.4	1.5	17.2	*

Subsequent Records

1946	2.9	3.1	3.8	3.5	3.5	3.6	3.5	3.9	3.4	3.5	3.6	3.8	42.1	3/
1947	4.3	4.4	5.0	4.8	4.1	4.6	4.6	4.7	4.4	4.3	4.5	4.4	54.1	3/
1948	5.4	5.5	4.7	4.5	4.3	4.7	5.0	5.2	4.8	4.9	4.9	5.0	58.9	3/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 1009.

3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COOPER WASTEWAY NEAR YUMA, ARIZONA

Location: On Arizona side of Colorado River, 1½ miles downstream from California-Mexico boundary, and 8½ miles downstream from gaging station on Colorado River at Yuma. Cooper wasteway was completed in March 1927.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1927													1.2	
1928													2.0	
1929													2.0	
1930													2.0	*
1931													2.0	
1932													2.0	
1933													2.0	
1934													2.5	
1935									0.2	0.4	0.6	0.4	*4.0	
1936	0.4	0.5	0.2	0	0	0	0.4	0.3	0.2	0.2	0	0	2.2	1/
1937	0.1	0.4	0.1	0.3	0.1	0	0.2	0.1	0.1	0.2	0.1	0.1	1.8	
1938	0.1	0.2	0.2	0.4	0.1	0.1	0.2	0.1	0.1	0	0	0	1.5	
1939	0	0.1	0.2	0.3	0.1	0	0.1	0.2	0.2	0.2	0.1	0	1.5	
1940	0.2	0.3	0.6	0.9	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0	3.2	
1941	0.2	0.2	0.6	0.3	0.3	0.5	0.4	0.1	0.4	0.2	0	0	3.2	2/
1942	0.2	0.2	0.5	0.1	0.3	0.3	0.3	0.1	0.1	0	0.1	0.1	2.3	
1943	0.1	0.1	0.4	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0	1.8	
1944	0.1	0	0.3	0.3	0.4	0.2	0	0.3	0.1	0	0	0.1	1.8	
1945	0.2	0.2	0.2	0.3	0.2	0.3	0.4	0.2	0.3	0.5	0	0	2.8	3/
14-45 Mean	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.	1.3	*

Subsequent Records

1946	0	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0	0	1.2	3/
1947	0.1	0.1	0.3	0.1	0.1	0.2	0.1	0.1	0.1	0	0.1	0.1	1.4	3/
1948	0	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0	0	1.5	3/

* Estimated.
1/ Geological Survey Water-Supply Paper 1049 except (*).
2/ Geological Survey Water-Supply Paper 1009.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

ELEVEN-MILE WASTEWAY NEAR YUMA, ARIZONA

Location: On Arizona side of Colorado River, 5¼ miles downstream from Rockwood gate, and 11¼ miles downstream from station on Colorado River at Yuma.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914													60.0	
1915													60.2	
1916													60.4	
1917													60.6	
1918													60.8	*
1919													61.0	
1920													61.2	
1921													61.4	
1922													61.6	
1923													61.8	
1924				8.9	4.8	4.8	7.0	6.3	4.3	3.6	1.4	0.7	*61.6	
1925	5.0	6.1	6.8	6.5	4.0	3.3	6.1	6.1	2.7	3.5	3.7	6.9	60.7	
1926	7.6	6.1	8.8	8.1	7.8	4.0	6.8	4.5	4.0	2.8	1.3	2.7	64.5	
1927	7.9	7.6	3.6	7.2	6.5	4.9	5.7	6.9	5.8	7.4	7.0	5.7	76.2	
1928	13.7	16.5	10.6	12.4	8.7	6.7	9.1	7.5	6.6	5.3	7.4	5.9	110.4	
1929	8.6	11.2	12.9	12.1	6.4	5.8	10.5	7.9	6.3	5.5	6.1	8.4	101.7	
1930	13.7	13.6	14.0	14.6	5.7	11.1	11.3	8.7	5.9	5.6	5.8	9.4	119.4	
1931	9.0	10.6	11.1	9.2	4.6	4.7	5.9	7.9	5.9	4.5	3.7	0.8	77.9	1/
1932	7.9	9.2	9.0	10.1	9.4	9.4	9.5	8.2	6.7	6.4	6.3	9.4	101.5	
1933	8.8	7.6	9.2	9.7	8.6	6.9	6.1	8.9	4.6	3.9	5.4	3.1	82.8	
1934	5.3	6.4	8.7	8.4	4.4	2.1	1.3	4.7	3.1	0	0	0	44.4	
1935	0	2.0	3.0				0.6	4.0	4.4	3.9	5.1	4.5	*40.5	
1936	5.0	8.2	2.7	0.3	0.7	2.5	3.3	3.9	1.1	2.1	2.4	0.8	33.0	
1937	4.2	4.3	8.7	8.6	3.9	4.7	5.3	5.7	3.1	5.0	3.0	2.5	59.0	
1938	5.2	4.0	8.3	7.3	5.4	1.2	4.0	3.4	3.6	4.4	2.1	1.9	50.8	
1939	2.7	4.9	7.6	7.0	6.2	4.4	5.5	7.5	4.7	6.9	6.3	4.9	68.6	
1940	4.9	6.9	9.4	7.3	5.3	5.8	5.2	7.8	7.4	7.7	9.7	6.1	83.5	
1941	5.7	6.4	8.4	7.5	5.9	2.6	0	0.1	3.4	4.1	3.0	2.9	50.0	
1942	4.5	4.6	4.6	6.7	4.7	6.0	5.5	7.3	7.4	7.3	6.0	4.7	69.3	2/
1943	4.4	4.6	6.8	6.2	5.6	4.5	4.8	7.3	7.4	8.3	5.3	3.8	69.0	
1944	2.6	4.1	9.1	7.5	5.1	4.5	4.0	7.9	6.4	6.3	5.0	3.7	66.2	
1945	3.9	4.0	5.6	5.0	5.0	5.5	4.5	4.9	5.2	5.2	4.5	2.2	55.5	3/
14-45 Mean	6.0	6.8	7.7	7.7	5.4	4.8	5.3	5.9	4.8	4.8	4.3	3.9	67.4	*
Subsequent Records														
1946	3.4	3.6	4.7	6.6	4.6	4.4	3.2	5.5	5.7	4.7	2.4	1.5	50.3	3/
1947	1.5	3.6	7.9	5.6	3.3	4.0	2.9	4.5	7.3	6.6	2.5	3.8	53.5	3/
1948	2.2	6.5	9.3	6.9	5.7	5.7	3.9	4.4	5.6	6.9	3.7	1.5	62.3	3/

* Estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 1009.

3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

TWENTY-ONE MILE WASTEWAY NEAR YUMA, ARIZONA

Location: On Arizona side of Colorado River, 15-1/4 miles downstream from Rockwood gate, and 21-1/4 miles downstream from station on Colorado River at Yuma. Discharge began in March 1939.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1939						0.2	0.3	0.2	0.4	0.8	0.8	0.6	3.3	↑
1940	0.4	1.2	1.0	1.1	0.5	0.6	1.7	1.1	1.4	1.7	1.5	1.2	13.4	↑
1941	1.7	2.4	2.7	2.1	1.5	1.1	1.9	1.8	1.2	1.3	1.4	1.5	20.6	1/
1942	1.5	1.5	2.0	1.3	1.6	1.2	1.4	1.7	1.7	1.7	1.6	1.3	18.5	
1943	1.7	1.7	2.1	1.5	1.6	1.3	1.9	2.0	1.8	1.6	1.5	1.5	20.2	↓
1944	1.2	2.2	2.4	1.8	2.5	1.7	1.9	1.7	1.8	2.0	1.7	0.8	21.7	↓
1945	1.0	1.8	2.3	1.8	1.2	0.9	0.8	2.4	1.9	1.7	1.3	1.7	18.8	2/
14-45 Mean	0.2	0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.3	0.3	0.3	0.3	3.6	

Subsequent Records

1946	2.0	2.1	2.7	2.9	1.9	1.6	1.2	2.3	1.9	1.2	2.5	2.2	24.5	2/
1947	2.1	2.1	2.5	1.8	1.6	0.9	1.0	2.3	1.1	0.9	1.3	1.2	18.8	2/
1948	1.3	1.4	1.8	2.0	1.5	1.3	0.8	2.5	2.4	0.8	1.2	1.0	18.0	2/

1/ Geological Survey Water-Supply Paper 1009.
2/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

MAIN DRAIN FROM YUMA PROJECT, ARIZONA

Location: Across Arizona-Sonora boundary in NE¼ sec. 11, T. 11 S., R. 25 W., 1-3/8 miles from Colorado River. Discharge began in January 1919.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1919								*4.5	1.4	1.4	1.4	1.3	10.0	
1920	0.9	1.2	1.2	1.1	1.0	0.9	1.0	1.0	2.2	2.4	2.2	2.2	17.3	
1921	1.8	1.7	1.7	1.7	1.6	2.0	2.0	2.8	3.4	3.3	2.5	2.2	26.7	
1922	2.3	2.2	2.3	2.4	2.3	2.6	2.9	3.3	3.6	3.6	3.4	3.0	33.9	
1923	3.1	2.5	2.4	2.5	2.3	3.5	3.6	3.7	4.5	4.8	4.5	5.4	42.8	
1924	3.9	3.5	3.6	3.5	3.1	4.0	4.8	5.3	5.6	5.8	5.5	4.9	53.5	
1925	4.4	3.8	3.7	3.5	3.4	4.7	4.8	4.6	4.7	5.3	4.9	3.9	51.7	
1926	3.5	3.0	3.0	3.2	3.1	4.5	4.5	4.4	5.3	5.2	3.9	3.6	47.2	
1927	3.2	3.0	3.3	3.4	3.2	4.6	4.7	4.4	4.6	5.1	4.7	4.0	48.2	
1928	4.4	4.1	3.8	3.6	3.6	5.0	4.6	4.6	4.8	6.0	5.7	5.0	55.2	1/
1929	4.8	4.4	4.7	3.0	2.9	4.3	4.1	4.5	5.6	5.9	5.5	4.3	54.0	
1930	4.3	3.8	3.8	3.8	3.3	4.4	4.1	4.3	4.7	4.7	4.3	3.6	49.1	
1931	3.2	3.1	3.2	3.1	3.0	3.7	3.8	3.4	3.3	3.0	2.5	2.1	37.4	
1932	2.4	2.4	2.7	2.5	2.6	3.1	2.9	3.4	3.3	3.5	2.6	2.2	33.6	
1933	2.2	2.3	2.4	2.4	2.2	2.9	2.8	2.6	3.1	3.2	2.6	2.0	30.7	
1934	2.1	2.1	2.2	2.4	2.3	2.9	2.6	2.7	2.7	2.1	1.5	1.7	27.3	
1935	1.4	1.7	1.7	1.7	1.6	1.9	1.9	2.0	2.3	2.5	2.6	2.3	23.6	
1936	2.9	2.8	2.4	2.7	2.8	3.5	3.5	3.3	2.9	3.5	3.4	3.1	36.8	
1937	3.8	4.1	4.1	3.8	3.7	4.6	4.4	4.1	3.6	3.8	3.5	3.4	46.9	
1938	4.0	4.2	4.4	4.5	4.4	5.1	5.2	5.5	5.5	5.0	4.6	4.8	57.2	
1939	5.7	6.2	6.5	4.6	6.0	7.8	6.8	6.0	5.1	5.2	4.6	4.8	69.3	
1940	5.5	6.3	5.9	6.1	5.9	6.2	5.9	5.5	4.2	4.0	3.8	4.3	63.6	
1941	6.6	6.5	5.6	5.1	4.8	5.4	5.4	5.9	5.6	5.3	5.0	5.2	66.4	2/
1942	6.6	7.3	7.7	7.3	6.7	7.0	6.7	6.3	5.5	4.8	4.0	4.5	74.4	
1943	5.8	6.5	6.4	6.4	5.7	6.5	5.9	5.2	4.7	4.4	4.5	4.8	66.8	
1944	6.0	6.6	6.7	6.7	6.4	6.6	6.2	5.9	4.9	3.9	3.7	4.0	67.6	
1945	5.2	5.7	5.5	5.3	4.9	5.5	5.1	4.8	4.0	3.5	3.5	3.8	56.8	3/
14-45 Mean	3.1	3.2	3.1	3.0	2.9	3.6	3.5	3.4	3.5	3.5	3.2	3.0	39.0	

Subsequent Records

1946	4.5	5.3	5.3	5.6	5.3	6.1	6.0	6.0	5.4	4.6	5.0	4.8	63.9	3/
1947	6.0	6.3	6.7	6.6	7.0	8.2	7.9	7.7	6.7	5.8	5.9	6.8	81.6	3/
1948	8.3	8.7	9.0	9.3	9.1	9.8	9.0	9.5	7.9	7.2	8.2	9.1	105.1	3/

* Total for Jan. 1 to May 31, 1919; monthly distribution not available.

1/ Geological Survey Water-Supply Paper 1049.
2/ Geological Survey Water-Supply Paper 1009.
3/ Geological Survey annual Water-Supply Papers.

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

EAST AND WEST MAIN CANALS AT ARIZONA-SONORA BOUNDARY

Location: Combined discharge across Arizona-Sonora boundary of the two Yuma project canals at 1-1/2 miles and 3/4 mile, respectively, east of Colorado River. West Main Canal was completed in May 1915, and East Main Canal in 1913 or 1914. After May 1944, waste water from West Main Canal was returned to river through Twenty-one Mile Wasteway.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1924				2.5	2.5	1.3	1.9	2.0	1.6	1.4	0.7	0.4	*22.3	
1925	1.9	1.4	3.7	1.6	2.1	1.7	1.9	2.2	2.9	1.7	1.4	3.0	25.5	
1926	2.6	1.6	2.2	2.2	2.4	2.6	2.4	2.3	2.9	2.2	0.7	2.2	26.3	
1927	2.7	3.2	2.1	2.1	2.6	2.6	2.0	2.6	1.7	2.8	2.8	3.8	30.3	
1928	3.8	3.7	3.2	3.3	2.9	1.7	2.2	1.8	2.3				*30.5	
1929														
1930														
1931														1/
1932				2.1	1.7	1.9	1.9	3.0	1.3	1.5	1.6	1.2	*20.3	
1933	1.4	1.5	1.2	1.6	1.2	1.3	1.5	1.0	1.1	0.9	0.8	0.7	14.2	
1934	1.3	1.5	1.4										* 7.0	
1935							0.3	0.7	0.4	0.5	0.7	0.6	* 5.8	
1936	0.7	0.9	0.6	0.8	0.6	0.8	0.9	1.1	0.8	1.0	1.0	0.9	10.1	
1937	0.8	1.2	1.5	1.1	1.1	0.2	0.6	0.5	0.2	0.2	0.5	1.6	9.5	
1938	1.2	1.3	1.0	1.3	1.1	1.5	1.5	2.4	2.9	2.3	3.2	2.9	22.6	
1939	3.0	3.1	3.3	3.1	2.2	1.8	2.2	2.1	1.5	2.8	2.7	1.7	29.5	
1940	2.1	2.0	2.9	2.2	1.2	2.6	2.8	2.5	2.0	2.6	2.8	1.9	27.6	
1941	1.9	2.1	2.8	2.4	1.8	1.8	2.4	2.1	1.8	2.2	2.5	2.4	26.2	2/
1942	2.2	2.1	2.5	2.1	1.9	2.3	3.0	2.7	2.2	2.6	3.4	2.2	29.2	
1943	3.3	3.6	3.1	3.1	2.7	2.9	3.2	3.0	3.1	3.3	3.0	3.2	37.5	
1944	3.0	3.0	3.1	3.4	3.2	3.0	3.1	2.9	3.7	3.6	4.0	2.9	38.9	
1945	2.8	3.1	2.9	2.4	1.6	2.3	1.8	2.6	2.4	2.9	1.7	2.2	28.7	3/
14-45 Mean	2.1	2.1	2.2	2.0	1.8	1.7	1.9	2.0	1.8	1.9	1.9	1.9	23.3	4/

Subsequent Records for East Main Canal

1946	2.5	2.9	1.8	2.2	2.3	2.6	1.8	2.1	1.6	1.7	2.1	1.9	25.5	3/
1947	1.6	2.2	1.8	1.7	1.7	1.4	1.6	2.4	1.9	2.2	1.9	2.0	22.4	3/
1948	1.6	1.7	1.6	1.9	2.0	2.1	1.6	1.6	1.2	1.5	1.4	0.9	19.1	3/

* Partially estimated.

1/ Geological Survey Water-Supply Paper 1049 except (*).

2/ Geological Survey Water-Supply Paper 1009.

3/ Geological Survey annual Water-Supply Papers.

4/ 1914-1945 average annual discharge estimated to be the same as the average of the 19 recorded and partially estimated annual discharges during the period.

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER WITHIN LIMITROPHE SECTION AT INTERNATIONAL BOUNDARY

Location: This record is computed and represents the measured contributions of the United States to the flow of the Colorado River between the California-Baja California and Arizona-Sonora boundaries. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1914	542.7	441.5	364.4	400.9	587.8	817.7	1,257.1	3,166.1	6,393.8	3,004.0	1,207.7	479.4	18,663.1	
1915	741.1	541.6	750.6	487.6	1,446.4	827.7	1,662.7	2,801.7	2,668.1	1,741.8	542.6	112.7	14,324.6	
1916	309.2	271.4	271.6	2,734.9	1,515.3	2,058.4	1,934.1	3,153.6	3,293.7	2,124.7	1,483.0	581.7	19,731.6	
1917	1,501.7	618.5	379.0	472.4	341.4	478.6	1,406.1	2,831.2	5,117.2	5,527.4	1,310.2	340.0	20,323.7	
1918	288.3	304.5	319.3	287.2	180.5	826.7	547.5	1,563.9	3,452.7	2,445.2	494.3	199.4	10,909.5	
1919	299.5	367.4	349.2	132.0	298.1	386.6	1,033.8	1,995.5	1,810.3	975.0	423.8	144.1	8,215.3	
1920	164.1	482.8	831.4	579.6	2,056.0	933.7	1,011.6	2,613.9	7,481.2	2,396.3	856.2	313.1	19,719.9	
1921	217.1	472.5	291.1	304.5	274.8	667.4	650.5	2,509.8	6,426.4	2,621.7	2,000.1	895.1	17,331.0	
1922	409.5	330.4	521.8	697.1	487.2	839.4	970.4	3,260.2	5,633.3	1,740.2	541.2	331.0	15,761.7	
1923	32.9	151.2	351.5	198.0	201.9	357.9	892.3	2,650.6	4,852.0	2,384.1	1,275.7	1,055.7	14,403.8	1/
1924	568.3	658.8	526.9	616.6	316.3	316.2	1,137.9	2,339.2	2,945.7	868.2	142.2	99.8	10,536.1	
1925	105.3	238.9	243.6	105.1	238.4	366.9	904.0	1,574.2	2,275.6	1,513.3	437.2	1,062.7	9,065.2	
1926	1,013.3	549.2	375.7	235.1	138.5	263.5	1,245.4	2,573.0	3,351.1	1,217.5	338.3	102.1	11,402.7	
1927	284.3	125.1	424.0	205.4	1,002.5	578.2	816.8	2,822.0	3,210.1	2,491.5	751.5	1,635.4	14,346.8	
1928	838.3	598.8	369.5	356.6	356.4	374.0	639.1	3,089.7	3,615.0	1,373.0	348.9	98.6	12,057.9	
1929	249.3	370.6	239.9	153.7	171.8	518.4	1,273.2	2,536.0	4,521.1	1,896.3	1,936.6	1,324.9	15,191.8	
1930	780.6	356.9	277.4	158.4	162.3	346.4	1,008.0	1,647.3	2,517.1	886.8	1,282.8	245.0	9,669.0	
1931	209.7	199.3	118.0	73.6	345.1	117.3	202.7	684.5	1,036.2	241.9	180.5	36.7	3,445.5	
1932	253.0	193.0	114.5	140.0	984.5	639.3	1,292.4	2,505.0	3,503.8	2,246.0	552.5	492.7	12,916.7	
1933	173.6	191.3	195.3	125.1	105.6	251.5	236.3	779.6	3,232.5	1,224.8	184.8	134.9	6,835.3	
1934	170.0	57.3	155.3	136.4	98.6	97.3	116.6	677.5	356.2	29.9	24.9	45.2	1,965.2	
1935	15.9	25.9	63.5	162.2	112.1	149.0	116.0	152.5	574.3	322.5	268.7	256.0	2,218.6	
1936	233.9	291.8	101.2	56.2	95.2	174.0	194.9	179.9	146.8	259.3	233.2	150.9	2,117.3	
1937	87.6	88.3	75.4	88.3	262.7	292.9	179.7	150.6	124.9	209.4	222.0	167.3	1,949.1	

Table 6

LOWER COLORADO RIVER BASIN

Stream Flow in 1000 Acre-feet

COLORADO RIVER WITHIN LIMITROPHE SECTION AT INTERNATIONAL BOUNDARY (Continued)

Location: This record is computed and represents the measured contributions of the United States to the flow of the Colorado River between the California-Baja California and Arizona-Sonora boundaries. 1/

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Note
1938	104.8	112.0	125.7	119.1	109.8	265.7	197.1	152.7	116.4	235.7	264.8	204.5	2,008.3	
1939	140.5	140.6	223.4	386.7	1,016.3	414.5	247.3	184.9	177.6	259.9	266.4	687.4	4,145.5	
1940	372.6	403.9	461.4	480.4	242.9	203.2	291.5	254.5	171.1	243.0	266.8	300.1	3,691.4	
1941	402.1	425.8	635.3	518.1	298.3	650.6	467.0	999.0	1,307.7	637.4	922.4	1,161.9	8,425.6	1/
1942	1,221.8	1,446.0	1,856.0	1,704.0	1,418.3	1,204.3	779.5	1,246.4	1,176.9	927.4	580.8	469.1	14,030.5	
1943	458.3	751.4	1,008.3	822.9	524.1	562.2	531.7	596.3	625.0	717.0	686.3	668.9	7,952.4	
1944	787.7	883.5	1,108.8	1,021.9	1,034.7	1,026.0	832.0	782.8	608.0	634.3	803.2	797.3	10,320.2	
1945	813.7	959.4	972.8	1,016.5	811.7	915.6	626.9	573.9	521.6	502.2	490.5	482.0	8,686.8	
14-45 Mean	431.0	407.8	440.7	468.0	538.6	560.0	771.9	1,657.7	2,601.4	1,371.8	666.3	471.1	10,386.3	
Subsequent Records														
1946	581.7	740.8	896.6	788.5	781.5	616.3	448.5	449.4	321.2	387.2	369.0	344.5	6,725.2	1/
1947	350.5	524.5	673.3	718.3	637.7	632.1	402.9	499.0	450.1	414.0	550.4	429.5	6,282.3	1/
1948	364.4	591.5	867.1	881.3	887.2	769.0	654.2	742.3	624.2	679.0	584.1	543.5	8,187.8	1/

1/ Computed as the sum of (1) Colorado River at Yuma, Arizona, (2) Pilot Knob Wasteway near Pilot Knob, California, (3) Yuma Main Canal Wasteway at Yuma, Arizona, (4) California Drainage Canal near Yuma, Arizona, (5) Cooper Wasteway near Yuma, Arizona, (6) Eleven-Mile Wasteway near Yuma, Arizona, (7) Twenty-one Mile Wasteway near Yuma, Arizona, (8) Main Drain from Yuma Project, Arizona across Arizona-Sonora boundary, and (9) East and West Main Canals at Arizona-Sonora Boundary, less (10) Diversions for Use in California by Alamo Canal at Andrade, California. The discharge of Araz Drain (completed in spring of 1948) is included in 1948 record.

To obtain the historic flow for this station, these measured flows would need to be adjusted for unmeasured contributions and channel losses between Yuma and the California-Baja California boundary and along the Arizona boundary of the limitrophe section.

APPENDIX B

"CONSUMPTIVE USE OF WATER RATES IN
THE LOWER COLORADO RIVER BASIN"

by

Harry F. Blaney
and
Karl Harris

CONSUMPTIVE USE OF WATER RATES

in the

LOWER COLORADO RIVER BASIN

(Provisional)

By

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and
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Division of Irrigation Engineering and Water Conservation
Soil Conservation Service-Research
U. S. Department of Agriculture

Prepared under the direction of
George D. Clyde, Chief
Division of Irrigation Engineering and Water Conservation

March 1952

ACKNOWLEDGMENTS

The authors wish to express their appreciation to various members of the Bureau of Reclamation, United States Department of the Interior; Soil Conservation Service, United States Department of Agriculture; and University of Arizona for furnishing information in setting up the areas and compiling climatological and other data. In this connection, special thanks go to L. E. Sullivan, the late W. J. Wagner, and A. B. Weston for valuable service rendered. The advice rendered by V. E. Larson and H. P. Dugan of the Bureau of Reclamation is gratefully acknowledged. The assistance given by G. Marvin Litz of the Division of Irrigation Engineering, Soil Conservation Service, in reviewing and checking the tabulations in the report is greatly appreciated.

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CONSUMPTIVE USE OF WATER RATES in the LOWER COLORADO RIVER BASIN

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CONSUMPTIVE USE OF WATER RATES IN THE
LOWER COLORADO RIVER BASIN 1/
(Provisional)

INTRODUCTION

Before the available water resources and an equitable division of the use of the waters of a drainage basin can be satisfactorily ascertained, careful consideration must be given to the consumptive-use requirements for water in various sub-basins. Consumptive use of water involves problems of the water supply, both surface and underground, as well as those of the management and general economics of irrigation projects. It has become a highly important factor in the arbitration of controversies over major stream systems where the public welfare of valleys, States, Federal projects, and even nations is involved. One such stream is the Colorado River, which drains parts of seven western states and flows into the Gulf of California in Lower California, Mexico.

Because of experience accumulated by the Research Division of Irrigation Engineering and Water Conservation of the United States Soil Conservation Service, especially those encountered in the Rio Grande (2) 2/ and Pecos River (3) valleys, it was requested by the Upper Colorado River Basin Compact Commission in 1948 to make a study of consumptive use of water rates in the Upper Colorado River Basin (7). In September 1950 the Bureau of Reclamation of the United States Department of the Interior requested 3/ the Division to make a somewhat similar

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1/ Prepared by Harry F. Blaney, Principal Irrigation Engineer and Karl Harris, Senior Irrigation Engineer under the direction of George D. Clyde, Chief of Division of Irrigation and Water Conservation - Research, Soil Conservation Service, U. S. Department of Agriculture. (March 1952).

2/ Figures in parenthesis refer to Literature Cited.

3/ See appendix for letter from E. A. Moritz to George D. Clyde, September 29, 1950.

study of water consumption rates in the Lower Colorado River Basin.

The Colorado River drains some 242,000 square miles in the United States and 2,000 square miles in northern Mexico. It rises in the snow-capped Rocky Mountains of northern Colorado and its tributaries extend into seven of the States: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The Colorado River Compact of 1922 provides principally for a division of the available water of the Colorado River system between the "Upper Basin" and the "Lower Basin" at Lee Ferry, which is a few miles below the Arizona-Utah boundary.

From a valley-wide standpoint, consumptive use includes all transpiration and evaporation losses from lands on which there is growth of vegetation of any kind, whether agricultural crops or native vegetation, plus evaporation from bare land and from water surfaces (2) (3). The term "consumptive use" is considered synonymous with the term "evapo-transpiration" and is defined (3) as: The sum of the volumes of water used by the vegetative growth of a given area in transpiration or building of plant tissue and that evaporated from adjacent soil, snow, or intercepted precipitation on the area in any specified time. The consumptive-use rate may be expressed in acre-inches per acre or depth in inches and acre-feet per acre or depth in feet. The sources of water to supply consumptive use are precipitation, irrigation, surface and ground water.

The purpose of this report is to present the results of the study of the rates of water consumption at sites of use by agricultural crops and native or natural vegetation in various irrigated areas of Arizona, California, Nevada, New Mexico, and Utah in the Lower Colorado River

Basin. The authors were confronted with the problem of determining, within a limited time, the unit normal consumptive use of water in valley areas extending over many locations in the Lower Basin. Procedures developed in the Pecos River Joint Investigation (3) and the Upper Colorado River Basin (7) have been modified to meet the conditions in the Lower Basin. Because of the limited measurements of consumptive use in the Lower Colorado River Basin, estimates of unit consumptive use by various agricultural crops are based primarily on measurements made on use of water in the Salt River Valley, Arizona, by the Division of Irrigation and Water Conservation (11) (15) (16). Estimates of water consumption by native vegetation are based for the most part on observations made by the United States Geological Survey (14) in Safford Valley, Arizona. These data have been transferred to areas of the Lower Colorado River Basin through relationships established empirically between measured consumptive use and climatological data (8) (9).

GENERAL CHARACTERISTICS OF THE LOWER BASIN

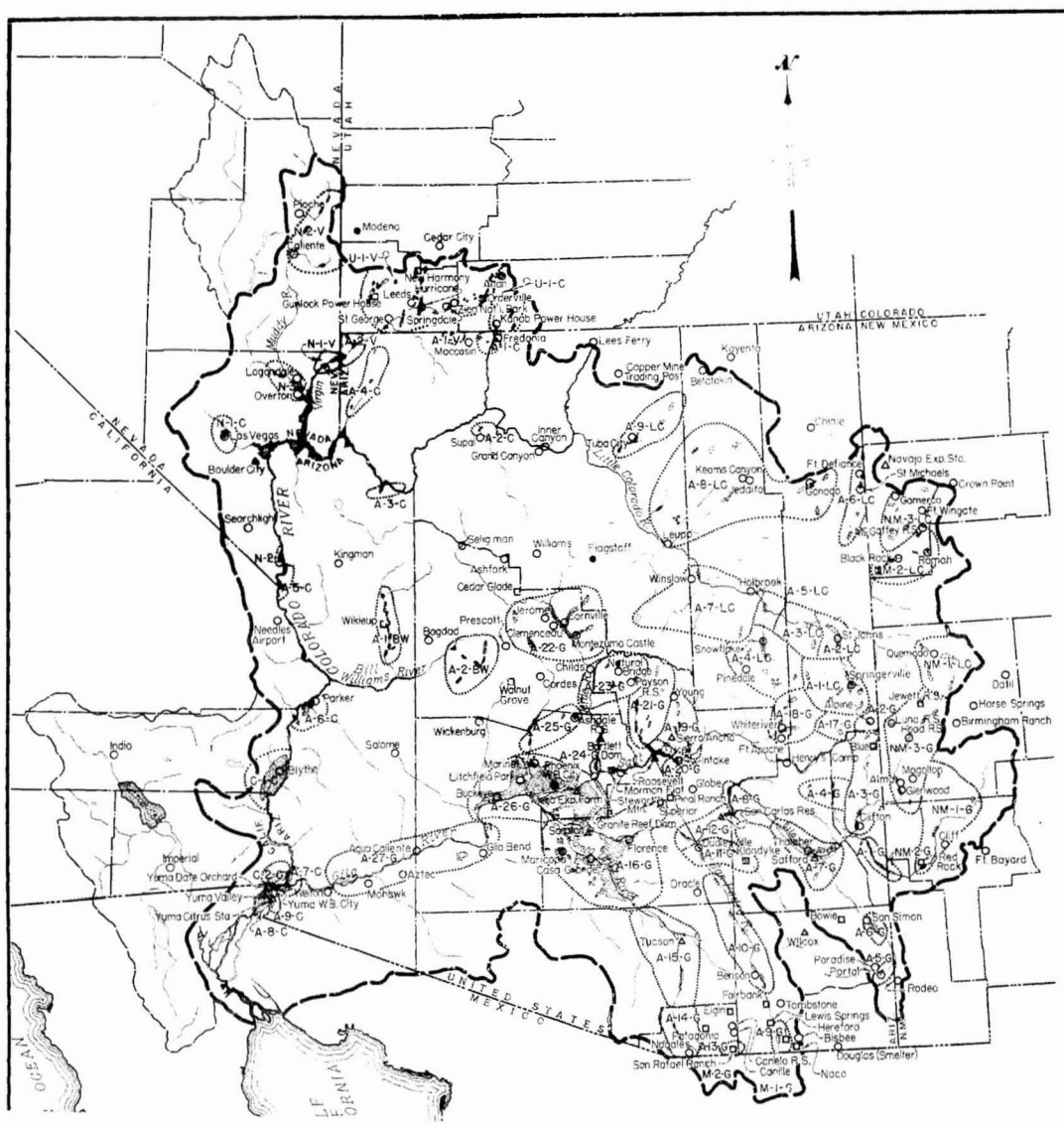
The Lower Colorado Basin, embracing an area of 133,500 square miles exclusive of the Salton Sea area, is about twice as large as the six New England States combined. It is slightly larger than the upper basin, on which it is dependent for most of its water supply. It includes parts of five States: Arizona, California, New Mexico, Nevada, and Utah and a small portion of the Republic of Mexico (See figure 1).

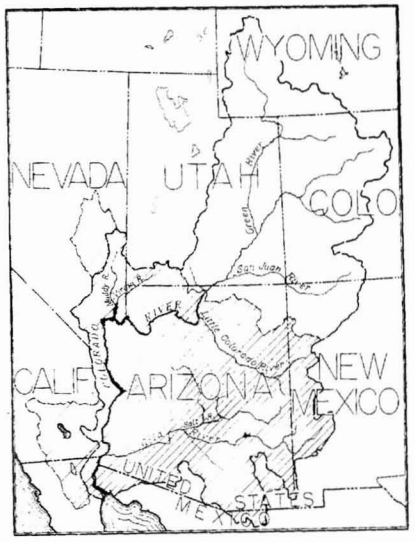
The term "lower basin" is here used to refer not only to areas downstream from Lee Ferry which drain into the Colorado, but also to the drainage basin of the Salton Sea, including Imperial and Coachella Valleys. With its vast areas of lands and excellent growing climate, the demands for water in the lower basin greatly exceed available water resources.

The water of the Colorado River is suitable for irrigation and domestic use and averages about 700 parts per million of total dissolved solids below Lake Mead. Water entering the basin at Lee Ferry carries an immense amount of sediment. Lake Mead receives the sediment load of both the Colorado and the Virgin rivers. In 1926, Fortier and Blaney estimated the normal quantity of silt transported annually by the river to the lower end of canyon section to be 137,000 acre-feet (13). Storage capacity in Lake Mead is being reduced an estimated 105,000 acre-feet (22) annually by the deposition of this sediment according to 1949 survey.

Agriculture

While agriculture and mining compete for first place in economic importance, agriculture is ranked generally as the most important





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- Irrigation areas.

10 0 10 20 30 40 50 60 70
SCALE OF MILES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LOWER COLORADO RIVER BASIN
WATER SUPPLY
LOCATION MAP
SELECTED WEATHER BUREAU STATIONS AND IRRIGATED LAND AREAS

DRAWN A.E.G.-T.H.G. SUBMITTED C. A. Pugh
TRACED E.H.G. RECOMMENDED H. Colorado
CHECKED A.B.W.-L.E.S. APPROVED

MARCH 11 1952 E7-314-22

industry in the lower basin. Crops were grown in the lower basin hundreds of years before any other part of what is now the United States was settled. Agriculture has been and always will continue to be dependent on a satisfactory supply of irrigation water. The southern portion of the area is favored with an all-year growing season. Many crops, such as small grains and vegetables, grown in most parts of the Nation only in summer, are produced here in winter. These combined with perennial crops such as alfalfa and pasture and semitropical crops in warmer parts of the basin result in a high degree of cropland occupancy. Double-cropping of the same land with both winter and summer crops is a common practice where irrigation water supplies are adequate.

Because of the wide variety of crops that can be grown successfully in the lower basin, the pattern of crop production is continually changing. New crops are being introduced and varieties of other crops developed.

Alfalfa, grown on approximately 35 per cent of the irrigated land, covers a larger acreage than any other crop. It is an important cash crop both for local sale and for shipment to other areas. All-year pasturing is possible in some sections of the basin.

Seed production is an important product of the lower basin. The yields of alfalfa, Bermuda grass, flax, and sugar beet seeds are high.

According to the 1946 report (21) of the Bureau of Reclamation, there were 1,351,000 acres of "irrigated land" and 29,291,000 acres of "other farm land" in the lower basin or about 34 per cent of the total area. A large portion of the basin area is used for grazing which includes the "other farm land." Production of farm crops without irri-

gation is generally unsuccessful in most areas of the basin because of scanty and uncertain rainfall. The following tabulation shows the area irrigated in the Lower Colorado River Basin as reported by the Bureau.

Year	Arizona	California	Nevada	New Mexico	Utah	Total
	Acres	Acres	Acres	Acres	Acres	Acres
1940	835,930	460,900	11,000	19,770	23,500	1,351,000

The cropped acreages in the basin, as reported by the Bureau of Reclamation and other agencies, for 1947, are shown in Table 1.

Soils

A Bureau of Reclamation report (21) in 1946 gives the following description of soils in the lower basin:

"Soils of the lower basin have developed in a climate where low rainfall and high temperatures prevail, with the result that they are very low in organic material and have lost little of their soluble plant nutrients through leaching. Soil colors vary from gray to red, with pinks and reds prominent. Practically all agricultural soils are of alluvial formation, but vary rather widely in composition, texture, and fertility.

"Valley bottom soils are generally derived from the more recent alluvial materials and range in texture from sands to clays. They are best suited to agriculture because of high fertility, smooth topography, and proximity to irrigation supplies.

"Bench and terrace soils make up the largest acreage of irrigable soils in the lower basin. Surface soils of this type vary from rather coarse and sandy to fine textured and contain abundant quantities of the mineral elements of fertility. The subsoil is usually finer textured

Table 1. Acreage of Irrigated Crops in the Lower Colorado River Basin in 1947 by States.

Crops	Arizona	Calif. 1/	Nevada	N. Mex.	Utah	Mexico 2/
	Acres	Acres	Acres	Acres	Acres	Acres
Year 1947						
Alfalfa	187,550	187,210	2,830	4,210	12,200	1,468
Alfalfa & grain	66,700					
Beans	2,015	1,827	2	369		398
Carrots	6,349	6,210				
Citrus	20,760	6,768				
Corn	8,547	3,382	719	2,880	1,410	522
Cotton	202,642	2,381		540		
Dates	628	5,216				
Deciduous fruits	1,755	31	89	147	2,125	153
Flax	15,438	76,286				
Grapes	309	6,025	7			
Lettuce--fall	26,943	898				
Lettuce--spring	14,482	7,688				
Melons	25,109	38,061	40	73		
Misc. hay & pasture	82,324	6,864	3,866	1,643	1,200	
Miscellaneous truck	9,556	10,835	821	333	825	246
Nurseries & flowers	4	174				
Nuts	1,032	208				
Olives	65					
Potatoes--sweet	17	414				
Potatoes--white	5,088	10	78	88	260	650
Rice		506				
Small grains	153,905	70,849	1,125	4,387	5,120	530
Soil building crops	2,443	2,991				
Sorghums	58,430	4,759	342	1,635		
Sugar beets and seed	3,763	27,006			1,500	
Tomatoes	27	3,752		25		
Total	895,881	470,351	9,919	16,330	24,640	3,967

1/ Includes 64,977 acres adjacent to Colorado River, 381,816 acres in Imperial Valley and 23,558 in Coachella Valley.

2/ Portion of Mexico in Gila River drainage area.

and in places is composed of heavy clay. Quite frequently, a zone of lime accumulation occurs in the subsoil and in some areas a definite lime hardpan has been formed at various depths below the surface.

"Extensive areas of desert soils in the lower basin usually grade from coarse sands and gravels near the base of mountains to fairly heavy clay loams and clays near the center of the valleys. Many areas are high in soluble salt content, but where good drainage can be provided, salts can be leached easily from the soils and the land made highly productive. These desert soils are stratified and the various horizons grade from coarse, raw sand to heavy, plastic clay. Where medium-textured soil occurs in sufficient depth at the surface or near enough to the surface to insure adequate water-holding capacity, the land merits agricultural development if the total salt content is low, or if leaching and drainage can be provided."

Climate

In general, the basin is arid except in the high altitudes of the headwater areas. The range of temperature between day and night is extreme, especially at elevations above 5,000 feet, where the nights are usually cool and comfortable, despite the intense heat registered during the summer days. At low elevations, hot nights may occur from the end of June to early September.

Throughout the lower sections, mainly in Southwestern Arizona where elevations are less than 3,000 feet above sea level, temperatures above 100° F. in the shade occur frequently during the long summer, which lasts from April to November.

The period between the last killing frost in spring and the first in fall is short, in some localities averaging less than three months in some places in the elevated areas of the northern and eastern parts of the basin. On the other hand, in the lower elevations of the Gila and Colorado River Valleys, a few favored localities often escape killing frost for two or three years in succession. Thus there are extremely wide variations in the length of the growing season.

Annual precipitation varies directly with elevation above sea level in the western half of the basin and in the upper reaches of the Gila River and its tributaries. From the Little Colorado River, northeastward, rainfall averages less than ten inches, while over the lower elevations of Southwestern Arizona the annual average is generally less than five inches. In some places along the Mexican border, the annual rainfall averages less than three inches.

PREVIOUS INVESTIGATIONS

Those responsible for planning irrigation projects or administering the waters of the West have, for many years, been attempting to define more clearly the amounts of water required to satisfy crop needs. It has been recognized that in addition to the water consumed through transpiration by the plants and evaporation from the water and soil surfaces during and after an irrigation, an allowance must be made for reasonable and necessary losses incident to irrigation.

Studies in Other Areas

The effect of sunshine and heat in stimulating transpiration was studied as early as 1691, according to a review of literature by Abbe (1). Measurements of transpiration of various kinds of plants by Briggs and Shantz indicate a close correlation between transpiration and evaporation from free-water surfaces, air temperature, solar radiation, and wet-bulb depression readings (12).

Various methods have been used throughout the West to determine the amount of water consumed by agricultural crops and native vegetation (6). Regardless of the method, the problems encountered are numerous and considerable time is required to make satisfactory measurements of consumptive use. The source of water used by plant life, whether from precipitation alone, irrigation plus rainfall, ground water plus precipitation, or irrigation plus ground water plus rainfall, is a factor influencing the selection of a method. Unit values of consumptive use may be determined for different kinds of native vegetation and agricultural crops by soil moisture studies, lysimeter or tank measurements, analysis or irrigation data, analysis of climatological data, and other methods (3).

At various times during the past forty-seven years, the Division of Irrigation Engineering and Water Conservation and its predecessors, in cooperation with state agricultural experiment stations and other agencies, have measured evapo-transpiration of different agricultural crops and native vegetation in many sections of the western United States (3) (23). In 1931 the practicability of using the evaporation pan and temperature records as an index for estimating evapo-transpiration losses from moist areas was demonstrated by the Division of Irrigation in southern California (4); similar use of such data was made in 1936 in the Joint Upper Rio Grande Investigation (2) and in 1940-41 in the Joint Pecos River Investigation (3).

For many years, irrigation engineers have used temperature data in estimating annual valley consumptive use of water in arid and semi-arid areas of the West. Hedke developed the effective heat method on the Rio Grande (2). From studies of the Bureau of Reclamation, conducted intermittently from 1937 to 1940 by Lowry and Johnson (19), a somewhat similar method was developed which has been used by the Bureau of Reclamation in estimating annual valley consumptive use. From research studies in 1940-41, in connection with the Pecos River Joint Investigation (3), the Research Division of Irrigation Engineering and Water Conservation of the Soil Conservation Service, developed empirical formulas for estimating monthly, seasonal, and annual rates of consumptive use from climatological data (5) (8). Since then, this method has been employed to estimate consumptive use in the Upper Colorado River Basin (7) and other areas (10).

Lower Colorado River Basin Studies

Measurements of consumptive use in the Lower Colorado River Basin have been limited in the past to a few areas. Some estimates have been made by engineers for various purposes, such as those made by Jacobs and Stevens (18) in 1937 and the Bureau of Reclamation (21) in 1946.

Studies of use of irrigation water in Salt River Valley, Arizona, were started in 1931 by Harris (15) and considerable work has been done since by Harris on water consumption for the following crops: alfalfa, citrus, cotton, dates, flax, guar, sorghum, and soy beans (11) (15) (16) (17).

Estimates of consumptive use of water by agricultural crops based on climatological and other data were made in 1949-50 for various locations in New Mexico (10) by Blaney and Hansen and in Arizona (11) by Blaney and Harris.

Measurements of use of water by bottom-land vegetation in Lower Safford Valley, Arizona, were made by the United States Geological Survey in 1943-44 (14). The Division of Irrigation Engineering and Water Conservation has made measurements of use of water by native vegetation in moist areas in California, Colorado, Idaho, New Mexico and Texas (2) (3) (23).

GENERAL PROCEDURE

Empirical formulae developed by the Division of Irrigation in 1939-1941 in the Pecos River Investigation (3) for estimating rates of evaporation and consumptive use give consideration to temperature, daytime hours, length of growing season and humidity. In 1945, Blaney and Criddle simplified the Pecos formulae by eliminating the humidity factor (8). Because of the limited measurements of consumptive use in the Lower Colorado River Basin, these formulae have been employed to compute the rates of water use by agricultural crops and native vegetation in this Basin.

Of the climatic factors affecting plant growth, temperature and precipitation undoubtedly have the greatest influence. Records of temperature and precipitation are far more universally available throughout the Western States than are data for other factors. The actual hours of sunshine play an important part in the rate at which plants grow and consume water, but sunshine records are not generally available. The theoretical daytime hours for each day are available for all the latitudes (20) and may be used in place of the actual data for computing the monthly percent of daytime hours for the year.

The procedure is to correlate existing measured consumptive use data for different crops and native vegetation with monthly temperatures, percent of daytime hours, and frost-free (growing) period, or irrigation season, to establish a consumptive use coefficient for each kind of vegetation. The coefficients so developed are used together with climatological data to compute consumptive use for crops in areas for which only climatological data are available.

Irrigated Areas

For the purpose of establishing consumptive use rates for the irrigated areas of the Lower Colorado River Basin, the Basin was divided into sixty-eight separate areas. The location of these areas and the Weather Bureau Stations used in computing consumptive use are shown in Figure 1. The irrigated areas, Weather Bureau Stations, average elevations, mean annual temperatures and precipitation and frost-free periods in the Lower Colorado River Basin are shown in Table 2. Information relative to irrigation, growing seasons, and crops in each of the areas were obtained from local, state and federal agencies. Unit rates of consumptive use were computed for the major crops grown in each of the areas shown in Table 2 by the Blaney-Criddle consumptive-use formula (8) which was employed by them in estimating water consumption in the Upper Colorado River Basin (7).

Consumptive-use Formula

Disregarding the other factors, consumptive use varies with the temperature, daytime hours, and available moisture. By multiplying the mean monthly temperature (t) by the monthly per cent of daytime hours of the year (p), there is obtained a monthly consumptive-use factor (f). It is assumed that the consumptive use varies directly as this factor when an ample water supply is available. Expressed mathematically, $U = KF =$ sum of kf where:

U = Consumptive use of crop (or evapo-transpiration) in inches for any period

F = Sum of the monthly consumptive-use factors (f) for the period (sum of the products of mean monthly temperature and monthly per cent of daytime hours of the year).

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	ARIZONA						
A-1-LC	Springerville	Springerville	6964	48.8	12.76	5/27	10/2
A-2-LC	St. Johns	St. Johns	5560	52.3	12.00	5/5	10/11
A-3-LC	Concho	St. Johns	5560	52.3	12.00	5/5	10/11
A-4-LC	Silver Creek--Showlow &Snowflake	Snowflake	5644	51.6	13.43	5/22	10/4
		Pinedale	6500	48.9	19.60	6/2	10/8
A-5-LC	Woodruff	Holbrook	5069	55.0	8.73	4/28	10/20
		St. Johns	5560	52.3	12.00	5/5	10/11
A-6-LC	Black Creek (Puerco River)	Fort Defiance	6750	48.1	12.74	5/23	10/1
A-7-LC	Holbrook	Holbrook	5069	55.0	8.73	4/28	10/20
		Winslow	4880	54.7	8.27	5/1	10/18
A-8-LC	Hopi, Ganado, and Leupp	Ganado	6350	49.1	12.32	5/8	10/3
		Jeddito	6700	50.9	12.58	5/20	10/5
		Leupp	4700	54.0	7.15	5/7	10/16
A-9-LC	Moenkopi--Navajo Reservation	Tuba City	4936	55.3	7.03	4/23	10/19
		Betatakin	7200	48.9	13.66	5/14	10/6
A-1-C	Kanab Creek	Fredonia	5000	52.1	11.31	5/24	10/6
		Moccasin	4500	52.3	11.85	5/13	10/1
A-2-C	Havasu Creek	Supai	3200	62.0	9.63	3/9	11/6
A-3-C	Hualpai Reservation &Meriwitica	Supai	3200	62.0	9.63	3/9	11/6
A-4-C	Grand Wash	St. George, Utah	2880	60.5	8.70	4/1	10/26
A-1-V	Short Creek	Moccasin	4500	52.3	11.85	5/13	10/1
A-2-V	Littlefield	St. George, Utah	2880	60.5	8.70	4/1	10/26
		Overton, Nevada	1275	68.1	5.30	3/2	11/14
A-5-C	Davis Dam to Topock	Needles Airport, Calif.	913	71.6	5.19	2/7	12/4
A-1-BW	Big Sandy	Bagdad	3900	63.6	15.79	3/29	11/13
		Wikieup	2125	-	11.97	3/26	11/4

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin (Continued)

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	ARIZONA (Continued)						
A-2-BW	Bill Williams (Santa Maria)	Bagdad	3900	63.6	15.79	3/29	11/13
		Wikieup	2125	-	11.97	3/26	11/4
A-6-C	Colorado River Indian Reservation and Cibola Valley	Parker	385	69.6	5.57	2/28	11/14
A-7-C	North and South Gila Valleys	Yuma Valley	110	69.3	3.46	2/23	11/24
A-8-C	Yuma Valley	Yuma Valley	110	69.3	3.46	2/23	11/24
A-9-C	Yuma Mesa	Yuma Citrus Station	191	72.0	3.72	1/19	12/16
A-1-G	Duncan Valley	Clifton	3465	66.7	13.15	2/28	11/24
		Cliff, New Mexico	4800	56.1	15.12	5/3	10/8
		Red Rock, New Mexico	4150	-	12.18	-	-
A-2-G	Alpine--Upper San Francisco	Alpine	8000	43.5	21.81	6/23	9/12
A-3-G	San Francisco River	Clifton	3465	66.7	13.15	2/28	11/24
		Blue	6500	-	19.48	5/9	10/15
		Alpine	8000	43.5	-	-	-
		Glenwood, New Mexico	4717	57.9	17.05	5/5	10/20
A-4-G	Double Circle Ranch-Eagle Creek (Elev.-4920)	Alpine	8000	43.5	21.81	6/23	9/12
		Clifton	3465	66.7	13.15	2/28	11/24
A-5-G	Portal--Upper San Simon	Portal	5000	55.5	18.52	4/29	10/23
A-6-G	San Simon Creek	San Simon	3609	61.1	9.16	4/4	11/7
A-7-G	Safford Valley	Safford	2900	63.0	9.38	4/6	11/3
A-8-G	San Carlos Indian Reservation	San Carlos Reservoir	2532	64.9	13.01	3/17	11/16
A-9-G	Hereford Valley--Upper San Pedro	Tombstone	4540	63.2	-	-	-
		Fairbank	3862	-	11.58	4/9	11/2
		Hereford	4180	-	13.57	3/30	10/29
		Lewis Springs	4029	-	10.29	4/11	10/20
A-10-G	Middle San Pedro River--Charleston to Mammoth	Benson	3550	62.8	11.92	4/8	11/2

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin (Continued)

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	ARIZONA (Continued)						
A-11-G	Lower San Pedro River	Dudleyville	2204	63.5	14.87	4/2	11/10
		Globe	3410	62.2	-	4/2	11/10
		Klondyke	3225	-	15.71	-	-
A-12-G	Coolidge Dam to Kelvin	Dudleyville	2204	63.5	14.87	4/2	11/10
A-13-G	San Rafael--Upper Santa Cruz	Nogales	3800	62.9	-	-	-
		San Rafael Ranch	4741	-	17.89	4/12	10/28
A-14-G	Santa Cruz County	Nogales	3800	62.9	16.11	4/1	11/17
A-15-G	Pima County--Santa Cruz River	Tucson (U. of A.)	2423	67.1	11.41	3/19	11/17
A-16-G	Pinal County--Gila & Santa Cruz	Casa Grande	1390	69.4	8.75	3/5	11/22
		Florence	1500	69.5	10.29	3/16	11/18
		Maricopa	1242	69.5	8.29	3/7	11/21
		Sacaton	1280	68.2	9.78	3/11	11/14
A-17-G	Black River--Upper Salt River	Henry's Camp	6925	51.7	28.55	5/20	10/11
A-18-G	Fort Apache Indian Reservation--Upper Salt River	Whiteriver	5200	54.7	17.83	5/4	10/16
A-19-G	Cherry Creek--Upper Salt River	Sierra Ancha	5100	59.8	28.70	4/25	11/7
		Young	5100	-	22.48	5/3	10/18
A-20-G	Salt River Canyon to Roosevelt	Intake	2220	-	13.76	3/11	11/25
		Roosevelt	2230	67.6	-	-	-
A-21-G	Tonto Creek & Tributaries	Natural Bridge	4607	57.8	26.20	4/10	11/11
		Payson Ranger Station	4900	52.7	21.90	5/26	10/9
		Roosevelt	2230	67.6	17.00	2/5	12/12
		Young	5100	-	22.48	5/3	10/18
A-22-G	Verde River upstream from Camp Verde	Childs	2650	63.6	18.40	3/27	11/12
		Jerome	5250	59.9	18.45	4/11	11/17
		Montezuma Castle	3180	61.9	12.21	4/3	11/2

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin (Continued)

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	ARIZONA (Continued)						
A-23-G	Middle Verde River & Tributaries	Childs	2650	63.6	18.40	3/27	11/12
		Natural Bridge	4607	57.8	26.20	4/10	11/11
		Payson Ranger Station	4900	52.7	21.90	5/26	10/9
A-24-G	Fort McDowell Indian Reservation	Bartlett Dam	1650	69.5	13.72	-	-
	Frost dates, see Maricopa Co.					3/12	11/19
A-25-G	Upper Agua Fria River Basin	Cordes	3773	60.6	14.32	4/14	11/16
A-26-G	Maricopa County upstream from Gillespie Dam	Buckeye	888	69.4	7.87	3/12	11/17
		Marinette	1150	69.0	8.09	3/9	11/24
		Mesa Experiment Farm	1245	67.5	8.11	3/13	11/20
		Sacaton	1280	68.2	9.78	3/11	11/14
A-27-G	Gillespie Dam to Dome--Gila River	Agua Caliente	516	71.6	5.13	2/26	11/25
		Gila Bend	737	71.9	6.28	2/24	11/28
		Mohawk	538	73.8	4.75	1/20	12/17
		Wellton	258	70.3	4.50	3/4	11/16
	CALIFORNIA						
C-1-C	Palo Verde District	Blythe	268	70.6	4.17	2/21	11/20
C-2-C	Yuma Valley	Yuma Valley, Arizona	110	69.3	3.46	2/23	11/24
	Salton Sea Drainage Area						
C-1-SS	Imperial Valley	Imperial	-69	72.3	3.66	1/30	12/8
C-2-SS	Coachella Valley	Indio	20	73.4	3.15	2/7	12/11

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin (Continued)

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	NEVADA						
N-1-V	Virgin River	Overton	1275	68.1	5.30	3/2	11/14
N-2-V	Meadow Valley Wash	Caliente	4402	52.6	9.29	5/1	10/9
		Pioche	6110	50.7	13.90	5/13	10/21
N-3-V	Muddy River	Logandale	1400	65.9	5.15	3/17	11/11
		Overton	1275	68.1	5.30	3/2	11/14
N-1-C	Las Vegas	Las Vegas	2006	65.8	5.03	3/9	11/17
N-2-C	Hoover Dam to Davis Dam	Needles Airport, Calif.	913	71.6	5.19	2/7	12/4
	NEW MEXICO						
NM-1-LC	Carrizo Wash	Quemado	6879	47.4	12.76	6/3	9/30
NM-2-LC	Zuni River	Black Rock	6455	49.7	12.65	5/14	10/12
		Ramah	7200	-	13.79	6/2	9/19
NM-3-LC	Puerco River--Gallup	Fort Wingate	7000	49.6	13.99	5/7	10/7
		Gamerco	6735	48.2	11.94	5/10	10/9
NM-1-G	Gila River upstream from Virden	Cliff	4800	56.1	15.12	5/3	10/8
		Red Rock	4150	-	12.18	-	-
NM-2-G	Virden Valley	Clifton, Arizona	3465	66.7	13.15	2/28	11/24
		Cliff	4800	56.1	15.12	5/3	10/8
		Red Rock	4150	-	12.18	-	-
NM-3-G	San Francisco River	Alma	4800	55.4	14.24	5/2	10/18
		Birmingham Ranch	6800	47.1	12.08	5/23	10/3
		Luna Ranger Station	7050	45.6	16.35	6/19	9/21

Table 2. Irrigated areas, Weather Bureau stations, average elevations, mean annual temperatures and precipitations, and frost-free periods in the Lower Colorado River Basin (Continued)

Area		Weather Bureau station		Mean annual		Average frost-free period	
Number	Name	Location	Elevation	Temperature	Precipitation	Spring	Fall
			Feet	°F.	Inches	Date	Date
	UTAH						
U-1-C	Kanab Creek	Alton	7150	44.7	16.48	6/4	9/26
		Kanab Power House	4925	54.1	13.14	5/4	10/13
U-1-V	Virgin River	Cedar City	5805	50.7	-	5/13	10/4
		Gunlock Power House	3600	-	12.06	4/21	10/31
		Leeds	3400	57.9	13.07	4/8	11/2
		New Harmony	5280	-	18.35	-	-
		Orderville	5250	-	15.00	-	-
		St. George	2880	60.5	8.70	4/1	10/26
		Zion National Park	4000	60.1	14.63	4/12	10/26
	MEXICO						
M-1-G	San Pedro River	Fairbank, Arizona	3862	-	11.58	4/9	11/2
		Hereford, Arizona	4180	-	13.57	3/30	10/29
		Lewis Springs, Arizona	4029	-	10.29	4/11	10/20
		Tombstone, Arizona	4540	63.2	-	-	-
M-2-G	Santa Cruz River	Nogales, Arizona	3800	62.9	16.11	4/1	11/17
		San Rafael Ranch, Ariz.	4741	-	17.89	-	-

K = Empirical consumptive-use coefficient (for period)

t = Mean monthly temperature, in degrees Fahrenheit.

p = Monthly per cent of daytime hours of the year.

$f = \frac{t \times p}{100}$ = Monthly consumptive-use factor.

k = Monthly consumptive-use coefficient.

$u = kf$ = Monthly consumptive use in inches.

The consumptive-use factor (F) for any period may be computed for areas for which monthly temperature records are available. Then by knowing the consumptive-use coefficient (K) for a particular crop in some locality, an estimate of the use by the same crop in some other area may be made by application of the formula - $U = KF$. The monthly per cent (p) of daytime hours of the year for various latitudes is shown in the appendix.

Consumptive-use coefficients

Coefficients (K) for the major agricultural crops in the Lower Colorado River Basin have been developed from monthly temperature daytime hours, length of growing season and measurements of use of water in Salt River Valley by Harris (11) (15) (16). Coefficients for native vegetation are based for the most part on observations made by the United States Geological Survey in Safford Valley, Arizona (14). The use of water measurements were correlated with temperature, daytime hours and growing season, and the coefficient (K) was computed for each crop and native vegetation by the formula $K = \frac{U}{F}$. These coefficients are shown in tables 3 and 4. They are based on the assumption that the vegetation receives a full water supply throughout the growing season or frost-free period (8).

Table 3. Consumptive-use coefficients used in computing consumptive use of water by irrigated crops (normal condition) in the Lower Colorado River Basin.

Crops	Coefficient (K)	Growing season or period
Alfalfa	0.85	Frost-free period. (Less August and first half of September in some areas.)
Alfalfa	.70	Frost period. (Growth during portion only.)
Alfalfa	.60	Frost period. (Growth during entire period.)
Alfalfa and grain	.85	Frost-free period. (Less August and first half of September in some areas.)
Alfalfa and grain	.70	Frost period.
Beans	.60	Start of frost-free period for growing season of 90 days. In areas of year-long growth, season is April through June.
Carrots--fall	.70	August through January.
Carrots--spring	.70	November through June.
Citrus	.60	Year long.
Corn	.75	From middle of June for 120 days in areas of year-long growth. Other areas from start of frost-free period for 120 days.
Cotton	.62	April through October.
Dates	.65	Year long.
Deciduous fruits	.65	Between frosts.
Flax	.80	November through June.
Grapes	.60	Between frosts.
Lettuce--fall	.65	September through November.
Lettuce--spring	.65	November through March.
Melons	.65	March through July in areas of year-long growth. Other areas, 120 days during frost-free period.
Misc. hay & pasture	.80	Between frosts in areas of year-long growth.
Misc. hay & pasture	.75	Between frosts in high areas.
Misc. hay & pasture	.60	Growth during frost period in all areas.
Miscellaneous truck	.70	August 15 through March 31 in areas of year-long growth. Frost-free period in other areas.
Nurseries & flowers	.65	Year long.
Nuts	.70	Between frosts.
Olives	.65	Year long.
Potatoes--sweet	.70	Between frosts.
Potatoes--white	.70	March through May in areas of year-long growth. Other areas from start of frost-free period for 90 days.
Rice	1.20	June through October.
Small grains	.70	October through April or December through April in areas of year-long growth. In other areas, 90 to 150 days during growing period.
Soil building crops	.85	Sesbania, guar, etc.--July through September.
Soil building crops	.70	Clovers, peas, etc.--November through March.
Sorghums	.70	July through October in areas of year-long growth. In other areas, 110 to 150 days during frost-free period.
Sugar beet seed	.70	September 15 through December plus March through June.
Tomatoes	.75	Start of frost-free period through July 10.

Table 4. Consumptive-use coefficients used in computing consumptive use of water by native vegetation and incidental areas in the Lower Colorado River Basin

Classification	Coefficient (K) 1/	Growing season or period
Native vegetation (100 percent volume density)		
Salt cedar	1.50	Entire growing period in areas other than year-long growth.
Salt cedar	1.40	Entire year in areas of year-long growth.
Cottonwood	1.25	Entire growing period in areas other than year-long growth.
Cottonwood	1.15	Entire year in areas of year-long growth.
Baccharis & phreatophytic brushes	1.00	Entire growing period in areas other than year-long growth.
Baccharis & phreatophytic brushes	.90	Entire year in areas of year-long growth.
Mesquite	.75	Entire growing period in areas other than year-long growth.
Mesquite	.65	Entire year in areas of year-long growth.
Tules 2/	1.50	Entire growing period in areas other than year-long growth.
Tules 2/	1.40	Entire year in areas of year-long growth.
Barren land (highwater table)		
Sand and gravel	.80	Frost-free period.
Sand and gravel	.60	Frost period.
Sand and gravel	.75	Annual.
Clay loam	.60	Frost-free period.
Clay loam	.50	Frost period.
Clay loam	.55	Annual.
Incidental areas		
Rights-of-way for roads, railroads, laterals, canals, drains, etc.	.65	Annual in areas of year-long growth.
Rights-of-way for roads, railroads, laterals, canals, drains, etc.	.80	Growing period in areas other than year-long growth.
Surfaces of roads and railroad roadbeds	Precipitation only.	
Farmsteads & cities	3/	Annual.
Surfaces of canals, laterals, drains, waste ditches, etc.	Evaporation for period that water is exposed in channel.	

1/ Coefficients for 100 percent densities as defined by the U. S. Geological Survey in Safford Valley Arizona Report. Densities should be reduced to field conditions.

2/ Based on measurements along the Mojave River, California and the Rio Grande, New Mexico, where the exposure to sun and wind is greater than in large swamp areas.

3/ Annual use an acre computed by application of the annual "F" factor on the basis that the city of Pasadena with an annual "F" of 62.89 has an annual consumptive use of 1.89 acre-feet an acre.

ESTIMATES OF CONSUMPTIVE USE

In computing rates of consumptive use by irrigated crops and native vegetation, formula $U = KF$ is used (8). Values of coefficient (K) shown in tables 3 and 4 and consumptive use factor, (F) for the growing, frost-free or irrigation period are used. Mean monthly temperature and precipitation records are shown in the appendix tables 2 and 3.

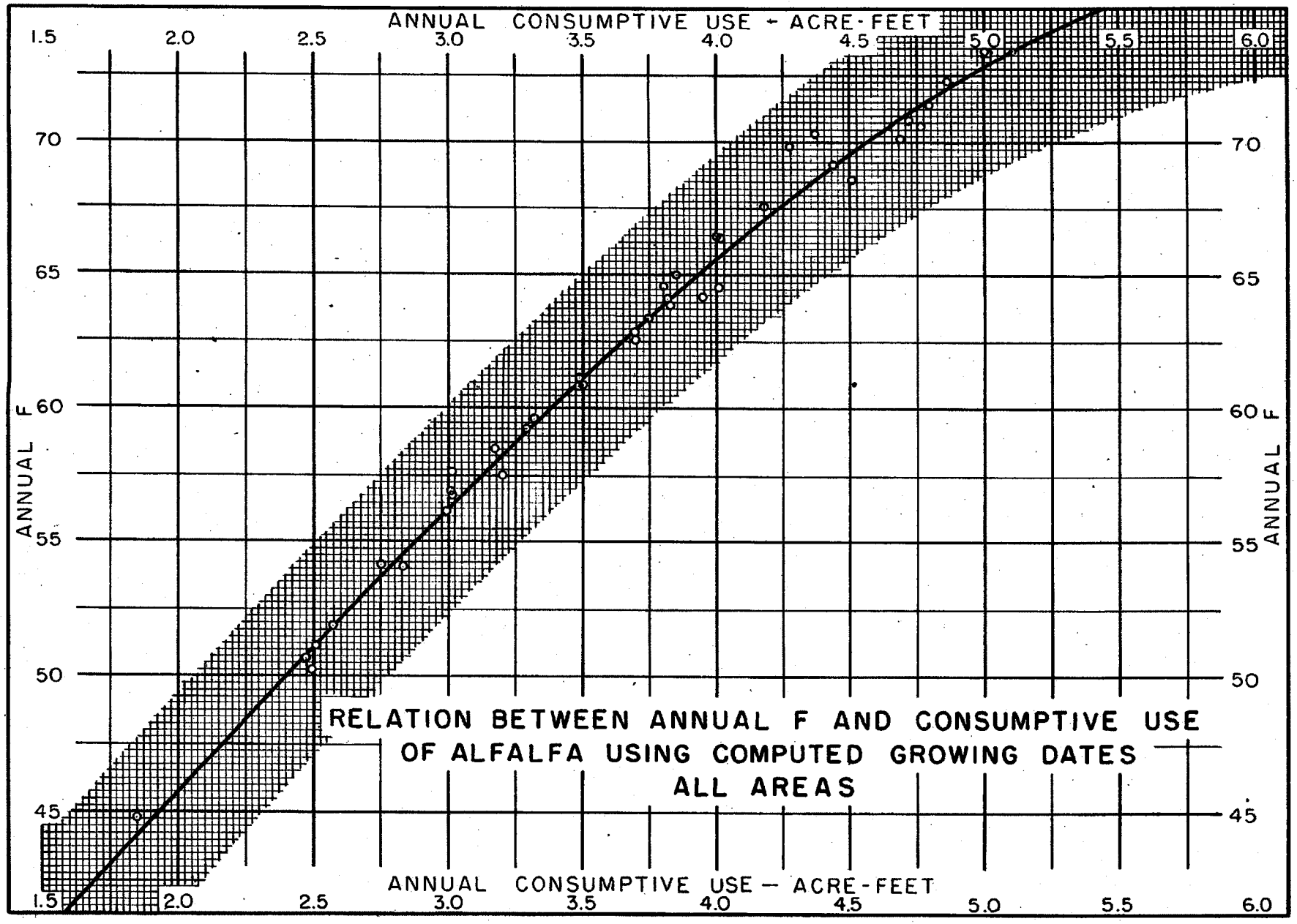
Irrigated Crops

Normal rates of consumptive use of water by agricultural crops are computed for the areas shown in table 1 and the different growing periods shown in table 3. The growing periods for crops such as deciduous fruits are considered to be the period between killing frosts, but for many annual crops it is shorter than the frost-free period, as such crops are usually planted after frosts are past and mature before they recur. For most perennial crops, growth starts as soon as the maximum temperature stays well above the freezing point for an extended period of days and continues throughout the season in spite of later freezes. Sometimes growth persists even after the first so-called killing frost. In the spring, and to less extent in the fall, daily minimum temperatures may fluctuate one or two degrees above and below 32° F. for several days before remaining definitely above or below the freezing point. The hardier crops survive these fluctuations and continue to grow unharmed during a few hours of sub-freezing temperature. It is difficult to determine the beginning and ending of the growing season for alfalfa and pasture.

As a result of a study by the Bureau of Reclamation Engineers to determine the beginning and ending of the growing season for alfalfa and pasture, a procedure was developed whereby the monthly factors (f) computed for areas of known year-long growth and known dormant periods were used as a guide to determine the value of "f" at which growth started and stopped. This consumptive use factor (f) was determined to be about 3.50. A method was devised to determine the date during the month when an average "f" of 3.50 would be obtained. Briefly this consisted of a straight line interpolation between the "f" factors of the preceding and subsequent months.

Questionnaires were sent to representative farmers and agricultural agents in the various areas throughout the Lower Colorado River Basin requesting the beginning and ending of the growing season for alfalfa and pasture in their respective sections. The computed growing dates were compared with the replies to questionnaires from twenty areas and the average computed growing date was about two days earlier in the spring and one day earlier in the fall than the average growing dates reported by the questionnaires, or the average computed growing season was about one day longer than that determined by the questionnaires. The relationship between annual F and consumptive use of alfalfa using computed growing dates for all areas in the lower Colorado River Basin is shown on Figure 2 prepared by the Bureau of Reclamation engineers.

Because of the erratic flows of tributary streams and the lack of regulatory storage, surface irrigation water is applied to the fields during the nongrowing season in most areas, other than those of year-long growth, throughout the Lower Colorado River Basin in an



RELATION BETWEEN ANNUAL F AND CONSUMPTIVE USE OF ALFALFA USING COMPUTED GROWING DATES ALL AREAS

attempt to store water in the soil for use during the growing period. Consequently, there is a consumptive use of irrigation water during the nongrowing season in these areas. It is estimated that an inch of irrigation water would be used consumptively during the nongrowing season in those areas where the practice of winter diversions of surface water is incidental to irrigated farming. If the water supply for an area is short during the latter part of the irrigation season, some correction should be made.

Rates of consumptive use of water have been computed for areas shown in table 2. A sample of computations for rates of water consumption in the Parker area is shown in tables 5 and 6. The results of similar computations for normal water consumption rates for irrigated crops during the growing period for areas in the entire Lower Colorado River Basin are summarized in table 7. These estimates are based on the assumption that a water supply ample to satisfy the water requirement of the plants is available from precipitation and irrigation. The estimates of rates of consumptive use (U) shown in table 7 include moisture supplied both by irrigation and rainfall. The rates of consumption of irrigation water at the point of use may be obtained by subtracting the effective precipitation (R) during the growing season from the rates of consumptive use (U). These values are shown as (U-R) in table 7. Since light showers during the hot summer add little or nothing to the soil moisture for use by the plants through transpiration, only monthly rainfall exceeding 0.55 of an inch has been considered effective.

Table 5. Example of observed mean monthly temperatures, percent of daytime hours, average monthly precipitation, and calculated consumptive-use factors in Parker Valley, Arizona.

Month	Mean temperature (t)	Daytime hours (p)	Average precipitation (r)	Growing season and crop: Alfalfa 2/28 - 11/14 (f)1/	Alfalfa 2/28 - 11/14 (r)2/	Cotton 4/1 - 10/31 (f)1/	Cotton 4/1 - 10/31 (r)2/
	°F	Percent	Inches		Inches		Inches
Jan	49.3	7.10	0.75	-	-		
Feb	55.1	6.92	.74	0.14	0.03		
Mar	60.7	8.35	.62	5.07	.62		
April	67.7	8.80	.30	5.96		5.96	
May	75.9	9.72	.04	7.38		7.38	
June	84.6	9.70	.04	8.21		8.21	
July	91.8	9.88	.35	9.07		9.07	
Aug	90.3	9.33	.57	8.42	.57	8.42	0.57
Sept	82.9	8.36	.65	6.93	.65	6.93	.65
Oct	69.5	7.90	.32	5.49		5.49	
Nov	57.5	7.02	.31	1.88			
Dec	50.2	6.92	.88	-	-		
Total	69.6	100.0	5.57	58.55	1.87	51.46	1.22

1/ $f = \frac{t \times p}{100}$ = Monthly consumptive-use factor.

2/ Effective precipitation. When the monthly rainfall is 0.55 inches or less, it is not used in calculating the consumptive use.

Table 6. Example of computations of normal rates of consumptive use of water in Parker Valley, Arizona.

Classification	Period	Consumptive-use factor (F)	Coefficient (K)	Consumptive use (U)	Precipitation (R)	U-R
				Inches	Inches	Inches
Alfalfa	2/28-11/14	58.55	0.85	49.77	1.87	47.90
Alfalfa	11/15-2/27	12.80	.60	7.68	2.34	5.34
Corn	6/15-10/15	31.54	.75	23.65	1.22	22.43
Cotton	4/1-10/31	51.46	.62	31.90	1.22	30.68
Melons	3/1-6/30	26.62	.65	17.30	.62	16.68
Misc. hay & pasture	11/15-2/27	12.80	.60	7.68	2.34	5.34
Misc. hay & pasture	2/28-11/14	58.55	.80	46.84	1.87	44.97
Misc. truck	8/15-3/31	36.93	.70	25.85	3.95	21.90
Rice	6/1-10/31	38.12	1.20	45.74	1.22	44.52
Small grains	10/1-4/30	31.34	.70	21.94	2.99	18.95
Small grains	12/1-4/30	21.81	.70	15.27	2.99	12.28
Sorghums	7/1-10/31	29.91	.70	20.94	1.22	19.72

F = Sum of monthly consumptive-use factors (f) from table 5.
K = Consumptive-use coefficient from table 3.
U = KF = Consumptive use in inches.
R = Effective precipitation in inches.

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin.

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA						
A-1-LC	Springerville						
	Alfalfa	5/27-10/2	24.89	0.85	21.16	7.67	13.49
	Alfalfa	3/24-5/26 & 10/3-10/29	12.87	.70	9.01	.77	8.24
	Beans	6/1-8/31	18.78	.60	11.27	6.06	5.21
	Corn	6/1-9/30	23.77	.75	17.83	7.62	10.21
	Deciduous fruits	5/27-10/2	24.89	.65	16.18	7.67	8.51
	Misc. hay & pasture	5/27-10/2	24.89	.75	18.67	7.67	11.00
	Misc. hay & pasture	3/24-5/26 & 10/3-10/29	12.87	.60	7.72	.77	6.95
	Miscellaneous truck	5/27-10/2	24.89	.70	17.42	7.67	9.75
	Small grains	5/15-9/10	23.35	.70	16.35	6.58	9.77
A-2-LC	St. Johns						
	Alfalfa	5/5-10/11	32.45	.85	27.58	7.05	20.53
	Alfalfa	3/13-5/4 & 10/12-11/2	10.37	.70	7.26	1.73	5.53
	Beans	5/15-8/15	20.24	.60	12.14	4.16	7.98
	Corn	5/15-9/15	26.38	.75	19.79	5.93	13.86
	Deciduous fruits	5/5-10/11	32.45	.65	21.09	7.05	14.04
	Misc. hay & pasture	5/5-10/11	32.45	.75	24.34	7.05	17.29
	Misc. hay & pasture	3/13-5/4 & 10/12-11/2	10.37	.60	6.22	1.73	4.49
	Miscellaneous truck	5/5-10/11	32.45	.70	22.72	7.05	15.67
	Small grains	5/1-7/31	19.61	.70	13.73	3.41	10.32
	Sorghums	6/1-9/15	23.23	.70	16.26	5.61	10.65

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
A-3-LC	Concho						
	Beans	5/15-8/15	20.24	0.60	12.14	4.16	7.98
	Corn	5/15-9/15	26.38	.75	19.79	5.93	13.86
	Deciduous fruits	5/5-10/11	32.45	.65	21.09	7.05	14.04
	Miscellaneous truck	5/5-10/11	32.45	.70	22.72	7.05	15.67
	Small grains	5/1-7/31	19.61	.70	13.73	3.41	10.32
A-4-LC	Silver Creek--Showlow and Snowflake						
	Alfalfa	5/28-10/6	26.55	.85	22.57	8.03	14.54
	Alfalfa	3/19-5/27 & 10/7-10/29	13.42	.70	9.39	2.98	6.41
	Beans	6/1-8/31	19.83	.60	11.90	6.01	5.89
	Corn	6/1-9/30	25.06	.75	18.80	7.70	11.10
	Deciduous fruits	5/28-10/6	26.55	.65	17.26	8.03	9.23
	Misc. hay & pasture	5/28-10/6	26.55	.75	19.91	8.03	11.88
	Misc. hay & pasture	3/19-5/27 & 10/7-10/29	13.42	.60	8.05	2.98	5.07
	Miscellaneous truck	5/28-10/6	26.55	.70	18.59	8.03	10.56
	Potatoes--white	6/1-8/31	19.83	.70	13.88	6.01	7.87
	Small grains	5/1-7/31	18.77	.70	13.14	3.89	9.25
	Sorghums	6/1-9/15	22.45	.70	15.72	6.85	8.87
A-5-LC	Woodruff						
	Alfalfa	5/1-10/15	34.59	.85	29.40	5.19	24.21
	Alfalfa	3/10-4/30 & 10/16-11/5	9.85	.70	6.90	1.47	5.43
	Misc. hay & pasture	5/1-10/15	34.59	.75	25.94	5.19	20.75
	Misc. hay & pasture	3/10-4/30 & 10/16-11/5	9.85	.60	5.91	1.47	4.44
	Small grains	5/1-7/31	20.08	.70	14.06	1.88	12.18

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-6-LC	Black Creek (Puerco River) 2/						
	Alfalfa	5/23-10/1	26.27	0.85	22.33	5.81	16.52
	Alfalfa	3/27-5/22 & 10/2-10/25	11.38	.70	7.97	1.55	6.42
	Beans	6/1-8/31	19.52	.60	11.71	4.37	7.34
	Corn	6/1-9/30	24.59	.75	18.44	5.78	12.66
	Melons	6/1-9/30	24.59	.65	15.98	5.78	10.20
	Misc. hay & pasture	5/23-10/1	26.27	.75	19.70	5.81	13.89
	Misc. hay & pasture	3/27-5/22 & 10/2-10/25	11.38	.60	6.83	1.55	5.28
	Potatoes--white	6/1-8/31	19.52	.70	13.66	4.37	9.29
	Small grains	5/1-7/31	18.51	.70	12.96	2.10	10.86
A-7-LC	Holbrook						
	Alfalfa	4/29-10/19	36.42	.85	30.96	4.41	26.55
	Alfalfa	3/7-4/28 & 10/20-11/6	9.78	.70	6.85	.75	6.10
	Beans	5/15-8/15	21.35	.60	12.81	2.18	10.63
	Corn	6/1-9/30	27.39	.75	20.54	4.00	16.54
	Deciduous fruits	4/29-10/19	36.42	.65	23.67	4.41	19.26
	Misc. hay & pasture	4/29-10/19	36.42	.75	27.32	4.41	22.91
	Misc. hay & pasture	3/7-4/28 & 10/20-11/6	9.78	.60	5.87	.75	5.12
	Miscellaneous truck	4/29-10/19	36.42	.70	25.49	4.41	21.08
	Small grains	5/1-7/31	20.66	.70	14.46	1.48	12.98
	Sorghums	5/15-9/10	26.89	.70	18.82	3.28	15.54

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and Crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-8-LC	Hopi, Ganado and Leupp 3/						
	Alfalfa	5/11-10/8	30.89	0.85	26.26	4.70	21.56
	Alfalfa	3/18-5/10 & 10/9-10/31	10.84	.70	7.59	1.72	5.87
	Beans	5/15-8/15	20.22	.60	12.13	2.29	9.84
	Corn	5/15-9/15	26.39	.75	19.79	3.82	15.97
	Melons	6/1-9/30	25.99	.65	16.89	4.48	12.41
	Misc. hay & pasture	5/11-10/8	30.89	.75	23.17	4.70	18.47
	Misc. hay & pasture	3/18-5/10 & 10/9-10/31	10.84	.60	6.50	1.72	4.78
	Miscellaneous truck	5/11-10/8	30.89	.70	21.62	4.70	16.92
	Potatoes—white	5/15-8/15	20.22	.70	14.15	2.29	11.86
	Small grains	5/1-7/31	19.51	.70	13.66	1.48	12.18
A-9-LC	Moenkopi--Navajo Indian Reservation 4/						
	Alfalfa	5/3-10/12	33.58	.85	28.54	4.63	23.91
	Alfalfa	3/17-5/2 & 10/13-11/1	9.16	.70	6.41	1.64	4.77
	Beans	5/15-8/15	20.71	.60	12.43	2.43	10.00
	Corn	5/15-9/15	26.97	.75	20.23	3.54	16.69
	Deciduous fruits	5/3-10/12	33.58	.65	21.83	4.63	17.20
	Grapes	5/3-10/12	33.58	.60	20.15	4.63	15.52
	Melons	6/1-9/30	26.51	.65	17.23	3.71	13.52
	Misc. hay & pasture	5/3-10/12	33.58	.75	25.19	4.63	20.56
	Misc. hay & pasture	3/17-5/2 & 10/13-11/1	9.16	.60	5.50	1.64	3.86
	Miscellaneous truck	5/3-10/12	33.58	.70	23.51	4.63	18.88
	Small grains	5/1-7/31	20.04	.70	14.03	2.10	11.93

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Unit Area and crops	Growing period Dates	Consumptive use Factor (F)	Consumptive use Coefficient (K)	Consumptive use Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-1-C	Kanab Creek						
	Alfalfa	5/18-10/4	29.35	0.85	24.95	3.99	20.96
	Alfalfa	3/14-5/17 & 10/5-10/31	13.31	.70	9.32	2.43	6.89
	Corn	6/1-9/30	26.23	.75	19.67	3.64	16.03
	Deciduous fruits	5/18-10/4	29.35	.65	19.08	3.99	15.09
	Misc. hay & pasture	5/18-10/4	29.35	.75	22.01	3.99	18.02
	Misc. hay & pasture	3/14-5/17 & 10/5-10/31	13.31	.60	7.99	2.43	5.56
	Miscellaneous truck	5/18-10/4	29.35	.70	20.55	3.99	16.56
	Small grains	10/1-10/31 & 3/14-7/15	26.68	.70	18.68	3.39	15.29
	Small grains	3/14-7/15	22.51	.70	15.76	2.69	13.07
A-2-C	Havasu Creek						
	Alfalfa	3/9-11/6	50.99	.85	43.34	5.50	37.84
	Alfalfa	2/15-3/8 & 11/7-11/20	4.38	.70	3.07	1.08	1.99
	Corn	5/15-9/15	30.31	.75	22.73	2.78	19.95
	Deciduous fruits	3/9-11/6	50.99	.65	33.14	5.50	27.64
	Misc. hay & pasture	3/9-11/6	50.99	.75	38.24	5.50	32.74
	Misc. hay & pasture	2/15-3/8 & 11/7-11/20	4.38	.60	2.63	1.08	1.55
	Miscellaneous truck	3/9-11/6	50.99	.70	35.69	5.50	30.19

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-3-C	Hualpai Reservation & Meriwitica						
	Alfalfa	3/9-11/6	50.99	0.85	43.34	5.50	37.84
	Alfalfa	2/15-3/8 & 11/7-11/20	4.38	.70	3.07	1.08	1.99
	Corn	5/15-9/15	30.31	.75	22.73	2.78	19.95
	Deciduous fruits	3/9-11/6	50.99	.65	33.14	5.50	27.64
	Miscellaneous truck	3/9-11/6	50.99	.70	35.69	5.50	30.19
A-4-C	Grand Wash						
	Alfalfa	4/1-10/26	45.70	.85	38.84	3.18	35.66
	Alfalfa	2/22-3/31 & 10/27-11/15	7.50	.70	5.25	1.34	3.91
	Deciduous fruits	4/1-10/26	45.70	.65	29.70	3.18	26.52
	Miscellaneous truck	4/1-10/26	45.70	.70	31.99	3.18	28.81
	Small grains	4/1-7/31	27.85	.70	19.49	1.24	18.25
A-1-V	Short Creek						
	Alfalfa	5/13-10/1	29.94	.85	25.45	3.23	22.22
	Alfalfa	3/14-5/12 & 10/2-10/31	12.79	.70	8.95	2.38	6.57
	Corn	6/1-9/30	26.29	.75	19.72	3.21	16.51
	Deciduous fruits	5/13-10/1	29.94	.65	19.46	3.23	16.23
	Miscellaneous truck	5/13-10/1	29.94	.70	20.96	3.23	17.73
	Small grains	5/1-7/31	19.93	.70	13.95	1.35	12.60

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-2-V	Littlefield						
	Alfalfa	3/17-11/5	52.05	0.85	44.24	1.10	43.14
	Alfalfa	2/13-3/16 & 11/6-11/22	6.23	.70	4.36	.95	3.41
	Deciduous fruits	3/17-11/5	52.05	.65	33.83	1.10	32.73
	Misc. hay & pasture	3/17-11/5	52.05	.75	39.04	1.10	37.94
	Misc. hay & pasture	2/13-3/16 & 11/6-11/22	6.23	.60	3.74	.95	2.79
	Miscellaneous truck	3/17-11/5	52.05	.70	36.43	1.10	35.33
	Small grains	10/1-11/5 & 2/13-6/15	28.92	.70	20.24	1.31	18.93
	Small grains	2/15-6/15	23.06	.70	16.14	1.24	14.90
	Sorghums	6/1-9/30	31.36	.70	21.95	.74	21.21
A-5-C	Davis Dam to Topock						
	Alfalfa	2/7-12/4	65.85	.85	55.97	1.34	54.63
	Alfalfa	12/5-2/6	7.55	.60	4.53	1.49	3.04
	Grapes	2/7-12/4	65.85	.60	39.51	1.34	38.17
	Miscellaneous truck	8/15-3/31	37.73	.70	26.41	2.51	23.90
	Small grains	10/1-4/30	32.21	.70	22.55	2.17	20.38
	Small grains	12/1-4/30	22.49	.70	15.74	2.17	13.57
A-1-BW	Big Sandy						
	Alfalfa	3/27-11/9	48.61	.85	41.32	6.08	35.24
	Alfalfa	2/9-3/26 & 11/10-12/9	9.84	.70	6.89	3.57	3.32
	Corn	5/15-9/15	30.15	.75	22.61	3.71	18.90
	Dates	1/1-12/31	65.02	.65	42.26	12.96	29.30

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit		Growing period	Consumptive use			Effective precipitation 1/	(U-R)
No.	Area and crops		Factor (F)	Coefficient (K)	Use rate (U)	(R)	
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Big Sandy (Continued)						
	Deciduous fruits	3/27-11/9	48.61	0.65	31.60	6.08	25.52
	Grapes	3/27-11/9	48.61	.60	29.17	6.08	23.09
	Melons	4/1-7/31	27.56	.65	17.91	2.03	15.88
	Misc. hay & pasture	3/27-11/9	48.61	.75	36.46	6.08	30.38
	Misc. hay & pasture	2/9-3/26 & 11/10-12/9	9.84	.60	5.90	3.57	2.33
	Potatoes--sweet	3/27-11/9	48.61	.70	34.03	6.08	27.95
	Small grains	10/1-12/9 & 2/9-6/15	32.45	.70	22.72	5.29	17.43
	Small grains	2/15-6/15	21.76	.70	15.23	2.91	12.32
	Sorghums	6/1-9/30	29.72	.70	20.80	4.36	16.44
A-2-BW	Bill Williams River (Santa Maria)						
	Alfalfa	3/27-11/9	48.61	.85	41.32	6.08	35.24
	Alfalfa	2/9-3/26 & 11/10-12/9	9.84	.70	6.89	3.57	3.32
	Corn	6/1-9/30	29.72	.75	22.29	4.36	17.93
	Deciduous fruits	3/27-11/9	48.61	.65	31.60	6.08	25.52
	Misc. hay & pasture	3/27-11/9	48.61	.75	36.46	6.08	30.38
	Misc. hay & pasture	2/9-3/26 & 11/10-12/9	9.84	.60	5.90	3.57	2.33
	Miscellaneous truck	3/27-11/9	48.61	.70	34.03	6.08	27.95
	Potatoes--white	4/1-6/30	19.30	.70	13.51	.69	12.82
	Small grains	10/1-12/9 & 2/9-6/15	32.45	.70	22.72	5.29	17.43
	Small grains	2/15-6/15	21.76	.70	15.23	2.91	12.32

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-6-C	Colorado River Indian Reservation and Cibola Valley						
	Alfalfa	2/28-11/14	58.55	0.85	49.77	1.87	47.90
	Alfalfa	11/15-2/27	12.80	.60	7.68	2.34	5.34
	Corn	6/15-10/15	31.54	.75	23.65	1.22	22.43
	Cotton	4/1-10/31	51.46	.62	31.90	1.22	30.68
	Melons	3/1-6/30	26.62	.65	17.30	.62	16.68
	Misc. hay & pasture	2/28-11/14	58.55	.80	46.84	1.87	44.97
	Misc. hay & pasture	11/15-2/27	12.80	.60	7.68	2.34	5.34
	Miscellaneous truck	8/15-3/31	36.93	.70	25.85	3.95	21.90
	Rice	6/1-10/31	38.12	1.20	45.74	1.22	44.52
	Small grains	10/1-4/30	31.34	.70	21.94	2.99	18.95
	Small grains	12/1-4/30	21.81	.70	15.27	2.99	12.28
	Sorghums	7/1-10/31	29.91	.70	20.94	1.22	19.72
A-7-C	North and South Gila Valleys						
	Alfalfa	2/23-11/24	59.30	.85	50.40	.64	49.76
	Alfalfa	11/25-2/22	11.33	.60	6.80	0	6.80
	Cotton	4/1-10/31	49.97	.62	30.98	.64	30.34
	Flax	11/1-6/30	33.64	.80	26.91	0	26.91
	Lettuce--fall	9/1-11/30	16.62	.65	10.80	.64	10.16
	Lettuce--spring	11/1-3/31	20.66	.65	13.43	0	13.43
	Misc. hay & pasture	2/23-11/24	59.30	.80	47.44	.64	46.80
	Misc. hay & pasture	11/25-2/22	11.33	.60	6.80	0	6.80
	Miscellaneous truck	8/15-3/31	37.54	.70	26.28	.64	25.64
	Nuts	2/23-11/24	59.30	.70	41.51	.64	40.87

Table 7 - Summary of estimates of normal consumptive use of water for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
	North and South Gila Valleys (Continued)						
	Small grains	10/1-4/30	32.12	0.70	22.48	0	22.48
	Small grains	12/1-4/30	22.33	.70	15.63	0	15.63
	Soil building crops	7/1-9/30	23.63	.85	20.09	.64	19.45
	Soil building crops	11/1-3/31	20.66	.70	14.46	0	14.46
	Sorghums	7/1-10/31	29.21	.70	20.45	.64	19.81
A-8-C	Yuma Valley						
	Alfalfa	2/23-11/24	59.30	.85	50.40	.64	49.76
	Alfalfa	11/25-2/22	11.33	.60	6.80	0	6.80
	Beans	3/1-5/31	18.10	.60	10.86	0	10.86
	Carrots--fall	8/1-1/31	32.21	.70	22.55	.64	21.91
	Carrots--spring	11/1-6/30	41.42	.70	28.99	0	28.99
	Citrus	1/1-12/31	70.63	.60	42.38	.64	41.74
	Corn	6/15-10/15	30.48	.75	22.86	.64	22.22
	Cotton	4/1-10/31	49.97	.62	30.98	.64	30.34
	Dates	1/1-12/31	70.63	.65	45.91	.64	45.27
	Deciduous fruits	2/23-11/24	59.30	.65	38.54	.64	37.90
	Flax	11/1-6/30	33.64	.80	26.91	0	26.91
	Grapes	2/23-11/24	59.30	.60	35.58	.64	34.94
	Lettuce--fall	9/1-11/30	16.62	.65	10.80	.64	10.16
	Lettuce--spring	11/1-3/31	20.66	.65	13.43	0	13.43
	Melons	3/1-7/31	34.52	.65	22.44	0	22.44
	Misc. hay & pasture	2/23-11/24	59.30	.80	47.44	.64	46.80
	Misc. hay & pasture	11/25-2/22	11.33	.60	6.80	0	6.80

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
	Yuma Valley (Continued)						
	Miscellaneous truck	8/15-3/31	37.54	0.70	26.28	0.64	25.64
	Nurseries & flowers	1/1-12/31	70.63	.65	45.91	.64	45.27
	Nuts	2/23-11/24	59.30	.70	41.51	.64	40.87
	Potatoes--sweet	2/23-11/24	59.30	.70	41.51	.64	40.87
	Potatoes--white	3/1-5/31	18.10	.70	12.67	0	12.67
	Rice	6/1-10/31	36.99	1.20	44.39	.64	43.75
	Small grains	10/1-4/30	32.12	.70	22.48	0	22.48
	Small grains	12/1-4/30	22.33	.70	15.63	0	15.63
	Soil building crops	7/1-9/30	23.63	.85	20.09	.64	19.45
	Soil building crops	11/1-3/31	20.66	.70	14.46	0	14.46
	Sorghums	7/1-10/31	29.21	.70	20.45	.64	19.81
	Sugar beet seed	9/15-12/31 & 3/1-6/30	43.01	.70	30.11	.34	29.77
	Tomatoes	3/1-7/10	28.67	.75	21.50	0	21.50
A-9-C	Yuma Mesa						
	Alfalfa	1/19-12/16	69.27	.85	58.88	.61	58.27
	Alfalfa	12/17-1/18	4.11	.60	2.47	0	2.47
	Citrus	1/1-12/31	73.38	.60	44.03	.61	43.42
	Dates	1/1-12/31	73.38	.65	47.70	.61	47.09
	Deciduous fruits	1/19-12/16	69.27	.65	45.03	.61	44.42
	Grapes	1/19-12/16	69.27	.60	41.56	.61	40.95
	Melons	3/1-7/31	35.88	.65	23.32	0	23.32
	Misc. hay & pasture	1/19-12/16	69.27	.80	55.42	.61	54.81
	Misc. hay & pasture	12/17-1/18	4.11	.60	2.47	0	2.47

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Yuma Mesa (Continued)						
	Miscellaneous truck	8/15-3/31	38.98	0.70	27.29	0.33	26.96
	Nurseries & flowers	1/1-12/31	73.38	.65	47.70	.61	47.09
	Potatoes--white	3/1-5/31	18.77	.70	13.14	0	13.14
	Soil building crops	7/1-9/30	24.47	.85	20.80	.61	20.19
	Soil building crops	11/1-3/31	21.46	.70	15.02	0	15.02
	Sorghums	7/1-10/31	30.28	.70	21.20	.61	20.59
	Tomatoes	3/1-7/10	29.82	.75	22.36	0	22.36
A-1-G	Duncan Valley 5/						
	Alfalfa	4/1-10/31	45.75	.85	38.89	7.79	31.10
	Alfalfa	2/15-3/31 & 11/1-11/24	8.85	.70	6.20	1.76	4.44
	Cotton	4/1-10/31	45.75	.62	28.37	7.79	20.58
	Miscellaneous truck	4/1-10/31	45.75	.70	32.03	7.79	24.24
	Small grains	10/15-11/24 & 2/15-6/15	27.10	.70	18.97	2.30	16.67
	Small grains	4/15-7/15	20.63	.70	14.44	1.18	13.26
	Sorghums	6/1-9/30	28.96	.70	20.27	6.80	13.47
A-2-G	Alpine--Upper San Francisco River						
	Alfalfa	6/24-9/11	14.48	.85	12.31	8.56	3.75
	Alfalfa	4/7-6/23 & 9/12-10/16	16.35	.70	11.45	4.59	6.86
	Deciduous fruits	6/24-9/11	14.48	.65	9.41	8.56	0.85
	Small grains	5/15-8/15	16.76	.70	11.73	6.77	4.96

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
A-3-G	San Francisco River						
	Alfalfa	4/14-10/30	39.78	0.85	33.81	10.86	22.95
	Alfalfa	3/2-4/13 & 10/31-11/14	7.57	.70	5.30	1.82	3.48
	Corn	5/15-9/15	27.18	.75	20.39	7.74	12.65
	Miscellaneous truck	4/14-10/30	39.78	.70	27.85	10.86	16.99
	Small grains	4/15-7/15	18.90	.70	13.23	2.88	10.35
A-4-G	Eagle Creek						
	Alfalfa	4/6-11/1	43.56	.85	37.03	9.42	27.61
	Alfalfa	2/20-4/5 & 11/2-11/20	8.28	.70	5.80	2.01	3.79
	Corn	6/1-9/30	27.98	.75	20.99	7.76	13.23
	Misc. hay & pasture	4/6-11/1	43.56	.75	32.67	9.42	23.25
	Misc. hay & pasture	2/20-4/5 & 11/2-11/20	8.28	.60	4.97	2.01	2.96
	Miscellaneous truck	4/6-11/1	43.56	.70	30.49	9.42	21.07
	Small grains	10/15-11/20 & 2/20-6/15	25.29	.70	17.70	3.16	14.54
	Small grains	4/15-7/15	20.05	.70	14.04	1.66	12.38
A-5-G	Portal--Upper San Simon Creek						
	Alfalfa	4/29-10/23	35.54	.85	30.21	11.00	19.21
	Alfalfa	3/1-4/28 & 10/24-11/12	10.82	.70	7.57	1.81	5.76
	Deciduous fruits	4/29-10/23	35.54	.65	23.10	11.00	12.10
	Small grains	4/15-7/15	18.53	.70	12.97	2.29	10.68

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
A-6-G	San Simon Creek						
	Alfalfa	4/4-11/7	45.58	0.85	38.74	5.12	33.62
	Alfalfa	2/15-4/3 & 11/8-11/26	8.73	.70	6.11	.89	5.22
	Beans	5/1-7/31	21.81	.60	13.09	1.91	11.18
	Corn	5/15-9/15	28.97	.75	21.73	4.12	17.61
	Cotton	4/1-10/31	45.25	.62	28.06	5.12	22.94
	Deciduous fruits	4/4-11/7	45.58	.65	29.63	5.12	24.51
	Misc. hay & pasture	4/4-11/7	45.58	.75	34.19	5.12	29.07
	Misc. hay & pasture	2/15-4/3 & 11/8-11/26	8.73	.60	5.24	.89	4.35
	Miscellaneous truck	4/4-11/7	45.58	.70	31.91	5.12	26.79
	Small grains	10/1-11/26 & 2/15-5/31	25.63	.70	17.94	1.46	16.48
	Small grains	3/1-6/20	20.84	.70	14.59	.56	14.03
	Sorghums	6/10-11/7	32.29	.70	22.60	5.12	17.48
A-7-G	Safford Valley 6/						
	Alfalfa	4/6-11/3	46.24	.85	39.30	5.21	34.09
	Alfalfa	2/9-4/5 & 11/4-11/26	10.63	.70	7.44	1.58	5.86
	Beans	4/1-6/30	19.71	.60	11.83	0	11.83
	Corn	6/15-10/15	28.51	.75	21.38	4.86	16.52
	Cotton	4/1-10/31	46.76	.62	28.99	5.15	23.84
	Deciduous fruits	4/6-11/3	46.24	.65	30.06	5.21	24.85
	Misc. hay & pasture	4/6-11/3	46.24	.75	34.68	5.21	29.47
	Misc. hay & pasture	2/9-4/5 & 11/4-11/26	10.63	.60	6.38	1.58	4.80
	Miscellaneous truck	4/6-11/3	46.24	.70	32.37	5.21	27.16
	Potatoes—white	4/15-7/15	21.01	.70	14.71	.76	13.95

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Safford Valley (Continued)						
	Small grains	10/15-11/26 & 2/9-5/31	24.96	0.70	17.47	1.93	15.54
	Small grains	3/1-5/31	16.60	.70	11.62	.58	11.04
	Sorghums	6/15-11/3	31.48	.70	22.04	5.21	16.83
	Sugar beet seed	9/15-11/26 & 3/1-6/30	35.78	.70	25.05	2.38	22.67
A-8-G	San Carlos Indian Reservation						
	Alfalfa	3/17-11/16	52.35	.85	44.50	6.86	37.64
	Alfalfa	2/6-3/16 & 11/17-12/1	7.10	.70	4.97	2.38	2.59
	Corn	6/1-9/30	30.59	.75	22.94	4.52	18.42
	Deciduous fruits	3/17-11/16	52.35	.65	34.03	6.86	27.17
	Misc. hay & pasture	3/17-11/16	52.35	.75	39.26	6.86	32.40
	Misc. hay & pasture	2/6-3/16 & 11/17-12/1	7.10	.60	4.26	2.38	1.88
	Miscellaneous truck	3/17-11/16	52.35	.70	36.64	6.86	29.78
	Small grains	10/15-12/1 & 2/6-5/31	26.49	.70	18.54	4.45	14.09
	Small grains	3/1-5/31	16.88	.70	11.82	1.72	10.08
	Sorghums	7/1-10/31	28.06	.70	19.64	5.11	14.53
A-9-G	Hereford Valley--Upper San Pedro River						
	Alfalfa	4/6-10/27	44.21	.85	37.58	8.17	29.41
	Alfalfa	2/3-4/5 & 10/28-12/16	15.01	.70	10.51	1.51	9.00
	Corn	5/15-9/15	29.11	.75	21.83	7.52	14.31
	Misc. hay & pasture	4/6-10/27	44.21	.75	33.16	8.17	24.99
	Misc. hay & pasture	2/3-4/5 & 10/28-12/16	15.01	.60	9.01	1.51	7.50

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	ARIZONA (Continued)						
	Hereford Valley (Continued)						
	Miscellaneous truck	4/6-10/27	44.21	0.70	30.95	8.17	22.78
	Small grains	10/1-12/16 & 2/3-5/31	30.67	.70	21.47	1.51	19.96
	Small grains	3/15-6/30	22.01	.70	15.41	.63	14.78
	Sorghums	6/15-10/15	27.57	.70	19.30	7.88	11.42
A-10-G	Middle San Pedro River--Charleston to Mammoth						
	Alfalfa	4/8-11/2	44.83	.85	38.11	7.69	30.42
	Alfalfa	2/5-4/7 & 11/3-12/3	12.56	.70	8.79	1.47	7.32
	Beans	5/1-7/31	21.97	.60	13.18	2.54	10.64
	Corn	5/15-9/15	29.38	.75	22.04	6.29	15.75
	Deciduous fruits	4/8-11/2	44.83	.65	29.14	7.69	21.45
	Lettuce--fall	9/1-11/30	15.01	.65	9.76	2.85	6.91
	Lettuce--spring	3/1-5/31	16.41	.65	10.67	0	10.67
	Melons	5/1-8/31	29.29	.65	19.04	5.51	13.53
	Misc. hay & pasture	4/8-11/2	44.83	.75	33.62	7.69	25.93
	Misc. hay & pasture	2/5-4/7 & 11/3-12/3	12.56	.60	7.54	1.47	6.07
	Miscellaneous truck	4/8-11/2	44.83	.70	31.38	7.69	23.69
	Potatoes--white	4/1-6/30	19.32	.70	13.52	0	13.52
	Small grains	10/1-12/3 & 2/5-5/31	28.54	.70	19.98	2.08	17.90
	Small grains	2/15-6/20	23.10	.70	16.17	0.42	15.75
	Sorghums	6/15-10/31	30.45	.70	21.32	7.64	13.68
	Tomatoes	4/15-8/15	28.33	.75	21.25	3.98	17.27

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
A-11-G	Lower San Pedro River						
	Alfalfa	4/2-11/10	47.29	0.85	40.20	7.45	32.75
	Alfalfa	2/8-4/1 & 11/11-11/28	9.51	.70	6.66	2.72	3.94
	Corn	5/15-9/15	29.79	.75	22.34	5.70	16.64
	Misc. hay & pasture	4/2-11/10	47.29	.75	35.47	7.45	28.02
	Misc. hay & pasture	2/8-4/1 & 11/11-11/28	9.51	.60	5.71	2.72	2.99
	Miscellaneous truck	4/2-11/10	47.29	.70	33.10	7.45	25.65
	Small grains	10/1-11/28 & 2/8-5/31	27.50	.70	19.25	3.82	15.43
	Small grains	2/15-6/20	23.14	.70	16.20	2.59	13.61
A-12-G	Coolidge Dam to Kelvin						
	Alfalfa	4/2-11/10	47.39	.85	40.28	7.60	32.68
	Alfalfa	2/3-4/1 & 11/11-12/3	10.93	.70	7.65	2.89	4.76
	Miscellaneous truck	4/2-11/10	47.39	.70	33.17	7.60	25.57
	Small grains	10/1-12/3 & 2/3-5/31	29.05	.70	20.20	4.12	16.22
	Small grains	2/15-6/20	23.40	.70	16.38	2.50	13.88
A-13-G	San Rafael Ranch--Upper Santa Cruz River						
	Misc. hay & pasture	4/12-10/28	43.11	.75	32.33	11.65	20.68
	Misc. hay & pasture	2/4-4/11 & 10/29-12/17	15.83	.60	9.50	3.73	5.77

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
A-14-G	Santa Cruz County						
	Alfalfa	4/1-11/17	47.73	0.85	40.57	10.55	30.02
	Alfalfa	2/4-3/31 & 11/18-12/17	11.19	.70	7.83	2.75	5.08
	Beans	5/1-7/31	21.74	.60	13.04	3.77	9.27
	Corn	5/15-9/15	29.07	.75	21.80	8.67	13.13
	Cotton	4/1-10/31	45.53	.62	28.23	10.07	18.16
	Flax	11/1-12/17 & 2/4-6/30	32.61	.80	26.09	3.23	22.86
	Lettuce--fall	9/1-11/30	15.19	.65	9.87	3.05	6.82
	Lettuce--spring	3/1-5/31	16.35	.65	10.63	.79	9.84
	Misc. hay & pasture	4/1-11/17	47.73	.75	35.80	10.55	25.25
	Misc. hay & pasture	2/4-3/31 & 11/18-12/17	11.19	.60	6.71	2.75	3.96
	Miscellaneous truck	4/1-11/17	47.73	.70	33.41	10.55	22.86
	Potatoes--sweet	4/1-11/17	47.73	.70	33.41	10.55	22.86
	Potatoes--white	4/1-6/30	19.22	.70	13.45	0	13.45
	Small grains	10/1-12/17 & 2/4-5/31	30.34	.70	21.24	3.82	17.42
	Small grains	3/15-6/30	21.70	.70	15.19	.43	14.76
	Sorghums	6/20-11/17	31.22	.70	21.85	10.55	11.30
A-15-G	Pima County--Santa Cruz River						
	Alfalfa	3/19-11/17	53.12	.85	45.15	6.27	38.88
	Alfalfa	11/18-3/18	15.41	.60	9.25	3.70	5.55
	Beans	4/1-6/30	20.44	.60	12.26	0	12.26
	Citrus	1/1-12/31	68.53	.60	41.12	9.97	31.15
	Corn	4/1-7/31	28.89	.75	21.67	1.84	19.83
	Cotton	4/1-10/31	48.79	.62	30.25	5.45	24.80

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Pima County (Continued)						
	Deciduous fruits	3/19-11/17	53.12	0.65	34.53	6.27	28.26
	Lettuce--fall	9/1-11/30	16.17	.65	10.51	2.31	8.20
	Lettuce--spring	11/1-3/31	19.74	.65	12.83	4.52	8.31
	Melons	4/1-7/31	28.89	.65	18.78	1.84	16.94
	Misc. hay & pasture	3/19-11/17	53.12	.80	42.50	6.27	36.23
	Misc. hay & pasture	11/18-3/18	15.41	.60	9.25	3.70	5.55
	Miscellaneous truck	8/15-3/31	36.11	.70	25.28	7.14	18.14
	Potatoes--white	4/1-6/30	20.44	.70	14.31	0	14.31
	Small grains	3/1-6/10	20.03	.70	14.02	.73	13.29
	Small grains	10/15-5/31	35.33	.70	24.73	4.52	20.21
	Sorghums	6/15-9/30	27.08	.70	18.96	5.45	13.51
A-16-G	Pinal County--Gila and Santa Cruz Rivers 7/						
	Alfalfa 8/	3/10-11/19	45.25	.85	38.46	2.74	35.72
	Alfalfa	11/20-3/9	13.83	.60	8.30	3.45	4.85
	Beans	4/1-6/30	21.22	.60	12.73	0	12.73
	Carrots--fall	8/1-12/31	28.38	.70	19.87	4.46	15.41
	Carrots--spring	11/1-6/30	41.16	.70	28.81	4.48	24.33
	Corn	6/15-10/15	31.06	.75	23.30	3.75	19.55
	Cotton	4/1-10/31	50.82	.62	31.51	3.75	27.76
	Dates	1/1-12/31	70.76	.65	45.99	8.23	37.76
	Deciduous fruits	3/10-11/19	56.93	.65	37.00	4.78	32.22
	Flax	10/1-6/30	46.73	.80	37.38	4.48	32.90
	Grapes	3/10-11/19	56.93	.60	34.16	4.78	29.38

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Pinal County (Continued) 7/						
	Lettuce--fall	9/1-11/31	16.58	0.65	10.78	1.69	9.09
	Lettuce--spring	11/1-3/31	19.94	.65	12.96	4.48	8.48
	Melons	3/10-7/31	33.63	.65	21.86	1.84	20.02
	Misc. hay & pasture	3/10-11/19	56.93	.80	45.54	4.78	40.76
	Misc. hay & pasture	11/20-3/9	13.83	.60	8.30	3.45	4.85
	Miscellaneous truck	8/15-3/31	32.41	.70	22.69	6.21	16.48
	Potatoes--sweet	3/10-11/19	56.93	.70	39.85	4.78	35.07
	Potatoes--white	3/1-5/31	18.05	.70	12.64	.79	11.85
	Small grains	10/1-4/30	31.35	.70	21.95	4.48	17.47
	Small grains	12/1-4/30	21.67	.70	15.17	3.74	11.43
	Sorghums	7/1-10/31	29.60	.70	20.72	3.75	16.97
	Tomatoes	3/10-7/10	27.60	.75	20.70	.97	19.73
A-17-G	Black River--Upper Salt River						
	Misc. hay & pasture	5/20-10/11	28.68	.75	21.51	12.09	9.42
	Misc. hay & pasture	3/16-5/19 & 10/12-11/14	12.59	.60	7.55	4.09	3.46
	Small grains	5/1-7/31	18.79	.70	13.15	5.68	7.47
A-18-G	Fort Apache Indian Reservation--Upper Salt River						
	Alfalfa	5/4-10/16	33.82	.85	28.75	8.04	20.71
	Alfalfa	3/7-5/3 & 10/17-11/10	11.45	.70	8.01	3.07	4.94
	Beans	5/15-8/15	20.42	.60	12.25	4.15	8.10
	Corn	6/1-9/30	26.24	.70	18.37	7.51	10.86

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
	Fort Apache Indian Reservation (Continued)						
	Deciduous fruits	5/4-10/16	33.82	0.65	21.98	8.04	13.94
	Misc. hay & pasture	5/4-10/16	33.82	.75	25.37	8.04	17.33
	Misc. hay & pasture	3/7-5/3 & 10/17-11/10	11.45	.60	6.87	3.07	3.80
	Miscellaneous truck	5/4-10/16	33.82	.70	23.67	8.04	15.63
	Potatoes--white	5/15-8/15	20.42	.70	14.29	4.15	10.14
	Small grains	3/15-6/15	15.90	.70	11.13	1.74	9.39
	Sorghums	6/1-9/30	26.24	.70	18.37	7.51	10.86
A-19-G	Cherry Creek--Upper Salt River						
	Alfalfa	4/29-10/28	39.08	.85	33.22	11.17	22.05
	Alfalfa	2/20-4/28 & 10/29-11/26	13.42	.70	9.39	6.45	2.94
	Deciduous fruits	4/29-10/28	39.08	.65	25.40	11.17	14.23
	Misc. hay & pasture	4/29-10/28	39.08	.75	29.31	11.17	18.14
	Misc. hay & pasture	2/20-4/28 & 10/29-11/26	13.42	.60	8.05	6.45	1.60
	Miscellaneous truck	4/29-10/28	39.08	.70	27.36	11.17	16.19
	Small grains	5/1-7/31	21.13	.70	14.79	4.57	10.22
A-20-G	Salt River Canyon to Roosevelt						
	Alfalfa	3/11-11/25	56.62	.85	48.13	8.07	40.06
	Alfalfa	2/1-3/10 & 11/26-12/22	8.21	.70	5.75	3.26	2.49
	Deciduous fruits	3/11-11/25	56.62	.65	36.80	8.07	28.73
	Miscellaneous truck	3/11-11/25	56.62	.70	39.63	8.07	31.56
	Small grains	3/1-5/31	17.73	.70	12.41	1.83	10.58

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	ARIZONA (Continued)						
A-21-G	Tonto Creek & Tributaries						
	Alfalfa	4/11-11/5	43.12	0.85	36.65	9.84	26.81
	Alfalfa	2/22-4/10 & 11/6-11/22	8.59	.70	6.01	4.05	1.96
	Corn	5/15-9/15	28.60	.75	21.45	6.42	15.03
	Deciduous fruits	4/11-11/5	43.12	.65	28.03	9.84	18.19
	Misc. hay & pasture	4/11-11/5	43.12	.75	32.34	9.84	22.50
	Misc. hay & pasture	2/22-4/10 & 11/6-11/22	8.59	.60	5.15	4.05	1.10
	Miscellaneous truck	4/11-11/5	43.12	.70	30.18	9.84	20.34
	Small grains	10/1-11/22 & 2/22-6/15	27.13	.70	18.99	6.50	12.49
	Small grains	3/1-6/15	18.97	.70	13.28	3.44	9.84
A-22-G	Verde River & Tributaries upstream from Camp Verde						
	Alfalfa	4/3-11/10	46.75	.85	39.74	8.23	31.51
	Alfalfa	2/15-4/2 & 11/11-11/27	8.42	.70	5.89	2.89	3.00
	Beans	5/1-7/31	22.07	.60	13.24	1.89	11.35
	Corn	5/15-9/15	29.60	.75	22.20	5.06	17.14
	Deciduous fruits	4/3-11/10	46.75	.65	30.39	8.23	22.16
	Grapes	4/3-11/10	46.75	.60	28.05	8.23	19.82
	Misc. hay & pasture	4/3-11/10	46.75	.75	35.06	8.23	26.83
	Misc. hay & pasture	2/15-4/2 & 11/11-11/27	8.42	.60	5.05	2.89	2.16
	Miscellaneous truck	4/3-11/10	46.75	.70	32.72	8.23	24.49
	Small grains	10/1-11/27 & 2/15-6/15	29.80	.70	20.86	5.22	15.64
	Small grains	3/1-6/15	19.86	.70	13.90	2.41	11.49

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
A-23-G	Middle Verde River & Tributaries						
	Alfalfa	4/21-11/1	40.10	0.85	34.08	9.30	24.78
	Alfalfa	2/26-4/20 & 11/2-11/18	9.57	.70	6.70	4.17	2.53
	Corn	6/1-9/30	27.58	.75	20.68	7.44	13.24
	Deciduous fruits	4/21-11/1	40.10	.65	26.06	9.30	16.76
	Misc. hay & pasture	4/21-11/1	40.10	.75	30.07	9.30	20.77
	Misc. hay & pasture	2/26-4/20 & 11/2-11/18	9.57	.60	5.74	4.17	1.57
	Miscellaneous truck	4/21-11/1	40.10	.70	28.07	9.30	18.77
	Small grains	4/1-6/30	17.97	.70	12.58	1.46	11.12
A-24-G	Fort McDowell Indian Reservation						
	Alfalfa	3/12-11/19	45.04	.85	38.28	6.01	32.27
	Alfalfa	11/20-3/11	14.32	.60	8.59	5.74	2.85
	Corn	6/15-10/15	31.05	.75	23.29	4.83	18.46
	Misc. hay & pasture	3/12-11/19	56.71	.80	45.37	7.78	37.59
	Misc. hay & pasture	11/20-3/11	14.32	.60	8.59	5.74	2.85
	Miscellaneous truck	8/15-3/31	37.27	.70	26.09	9.49	16.60
	Small grains	10/1-4/30	31.63	.70	22.14	8.69	13.45
	Small grains	12/1-4/30	21.74	.70	15.22	6.92	8.30
	Sorghums	7/1-10/31	29.60	.70	20.72	4.82	15.90
A-25-G	Upper Agua Fria River Basin						
	Alfalfa	4/14-11/16	44.47	.85	37.80	6.85	30.95
	Alfalfa	2/17-4/13 & 11/17-11/27	9.19	.70	6.43	2.82	3.61
	Corn	5/15-9/15	28.28	.75	21.21	4.16	17.05
	Miscellaneous truck	4/14-11/16	44.47	.70	31.13	6.85	24.28
	Small grains	4/1-6/30	18.56	.70	12.99	.99	12.00

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
A-26-G	Maricopa County upstream from Gillespie Dam						
	Alfalfa 9/	3/12-11/19	42.49	0.85	36.12	2.33	33.79
	Alfalfa	11/20-3/11	14.08	.60	8.45	3.47	4.98
	Alfalfa & grain	3/12-11/19	42.49	.85	36.12	2.33	33.79
	Alfalfa & grain	11/20-3/11	14.08	.70	9.86	3.47	6.39
	Beans	4/1-6/30	21.01	.60	12.61	0	12.61
	Carrots--fall	8/1-1/31	31.60	.70	22.12	4.75	17.37
	Carrots--spring	11/1-6/30	40.86	.70	28.60	4.37	24.23
	Citrus	1/1-12/31	70.11	.60	42.07	7.41	34.66
	Corn	6/15-10/15	30.69	.75	23.02	3.04	19.98
	Cotton	4/1-10/31	50.26	.62	31.16	3.82	27.34
	Dates	1/1-12/31	70.11	.65	45.57	7.41	38.16
	Deciduous fruits	3/12-11/19	56.03	.65	36.42	3.94	32.48
	Flax	10/1-6/30	46.36	.80	37.09	4.37	32.72
	Grapes	3/12-11/19	56.03	.60	33.62	3.94	29.68
	Lettuce--fall	9/1-11/31	16.38	.65	10.65	1.49	9.16
	Lettuce--spring	11/1-3/31	19.85	.65	12.90	4.37	8.53
	Melons	3/1-7/31	34.75	.65	22.59	1.78	20.81
	Misc. hay & pasture	3/12-11/19	56.03	.80	44.82	3.94	40.88
	Misc. hay & pasture	11/20-3/11	14.08	.60	8.45	3.47	4.98
	Miscellaneous truck	8/15-3/31	36.62	.70	25.63	5.84	19.79
	Nurseries & flowers	1/1-12/31	70.11	.65	45.57	7.41	38.16
	Nuts	3/12-11/19	56.03	.70	39.22	3.94	35.28
	Olives	1/1-12/31	70.11	.65	45.57	7.41	38.16
	Potatoes--sweet	3/12-11/19	56.03	.70	39.22	3.94	35.28
	Potatoes--white	3/1-5/31	17.92	.70	12.54	.78	11.76

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	ARIZONA (Continued)	Dates			Inches	Inches	Inches
	Maricopa County upstream from Gillespie Dam (Continued)						
	Small grains	10/1-4/30	31.15	0.70	21.80	4.37	17.43
	Small grains	12/1-4/30	21.58	.70	15.11	3.74	11.37
	Sorghums	7/1-10/31	29.25	.70	20.48	3.04	17.44
	Sugar beet seed	9/15-12/31 & 3/1-6/30	42.69	.70	29.88	3.11	26.77
	Tomatoes	3/12-7/10	27.04	.75	20.28	.82	19.46
A-27-G	Gillespie Dam to Dome						
	Alfalfa 10/	2/17-11/29	51.48	.85	43.76	0.31	43.45
	Alfalfa	11/30-2/16	9.91	.60	5.95	1.34	4.61
	Alfalfa & grain	2/17-11/29	51.48	.85	43.76	0.31	43.45
	Alfalfa & grain	11/30-2/16	9.91	.70	6.94	1.34	5.60
	Beans	4/1-6/30	21.88	.60	13.13	0	13.13
	Cotton	4/1-10/31	52.42	.62	32.50	1.54	30.96
	Dates	1/1-12/31	73.44	.65	47.74	2.88	44.86
	Flax	11/1-6/30	42.90	.80	34.32	1.34	32.98
	Lettuce--spring	11/1-3/31	21.02	.65	13.66	1.34	12.32
	Melons	3/1-7/31	36.27	.65	23.57	0	23.57
	Misc. hay & pasture	2/17-11/29	63.53	.80	50.82	1.54	49.28
	Misc. hay & pasture	11/30-2/16	9.91	.60	5.95	1.34	4.61
	Miscellaneous truck	8/15-3/31	38.59	.70	27.01	2.46	24.55
	Nuts	2/17-11/29	63.53	.70	44.47	1.54	42.93
	Small grains	10/1-4/30	32.91	.70	23.04	1.34	21.70
	Small grains	12/1-4/30	22.83	.70	15.98	1.34	14.64
	Sorghums	7/1-10/31	30.54	.70	21.38	1.54	19.84

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	CALIFORNIA						
C-1-C	Palo Verde District						
	Alfalfa	2/21-11/20	60.79	0.85	51.67	0.58	51.09
	Alfalfa	11/21-2/20	11.47	.60	6.88	.77	6.11
	Carrots--fall	8/1-1/31	32.43	.70	22.70	1.35	21.35
	Carrots--spring	11/1-6/30	42.24	.70	29.57	.77	28.80
	Corn	6/15-10/15	31.47	.75	23.60	.58	23.02
	Cotton	4/1-10/31	51.67	.62	32.04	.58	31.46
	Dates	1/1-12/31	72.26	.65	46.97	1.35	45.62
	Deciduous fruits	2/21-11/20	60.79	.65	39.51	.58	38.93
	Flax	11/1-6/30	42.24	.80	33.79	.77	33.02
	Grapes	2/21-11/20	60.79	.60	36.47	.58	35.89
	Lettuce--fall	9/1-11/30	16.74	.65	10.88	.58	10.30
	Lettuce--spring	11/1-3/31	20.59	.65	13.38	.77	12.61
	Melons	3/1-7/31	35.91	.65	23.34	0	23.34
	Misc. hay & pasture	2/21-11/20	60.79	.80	48.63	.58	48.05
	Misc. hay & pasture	11/21-2/20	11.47	.60	6.88	.77	6.11
	Miscellaneous truck	8/15-3/31	37.78	.70	26.45	1.35	25.10
	Nuts	2/21-11/20	60.79	.70	42.55	.58	41.97
	Potatoes--sweet	2/21-11/20	60.79	.70	42.55	.58	41.97
	Small grains	10/1-4/30	32.29	.70	22.60	.77	21.83
	Small grains	12/1-4/30	22.51	.70	15.76	.77	14.99
	Sorghums	7/1-10/31	30.02	.70	21.01	.58	20.43
	Sugar beet seed	9/15-12/31 & 3/1-6/30	43.98	.70	30.79	1.08	29.71
	Tomatoes	3/1-7/10	29.79	.75	22.34	0	22.34

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	CALIFORNIA (Continued)						
C-2-C	Yuma Valley						
	Alfalfa	2/23-11/24	59.30	0.85	50.40	0.64	49.76
	Alfalfa	11/25-2/22	11.33	.60	6.80	0	6.80
	Beans	3/1-5/31	18.10	.60	10.86	0	10.86
	Carrots--fall	8/1-1/31	32.21	.70	22.55	.64	21.91
	Carrots--spring	11/1-6/30	41.42	.70	28.99	0	28.99
	Citrus	1/1-12/31	70.63	.60	42.38	.64	41.74
	Corn	6/15-10/15	30.48	.75	22.86	.64	22.22
	Cotton	4/1-10/31	49.97	.62	30.98	.64	30.34
	Dates	1/1-12/31	70.63	.65	45.91	.64	45.27
	Deciduous fruits	2/23-11/24	59.30	.65	38.54	.64	37.90
	Flax	11/1-6/30	33.64	.80	26.91	0	26.91
	Lettuce--fall	9/1-11/30	16.62	.65	10.80	.64	10.16
	Lettuce--spring	11/1-3/31	20.66	.65	13.43	0	13.43
	Melons	3/1-7/31	34.52	.65	22.44	0	22.44
	Misc. hay & pasture	2/23-11/24	59.30	.80	47.44	.64	46.80
	Misc. hay & pasture	11/25-2/22	11.33	.60	6.80	0	6.80
	Miscellaneous truck	8/15-3/31	37.54	.70	26.28	.64	25.64
	Nurseries & flowers	1/1-12/31	70.63	.65	45.91	.64	45.27
	Nuts	2/23-11/24	59.30	.70	41.51	.64	40.87
	Potatoes--sweet	2/23-11/24	59.30	.70	41.51	.64	40.87
	Small grains	10/1-4/30	32.12	.70	22.48	0	22.48
	Small grains	12/1-4/30	22.33	.70	15.63	0	15.63
	Soil building crops	7/1-9/30	23.63	.85	20.09	.64	19.45
	Soil building crops	11/1-3/31	20.66	.70	14.46	0	14.46
	Sorghums	7/1-10/31	29.21	.70	20.45	.64	19.81
	Tomatoes	3/1-7/10	28.67	.75	21.50	0	21.50

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	CALIFORNIA (Continued)						
C-1-SS	Imperial Valley						
	Alfalfa 11/	1/29-12/9	55.45	0.85	47.13	1.67	45.46
	Alfalfa	12/9-1/29	6.33	.60	3.80	.60	3.20
	Carrots	10/1-6/30	49.27	.70	34.49	1.67	32.82
	Citrus	1/1-12/31	73.76	.60	44.26	2.27	41.99
	Cotton	4/1-10/31	52.24	.62	32.39	.60	31.79
	Dates	1/1-12/31	73.76	.65	47.94	2.27	45.67
	Flax	11/1-5/31	35.22	.80	28.18	1.67	26.51
	Grapes	2/1-9/30	55.84	.60	33.50	1.46	32.04
	Lettuce	10/1-2/28	21.96	.65	14.27	1.67	12.60
	Melons	12/1-6/30	39.05	.65	25.38	1.67	23.71
	Miscellaneous truck	10/1-6/30	49.27	.70	34.49	1.67	32.82
	Peas	2/1-5/31	23.14	.65	15.04	.86	14.18
	Rice	6/1-10/31	38.58	1.20	46.30	.60	45.70
	Sesbania	6/1-9/30	32.74	.85	27.83	.60	27.23
	Small grains	11/1-4/30	27.72	.70	19.40	1.67	17.73
	Sorghums	6/1-10/31	38.58	.70	27.01	.60	26.41
	Sugar beets	10/1-4/30	33.56	.70	23.49	1.67	21.82
	Tomatoes	11/1-5/31	35.22	.75	26.42	1.67	24.75
C-2-SS	Coachella Valley						
	Alfalfa 12/	2/6-12/12	54.55	.85	46.37	.22	46.15
	Alfalfa	12/12-2/6	8.30	.60	4.98	1.02	3.96
	Carrots	10/1-6/30	50.07	.70	35.05	1.24	33.81
	Citrus	1/1-12/31	75.00	.60	45.00	1.24	43.76

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	CALIFORNIA (Continued)						
	Coachella Valley (Continued)						
	Corn (sweet)	2/1-5/31	23.56	0.75	17.67	0	17.67
	Cotton	4/1-10/31	53.38	.62	33.10	0	33.10
	Dates	1/1-12/31	75.00	.65	48.75	1.24	47.51
	Flax	11/1-5/31	35.66	.80	28.53	1.24	27.29
	Grapes	2/1-9/30	56.98	.60	34.19	0	34.19
	Melons	12/1-6/30	39.72	.65	25.82	1.24	24.58
	Miscellaneous truck	10/1-6/30	50.07	.70	35.05	1.24	33.81
	Small grains	11/1-4/30	27.99	.70	19.59	1.24	18.35
	Tomatoes	11/1-5/31	35.66	.75	26.75	1.24	25.51
	NEVADA						
N-1-V	Virgin River						
	Alfalfa	3/2-11/14	58.35	.85	49.60	.68	48.92
	Alfalfa	2/6-3/1 & 11/15-11/28	4.78	.70	3.35	.69	2.66
	Deciduous fruits	3/2-11/14	58.35	.65	37.93	.68	37.25
	Melons	4/1-7/31	31.28	.65	20.33	0	20.33
	Misc. hay & pasture	3/2-11/14	58.35	.75	43.76	.68	43.08
	Misc. hay & pasture	2/6-3/1 & 11/15-11/28	4.78	.60	2.87	.69	2.18
	Miscellaneous truck	3/2-11/14	58.35	.70	40.84	.68	40.16
	Small grains	10/1-11/14 & 2/6-6/15	34.45	.70	24.12	.69	23.43
	Small grains	2/15-6/15	24.53	.70	17.17	.42	16.75
	Sorghums	6/1-9/30	32.85	.70	23.00	.68	22.32

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
	NEVADA (Continued)	Dates			Inches	Inches	Inches
N-2-V	Meadow Valley Wash						
	Alfalfa	5/7-10/15	33.20	0.85	28.22	4.20	24.02
	Alfalfa	3/17-5/6 & 10/16-10/29	9.03	.70	6.32	2.02	4.30
	Beans	5/15-8/15	20.84	.60	12.50	2.12	10.38
	Corn	5/15-9/15	27.08	.75	20.31	3.17	17.14
	Deciduous fruits	5/7-10/15	33.20	.65	21.58	4.20	17.38
	Misc. hay & pasture	5/7-10/15	33.20	.75	24.90	4.20	20.70
	Misc. hay & pasture	3/17-5/6 & 10/16-10/29	9.03	.60	5.42	2.02	3.40
	Miscellaneous truck	5/7-10/15	33.20	.70	23.24	4.20	19.04
	Potatoes—white	5/15-8/15	20.84	.70	14.59	2.18	12.41
	Small grains	5/1-7/31	20.12	.70	14.08	1.90	12.18
	Sorghums	6/1-9/30	26.60	.70	18.62	3.11	15.51
N-3-V	Muddy River						
	Alfalfa	3/9-11/13	55.90	.85	47.52	.62	46.90
	Alfalfa	2/6-3/8 & 11/14-11/28	5.98	.70	4.19	.62	3.57
	Corn	6/15-10/15	30.85	.75	23.14	.62	22.52
	Deciduous fruits	3/9-11/13	55.90	.65	36.34	.62	35.72
	Melons	4/1-7/31	30.46	.65	19.80	.62	19.18
	Misc. hay & pasture	3/9-11/13	55.90	.75	41.93	.62	41.31
	Misc. hay & pasture	2/6-3/8 & 11/14-11/28	5.98	.60	3.59	.62	2.97
	Miscellaneous truck	3/9-11/13	55.90	.70	39.13	.62	38.51
	Small grains	10/1-11/28 & 2/6-6/15	33.87	.70	23.71	.62	23.09
	Small grains	2/15-6/15	23.97	.70	16.78	.38	16.40
	Sorghums	6/1-9/30	32.09	.70	22.46	.62	21.84
	Sugar beet seed	9/15-11/28 & 3/1-6/30	38.62	.70	27.03	0	27.03

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period Dates	Consumptive use Factor (F)	Coefficient (K)	Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	NEVADA (Continued)						
N-1-C	Las Vegas						
	Alfalfa	3/9-11/17	54.79	0.85	46.57	1.14	45.43
	Alfalfa	2/5-3/8 & 11/18-11/30	5.87	.70	4.11	.55	3.56
	Corn	3/15-7/15	27.55	.75	20.66	.28	20.38
	Deciduous fruits	3/9-11/17	54.79	.65	35.61	1.14	34.47
	Grapes	3/9-11/17	54.79	.60	32.87	1.14	31.73
	Misc. hay & pasture	3/9-11/17	54.79	.75	41.09	1.14	39.95
	Misc. hay & pasture	2/5-3/8 & 11/18-11/30	5.87	.60	3.52	.55	2.97
	Miscellaneous truck	3/9-11/17	54.79	.70	38.35	1.14	37.21
	Small grains	10/1-11/30 & 2/5-6/15	33.53	.70	23.47	.55	22.92
	Small grains	2/15-6/15	23.31	.70	16.32	.32	16.00
N-2-C	Hoover Dam to Davis Dam						
	Alfalfa	2/7-12/4	65.85	.85	55.97	1.34	54.63
	Alfalfa	12/5-2/6	7.55	.60	4.53	1.49	3.04
	Small grains	10/1-4/30	32.21	.70	22.55	2.17	20.38
	NEW MEXICO						
NM-1-LC	Carrizo Wash						
	Corn	6/3-9/30	23.28	.75	17.46	7.26	10.20
	Misc. hay & pasture	6/3-9/30	23.28	.75	17.46	7.26	10.20
	Misc. hay & pasture	3/31-6/2 & 10/1-10/24	12.59	.60	7.55	1.91	5.64
	Small grains	5/15-9/10	23.19	.70	16.23	6.67	9.56

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Unit Area and crops	Growing period Dates	Consumptive use Factor (F)	Consumptive use Coefficient (K)	Consumptive use Use rate (U) Inches	Effective precipitation 1/ (R) Inches	(U-R) Inches
	NEW MEXICO (Continued)						
NM-2-LC	Zuni River						
	Alfalfa	5/23-9/30	26.61	0.85	22.62	5.89	16.73
	Alfalfa	3/22-5/22 & 10/1-10/28	12.80	.70	8.96	2.66	6.30
	Beans	6/1-8/31	19.80	.60	11.88	4.35	7.53
	Corn	6/1-9/30	25.03	.75	18.77	5.69	13.08
	Melons	6/1-9/30	25.03	.65	16.27	5.69	10.58
	Misc. hay & pasture	5/23-9/30	26.61	.75	19.96	5.89	14.07
	Misc. hay & pasture	3/22-5/22 & 10/1-10/28	12.80	.60	7.68	2.66	5.02
	Miscellaneous truck	5/23-9/30	26.61	.70	18.63	5.89	12.74
	Potatoes--white	6/1-8/31	19.80	.70	13.86	4.35	9.51
	Small grains	5/15-9/10	24.52	.70	17.16	5.14	12.02
NM-3-LC	Puerco River--Gallup						
	Alfalfa	5/8-10/8	30.20	.85	25.67	6.89	18.78
	Alfalfa	3/24-5/7 & 10/9-10/26	8.48	.70	5.94	1.81	4.13
	Beans	6/1-8/31	19.79	.60	11.87	4.45	7.42
	Corn	6/1-9/30	24.96	.75	18.72	5.99	12.73
	Misc. hay & pasture	5/8-10/8	30.20	.75	22.65	6.89	15.76
	Misc. hay & pasture	3/24-5/7 & 10/9-10/26	8.48	.70	5.09	1.81	3.28
	Miscellaneous truck	5/8-10/8	30.20	.70	21.14	6.89	14.25
	Small grains	5/1-7/31	18.81	.70	13.17	3.14	10.03

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	NEW MEXICO (Continued)						
NM-1-G	Gila River upstream from Virden						
	Alfalfa	5/3-10/8	33.64	0.85	28.59	7.09	21.50
	Alfalfa	3/4-5/2 & 10/9-11/13	13.38	.70	9.37	1.72	7.65
	Beans	5/15-8/15	20.90	.60	12.54	3.77	8.77
	Corn	5/15-9/15	27.33	.75	20.50	5.96	14.54
	Cotton	4/1-10/31	42.12	.62	26.11	7.88	18.23
	Deciduous fruits	5/3-10/8	33.64	.65	21.87	7.09	14.78
	Lettuce--spring	5/1-7/31	20.22	.65	13.14	2.53	10.61
	Misc. hay & pasture	5/3-10/8	33.64	.75	25.23	7.09	18.14
	Misc. hay & pasture	3/4-5/2 & 10/9-11/13	13.38	.60	8.03	1.72	6.31
	Miscellaneous truck	5/3-10/8	33.64	.70	23.55	7.09	16.46
	Potatoes--white	5/15-8/15	20.90	.70	14.63	3.77	10.86
	Small grains	4/15-7/15	18.72	.70	13.10	1.22	11.88
	Sorghums	6/1-9/30	26.93	.70	18.85	6.82	12.03
	Sugar beet seed	9/1-10/31 & 4/1-8/15	38.54	.70	26.98	6.55	20.43
NM-2-G	Virden Valley 13/						
	Alfalfa	4/1-10/31	45.75	.85	38.89	7.79	31.10
	Alfalfa	2/15-3/31 & 11/1-11/24	8.85	.70	6.20	1.76	4.44
	Cotton	4/1-10/31	45.75	.62	28.37	7.79	20.58
	Miscellaneous truck	4/1-10/31	45.75	.70	32.03	7.79	24.24
	Small grains	10/15-11/24 & 2/15-6/15	27.10	.70	18.97	2.30	16.67
	Small grains	4/15-7/15	20.63	.70	14.44	1.18	13.26
	Sorghums	6/1-9/30	28.96	.70	20.27	6.80	13.47

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use Factor (F)	Coefficient (K)	Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	NEW MEXICO (Continued)						
NM-3-G	San Francisco River						
	Alfalfa	5/25-10/4	25.96	0.85	22.07	7.86	14.21
	Alfalfa	3/21-5/24 & 10/5-10/29	12.67	.70	8.87	2.26	6.61
	Beans	6/1-8/31	19.14	.60	11.48	5.75	5.73
	Corn	6/1-9/30	24.24	.75	18.18	7.60	10.58
	Deciduous fruits	5/25-10/4	25.96	.65	16.87	7.86	9.01
	Misc. hay & pasture	5/25-10/4	25.96	.75	19.47	7.86	11.61
	Misc. hay & pasture	3/21-5/24 & 10/5-10/29	12.67	.60	7.60	2.26	5.34
	Miscellaneous truck	5/25-10/4	25.96	.70	18.17	7.86	10.31
	Potatoes--white	6/1-8/31	19.14	.70	13.40	5.75	7.65
	Small grains	5/1-7/31	18.24	.70	12.77	3.83	8.94
	Sorghums	6/1-9/30	24.24	.70	16.97	7.60	9.37
	UTAH						
U-1-C	Kanab Creek						
	Alfalfa	5/19-10/4	27.75	.85	23.59	4.73	18.86
	Alfalfa	3/24-5/18 & 10/5-10/28	11.27	.70	7.89	2.75	5.14
	Corn	6/1-9/30	24.95	.75	18.71	4.30	14.41
	Deciduous fruits	5/19-10/4	27.75	.65	18.04	4.73	13.31
	Misc. hay & pasture	5/19-10/4	27.75	.75	20.81	4.73	16.08
	Misc. hay & pasture	3/24-5/18 & 10/5-10/28	11.27	.60	6.76	2.75	4.01
	Miscellaneous truck	5/19-10/4	27.75	.70	19.42	4.73	14.69
	Small grains	10/1-10/28 & 3/24-7/15	23.77	.70	16.64	3.86	12.78
	Small grains	4/1-7/15	19.30	.70	13.51	2.52	10.99

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	UTAH (Continued)						
U-1-V	Virgin River 14/						
	Alfalfa	4/17-10/24	40.61	0.85	34.52	5.02	29.50
	Alfalfa	3/3-4/16 & 10/25-11/11	8.54	.70	5.98	2.56	3.42
	Corn	5/1-8/31	28.90	.75	21.68	2.75	18.93
	Deciduous fruits	4/17-10/24	40.61	.65	26.40	5.02	21.38
	Misc. hay & pasture	4/17-10/24	40.61	.75	30.46	5.02	25.44
	Misc. hay & pasture	3/3-4/16 & 10/25-11/11	8.54	.60	5.12	2.56	2.56
	Miscellaneous truck	4/17-10/24	40.61	.70	28.43	5.02	23.41
	Potatoes--white	4/17-7/15	19.70	.70	13.79	1.64	12.15
	Small grains	10/1-11/11 & 3/3-7/15	31.78	.70	22.25	4.95	17.30
	Small grains	3/15-7/15	24.49	.70	17.14	3.09	14.05
	Sorghums	6/1-9/30	28.51	.70	19.96	3.13	16.83
	Sugar beet seed	9/15-11/11 & 3/3-6/30	31.04	.70	21.73	4.98	16.75
	MEXICO						
M-1-G	San Pedro River						
	Alfalfa	4/6-10/27	44.21	.85	37.58	8.17	29.41
	Alfalfa	2/3-4/5 & 10/28-12/16	15.01	.70	10.51	1.51	9.00
	Corn	5/15-9/15	29.11	.75	21.83	7.52	14.31
	Miscellaneous truck	4/6-10/27	44.21	.70	30.95	8.17	22.78
	Potatoes--white	4/1-6/30	19.51	.70	13.66	0.63	13.03
	Small grains	10/1-12/16 & 2/3-5/31	30.67	.70	21.47	1.51	19.96
	Small grains	3/15-6/30	22.01	.70	15.41	0.63	14.78

Table 7 - Summary of estimates of normal consumptive use of water rates for irrigated crops for areas in the Lower Colorado River Basin (Continued).

Unit No.	Area and crops	Growing period	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 1/ (R)	(U-R)
		Dates			Inches	Inches	Inches
	MEXICO (Continued)						
M-2-G	Santa Cruz River						
	Alfalfa	4/1-11/17	47.71	0.85	40.55	11.68	28.87
	Alfalfa	2/4-3/31 & 11/18-12/17	11.19	.70	7.83	2.93	4.90
	Beans	4/15-7/15	20.49	.60	12.29	2.65	9.64
	Corn	4/15-8/15	28.00	.75	21.00	6.71	14.29
	Deciduous fruits	4/1-11/17	47.71	.65	31.01	11.68	19.33
	Miscellaneous truck	4/1-11/17	47.71	.70	33.40	11.68	21.72
	Potatoes--white	4/15-7/15	20.49	.70	14.34	2.65	11.69
	Small grains	10/1-12/17 & 2/4-5/31	30.35	.70	21.25	4.11	17.14
	Small grains	3/15-6/30	21.67	.70	15.17	1.11	14.06

1/ Months with precipitation of 0.55 inch or less omitted.
2/ Average water-supply shortage of 20 percent estimated for Black Creek.
3/ Average water-supply shortage of 20 percent estimated for Hopi, Ganado, and Leupp.
4/ Average water-supply shortage of 20 percent estimated for Moenkopi.
5/ Average water-supply shortage of 12 percent estimated for Duncan Valley.
6/ Average water-supply shortage of 14 percent estimated for Safford Valley.
7/ Average water-supply shortage of 12 percent estimated for Pinal County.
8/ Alfalfa permitted to lie dormant from August 1 to September 15 in Pinal County.
9/ Alfalfa permitted to lie dormant from August 1 to September 15 in Maricopa County upstream from Gillespie Dam.
10/ Alfalfa permitted to lie dormant from August 1 to September 15 in area from Gillespie Dam to Dome.
11/ Alfalfa permitted to lie dormant from August 1 to September 15 in Imperial Valley.
12/ Alfalfa permitted to lie dormant from August 1 to September 15 in Coachella Valley.
13/ Average water-supply shortage of 12 percent estimated for Virden Valley.
14/ Average water-supply shortage of 12 percent estimated for Virgin River in Utah.

Native Vegetation and Incidental Areas

Native or natural vegetation generally has first use of the water of a region. The consumption of water by native vegetation thus becomes of increasing importance as greater land areas are irrigated and during periods of drought. Careful consideration must be given to the consumptive water requirements of native vegetation before a complete inventory can be made of the water resources of the Lower Colorado River Basin.

Consumptive use of water by native vegetation varies according to the quantity of moisture available (3) (23). Plants adapted to an extreme economy of water do not continue the same low rate of use during periods of more abundant supply. Precipitation, varying widely from year to year, produces a more vigorous growth that has a greater consumptive use in wet years than in dry. Drought periods are seldom so severe that there is a widespread destruction of vegetation from lack of moisture.

Adaptation of plants to natural moisture conditions has distributed vegetation in more or less dominant communities which may be roughly classified as drought-resistant plants, phreatophytes (ground-water plants), and hydrophytes (plants that grow with roots submerged). Neither group is confined to any particular geographical area but is governed by local conditions. There are no fixed boundary lines between groups, for as ground-water conditions change with increased or decreased precipitation, the dominant communities advance or recede according to moisture available in the soil.

Much of the arid region has ground water only at depths beyond reach of plant roots, and in these areas plants depend entirely upon the scanty rainfall and the moisture that is held in the upper soil horizon. Desert sage, sage brush, creosote bush, desert grass and cacti are a few desert growths which subsist upon a meager rainfall.

Phreatophytes comprise a great variety, ranging from saltgrass to large cottonwood trees. River-bottom growths, such as salt cedars (tamarisk), cottonwoods, willows (baccharis) and tules, consume more water per given area than irrigated crops (2). In the Pecos River Joint Investigation the Division of Irrigation estimated that 70,000 acre-feet of water was consumed annually by some 13,000 acres of salt cedar in the vicinity of Lake McMillian (3).

Studies were made by the United States Geological Survey (14) in the Safford Valley along Gila River in southeastern Arizona in 1943 and 1944 to determine for that period the amount of water used by river-bottom vegetation in the 46-mile reach of valley between Thatcher and Calva. The portion of the valley studied included 9,279 acres of river-bottom land, covered more or less thickly by phreatophytes, plants which depend on ground-water for their water supply. A vegetation survey showed that the 9,279 acres contained the equivalent of 4,859 acres of plant growth at 100 per cent density or optimum natural concentration of growth. The consumptive use of water by the different species was computed by several methods, two of which are as follows: (A) from records obtained at an experiment station located in the river bottom area where plants were grown in tanks with known amounts of water added to maintain constant water levels in the tanks, and (B) from

records of the daily fluctuation of the water table obtained from wells located in river-bottom areas covered by the different species. By the two methods, the mean value of the depth of water used annually by each species at 100 per cent density of growth was computed by the United States Geological Survey (14) as 7.2 feet (86.4 inches) for salt cedar, 4.7 feet (56.4 inches) for baccharis, 6.0 feet (72 inches) for cottonwood, and 3.3 feet (39.6 inches) for mesquite. These data have been used to compute the values of consumptive-use coefficients (K) on a 100 per cent volume density basis for native vegetation as shown in table 4. Similar measurements on evaporation from sand, gravel and clayscil were also used to compute values of (K) for barren land in river-bottom areas. Coefficients shown in table 4 are applicable for 100 per cent volume density as defined by the U. S. Geological Survey in Safford Valley, Arizona Report (14). These coefficients should be reduced to represent densities determined by field surveys in accordance with criteria established for the Safford Valley.

Incidental areas, such as seeped lands, are moist areas within irrigation projects. These areas are the result of high ground water due to seepage from canals, over-irrigation, or both, and poor drainage. Seeped lands are generally in greasewood, rabbit-brush, willows, and tules depending on the degree of moisture present. In some areas, where alkali is concentrated, no vegetation grows and the water loss may be by evaporation from bare soil only.

Evaporation and meterological observations have been made at over fifteen stations in the Lower Colorado River Basin, some of which are shown in the appendix. The evaporation from the pans at these stations

vary considerably owing to differences in local climatic conditions and environment. Engineers usually employ a "reduction factor" of 0.70 to adjust U. S. Weather Bureau pan records to lake evaporation. However, this "reduction factor" has been known to vary from 0.60 for pans located in desert areas fully exposed to radiation from surrounding bare sand or rocks to 0.80 for pans located in irrigated or moist areas.

Coefficients (K) can be developed for computing evaporation by the formula U = KF. Since there is a difference of opinion as to which is the best method to use in estimating evaporation from lake and river surfaces in the Basin, it was decided not to include estimates of rates of evaporation in this report until further study was made of site conditions.

The results of computations of water consumption rates (U) for native vegetation and incidental areas by the formula U = KF are summarized in table 8. The estimates of rates of consumptive use (U) in table 8 include moisture supplied from all sources. By subtracting the effective rainfall for the period from these rates of use, the rates of consumption of ground water (U-R) at the point of use may be obtained.

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use Factor	Consumptive use Coefficient (K)	Consumptive use Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA							
Springerville							
Baccharis	3/24-10/29	38	1.00	37.76	0.38	14.35	8.44
Baccharis	3/24-10/29	31	1.00	37.76	.31	11.71	8.44
St. Johns to above Zuni River							
Baccharis	3/13-11/2	38	1.00	42.82	.38	16.27	8.78
Baccharis	3/13-11/2	31	1.00	42.82	.31	13.27	8.78
Arizona-New Mexico State Line to mouth of Zuni River							
Baccharis	3/13-11/2	38	1.00	42.82	.38	16.27	8.78
Baccharis	3/13-11/2	31	1.00	42.82	.31	13.27	8.78
Mouth of Zuni River to gage near Hunt							
Baccharis	3/13-11/2	38	1.00	42.82	.38	16.27	8.78
Silver Creek							
Baccharis	3/19-10/29	38	1.00	39.96	.38	15.18	11.01
Woodruff							
Baccharis	3/10-11/5	38	1.00	44.44	.38	16.89	6.66
Sand & gravel	1/1-12/31	100	.75	55.40	.75	41.55	10.37
Puerco River, Arizona-New Mexico State Line to Black Creek							
Cottonwood	3/24-10/26	50	1.25	38.68	.62	23.98	8.70
Black Creek							
Baccharis	3/27-10/25	38	1.00	37.65	.38	14.31	7.36
Puerco River, Black Creek to Adamana							
Cottonwood	3/15-11/1	25	1.25	42.44	.31	13.16	6.93
Puerco River, Adamana to mouth							
Cottonwood	3/7-11/6	25	1.25	46.20	.31	14.32	5.16

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Holbrook							
Salt cedar	3/7-11/6	38	1.50	46.20	0.57	26.33	5.16
Cottonwood	3/7-11/6	50	1.25	46.20	.62	28.64	5.16
Baccharis	3/7-11/6	25	1.00	46.20	.25	11.55	5.16
Hopi, Ganado, and Leupp							
Baccharis	3/18-10/31	38	1.00	41.73	.38	15.86	6.42
Sunrise to Grand Falls							
Cottonwood	3/8-11/3	25	1.25	45.34	.31	14.06	4.11
Moenkopi-Navajo Reservation							
Baccharis	3/17-11/1	38	1.00	42.74	.38	16.24	6.27
Grand Falls to Coconino Damsite							
Cottonwood	3/5-11/7	100	1.25	47.10	1.25	58.88	3.32
Kanab Creek--Fredonia							
Cottonwood	3/14-10/31	25	1.25	42.66	.31	13.22	6.42
Baccharis	3/14-10/31	38	1.00	42.66	.38	16.21	6.42
Grand Wash							
Cottonwood	2/22-11/15	50	1.25	53.20	.62	32.98	4.52
Virgin River--Littlefield							
Salt cedar	2/13-11/22	56	1.50	58.28	.84	48.96	2.05
Cottonwood	2/13-11/22	50	1.25	58.28	.62	36.13	2.05
Mesquite	2/13-11/22	56	.75	58.28	.42	24.48	2.05
Hoover Dam to Davis Dam (ARIZONA-NEVADA)							
Cottonwood	1/1-12/31	50	1.15	73.40	.58	42.57	2.83
Baccharis	1/1-12/31	56	.90	73.40	.50	36.70	2.83
Mesquite	1/1-12/31	56	.65	73.40	.36	26.42	2.83

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Davis Dam to Topock (ARIZONA-CALIFORNIA-NEVADA)							
Salt cedar	1/1-12/31	75	1.40	73.40	1.05	77.07	2.83
Cottonwood	1/1-12/31	75	1.15	73.40	.86	63.12	2.83
Baccharis	1/1-12/31	75	.90	73.40	.68	49.91	2.83
Mesquite	1/1-12/31	75	.65	73.40	.49	35.97	2.83
Tules	1/1-12/31	100	1.40	73.40	1.40	102.76	2.83
Salt cedar	1/1-12/31	56	1.40	73.40	.78	57.25	2.83
Cottonwood	1/1-12/31	56	1.15	73.40	.64	46.98	2.83
Baccharis	1/1-12/31	56	.90	73.40	.50	36.70	2.83
Mesquite	1/1-12/31	56	.65	73.40	.36	26.42	2.83
Baccharis	1/1-12/31	38	.90	73.40	.34	24.96	2.83
Mesquite	1/1-12/31	38	.65	73.40	.25	18.35	2.83
Topock to Parker Dam (ARIZONA-CALIFORNIA)							
Salt cedar	1/1-12/31	56	1.40	72.38	.78	56.46	3.52
Cottonwood	1/1-12/31	56	1.15	72.38	.64	46.32	3.52
Mesquite	1/1-12/31	56	.65	72.38	.36	26.06	3.52
Tules	1/1-12/31	100	1.40	72.38	1.40	101.33	3.52
Bill Williams River, (ARIZONA)							
Cottonwood	2/9-12/9	38	1.25	58.45	.48	28.06	9.65
Parker Dam to Laguna Dam (ARIZONA-CALIFORNIA)							
Salt cedar	1/1-12/31	75	1.40	71.42	1.05	74.99	2.07
Cottonwood	1/1-12/31	75	1.15	71.42	.86	61.42	2.07
Baccharis	1/1-12/31	75	.90	71.42	.68	48.57	2.07
Mesquite	1/1-12/31	75	.65	71.42	.49	35.00	2.07
Salt cedar	1/1-12/31	56	1.40	71.42	.78	55.71	2.07
Cottonwood	1/1-12/31	56	1.15	71.42	.64	45.71	2.07
Baccharis	1/1-12/31	56	.90	71.42	.50	35.71	2.07
Mesquite	1/1-12/31	56	.65	71.42	.36	25.71	2.07
Baccharis	1/1-12/31	31	.90	71.42	.28	20.00	2.07
Mesquite	1/1-12/31	31	.65	71.42	.20	14.28	2.07
Tules	1/1-12/31	100	1.40	71.42	1.40	99.99	2.07

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Laguna Dam to International Boundary (ARIZONA-CALIFORNIA)							
Salt cedar	1/1-12/31	75	1.40	70.63	1.05	74.16	0.64
Cottonwood	1/1-12/31	75	1.15	70.63	.86	60.74	.64
Baccharis	1/1-12/31	75	.90	70.63	.68	48.03	.64
Mesquite	1/1-12/31	75	.65	70.63	.49	34.61	.64
Salt cedar	1/1-12/31	56	1.40	70.63	.78	55.09	.64
Cottonwood	1/1-12/31	56	1.15	70.63	.64	45.20	.64
Baccharis	1/1-12/31	56	.90	70.63	.50	35.32	.64
Mesquite	1/1-12/31	56	.65	70.63	.36	25.43	.64
Baccharis	1/1-12/31	31	.90	70.63	.28	19.78	.64
Mesquite	1/1-12/31	31	.65	70.63	.20	14.13	.64
Sand & gravel	1/1-12/31	100	.75	70.63	.75	52.97	3.46
Tules	1/1-12/31	100	1.40	70.63	1.40	98.88	.64
Duncan Valley (Gila River)							
Salt cedar	2/15-11/24	50	1.50	54.59	.75	40.94	9.56
Cottonwood	2/15-11/24	50	1.25	54.59	.62	33.85	9.56
Baccharis	2/15-11/24	25	1.00	54.59	.25	13.65	9.56
Mesquite	2/15-11/24	25	.75	54.59	.19	10.37	9.56
Mesquite	2/15-11/24	38	.75	54.59	.28	15.29	9.56
San Francisco River							
Cottonwood	3/2-11/14	50	1.25	47.35	.62	29.36	12.68
Mesquite	3/2-11/14	56	.75	47.35	.42	19.89	12.68
Eagle Creek							
Cottonwood	2/20-11/20	50	1.25	51.84	.62	32.14	11.43
Mesquite	2/20-11/20	38	.75	51.84	.28	14.52	11.43
Safford Valley--Solomon to Ft. Thomas							
Salt cedar	2/9-11/26	56	1.50	56.87	.84	47.77	6.79
Cottonwood	2/9-11/26	50	1.25	56.87	.62	35.26	6.79
Baccharis	2/9-11/26	38	1.00	56.87	.38	21.61	6.79

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Safford Valley--Solomon to Ft. Thomas (Continued)							
Cottonwood	2/9-11/26	25	1.25	56.87	0.31	17.63	6.79
Baccharis	2/9-11/26	25	1.00	56.87	.25	14.22	6.79
Baccharis	2/9-11/26	56	1.00	56.87	0.56	31.85	6.79
Mesquite	2/9-11/26	56	.75	56.87	.42	23.89	6.79
Mesquite	2/9-11/26	38	.75	56.87	.28	15.92	6.79
Mesquite	2/9-11/26	25	.75	56.87	.19	10.81	6.79
Safford Valley--Ft. Thomas to Calva							
Salt cedar	2/6-12/1	56	1.50	59.45	.84	49.94	9.24
Cottonwood	2/6-12/1	50	1.25	59.45	.62	36.86	9.24
Baccharis	2/6-12/1	56	1.00	59.45	.56	33.29	9.24
Mesquite	2/6-12/1	56	.75	59.45	.42	24.97	9.24
Cottonwood	2/6-12/1	25	1.25	59.45	.31	18.43	9.24
Mesquite	2/6-12/1	29	.75	59.45	.22	13.08	9.24
Cottonwood	2/6-12/1	75	1.25	59.45	.94	55.88	9.24
Baccharis	2/6-12/1	25	1.00	59.45	.25	14.86	9.24
San Carlos River							
Cottonwood	2/6-12/1	50	1.25	59.45	.62	36.86	9.24
Baccharis	2/6-12/1	56	1.00	59.45	.56	33.29	9.24
Calva to Coolidge Dam							
Salt cedar	2/6-12/1	56	1.50	59.45	.84	49.94	9.24
Cottonwood	2/6-12/1	50	1.25	59.45	.62	36.86	9.24
Mesquite	2/6-12/1	38	.75	59.45	.28	16.65	9.24
Hereford Valley--Upper San Pedro							
Baccharis	2/3-12/16	50	1.00	59.22	.50	29.61	9.68
Baccharis	2/3-12/16	38	1.00	59.22	.38	22.50	9.68
Sand & gravel	1/1-12/31	100	.75	64.47	.75	48.35	11.81

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Middle San Pedro River--Charleston to Mammoth							
Cottonwood	2/5-12/3	50	1.25	57.39	0.62	35.58	9.16
Baccharis	2/5-12/3	56	1.00	57.39	.56	32.14	9.16
Mesquite	2/5-12/3	47	.75	57.39	.35	20.09	9.16
Sand & gravel	1/1-12/31	100	.75	64.15	.75	48.11	11.92
Cottonwood	2/5-12/3	25	1.25	57.39	.31	17.79	9.16
Baccharis	2/5-12/3	38	1.00	57.39	.38	21.81	9.16
Mesquite	2/5-12/3	38	.75	57.39	.28	16.07	9.16
San Pedro River--Mammoth to mouth							
Cottonwood	2/8-11/28	50	1.25	56.80	.62	35.22	10.17
Baccharis	2/8-11/28	50	1.00	56.80	.50	28.40	10.17
Mesquite	2/8-11/28	50	.75	56.80	.38	21.58	10.17
Sand & gravel	1/1-12/31	100	.75	64.30	.75	48.23	15.29
Baccharis	2/8-11/28	57	1.00	56.80	.57	32.38	10.17
Mesquite	2/8-11/28	57	.75	56.80	.43	24.42	10.17
Coolidge Dam to Kelvin (Gila River)							
Salt cedar	2/3-12/3	56	1.50	58.13	.84	48.83	10.49
Cottonwood	2/3-12/3	50	1.25	58.13	.62	36.04	10.49
Baccharis	2/3-12/3	56	1.00	58.13	.56	32.55	10.49
Mesquite	2/3-12/3	56	.75	58.13	[illegible]	24.41	10.49
San Rafael--Upper Santa Cruz							
Cottonwood	2/4-12/17	50	1.25	58.94	.62	36.54	15.38
Baccharis	2/4-12/17	38	1.00	58.94	.38	22.40	15.38
Mesquite	2/4-12/17	38	.75	58.94	.28	16.50	15.38
Santa Cruz County--Santa Cruz River							
Cottonwood	2/4-12/17	50	1.25	58.94	.62	36.54	13.30
Baccharis	2/4-12/17	38	1.00	58.94	.38	22.40	13.30
Mesquite	2/4-12/17	47	.75	58.94	.35	20.63	13.30
Sand & gravel	1/1-12/31	100	.75	64.21	.75	48.16	16.11

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Pima County--Santa Cruz River							
Cottonwood	1/1-12/31	25	1.15	68.53	0.29	19.87	9.97
Baccharis	1/1-12/31	38	.90	68.53	.34	23.30	9.97
Mesquite	1/1-12/31	38	.65	68.53	.25	17.13	9.97
Baccharis	1/1-12/31	41	.90	68.53	.37	25.36	9.97
Cottonwood	1/1-12/31	50	1.15	68.53	.58	39.75	9.97
Baccharis	1/1-12/31	34	.90	68.53	.31	21.24	9.97
Pinal County--Gila & Santa Cruz Rivers							
Salt cedar	1/1-12/31	38	1.40	70.76	.53	37.50	8.23
Cottonwood	1/1-12/31	50	1.15	70.76	.58	41.04	8.23
Baccharis	1/1-12/31	38	.90	70.76	.34	24.06	8.23
Mesquite	1/1-12/31	56	.65	70.76	.36	25.47	8.23
Tules	1/1-12/31	100	1.40	70.76	1.45	99.06	8.23
Baccharis	1/1-12/31	47	.90	70.76	.42	29.72	8.23
Mesquite	1/1-12/31	66	.65	70.76	.43	30.43	8.23
Clay loam	1/1-12/31	100	.55	70.76	.55	38.92	9.28
Black River--Upper Salt River							
Baccharis	4/8-10/16	50	1.00	30.83	.50	15.42	13.15
Fort Apache Indian Reservation--Upper Salt River							
Cottonwood	3/7-11/10	25	1.25	45.27	.31	14.03	11.11
Baccharis	3/7-11/10	100	1.00	45.27	1.00	45.27	11.11
Baccharis	3/7-11/10	50	1.00	45.27	.50	22.64	11.11
Cherry Creek--Upper Salt River							
Baccharis	2/20-11/26	50	1.00	52.50	.50	26.25	17.62
Salt River Canyon to Roosevelt Reservoir							
Cottonwood	2/1-12/22	50	1.25	64.83	.62	40.19	11.33
Mesquite	2/1-12/22	38	.75	64.83	.28	18.15	11.33

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Tonto Creek and Tributaries							
Cottonwood	2/22-11/22	50	1.25	51.71	0.62	32.06	13.89
Mesquite	2/22-11/22	38	.75	51.71	.28	14.48	13.89
Roosevelt Reservoir							
Salt cedar	2/1-12/22	56	1.50	64.83	.84	54.46	11.33
Cottonwood	2/1-12/22	50	1.25	64.83	.62	40.19	11.33
Baccharis	2/1-12/22	25	1.00	64.83	.25	16.21	11.33
Mesquite	2/1-12/22	56	.75	64.83	.42	27.23	11.33
Apache Lake (Horse Mesa Dam)							
Cottonwood	1/1-12/31	50	1.15	71.33	.58	41.37	14.94
Mesquite	1/1-12/31	56	.65	71.33	.36	25.68	14.94
Canyon Lake (Mormon Flat Dam)							
Cottonwood	1/1-12/31	50	1.15	73.47	.58	42.61	13.68
Mesquite	1/1-12/31	56	.65	73.47	.36	26.45	13.68
Sahuaro Lake (Stewart Mountain Dam)							
Mesquite	1/1-12/31	56	.65	73.47	.36	26.45	12.09
Stewart Mountain Dam to Granite Reef Dam							
Mesquite	1/1-12/31	38	.65	73.47	.25	18.37	12.09
Sand & gravel	1/1-12/31	100	.75	73.47	.75	55.10	13.06
Sand & gravel	1/1-12/31	100	.75	58.92	.75	44.19	9.32
Sand & gravel	1/1-12/31	100	.75	50.80	.75	38.10	8.52
Verde River upstream from Camp Verde							
Cottonwood	2/15-11/27	50	1.25	55.17	.62	34.21	11.12
Mesquite	2/15-11/27	38	.75	55.17	.28	15.45	11.12
Middle Verde River and Tributaries							
Cottonwood	2/26-11/18	50	1.25	49.67	.62	30.80	13.47
Mesquite	2/26-11/18	38	.75	49.67	.28	13.91	13.47

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Bartlett Reservoir							
Cottonwood	1/1-12/31	50	1.15	71.03	0.58	41.20	13.52
Mesquite	1/1-12/31	56	.65	71.03	.36	25.57	13.52
Bartlett Dam to mouth of Verde River							
Cottonwood	1/1-12/31	50	1.15	71.03	.58	41.20	13.52
Mesquite	1/1-12/31	47	.65	71.03	.31	22.02	13.52
Lake Pleasant (Agua Fria River)							
Mesquite	1/1-12/31	38	.65	70.63	.25	17.66	7.03
Maricopa County upstream from Gillespie Dam							
Salt cedar	1/1-12/31	75	1.40	70.11	1.05	73.62	7.41
Salt cedar	1/1-12/31	56	1.40	70.11	.78	54.69	7.41
Salt cedar	1/1-12/31	50	1.40	70.11	.70	49.08	7.41
Salt cedar	1/1-12/31	38	1.40	70.11	.53	37.16	7.41
Salt cedar	1/1-12/31	25	1.40	70.11	.35	24.54	7.41
Salt cedar	1/1-12/31	19	1.40	70.11	.27	18.93	7.41
Cottonwood	1/1-12/31	75	1.15	70.11	.86	60.29	7.41
Cottonwood	1/1-12/31	50	1.15	70.11	.58	40.66	7.41
Cottonwood	1/1-12/31	25	1.15	70.11	.29	20.33	7.41
Baccharis	1/1-12/31	50	.90	70.11	.45	31.55	7.41
Baccharis	1/1-12/31	38	.90	70.11	.34	23.84	7.41
Baccharis	1/1-12/31	25	.90	70.11	.22	15.42	7.41
Baccharis	1/1-12/31	12	.90	70.11	.11	7.71	7.41
Mesquite	1/1-12/31	75	.65	70.11	.49	34.35	7.41
Mesquite	1/1-12/31	56	.65	70.11	.36	25.24	7.41
Mesquite	1/1-12/31	38	.65	70.11	.25	17.53	7.41
Mesquite	1/1-12/31	19	.65	70.11	.12	8.41	7.41
Gillespie Dam to Dome--Gila River							
Salt cedar	1/1-12/31	56	1.40	73.44	.78	57.28	2.88
Salt cedar	1/1-12/31	38	1.40	73.44	.53	38.92	2.88
Salt cedar	1/1-12/31	19	1.40	73.44	.27	19.83	2.88

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
ARIZONA (Continued)							
Gillespie Dam to Dome--Gila River (Continued)							
Cottonwood	1/1-12/31	56	1.15	73.44	0.64	47.00	2.88
Mesquite	1/1-12/31	56	.65	73.44	.36	26.44	2.88
Mesquite	1/1-12/31	38	.65	73.44	.25	18.36	2.88
Sand & gravel	1/1-12/31	100	.75	73.44	.75	55.08	5.17
CALIFORNIA							
Imperial Valley							
Salt cedar	1/1-12/31	75	1.40	73.76	1.05	77.45	.62
Cottonwood	1/1-12/31	75	1.15	73.76	.86	63.43	.62
Baccharis & Misc. brush	1/1-12/31	75	.90	73.76	.68	50.16	.62
Mesquite	1/1-12/31	75	.65	73.76	.49	36.14	.62
Salt cedar	1/1-12/31	50	1.40	73.76	.70	51.63	.62
Cottonwood	1/1-12/31	50	1.15	73.76	.58	42.78	.62
Baccharis & Misc.	1/1-12/31	50	.90	73.76	.45	33.19	.62
Mesquite	1/1-12/31	50	.65	73.76	.33	24.34	.62
Salt cedar	1/1-12/31	25	1.40	73.76	.35	25.82	.62
Cottonwood	1/1-12/31	25	1.15	73.76	.29	21.39	.62
Baccharis & Misc.	1/1-12/31	25	.90	73.76	.22	16.23	.62
Mesquite	1/1-12/31	25	.65	73.76	.16	11.80	.62
Tules	1/1-12/31	100	1.40	73.76	1.40	103.26	.62
Clay loam (Wet)	1/1-12/31	100	.55	73.76	.55	40.57	3.66
Coachella Valley							
Salt cedar	1/1-12/31	75	1.40	75.00	1.05	78.75	.14
Cottonwood	1/1-12/31	75	1.15	75.00	.86	64.50	.14
Baccharis & Misc.	1/1-12/31	75	.90	75.00	.68	51.00	.14
Mesquite	1/1-12/31	75	.65	75.00	.49	36.75	.14

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
CALIFORNIA (Continued)							
Coachella Valley (Continued)							
Salt cedar	1/1-12/31	50	1.40	75.00	0.70	52.50	0.14
Cottonwood	1/1-12/31	50	1.15	75.00	.58	43.50	.14
Baccharis & Misc.	1/1-12/31	50	.90	75.00	.45	33.75	.14
Mesquite	1/1-12/31	50	.65	75.00	.33	24.75	.14
Salt cedar	1/1-12/31	25	1.40	75.00	.35	26.25	.14
Cottonwood	1/1-12/31	25	1.15	75.00	.29	21.75	.14
Baccharis & Misc.	1/1-12/31	25	.90	75.00	.22	16.50	.14
Mesquite	1/1-12/31	25	.65	75.00	.16	12.00	.14
Tules	1/1-12/31	100	1.40	75.00	1.40	105.00	.14
Sand & gravel (Wet)	1/1-12/31	100	.75	75.00	.75	56.25	3.15
NEVADA							
Virgin River (NEVADA-UTAH)							
Salt cedar	2/6-11/28	56	1.50	63.13	.84	53.03	1.37
Cottonwood	2/6-11/28	50	1.25	63.13	.62	39.14	1.37
Mesquite	2/6-11/28	56	.75	63.13	.42	26.51	1.37
Salt cedar	2/6-11/28	19	1.50	63.13	.28	17.68	1.37
Mesquite	2/6-11/28	38	.75	63.13	.28	17.68	1.37
Meadow Valley Wash							
Mesquite	3/17-10/29	75	.75	42.23	.56	23.65	6.22
Muddy River							
Cottonwood	2/6-11/28	75	1.25	61.88	.94	58.17	1.24
Mesquite	2/6-11/28	50	.75	61.88	.38	23.51	1.24
Mesquite	2/6-11/28	44	.75	61.88	.33	20.42	1.24
NEW MEXICO							
Zuni River							
Baccharis	3/22-10/28	38	1.00	39.41	.38	14.98	8.55

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
NEW MEXICO (Continued)							
Puerco River--Gallup							
Baccharis	3/24-10/26	38	1.00	38.68	0.38	14.70	8.70
Gila River upstream from Virden							
Cottonwood	3/4-11/13	50	1.25	47.02	.62	29.15	8.81
Baccharis	3/4-11/13	38	1.00	47.02	.38	17.87	8.81
Mesquite	3/4-11/13	38	.75	47.02	.28	13.17	8.81
Virden Valley							
Cottonwood	2/15-11/24	50	1.25	54.60	.62	33.85	9.55
Baccharis	2/15-11/24	25	1.00	54.60	.25	13.65	9.55
Mesquite	2/15-11/24	38	.75	54.60	.28	15.29	9.55
Mesquite	2/15-11/24	25	.75	54.60	.19	10.37	9.55
San Francisco River							
Cottonwood	3/21-10/29	50	1.25	38.63	.62	23.95	10.12
Baccharis	3/21-10/29	25	1.00	38.63	.25	9.66	10.12
Mesquite	3/21-10/29	38	.75	38.63	.28	10.82	10.12
UTAH							
Kanab Creek							
Cottonwood	3/24-10/28	50	1.25	39.02	.62	24.19	7.48
Baccharis	3/24-10/28	38	1.00	39.02	.38	14.83	7.48
Virgin River							
Cottonwood	3/3-11/11	56	1.25	49.15	.70	34.40	7.58
MEXICO							
San Pedro River							
Baccharis	2/3-12/16	25	1.00	59.22	.25	14.80	9.68
Sand & gravel	1/1-12/31	100	.75	64.47	.75	48.35	11.81

Table 8. Summary of estimates of normal consumptive use of water rates for native vegetation and incidental areas in the Lower Colorado River Basin (Continued).

Area and type 1/	Period 2/	Volume density 3/	K 100% volume density	Consumptive use: Factor (F)	Consumptive use: Coefficient (K)	Consumptive use: Use rate (U)	Effective precipitation 4/ (R)
	Dates	Percent				Inches	Inches
MEXICO (Continued)							
Santa Cruz River							
Cottonwood	2/4-12/17	50	1.25	58.90	0.62	36.52	14.61
Baccharis	2/4-12/17	38	1.00	58.90	.38	22.38	14.61
Mesquite	2/4-12/17	38	.75	58.90	.28	16.49	14.61

1/ Baccharis includes phreatophytic brushes.

2/ Computed on the basis of monthly consumptive-use factor (f) of 3.50.

3/ Volume density as determined by field survey of Bureau of Reclamation.

4/ Months with precipitation of 0.55 inch or less omitted for native vegetation. Total precipitation is effective for sand and gravel, and clay loam.

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APPENDIX

Table 1 - Selected Weather Bureau Stations and average killing frosts, October 1, 1913 - September 30, 1945, Lower Colorado River Basin

Table 2 - Average temperature in degrees fahrenheit, October 1, 1913 - September 30, 1945, Lower Colorado River Basin

Table 3 - Average precipitation in inches, October 1, 1913 - September 30, 1945, Lower Colorado River Basin

Table 4 - Average evaporation in inches, October 1, 1913 - September 30, 1945, Lower Colorado River Basin

Table 5 - Monthly and annual evaporation from pans in various stations in the Lower Colorado River Basin

Table 6 - Daytime hour percentages for each month of the year for latitudes 30 to 40 degrees north of equator

Copy of letter dated September 29, 1950 from E. A. Moritz, Regional Director, Region III, U. S. Bureau of Reclamation, to George D. Clyde, Chief of Division of Irrigation and Water Conservation, U. S. Soil Conservation Service.

Note: Tables 1 through 5 have been omitted here as they are included in Appendix A of the report on water supply in the Lower Colorado River Basin.

Table 6. Daytime hour percentages for each month of the year for latitudes 31 to 39 degrees north of the equator 1/.

Latitude	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
31°													
Regular year	7.25	6.99	8.37	8.74	9.58	9.55	9.72	9.25	8.34	7.96	7.15	7.10	100
Leap year	7.23	7.23	8.35	8.72	9.56	9.52	9.70	9.22	8.32	7.94	7.13	7.08	100
32°													
Regular year	7.20	6.97	8.36	8.75	9.63	9.60	9.77	9.28	8.34	7.94	7.10	7.06	100
Leap year	7.18	7.21	8.34	8.73	9.60	9.57	9.75	9.25	8.32	7.92	7.09	7.04	100
33°													
Regular year	7.15	6.94	8.36	8.78	9.67	9.64	9.83	9.31	8.35	7.92	7.06	6.99	100
Leap year	7.13	7.18	8.34	8.76	9.65	9.61	9.81	9.28	8.33	7.90	7.04	6.97	100
34°													
Regular year	7.10	6.92	8.35	8.80	9.72	9.70	9.88	9.33	8.36	7.90	7.02	6.92	100
Leap year	7.08	7.16	8.33	8.78	9.69	9.68	9.85	9.31	8.33	7.88	7.00	6.91	100
35°													
Regular year	7.05	6.88	8.35	8.83	9.76	9.77	9.93	9.37	8.36	7.87	6.97	6.86	100
Leap year	7.03	7.12	8.33	8.80	9.74	9.74	9.90	9.35	8.34	7.85	6.96	6.84	100
36°													
Regular year	6.99	6.86	8.35	8.85	9.81	9.83	9.99	9.40	8.36	7.85	6.92	6.79	100
Leap year	6.97	7.09	8.33	8.83	9.79	9.80	9.96	9.38	8.34	7.83	6.91	6.77	100
37°													
Regular year	6.93	6.82	8.35	8.87	9.87	9.89	10.05	9.44	8.37	7.82	6.87	6.72	100
Leap year	6.91	7.06	8.33	8.85	9.84	9.87	10.02	9.41	8.35	7.80	6.85	6.71	100
38°													
Regular year	6.87	6.79	8.34	8.90	9.92	9.95	10.10	9.47	8.38	7.80	6.82	6.66	100
Leap year	6.85	7.03	8.32	8.87	9.89	9.93	10.08	9.45	8.36	7.78	6.80	6.64	100
39°													
Regular year	6.81	6.76	8.33	8.93	9.97	10.02	10.16	9.51	8.38	7.77	6.77	6.59	100
Leap year	6.80	6.99	8.31	8.90	9.95	9.99	10.14	9.49	8.36	7.75	6.75	6.57	100

1/ Computed from data in Weather Bureau Bulletin No. 805, Sunshine Tables by C. F. Marvin (Edition 1905, reprinted 1944).

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION III
BOULDER CITY, NEVADA

September 29, 1950

Mr. George D. Clyde
Chief, Division of Irrigation
Soil Conservation Service
College Hill, Box D
Logan, Utah

Dear Mr. Clyde:

You will recall that a final report by the Engineering Advisory Committee to the Upper Colorado River Basin Commission was released on November 29, 1948. This report comprises a water supply study for the Upper Colorado River Basin. You will also recall that arrangements were made with you for Mr. Harry F. Blaney and Mr. Wayne D. Criddle to assist in the preparation of that report. Your representatives prepared an appendix which deals with the rates of consumptive use of water by various agricultural crops and native vegetation and evaporation from water surfaces in the Upper Colorado River Basin, which includes portions of Arizona, Colorado, New Mexico, Utah and Wyoming.

A similar report for the Lower Colorado River Basin, which includes parts of Arizona, California, Nevada, New Mexico and Utah, is now in the preliminary stage of preparation by the Bureau of Reclamation. A preliminary draft of this report will be made available to the interested Basin States prior to its release in final form. During the past few months, Messrs. Blaney and Harris of your division have conferred in Phoenix with representatives of the Bureau of Reclamation on various problems relating to the preparation of this report. I understand that you were able to attend one of these discussions in Phoenix.

We would appreciate it if you could arrange for Messrs. Blaney and Harris to prepare an appendix for the water supply report on the Lower Colorado River Basin similar to that prepared by Messrs. Blaney and Criddle for the Upper Colorado River Basin. I understand that the details of what is desired to be included in this appendix were discussed tentatively by Messrs. Blaney and Harris and Bureau of Reclamation representatives during a recent conference in Phoenix. It would be appreciated if a preliminary draft of this appendix could be made available at an early date.

The referenced appendix would be included in its entirety in the report. I believe it would be highly desirable, if agreeable to you,

for your representatives to review the preliminary drafts of the complete report prior to review by the States.

If you are agreeable to Messrs. Blaney and Harris undertaking this assignment, and if you will furnish us an estimate of the cost, we will undertake to find means of reimbursing the Soil Conservation Service for that cost.

Sincerely yours,

/s/ E. A. Moritz
E. A. Moritz
Regional Director

C O P Y