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WATER BULLETIN NUMBER 8

Flow of the Rio Grande and Tributary Contributions

From San Marcial, New Mexico
to the Gulf of Mexico

1938

WITH MAXIMUMS, MINIMUMS, AND NORMALS

AUTHENTICATED DISCHARGE RECORDS 1889-1938

STORAGE CAPACITIES AND WATER STORED IN LARGE RESERVOIRS OF THE RIO GRANDE BASIN 1938

RUN-OFFS FROM SUB-DIVISIONS OF THE RIO GRANDE BASIN 1924-1938

DIVERSIONS

SILT, CHEMICAL CONSTITUENTS, BACTERIA AND DISSOLVED OXYGEN

THE RIO GRANDE SALT BURDEN 1935-1938

FLOODS SINCE 1828 ABOVE PRESIDIO, TEXAS

RAINFALL AND EVAPORATION

DRAINAGE BASIN AND IRRIGATED AREAS

CONTENTS

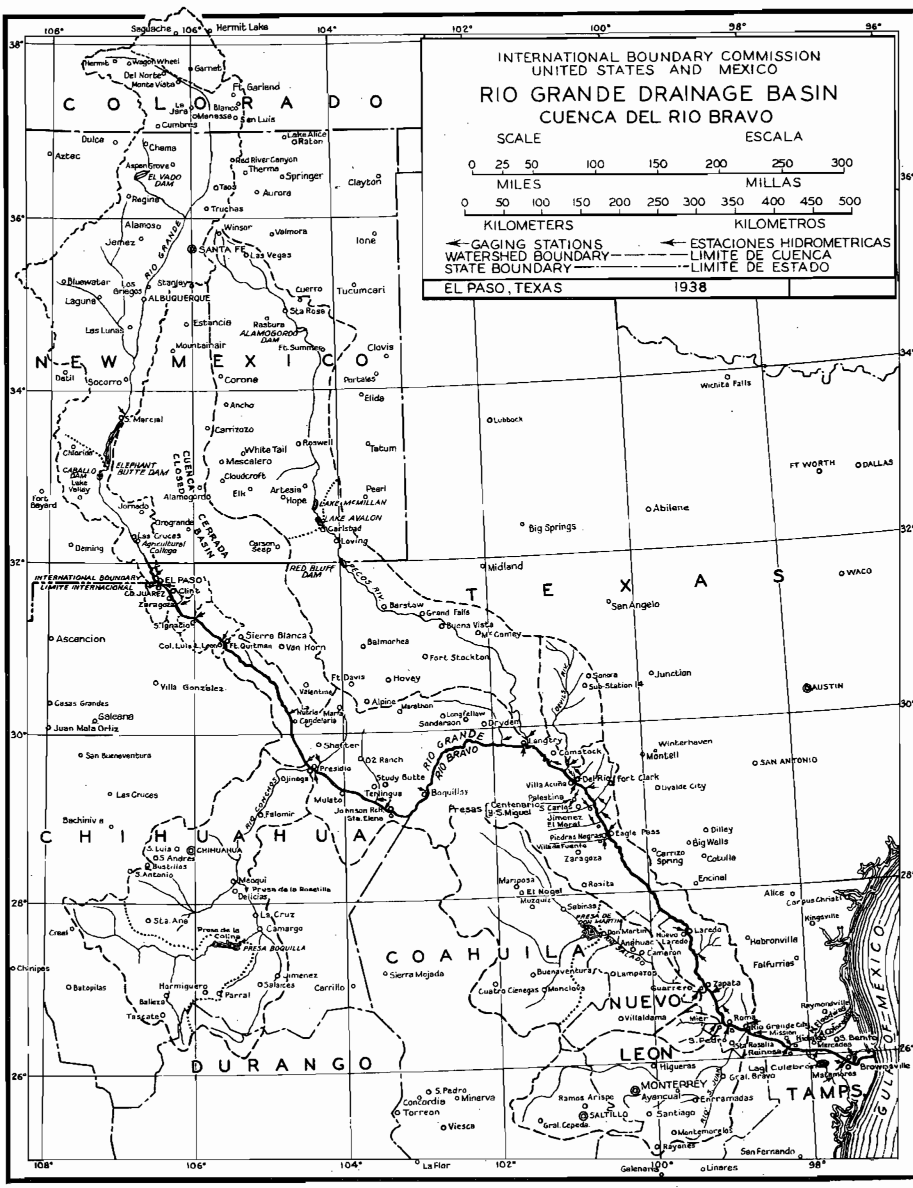

Photo-Offset—McMath, El Paso

RIO GRANDE DRAINAGE BASIN

CUENCA DEL RIO BRAVO

FOREWORD

This compilation of stream discharges and related data is the eighth unified publication relative to the cooperative determination of the flow of the international portion of the Rio Grande. The first such publication was Water Bulletin No. 1, covering the year 1931. These data are published jointly by the United States and Mexican Sections of the International Boundary Commission and represent the results of stream flow measurements made on the Rio Grande and on important tributaries near their confluence, from San Marcial, New Mexico, which is at the head of Elephant Butte reservoir, to the Gulf of Mexico, for the year 1938 as well as adjustments to and authentications of hydrographic records.

International stream gaging was begun in 1889, with the operation of the station at El Paso, Texas. A number of stations on the Lower Rio Grande and tributaries below El Paso were established in 1900 and operated until 1914. From 1914 to 1923, all such work was suspended except for a few months in 1919 and 1920. In 1923 the work was resumed and carried on independently by the two countries until 1931, when the present cooperative work began.

The duties and functions of the United States Section of the International Water Commission were transferred to the United States Section of the International Boundary Commission by Act of June 30, 1932. On January 1, 1932, the Mexican Section of the International Boundary Commission similarly took over the duties of the Mexican Section of the International Water Commission. On January 1, 1935, an International Water Commissioner for Mexico was again appointed and since then, though separated, the two Commissions function as one.

This cooperative arrangement for obtaining hydrologic data is the result of the concurrence and agreement by both sections of the International Commission that a coordinated result should be insured and that an accurate and complete hydrographic record of international flow was necessary.

Of stream gaging stations on the Rio Grande, those at Juarez, Chihuahua, Laredo, Texas, and Matamoros, Tamaulipas, were operated in 1938 by the Mexican Section of the Commission, the others by the United States Section. Each section operated the gaging stations on tributaries entering the Rio Grande from its own country, or on floodways or diversions within its borders.

Acknowledgments

Some of the data published herein relative to chemical and bacteriological analyses, silt, stored water, evaporation and rainfall have been furnished by the following agencies within the two countries; United States Department of Agriculture, United States Bureau of Reclamation, Agricultural and Mechanical College of Texas, Middle Rio Grande Conservancy District, Red Bluff Water Power Control District, El Paso City-County Health Unit, Federal Board of Public Improvements of Nuevo Laredo, Tamaulipas, National Irrigation Commission of Mexico, Cia. Agricola y de Fuerza Electrica Del Rio Conchos, S. A., the Mexican Department of Agriculture and Development. Specific acknowledgment is made where the data appear.

General Hydrologic Conditions for 1938

Along and Adjacent to
The International Portion of the Rio Grande

For 1938 the yearly flow of the Rio Grande and most of its tributaries were above normal. From Lower Presidio to Langtry it was the maximum year for the period 1924 to 1938. This was caused by 2 floods from the Conchos during 1938. After receiving the contributions of all tributaries the flow at Rio Grande City was 118% of normal. However, the flow during the first 6 months of 1938 at Rio Grande City was only 57% of normal. The lowest flow for the year at this point was 984 second feet on June 11. Two periods of extreme low flow occurred in the Lower Rio Grande Valley in the first six months of the year, viz: an average flow at Lower Brownsville Station of 40 second feet from April 13 to April 19, and 17 second foot average from June 9 to June 19. During the former period the river was dry for part of the day of April 15, and during the latter period the river was dry from June 16 to June 18 and part of June 19.

The measured United States tributaries below Fort Quitman flowed about 1,161,000 acre feet, or 105% of their annual average, while the Mexican measured tributaries flowed about 4,125,000 acre feet, or 143% of their annual average.

During 1938 three flood peaks occurred at Rio Grande City, the first on July 28 with a peak flow of 89,000 second feet. It came largely out of the Devils river and was contributed to by the area along the Rio Grande from Langtry to Del Rio. The second occurred August 31 with a peak flow of 147,000* second feet. It came wholly from the Rio San Juan. The third occurred September 29, with a peak flow of 52,000 second feet. It came wholly from the Rio Conchos, and flooded the Presidio Valley causing $140,000 of damage there.

The monthly average amount of water in storage in all large reservoirs on the Rio Grande basin was about 3,280,000 acre feet, which was about normal. The Caballo Reservoir on the Rio Grande, with a storage capacity of 153,000 acre feet began operation this year.

The amount of water consumed in irrigation decreased slightly in the El Paso-Juarez Valley. Along the Rio Grande from Ft. Quitman to Upper Presidio on the Mexican side, there was slightly increased consumption; on the Conchos, consumption was about the same as in 1937 and 151% of normal. On the Pecos below Red Bluff Dam, consumption in 1938 was about 15% greater than in 1937 and 122% of normal. Consumption increased some near Eagle Pass. On the Rio Salado, consumption was only about 16% of the 1937 consumption and 15% of normal, due to water shortage. In the Lower Rio Grande Valley, consumption was about 107% of 1937 and 112% of normal. At other places along the Rio Grande and its tributaries below Fort Quitman, there was little change in the amount of water consumed in irrigation.

Precipitation was subnormal for the year in the entire basin below Fort Quitman, and was shortest on the United States side.

Evaporation over the entire basin was greater than usual, being 104% of normal.

Seventeen thousand acre feet of suspended silt passed down the Rio Grande at Eagle Pass. This was about 172% of average. At Roma, the suspended silt was about 19,800 acre feet, which was 157% of normal.

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* See page 41.

FOREWORD — continued

The tonnage of salts for the year carried by the Rio Grande at the various gaging stations, and the tributary contributions of salts was in general above the average; in general there was a decrease in the salt concentration. This decrease in concentration was greatest on the Conchos and San Juan rivers.

Total bacteria and bacilus coli in the Rio Grande water at El Paso on the Ysleta-Zaragosa bridge was less than 1937. At Nuevo Laredo these were about normal.

Authenticated Discharge Records

A table shows the publications in which may be found discharge records of the Rio Grande and its tributary inflows below San Marcial, New Mexico, which have been authenticated by this Commission.

Quantity of Water

There are here shown for the year 1938: Descriptions of gaging stations and their equipment with pertinent notes concerning elevations of gages, station records, high and low flows in previous years, and factors modifying the stream discharge including acreages irrigated, also the mean daily discharges at points along the Rio Grande and the mean daily inflows from measured tributaries.

Extreme monthly high and low gage heights and peak discharges also average monthly rates of discharge, for each regular station.

The flow of the Rio Conchos was not measured directly, but its flow is shown.

There are also shown: Monthly and annual maximum, minimum and normal discharges in acre feet for the period 1924 to 1938, inclusive, for each gaging station.

The amount of water in storage at the end of each month of 1938 in all large reservoirs of the Rio Grande basin.

The average dry weather losses and gains in river channel from Fort Quitman to Rio Grande City are also shown.

Sources of River Flow

By graph there is shown progressively from station to station downstream, the normal flow for the two periods 1900 to 1913 and 1924 to 1938, and also the maximum and minimum flows. On this graph there is also shown normal unused run-off per square mile for various sub-divisions of the Rio Grande basin below Fort Quitman.

Three maps are presented for the period 1924 to 1938. For sub-divisions of the water-shed they show in average annual acre feet per square mile: (a) the unused stream flow, (b) the total water-shed yield and (c) the total water-shed yield less the estimated deep spring flow.

Diversions

The tabulations covering 1938 or portions thereof, show for the Acequia Madre (Mexican Canal) near Juarez, Chihuahua, the El Paso Valley above Fort Quitman, Texas, and for Hidalgo and Cameron Counties, Texas, the amount of water diverted from the Rio Grande, the average acreage of land irrigated, the average duty of water, and the average annual rainfall. The diversions into the American Canal at El Paso are also shown.

Quality of Water

With reference to the probable life of storage reservoirs on the Rio Grande, there is shown the results of silt sampling at 3 points on the Rio Grande and on 2 tributaries.

Showing the suitability of the water of the Rio Grande and tributaries for irrigation use, there is recorded detailed chemical analyses of water samples from seven important points on the Rio Grande and from four tributaries in 1938, and also a graphical representation of the salt burden in tons, its sources and its concentration in the stream flow for 1937 and three year averages for 1935 to 1938.

With reference to the use of Rio Grande water for domestic, recreational, municipal or industrial purposes, there is shown the results of bacteriological examinations of water samples at Nuevo Laredo, Tamaulipas, and in the vicinity of El Paso, Texas. The results of tests for dissolved oxygen in Rio Grande water, near El Paso, are also shown.

Floods

The average frequency of Rio Grande floods of different peak flows is shown for the past 109 years at Fort Quitman and Lower Presidio, together with other related flood occurrences.

Evaporation and Rainfall

For its pertinent relation to floods, irrigation and losses from reservoirs there is brought together here from numerous sources, evaporation observations at points on both sides of the basin, also rainfall records from the United States side for 1938 and previous years not published elsewhere, and many rainfall records from the Mexican side of the basin for 1938.

Drainage Basin and Irrigated Areas

The drainage basin areas shown in the descriptive matter for each gaging station have been determined from the most reliable sources available. This year the drainage basin areas between the El Paso and Fort Quitman gaging stations were more carefully determined and these new figures are used herein, otherwise last year's figures are used.

From the best sources available there are shown in the descriptive matter for each gaging station the acreages irrigated from point to point within the basin below San Marcial, New Mexico on the Rio Grande, and below Red Bluff Dam on the Pecos river.

AUTHENTICATED DISCHARGE RECORDS

The tabulation below shows in what publications authenticated discharge records may be found for gaging stations on the Rio Grande from San Marcial, New Mexico, to the Gulf of Mexico, and on tributaries at points near their confluence with the Rio Grande below San Marcial. The table covers all of the years of record for San Marcial and El Paso gaging stations. For stations below El Paso the table covers only the years of record within the two periods: 1900 to 1913 and 1924 to 1938

Name of Gaging Station	Records for The Years (inclusive)	Considered Correct as Published in the Following
San Marcial	Jan. and Sept. - Dec. 1895	W. B. 7
	Feb. - Aug. 1895	W.S.P. 358
	1896 - 1930	W.S.P. 358, 388, 408, 438, 458, 478, 508, 528, 628, 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Below Elephant Butte Dam	1938	W. B. 8
Below Caballo Dam	1938	W. B. 8
El Paso	Jan. 1 - May 9, 1889	W. B. 7
	May 10, 1889 - June 30, 1893	W.S.P. 358
	July - Dec. 1893	W.B. 7
	1894, 1895, 1896	W. B. 7
	Jan. 1897 - Mar. 1914	W.S.P. 358, 388
	Apr. 1914 - July 1914	W. B. 7
	Aug. 1914 - Nov. 1915	W.S.P. 388, 408, 568
	Dec. 1915	W. B. 7
	1916 - 1930	W.S.P. 568, 588, 608, 628, 648, 668e, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Below American Dam	June - Dec. 1938	W. B. 8
El Paso Sewage Outfall	1936 - 1938	W. B. 8
Cd. Juarez	April - Dec. 1938	W. B. 8
Island	Aug. 17-Dec. 1938	W. B. 8
Tornillo Bridge	1924 - 1927	W. B. 5
	Oct. 1927 - 1930	W.S.P. 668, 688, 703, 718
	1931 - 1937	W. B. 1, 2, 3, 4, 5, 6, 7
County Line	1938	W. B. 8
Ft. Quitman	1924 - 1930	W.S.P. 588, 608, 628, 648, 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8

Name of Gaging Station	Records for The Years (inclusive)	Considered Correct as Published in the Following
La Nutria	June 1935 - 1938	W. B. 5, 6, 7, 8
Upper Presidio	May * 1900 - 1913	W. B. 7
	1924 - 1925	W.S.P. 588,608,628
	1926 *	W. B. 4
	1927 - 1928	W. B. 4
	1929 - 1930	W. B. 3
	1931 - 1932	W. B. 1, 2
	1933 *	W. B. 3, 4
	1934 - 1938	W. B. 4, 5, 6, 7, 8
Rio Conchos	May 1900 - 1913	W. B. 7
	1924 - 1932 *	W. B. 7
	1933 - 1938	W. B. 5, 6, 7, 8
Lower Presidio	May * 1900 - 1913	W. B. 7
	1924 * - 1932 †	W. B. 7
	1933 - 1938	W.B. 3,4,5,6,7,8
Alamito Creek	1932 - 1938	W. B. 2, 3, 4, 5 6, 7, 8
Terlingua Creek	1932 - 1936	W. B. 2, 3, 4, 5, 6
	1937 *	W. B. 7, 8
	1938	W. B. 8
Johnson Ranch	Apr. 1936 - 1938	W. B. 6, 7, 8
Boquillas	1924 - 1928	W. B. 5
	1929 - 1930	W. S. P. 688, 703, 718
	Apr. 1931 - 1936	W. B. 1, 2, 3, 4, 5, 6
Lozier Creek	1932 - 1935	W. B. 2, 3, 4, 5
Langtry	May * 1900 - 1913	W. B. 7
	1924 * - 1927	W. B. 4
	1928 - 1930	W.S.P. 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Pecos River	May 1900 - 1913	W. B. 7
	1924 - 1930	W.S.P. 588, 608, 628, 648, 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8

W. S. P. - Water Supply Paper of the U. S. Geological Survey. † Station moved June, 1932.
W. B. - Water Bulletins of this Commission. * Partially revised in last named Water Bulletin.
e - The monthly totals for the year 1928 are slightly revised on page 46, Water Bulletin No. 6.

AUTHENTICATED DISCHARGE RECORDS — continued

Name of Gaging Station	Records for The Years (inclusive)	Considered Correct as Published in the Following
Goodenough Springs	1924 - 1929	W. B. 5
	Feb. 1929 - 1930	W.S.P. 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Devils River	May 1900 - 1913	W. B. 7
	1924 - 1930	W.S.P. 588, 608, 628, 648, 668, 688, 703, 718
	1931 - 1932 *	W. B. 1, 2, 5
	1933 * - 1934 *	W. B. 3, 4, 5
	1935 - 1938	W. B. 5, 6, 7, 8
Cienegas Creek	Sept. 1931 - June 1935	W. B. 1, 2, 3, 4, 5
Del Rio	May* 1900 - 1913	W. B. 7
	1924 *	W.S.P.588,608-W.B.4
	1925 - 1930	W.S.P. 608,628,648, 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Arroyo Las Vacas	Partial Records June 1935 - Mar. 1938	W. B. 6, 7, 8
	Apr. - Dec. 1938	W. B. 8
San Felipe Creek	Sept. 1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Sycamore Creek	May 1932 - 1935	W. B. 2, 3, 4, 5
Pinto Creek	Nov. 1928 - 1930	W.S.P. 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Rio San Diego	Oct. 1932 - 1938	W. B. 2, 3, 4, 5, 6, 7, 8
Las Moras Creek	1932 - 1934 *	W.B. 2, 3, 4, 5
	1935	W. B. 5
Rio San Rodrigo	1932 - 1938	W. B. 2, 3, 4, 5, 6, 7, 8
Eagle Pass	May * 1900 - 1913	W. B. 7
	1924 * - 1926	W. B. 4
	1927 - 1930	W.S.P. 648, 668, 688, 703, 718
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Rio Escondido	1932 - 1938	W. B. 2, 3, 4, 5 6, 7, 8
Laredo	May * 1900 - 1913	W. B. 7
	1924 - 1925 *	W. B. 4
	1926 *	W. B. 4, 5
	1927 - 1928	W. B. 4
	1929 - 1930	W. B. 3
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Dolores Creek	May 1932 - 1936	W. B. 2, 3, 4, 5, 6
Rio Salado	May 1900 - 1913	W. B. 7
	1924 - 1928	W. B. 5
	1929 - 1930	W. B. 3
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Zapata	1932 - 1938	W. B. 2, 3, 4, 5, 6, 7, 8
El Tigre Creek	Apr. 1932 - 1936	W. B. 2, 3, 4, 5, 6
Rio Alamo	1924 - 1928	W. B. 5
	1929 - 1930	W. B. 3
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Roma	Sept.* 1900 -1913	W. B. 7
	1924 - 1929	W. B. 5
	Mar. 1929 - 1930	W.S.P. 688, 703, 718
	1931	W. B. 1
	1932 *	W. B. 2, 3
	1933 - 1938	W. B. 3,4,5,6,7,8
Rio San Juan	Oct. 1900 - 1913	W. B. 7
	1924 - 1928	W. B. 5
	1929 - 1930	W. B. 3
	1931,1932* - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Los Olmos Creek	Mar. 1932 - 1936	W. B. 2, 3, 4, 5, 6
Rio Grande City	1924 - 1931	W. B. 5
	1932* - 1938	W. B. 2, 3, 4, 5, 6, 7, 8
Hidalgo	July 1928 - 1930	W.S.P. 668, 688, 703, 718
	1931	W. B. 1
	Partial Records 1932 - 1936	W. B. 2, 3, 4, 5, 6
	May - Dec. 1938	W. B. 8
Mercedes Bridge	Sept. Oct. 1932 - 1932	W. B. 2
	Partial Records 1935 - 1936	W. B. 5, 6
	Nov. Dec. 1937 - 1937	W. B. 7
	Partial Record 1938	W. B. 8
Matamoros	May 1900 - 1913	W. B. 7
	Sept. 1924 - 1926	W.S.P. 588, 608, 628
	Oct. 1926 - 1928	W. B. 5
	1929 - 1930	W. B. 3
	1931 - 1938	W. B. 1, 2, 3, 4, 5, 6, 7, 8
Lower Brownsville	1934 - 1938	W. B. 4, 5, 6, 7, 8

W.S.P. - Water Supply Paper of the U. S. Geological Survey.
W. B. - Water Bulletins of this Commission. * Partially revised in last named Water Bulletin.

RIO GRANDE AT SAN MARCIAL STATION

DESCRIPTION: Two water-stage recorders and cable with sit down cable car and winch located at railroad bridge about one mile below San Marcial, N. M. One recorder is on the downstream end of the South abutment of the bridge. The zero of this gage is 4,459.08 feet, U.S.C. & G.S. sea level datum. This recorder was the official gage from April 13, 1937, to June 30, 1938. It was removed on Nov. 17, 1938. Beginning July 1, 1938, the other recorder was the official gage. It is on the upstream end of the first bridge pier from the south abutment of the bridge. The zero of its gage is 4,455.38 feet, on above datum.

RECORDS: Based upon 160 meter measurements, by wading, and from cable about 1,000 feet above railroad bridge (124 measurements by I.B.C. and 36 by U.S.G.S.). Computations by shifting channel methods. 1938 records good. Records available Jan. 1895 to Dec. 1938. See table of Authenticated Discharge Records herein.

REMARKS: For gage history 1895 to 1937 see Water Bulletins Nos. 4 and 7. During 1938 the river continued to flow through the Val Verde area. See Water Bulletin No. 7.

El Vado reservoir on the Rio Chama in New Mexico and many irrigation diversions above this station in Colorado and New Mexico modify the river flow. With all closed basins eliminated, the drainage area above this station is 24,717 square miles, all in the United States.

COMPARATIVE FLOWS FROM PREVIOUS RECORDS: Momentary peak: Max., Oct. 11, 1904, 50,000 sec. ft. with water surface level of 4,459.5 ft. on U.S.C. & G.S. datum about 1/4 mile above the present station gage. This is the greatest flood peak flow in the past 110 years, or since 1828 or before. Min., sometimes dry. See Water Bulletin No. 6, p. 79, for all large peak flows since 1828 and their average frequency. Daily: Max., Oct. 11, 1904, 33,000 sec. ft. average. Min., sometimes dry. Monthly: Max., May, 1905, 15,649 sec. ft. average. Min., sometimes dry. Yearly: Max., 1905, 3,350 sec. ft. average. Min., 1902, 277 sec. ft. average. Two Successive Years: Max., 1905 and 1906, 2,750 sec. ft. average. Min., 1899 and 1900, 487 sec. ft. average. Three Successive Years: Max., 1905 to 1907, 2,830 sec. ft. average. Min., 1900 to 1902, 609 sec. ft. average. Four Successive Years: Max., 1905 to 1908, 2,390 sec. ft. average. Min., 1899 to 1902, 539 sec. ft. average. Five Successive Years: Max., 1905 to 1909, 2,260 sec. ft. average. Min., 1898 to 1902, 697 sec. ft. average. Ten Successive Years: Max., 1903 to 1912, 1,980 sec. ft. average. Min., 1925 to 1934, 1,170 sec. ft. average. Forty-Three Year Average: 1,550 sec. ft.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	682	615	658	293	4,840	3,650	5,790	354	361	246	1,030	607
2	670	666	728	215	4,830	3,780	6,110	320	449	217	842	597
3	674	642	652	174	5,360	4,530	4,060	585	1,920	183	652	593
4	722	630	562	203	6,740	4,390	3,420	233	3,830	170	663	707
5	780	578	1,020	152	6,910	3,840	3,250	* 150	3,780	188	623	857
6	809	628	1,340	168	*6,680	3,840	2,320	* 170	3,130	250	622	913
7	772	662	1,250	180	5,230	4,050	* 1,750	* 463	2,310	220	604	917
8	764	690	1,110	168	4,750	3,200	1,320	167	1,470	210	666	897
9	714	673	1,010	144	4,500	3,830	861	171	2,660	276	738	1,050
10	645	638	816	119	3,990	4,680	* 592	361	2,710	2,590	870	1,020
11	609	593	757	185	3,270	4,630	* 401	241	1,280	2,240	486	981
12	562	552	739	204	3,250	4,150	271	247	1,400	1,260	531	985
13	537	597	628	124	3,050	3,590	304	233	3,240	980	460	944
14	559	618	587	107	3,080	3,650	228	641	2,990	825	639	935
15	616	564	579	111	2,700	3,390	254	728	1,750	1,350	722	1,050
16	663	586	637	82.5	2,800	4,200	1,140	1,210	1,260	1,230	1,020	1,060
17	649	867	553	95.1	3,830	3,360	2,600	1,010	972	1,430	790	1,100
18	653	1,120	575	251	3,840	3,000	3,250	388	1,100	1,120	562	1,010
19	635	978	524	382	4,780	2,870	1,840	242	1,590	927	* 704	970
20	630	899	663	353	5,350	3,710	2,080	171	1,510	699	* 998	1,080
21	711	777	454	416	5,940	3,650	2,550	134	776	826	* 715	975
22	743	746	467	443	5,670	2,420	3,250	138	803	880	* 592	999
23	696	794	450	1,360	5,850	2,430	2,860	162	730	967	* 688	1,030
24	709	713	332	2,200	5,440	2,710	1,600	317	664	1,010	* 469	1,010
25	577	602	278	3,110	5,030	3,260	1,310	193	629	1,090	* 811	977
26	666	672	283	4,130	4,690	2,490	1,060	87.2	565	980	* 1,110	915
27	873	626	199	4,560	4,180	2,480	743	54.3	462	817	* 1,140	857
28	739	591	203	4,870	3,740	3,160	622	55.0	464	847	* 865	759
29	626		259	5,200	2,990	5,280	541	113	391	824	* 679	732
30	545		448	5,040	3,330	4,570	1,240	117	290	740	679	741
31	567		510		3,790		590	336		715		722
Sum	20,797	19,317	19,271	35,039.6	140,430	108,790	58,207	9,791.5	45,486	26,307	21,970	27,990

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	1.74	.41	27	1,060	26	306	671	41,300	42,063	56,000	17,400
Feb.	1.88	.56	19	1,170	12	377	690	38,300	47,329	77,100	29,600
Mar.	2.10	-.47	5	1,390	30	157	622	38,200	55,674	113,000	23,400
Apr.	3.55	-1.02	29	5,290	15	18.7	1,170	69,500	129,882	407,000	16,850
May	3.63	.62	4	7,410	15	2,280	4,530	279,000	263,369	608,000	4,450
June	2.32	-.25	29	6,160	23	2,240	3,630	216,000	147,161	368,000	228
July	6.06	.12	2	7,320	14	178	1,880	115,000	55,226	157,140	0
Aug.	2.38	-.72	17	1,570	28	46.9	316	19,400	50,712	275,000	1,620
Sept.	4.72	-.07	5	4,440	30	270	1,520	90,200	61,961	308,000	2,920
Oct.	3.58	-.33	10	2,980	4	164	849	52,200	35,367	123,000	0
Nov.	2.32	.18	26	1,730	24	298	732	43,600	30,275	76,200	2,550
Dec.	1.71	.65	17	1,160	1	491	903	55,500	41,031	58,400	15,100
Yearly	3.63	-.72		7,410		18.7	1,460	1,058,200	960,050	1,557,800	244,489

* Partly Estimated.

RIO GRANDE AT BELOW ELEPHANT BUTTE DAM STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car with winch. The recorder is located at the south side of the pool immediately below the dam. The cable is .75 mile below the recorder. Zero of the gage at the recorder is at elevation 4,255.10 feet on United States Coast and Geodetic Survey sea level datum.

RECORDS: Based upon 91 meter measurements during the year and a stable rating curve. Records available: 1915 to 1938. 1938 records good. Records furnished by the El Paso Office of the United States Bureau of Reclamation.

REMARKS: The station described here is operated by the Reclamation Bureau. It has been the official station since 1931. Prior to 1931 it was located at other points a little farther downstream. See United States Geological Survey Water Supply Papers. The river flow at this station is completely modified by irrigation diversions in Colorado and New Mexico, and by reservoirs. There are no irrigations above this station and below the San Marcial gaging station which is 43.9 river miles upstream at the upper end of Elephant Butte reservoir.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.6	10.6	630	1,890	1,820	2,520	599	1,990	933	1,220	11.8	2,950
2	10.6	10.6	725	1,920	1,830	2,340	789	2,080	11.6	1,110	11.8	2,950
3	10.6	8.4	725	1,980	1,820	2,440	1,120	2,570	11.6	838	11.8	2,950
4	10.6	10.6	805	1,970	1,800	2,530	1,300	2,510	10.5	598	11.8	2,950
5	10.6	10.6	1,060	2,010	1,710	2,530	1,300	2,670	10.5	355	11.8	2,950
6	10.6	10.6	1,070	2,090	1,710	2,460	1,540	2,570	11.6	351	16.0	2,950
7	10.6	395	1,070	2,090	1,720	2,390	1,720	2,460	10.5	133	13.1	2,950
8	10.6	524	938	2,090	1,720	2,390	1,770	2,690	10.5	37.2	11.8	2,940
9	10.6	392	764	2,190	1,720	2,330	2,340	2,440	10.5	11.8	13.1	2,940
10	9.9	316	818	2,190	1,720	2,110	2,380	2,570	9.8	13.0	11.8	2,940
11	10.6	520	884	2,200	1,730	2,180	2,250	2,370	9.8	11.8	11.8	2,930
12	10.6	797	1,080	2,290	1,730	2,330	2,020	2,180	9.8	10.7	10.7	1,950
13	10.6	821	1,100	2,400	1,790	2,330	2,060	2,150	9.8	11.8	10.7	15.0
14	10.6	838	1,100	2,400	1,900	2,330	2,150	2,070	10.5	541	11.8	16.8
15	10.6	884	1,100	1,880	1,900	2,330	1,910	2,070	10.5	2,010	11.8	15.9
16	9.1	856	1,100	1,980	1,900	2,280	2,070	2,000	10.5	2,020	827	14.0
17	9.9	848	1,070	2,010	1,930	2,160	2,220	1,950	9.8	2,020	11.8	14.0
18	9.9	596	1,110	2,010	1,960	2,160	2,230	1,950	9.8	2,020	892	14.0
19	9.1	1,040	1,620	2,010	1,960	2,160	2,140	1,810	500	1,810	2,560	15.0
20	9.1	1,810	2,240	1,940	1,960	1,660	1,870	1,880	903	1,020	686	15.0
21	9.1	409	2,640	1,840	1,960	2,120	1,660	2,010	1,320	795	11.8	15.0
22	10.6	409	1,350	1,870	1,920	1,960	1,570	2,000	1,130	11.8	11.8	15.9
23	10.6	385	1,580	2,040	1,880	2,580	1,490	1,980	425	11.8	679	16.8
24	10.6	328	1,660	2,100	1,850	2,340	1,490	1,930	647	13.1	1,920	16.8
25	11.8	377	1,720	2,120	1,770	2,400	1,540	1,930	827	11.8	13.1	15.9
26	10.6	582	1,870	2,120	1,740	2,400	1,590	2,000	925	13.1	718	15.9
27	10.6	582	1,870	2,180	1,900	1,370	1,590	2,130	1,130	11.8	2,580	16.8
28	10.6	583	1,870	2,100	2,040	1,100	1,790	2,200	1,220	11.8	2,810	17.8
29	10.6		1,900	2,000	2,060	731	1,840	2,240	1,220	11.8	2,960	17.8
30	10.6		1,900	1,770	1,480	477	1,870	2,180	1,220	11.8	2,960	16.8
31	10.6		1,900		2,170		2,010	1,900		11.8		15.0
Sum	321.7		41,269		57,100		54,218		12,577.6		19,822.1	
		14,353.4		61,680		63,438		67,480		17,057.9		34,650.2

Month 1938	Extreme Gage Feet — 1938		Extreme Second Feet * — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.			25	11.8	†16	9.1	10.4	638	2,584	11,000	184
Feb.			20	1,810	3	8.4	513	28,500	29,279	57,500	7,370
Mar.			21	2,640	1	630	1,330	81,900	66,607	88,500	43,200
Apr.			†13	2,400	30	1,770	2,060	122,000	113,020	136,000	84,400
May			31	2,170	30	1,480	1,840	113,000	107,007	155,000	78,500
June			23	2,580	30	477	2,110	126,000	121,533	146,000	101,000
July			10	2,380	1	599	1,750	108,000	123,787	137,000	97,800
Aug.			8	2,690	19	1,810	2,180	134,000	122,973	162,000	78,700
Sept.			21	1,320	†10	9.8	419	24,900	70,987	93,400	24,900
Oct.			†16	2,020	12	10.7	550	33,800	16,356	34,700	506
Nov.			†29	2,960	†12	10.7	661	39,300	13,963	39,300	4,810
Dec.			† 1	2,950	†16	14.0	1,120	68,700	14,007	68,700	1,490
Yearly				2,960		8.4	1,220	880,738	802,103	1,003,484	637,534

† And other days * Mean daily

RIO GRANDE AT BELOW CABALLO DAM STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car and winch located 3/4 river mile below Caballo Dam. Elevation of zero of the gage was 4,147.03 feet from February 26 to October 7, when it was changed to 4,146.03 feet. On October 13 it was again changed to 4,145.03 feet. All elevations are on U. S. C. & G. S. sea level datum.

RECORDS: Based upon 221 meter measurements since February 26, 1938. Records available: February 26 to December 31, 1938. 1938 records good. Records furnished by the El Paso Office of the United States Bureau of Reclamation.

REMARKS: This is a new gaging station installed by the Bureau of Reclamation on the Rio Grande on February 26, 1938 to measure the flow from the new Caballo reservoir. Caballo Dam is located on the Rio Grande 26.7 river miles below Elephant Butte Dam. The river flow here is completely modified by reservoirs and irrigation diversions above this station. Between Elephant Dam and Caballo Dam 93 acres were irrigated by diversions from the Rio Grande. This station is about 1-1/2 miles upstream from Percha Dam (a low diversion dam) at which point records have been kept in past years. Small accretions to the river take place between this station and Percha Dam. 1,430 acre feet of water, not accounted for in the tables below, were diverted from Caballo reservoir into a small irrigation canal (Bonito lateral) just below the dam.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	54.1	48.0	591	1,780	1,880	2,250	646	1,980	1,480	1,160	74.0	36.0
2	54.0	48.0	681	1,860	1,910	2,290	929	2,050	672	1,160	75.0	32.0
3	53.9	48.0	726	1,820	1,930	2,260	1,360	2,130	904	1,130	73.0	31.0
4	53.8	48.0	775	1,810	1,800	2,260	1,670	2,420	872	1,020	73.0	33.0
5	53.6	48.0	988	1,580	1,670	2,260	1,660	2,430	804	735	75.0	35.0
6	53.2	48.0	998	1,830	1,700	2,220	1,740	2,430	719	406	72.0	38.0
7	52.8	48.0	931	1,990	1,720	2,200	1,790	2,430	490	138	71.0	36.0
8	52.4	379	907	1,950	1,660	2,260	2,000	2,420	279	73.0	72.0	34.0
9	52.0	458	796	1,940	1,660	2,220	2,130	2,280	474	205	71.0	35.0
10	51.6	353	799	1,980	1,620	2,200	2,000	2,190	507	125	71.0	37.0
11	51.2	325	804	2,080	1,650	2,220	2,280	2,240	499	97.0	73.0	37.0
12	50.8	505	1,020	2,080	1,660	2,200	2,050	2,340	492	92.0	71.0	37.0
13	50.4	701	1,080	1,830	1,740	2,200	2,200	2,240	504	98.0	550	213
14	50.0	751	1,060	1,760	1,990	2,100	2,210	2,140	518	111	788	816
15	49.6	766	970	1,650	1,890	2,120	1,940	2,050	483	294	845	979
16	49.2	781	1,110	2,040	1,870	2,120	2,060	2,100	450	852	806	984
17	48.8	885	1,090	2,120	1,890	2,050	2,150	2,100	437	984	812	790
18	48.4	756	1,100	1,980	1,970	2,080	2,140	2,100	490	970	484	355
19	48.0	504	1,240	1,890	1,920	2,080	2,060	2,060	617	980	180	115
20	47.6	416	1,470	1,880	1,870	2,080	1,860	1,970	666	978	74.0	5.6
21	47.3	360	1,290	1,920	1,870	2,120	1,620	1,950	759	794	80.0	4.1
22	47.4	356	1,360	2,010	1,880	2,300	1,530	1,960	856	106	76.0	3.1
23	47.5	356	1,550	2,020	1,890	2,130	1,480	1,950	852	80.0	73.0	1.6
24	47.6	310	1,660	2,000	1,860	1,960	1,530	1,940	950	70.0	73.0	1.6
25	47.7	180	1,680	2,010	1,610	2,180	1,560	1,960	1,020	65.0	76.0	2.0
26	47.8	500	1,750	2,090	1,880	2,160	1,730	2,020	1,020	71.0	76.0	2.0
27	47.8	619	1,710	2,270	2,000	1,820	1,730	2,020	993	77.0	78.0	2.0
28	47.9	595	1,750	2,210	1,970	1,200	1,740	2,080	1,030	74.0	73.0	2.0
29	47.9		1,790	2,050	1,990	764	1,690	2,100	1,100	75.0	49.0	1.4
30	48.0		1,800	1,850	2,030	510	1,830	2,050	1,140	71.0	46.0	1.4
31	48.0		1,740		2,070		1,850	1,990		71.0		1.4
Sum	1,550.3	11,192	37,216	58,280	57,050	60,814	55,165	66,120	22,077	13,162	6,110	4,701.2

Month 1938	Extreme Gage Feet — 1938		Extreme Second Feet * — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.			1	54.1	21	47.3	50.0	3,080			
Feb.			17	885	†1	48.0	400	22,200			
Mar.			30	1,800	1	591	1,200	73,800			
Apr.			27	2,270	5	1,580	1,940	116,000			
May			31	2,070	25	1,610	1,840	113,000			
June			22	2,300	30	510	2,030	121,000			
July			11	2,280	1	646	1,780	109,000			
Aug.			†5	2,430	24	1,940	2,130	131,000			
Sept.			1	1,480	8	279	736	43,800			
Oct.			†1	1,160	25	65.0	425	26,100			
Nov.			15	845	30	46.0	204	12,100			
Dec.			16	984	†29	1.4	152	9,320			
Yearly				2,430		1.4	1,080	780,400			

†And other days * Mean daily

RIO GRANDE AT EL PASO STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car and winch located in the pass opposite Courchesne quarry, 4 miles northwest of El Paso, Texas and 5 miles northwest of Cd. Juarez, Chihuahua and .9 river miles above the American Dam. Zero of gage is 3,720.51 feet above U.S.C. and G.S. mean sea level datum. Also water-stage recorder 1 mile farther upstream with zero of its gage 3,722.52 feet on the above mentioned datum. This latter gage was the official gage after August 3, 1938.

RECORDS: Based upon 151 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: 1889 to 1938, inclusive. See table of Authenticated Discharge Records herein.

REMARKS: El Vado reservoir on the Rio Chama, Elephant Butte, and Caballo reservoirs on the Rio Grande,also many irrigation diversions in Colorado and New Mexico as well as irrigation diversion for 88,044 acres below San Marcial, completely modify the river flow. With all closed basins eliminated the drainage area above this station is 29,267 square miles, all in the United States.

COMPARATIVE FLOWS FROM PREVIOUS RECORDS: Momentary Peak: Max., June 12, 1905, 24,000 sec. ft. with 6.0 ft. stage (lower gage). This is the greatest peak flow in the past 110 years or since 1828, or possibly longer. Min., sometimes dry. Daily: Max., June 12, 1905, 23,680 sec. ft. average. Min., sometimes dry. Monthly: Max., June 1905, 14,300 sec. ft. average. Min., sometimes dry. Yearly: Max., 1905, 2,780 sec. ft. average. Min., 1902, 70.1 sec. ft. average. Two Successive Years: Max., 1905 and 1906, 2,160 sec. ft. average. Min., 1899 and 1900, 168 sec. ft. average. Three Successive Years: Max., 1905 to 1907, 2,280 sec. ft. average. Min., 1900 to 1902, 269 sec. ft. average. Four Successive Years: Max., 1904 to 1907, 1,880 sec. ft. average. Min., 1899 to 1902, 227 sec. ft. average. Five Successive Years: Max., 1903 to 1907, 1,790 sec. ft. average. Min., 1898 to 1902, 669 sec. ft. average. Ten Successive Years: Max., 1903 to 1912, 1,560 sec. ft. average. Min., 1928 to 1937, 743 sec. ft. average. Forty-nine Years: Average 1,010 sec. ft. See Water Bulletin No. 6, p.79, for all large peak flows since 1828 and their average frequency.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	197	153	301	979	1,260	1,230	ð 1,000	1,030	1,380	610	273	262
2	190	145	473	994	1,210	1,130	994	1,000	4,080	668	262	267
3	188	146	412	1,220	1,240	1,270	878	967	1,570	678	255	234
4	186	150	394	1,420	1,300	1,210	1,040	1,050	1,460	620	243	228
5	181	143	431	1,150	1,230	1,110	1,020	1,030	1,450	580	238	221
6	176	135	544	1,070	1,170	1,280	1,310	1,040	1,340	578	234	205
7	177	131	580	994	1,100	1,260	1,180	1,190	2,470	632	226	214
8	177	130	802	1,180	1,210	1,250	1,030	1,290	2,290	579	216	220
9	178	132	* 685	1,050	1,230	1,240	1,060	1,150	1,020	511	214	222
10	175	134	* 608	1,040	1,170	1,150	1,170	1,090	814	432	227	218
11	176	155	* 598	1,250	1,150	1,140	1,120	1,030	771	361	224	199
12	180	394	* 486	1,160	1,090	1,160	ð 1,200	1,070	722	352	220	192
13	177	405	* 561	1,180	1,040	1,360	1,470	1,070	1,330	344	224	194
14	176	382	630	1,080	1,060	1,280	1,140	1,220	1,150	331	221	198
15	176	405	662	1,050	1,110	1,210	1,200	1,250	887	312	211	206
16	172	485	625	992	1,310	1,170	ð 1,530	1,140	718	292	272	222
17	166	399	594	1,000	1,150	1,220	1,070	1,090	634	278	350	286
18	166	440	623	1,400	1,230	1,190	1,160	* 1,090	577	271	348	374
19	167	501	625	1,290	1,230	1,140	1,350	* 1,280	560	364	376	403
20	173	651	594	1,020	1,130	1,230	2,250	1,310	471	483	477	473
21	191	584	632	922	1,040	1,040	3,050	* 1,340	431	513	439	446
22	199	448	818	949	1,060	1,060	2,090	1,170	446	573	367	332
23	191	349	808	1,020	1,180	1,270	1,390	1,160	430	623	343	272
24	181	336	838	1,150	1,120	1,530	1,200	1,070	463	620	299	240
25	180	304	812	1,140	1,120	1,410	1,090	1,080	535	411	292	230
26	176	287	1,050	1,040	1,110	1,200	1,060	1,060	523	332	276	221
27	171	271	1,290	1,080	918	1,810	1,060	1,050	547	297	278	228
28	170	281	1,340	1,190	1,140	1,990	1,150	1,100	544	289	249	215
29	167		1,130	1,140	1,290	2,160	1,080	1,170	550	285	258	201
30	161		1,080	1,300	1,120	1,900	982	1,070	569	273	266	201
31	152		1,130		1,140		991	1,110		272		203
Sum	5,493	8,476	22,156	33,450	35,858	39,600	39,315	34,767	30,732	13,764	8,378	7,827

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day		1938	1938	Normal	Maximum	Minimum
Jan.	1.80	1.63	22	205	31	150	177	10,900	11,139	17,500	8,180
Feb.	2.92	1.61	21	689	8	127	303	16,800	20,923	48,500	8,800
Mar.	3.33	1.74	28	1,470	1	236	715	43,900	39,499	56,800	18,400
Apr.	3.58	2.68	3	1,550	17	844	1,120	66,300	63,681	91,000	44,900
May	3.52	2.82	16	1,470	27	791	1,160	71,100	68,363	122,000	47,600
June	4.96	3.26	29	2,600	21	986	1,320	78,500	70,776	98,200	56,200
July	5.86	3.09	21	3,730	3	812	1,270	78,000	82,013	111,000	69,900
Aug.	85.07	84.03	21	1,420	3	897	1,120	69,000	88,569	107,000	63,100
Sept.	87.27	83.34	2	5,330	24	388	1,020	61,000	64,080	87,400	48,000
Oct.	84.08	83.04	2	679	31	268	444	27,300	26,049	34,860	17,800
Nov.	83.78	82.88	20	520	15	206	279	16,600	18,425	29,500	11,400
Dec.	83.95	82.99	21	510	12	186	252	15,500	16,898	27,700	9,590
Yearly	87.27	1.61		5,330		127	766	554,900	570,415	810,200	459,910

* Partly Estimated.

ð Deduced.

RIO GRANDE AT BELOW AMERICAN DAM STATION

DESCRIPTION: Water-stage recorder at the lower side of the American Dam 2.1 miles above the Mexican Dam, near El Paso, Texas. Zero of the recorder gage is 3,722.30 feet above U. S. C. & G. S. sea level datum. Also, a staff gage 1,100 feet below the American Dam. The American Dam is 1,197.6 river miles above the Gulf of Mexico.

RECORDS: Based upon 62 meter measurements at normal and low stages after June 2, 1938. Computations by shifting channel methods. High flows determined by subtracting the American Canal diversion from the Rio Grande flow at El Paso Station. 1938 records good. Records available: June 1 to December 31, 1938.

REMARKS: This is a new gaging station on the Rio Grande. Its operation began June 2, 1938, when the new American Dam first began operating. At this dam part of the flow passing the El Paso Gaging Station (see preceding page) was diverted into the new American Canal (see records of "Diversions From The Rio Grande" elsewhere herein) and the remainder, including excess flood flows, passed this gaging station. Reservoirs and diversions in the United States completely modify the river flow. During the irrigation season, water for 88,044 acres in the United States was diverted from the Rio Grande above the American Dam and below San Marcial, New Mexico. With all closed basins eliminated, the drainage area above this station is 29,271 square miles in the United States.

PREVIOUS EXTREME FLOWS: See other Water Bulletins, especially No. 6, pages 79-81 where a record is given of all large floods and their average frequency since 1828. The largest such flow was 24,000 second feet on June 12, 1905.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						ð 1,230	133	111	ð 280	19.1	7.0	3.6
2						ð 742	120	76.8	ð 2,920	19.1	ð 179	3.6
3						307	125	74.8	ð 420	18.0	ð 250	3.2
4						296	150	77.1	ð 220	18.0	ð 236	3.2
5						292	147	90.0	ð 190	18.0	ð 233	3.2
6						330	193	98.8	ð 190	18.0	ð 212	3.2
7						ð 345	120	110	ð 1,280	9.9	ð 222	3.0
8						ð 318	141	134	ð 1,060	7.5	ð 214	3.0
9						ð 311	145	98.1	ð 135	5.0	ð 212	3.0
10						ð 253	153	103	106	5.0	ð 224	3.0
11						268	143	94.6	114	5.0	ð 122	3.0
12						262	162	83.8	110	4.7	7.0	3.0
13						306	286	84.1	ð 703	4.5	8.0	2.8
14						294	132	82.2	ð 390	4.4	10.0	2.7
15						292	146	80.2	104	4.0	10.0	2.7
16						247	ð 430	81.4	64.4	3.5	9.0	2.7
17						240	173	97.6	ð 67.0	3.0	9.0	2.8
18						247	145	79.3	42.1	3.0	9.0	3.8
19						239	ð 263	205	41.7	3.5	8.0	3.8
20						230	ð 1,230	326	41.9	4.0	8.0	3.8
21						209	ð 1,960	308	43.0	6.0	8.0	3.8
22						213	ð 1,080	195	38.5	35.0	7.0	3.8
23						252	366	151	40.2	65.0	7.0	3.4
24						371	229	145	43.6	80.0	6.0	3.4
25						238	161	144	49.1	23.0	6.0	3.4
26						224	157	145	ð 48.7	16.0	5.0	3.2
27						ð 780	145	150	ð 30.0	12.0	5.0	ð 68.2
28						ð 1,000	139	147	ð 16.0	10.0	4.0	ð 213
29						ð 1,110	141	150	ð 16.0	10.0	4.0	ð 199
30						ð 860	148	148	ð 18.0	10.0	4.0	ð 199
31							149	153		10.0		ð 201
Sum						12,306	9,212	4,023.8	8,822.2	454.2	2,247.0	964.3

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.											
Apr.											
May											
June			29	1,560	21	150	410	24,400			
July			21	2,590	3	93.0	297	18,300			
Aug.			21	462	3	35.0	130	7,980			
Sept.			2	4,140	28-29	16.0	294	17,500			
Oct.			24	* 100	17-18	3.0	14.7	901			
Nov.			3	250	28-30	4.0*	74.9	4,460			
Dec.			28	213	14-16	2.7*	31.1	1,910			
Period				4,140		2.7*	178	75,451			

* Partly Estimated.

ð By deduction. Flow passing El Paso Gaging Station minus flow in American Canal

RIO GRANDE AT CD. JUAREZ STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located 2-1/2 miles downstream from El Paso, Texas and Cd. Juarez, Chihuahua. This is a new gaging station, built by the Mexican Section on the newly rectified channel of the Rio Grande, 7.0 river miles below the new American Dam at El Paso, Texas, and 4.9 river miles below the Mexican Dam. The zero of the gage is 3,687.26 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 126 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available April 1 to December 31, 1938.

REMARKS: The operation of this station began April 1, 1938. Reservoirs and diversions in the United States above San Marcial, New Mexico, as well as irrigation diversions for 88,044 acres in the United States below San Marcial and above the El Paso-Juarez valley completely modify the river flow. Within the El Paso-Juarez valley above Fort Quitman gaging station water is diverted for irrigating approximately 61,751 acres in the United States and 48,429 acres in Mexico. See records of "Diversions From The Rio Grande" elsewhere herein.

With all closed basins eliminated, the drainage area above this station is 29,359 square miles, 29,312 being in the United States and 47 in Mexico.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1				600	675	530	950	509	805	331	146	67.8
2				505	544	530	689	544	3,670	385	231	79.1
3				657	501	622	607	544	1,530	367	229	59.3
4				918	523	561	727	597	890	264	213	47.7
5				689	473	561	607	597	946	305	190	52.6
6				565	501	646	749	607	805	282	198	38.8
7				466	445	646	706	706	1,770	357	191	66.4
8				689	501	622	622	788	2,090	262	196	214
9				727	544	622	572	749	851	192	201	223
10				565	417	586	643	735	579	138	204	234
11				565	417	561	657	657	600	101	223	210
12				629	396	561	657	671	466	76.6	107	203
13				607	275	667	869	671	918	75.9	45.9	216
14				607	244	667	657	727	1,100	157	56.5	211
15				523	334	667	749	819	678	239	55.4	203
16				586	586	622	1,050	727	509	238	87.9	196
17				470	501	586	713	636	274	238	162	221
18				918	501	667	713	636	251	234	158	265
19				855	501	530	848	689	274	303	186	201
20				498	473	685	1,370	622	194	298	322	314
21				374	374	470	2,680	727	144	244	427	329
22				278	353	470	1,720	653	194	247	353	210
23				332	501	706	932	671	194	323	338	118
24				470	417	1,000	622	604	194	326	292	83.3
25				470	473	749	509	590	193	143	290	84.4
26				297	417	622	554	572	193	84.8	260	69.6
27				332	275	1,330	554	572	249	70.3	230	59.3
28				396	334	1,640	657	590	279	79.5	199	199
29				586	629	1,770	622	653	290	78.8	206	192
30				675	523	1,430	459	636	279	66.0	123	167
31					473		420	671		77.0		171
Sum				16,849	14,121	22,326	24,884	20,170	21,409	6,582.9	6,120.7	5,005.3

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.											
Apr.	7.02	5.84	3	1,130	22	244	562	33,400			
May	6.82	5.64	29	939	27	164	456	28,000			
June	8.30	6.14	29	2,460	22	417	744	44,300			
July	8.76	5.31	21	3,140	31	353	803	49,400			
Aug.	6.63	5.35	15	1,010	1	434	651	40,000			
Sept.	9.74	4.56	2	5,010	20	119	714	42,500			
Oct.	5.31	4.53	2	473	14	62.2	212	13,100			
Nov.	5.41	4.36	20	470	15	44.1	204	12,100			
Dec.	5.35	4.56	21	385	6	34.3	161	9,930			
Period	9.74	4.36		5,010		34.3	500	272,730			

RIO GRANDE AT ISLAND STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located near Clint, Texas, and San Augustin, Chihuahua. This is a new gaging station built by the United States Section on the newly rectified channel of the Rio Grande, 27.1 river miles below the new American Dam at El Paso, Texas. The zero of the gage is 3,608.99 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 19 meter measurements after August 17, 1938. Computations by shifting channel methods. 1938 records good. Records available August 17 to December 31, 1938.

REMARKS: The operation of this station began August 17, 1938. Reservoirs and diversions in the United States above San Marcial, New Mexico, as well as irrigation diversions for 88,044 acres in the United States below San Marcial and above the El Paso-Juarez valley completely modify the river flow. Within the El Paso-Juarez valley above Fort Quitman gaging station water is diverted for irrigating approximately 61,751 acres in the United States and 48,429 acres in Mexico. See records of "Diversions From The Rio Grande" elsewhere herein.

With all closed basins eliminated, the drainage area above this station is 29,977 square miles, 29,458 being in the United States and 519 in Mexico.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1									174	33.0	6.2	6.0
2									2,400	34.5	5.2	14.7
3									2,140	30.7	4.9	22.8
4									456	31.9	4.5	17.7
5									605	28.5	4.4	15.6
6									758	25.1	4.4	14.5
7									1,070	26.2	4.7	14.0
8									2,150	27.5	4.6	12.8
9									683	23.3	4.9	11.6
10									389	18.1	5.7	11.6
11									349	14.6	6.3	11.5
12									261	11.3	6.9	12.1
13									394	9.8	6.3	12.1
14									1,210	7.8	5.2	12.1
15									512	8.7	11.8	14.9
16									289	8.5	29.2	51.3
17								31.3	214	8.4	81.2	58.5
18								21.7	192	10.3	82.4	86.6
19								21.3	133	10.8	58.3	54.8
20								39.3	92.6	11.7	156	26.6
21								16.1	70.7	16.6	292	71.7
22								39.8	54.0	28.9	134	87.7
23								21.6	33.2	79.2	20.9	30.7
24								25.1	32.5	159	13.8	24.3
25								6.4	31.8	97.2	16.8	24.3
26								2.5	30.2	15.2	42.1	23.5
27								* 1.6	27.7	11.3	45.2	21.5
28								* 1.2	27.8	9.1	28.0	43.3
29								* 4.7	28.0	8.0	22.2	117
30								* 39.6	33.6	6.8	8.7	166
31								* 6.5		5.7		160
Sum								278.7	14,841.1	817.7	1,116.8	1,251.8

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day		1938	1938	Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.											
Apr.											
May											
June											
July											
Aug.@	11.75	10.78	30	* 61.6	28	* 1.0	18.6	553			
Sept.	15.50	10.89	3	4,570	29	24.7	495	29,400			
Oct.	11.66	10.73	24	281	31	5.3	26.4	1,620			
Nov.	11.88	10.72	20	368	9	3.9	37.2	2,220			
Dec.	11.98	10.60	31	256	2	4.2	40.4	2,480			
Period	15.50	10.60		4,570		1.0	133	36,273			

* Partly Estimated.

@ Aug. 17 to Aug. 31.

RIO GRANDE AT COUNTY LINE STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located 0.8 mile downstream from the El Paso-Hudspeth county line. This is a new gaging station built by the United States Section on the newly rectified channel of the Rio Grande, 47.4 river miles below the new American Dam at El Paso, Texas. The zero of the gage is 3,547.59 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 57 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available January 1 to December 31, 1938.

REMARKS: The operation of the station began January 1, 1938. Reservoirs and diversions in the United States above San Marcial, New Mexico, as well as irrigation diversions for 88,044 acres in the United States below San Marcial and above the El Paso-Juarez valley completely modify the river flow. Within the El Paso-Juarez valley above Fort Quitman gaging station water is diverted for irrigating approximately 61,751 acres in the United States and 48,429 acres in Mexico. See records of "Diversions From The Rio Grande" elsewhere herein.

With all closed basins eliminated, the drainage area above this station is 30,648 square miles, 29,943 being in the United States and 705 in Mexico.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	271	241	323	330	374	122	1,750	224	286	154	152	135
2	229	298	306	299	355	134	1,100	156	1,560	185	208	150
3	223	290	373	216	249	140	927	149	2,770	247	251	170
4	328	297	330	406	337	223	816	143	940	247	260	148
5	352	248	332	382	372	173	761	156	928	255	274	166
6	385	196	382	271	292	189	705	141	1,220	240	285	178
7	303	191	393	299	316	245	798	150	1,460	315	283	125
8	274	172	362	186	316	319	557	218	3,030	366	334	112
9	247	164	419	397	408	232	454	347	1,510	347	335	137
10	228	175	370	402	312	173	404	344	893	279	262	120
11	231	181	330	276	276	207	508	334	692	255	267	139
12	263	201	312	339	252	274	437	164	712	232	279	113
13	238	317	265	250	135	299	536	223	721	192	246	159
14	270	345	166	193	163	344	463	329	1,930	199	176	242
15	216	321	153	289	119	282	375	429	908	302	82.3	258
16	189	328	113	366	154	274	420	293	647	258	68.6	280
17	236	378	88.8	376	187	238	545	416	548	264	78.2	240
18	243	374	76.7	379	139	248	353	434	440	145	156	273
19	284	388	86.6	453	121	292	362	269	370	85.5	164	294
20	278	428	93.7	334	149	284	635	313	266	72.3	182	291
21	292	497	102	181	146	263	1,920	362	250	163	313	319
22	337	481	89.0	127	102	140	1,800	358	199	201	244	305
23	304	442	96.1	102	227	212	1,500	282	167	237	216	254
24	336	383	* 92.4	112	239	601	837	280	163	294	190	266
25	338	356	* 101	201	231	732	646	189	148	264	186	275
26	335	339	* 116	142	188	583	405	150	186	206	156	271
27	211	308	* 289	98.0	110	735	310	164	154	154	180	372
28	218	344	* 408	108	92.0	1,680	273	223	128	125	220	326
29	229		443	148	160	2,130	309	230	134	144	173	302
30	217		335	280	282	2,100	247	216	130	149	208	306
31	205		312		224		212	279		118		290
Sum	8,310		7,658.3		7,027		21,365		23,490		6,429.1	
		8,683		7,942		13,868		7,965		6,694.8		7,016

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day			1938	Normal	Maximum	Minimum
Jan.	2.43	1.29	25	520	31	68.0	268	16,500			
Feb.	2.57	1.15	21	551	8	46.1	310	17,200			
Mar.	2.39	1.27	28	490	18	67.9	247	15,200			
Apr.	2.38	1.35	19	499	27	74.7	265	15,800			
May	2.20	1.24	9	448	19	61.4	227	13,900			
June	4.96	1.23	29	2,920	22	90.4	462	27,500			
July	5.41	2.02	21	2,790	31	163	689	42,400			
Aug.	2.95	1.85	15	498	6	126	257	15,800			
Sept.	6.39	2.48	3	4,050	28	114	783	46,600			
Oct.	3.21	2.12	24	399	20	61.6	216	13,300			
Nov.	3.36	2.08	7	537	16	59.6	214	12,800			
Dec.	3.48	2.18	31	596	8	68.6	226	13,900			
Yearly	6.39	1.15		4,050		46.1	347	250,900			

* Partly Estimated.

RIO GRANDE AT FORT QUITMAN STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located on the new rectified Rio Grande channel 1-1/2 miles below Old Fort Quitman, and 80.9 river miles below the American Dam at El Paso. The zero of the new gage is 3,450.57 feet, U. S. C. & G. S. datum. See Water Bulletin No. 7 for a gage history of this station.

RECORDS: Based upon 57 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: January 1923 to December 1938.

REMARKS: Reservoirs in the United States and many irrigation diversions in the United States and Mexico completely modify the river flow. Below San Marcial, New Mexico, diversions for irrigating 149,795 acres in the United States and 48,429 acres in Mexico, occurred above this station. With all closed basins eliminated, the drainage area above this station is 31,990 square miles, 30,606 being in the United States and 1,384 in Mexico.

COMPARATIVE FLOWS FROM PREVIOUS RECORDS: Momentary Peak: Max. about June 20, 1905, 17,000 sec. ft.δ. This is the greatest flow in the last 110 years. Max. since Jan. 1923, 3,100 sec. ft., Oct. 12, 1937. Min., frequently dry prior to Jan. 1915.** Since Jan. 1915, dry only once, March 30, 1935. Daily: Max. about 17,000 sec. ft. June 20, 1905δ. Since Jan. 1915, 2,600 sec. ft. average on Sept. 11, 1925. Min., frequently dry prior to Jan. 1915. Since Jan. 1915, 0.9 sec. ft. average May 31 to June 4, 1935. Monthly: Max., since Jan. 1923, 1,080 sec. ft. average in August 1928. Min., frequently dry prior to Jan. 1915. Since Jan. 1923, 14.3 sec. ft. average in May 1935. Yearly: Max., since Jan. 1923, 514 sec. ft. average in 1924. Min., since Jan. 1923, 141 sec. ft. average in 1934. Two Successive Years: Max., since Jan. 1923, 487 sec. ft. average 1923 and 1924. Min., 171 sec. ft. average 1934 and 1935. Three Successive Years: Max., since Jan. 1923, 448 sec. ft. average 1923 to 1925. Min., since Jan. 1923, 183 sec. ft. average 1934 to 1936. Four Successive Years: Max., since 1923, 431 sec. ft. average 1923 to 1926. Min. since Jan. 1923, 199 sec. ft. average 1934 to 1937. Five Successive Years: Max., since Jan. 1923, 412 sec. ft. average 1923 to 1927. Min., since 1923, 218 sec. ft. average 1933 to 1937. Fifteen Years: Average 310 sec. ft. See pages 71 and 72 herein for the magnitude and average frequency of floods in the past 110 years.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	* 272	294	271	323	* 128	124	2,240	255	150	178	234	346
2	* 232	250	239	274	* 231	104	1,690	159	797	174	254	305
3	* 214	244	276	* 285	252	123	1,270	128	2,380	226	295	308
4	* 184	234	273	308	263	148	988	92.7	2,090	237	307	322
5	* 249	235	278	274	320	161	919	88.9	1,560	243	310	275
6	* 240	250	* 316	* 320	320	151	781	60.1	1,430	254	291	240
7	* 214	230	* 395	* 263	309	141	1,090	74.9	1,890	260	345	243
8	205	210	* 392	* 265	342	142	785	65.7	2,690	353	373	232
9	218	210	456	306	440	183	455	95.9	2,690	376	351	197
10	211	200	* 454	458	526	159	364	117	1,570	321	344	216
11	219	210	326	363	398	158	443	127	1,250	243	276	191
12	231	200	263	283	322	183	493	115	1,230	197	253	214
13	288	205	257	261	248	211	422	67.0	1,180	194	274	239
14	246	371	241	216	202	217	594	94.8	1,580	186	256	252
15	245	332	240	258	195	266	403	207	1,590	216	297	197
16	204	280	231	257	186	274	324	292	1,070	201	233	197
17	207	305	217	* 393	195	256	584	243	766	206	122	161
18	206	* 342	196	* 377	177	201	986	179	586	172	145	187
19	205	324	200	368	169	206	1,010	179	412	152	244	210
20	179	* 312	185	* 403	164	193	1,130	185	341	185	351	193
21	190	* 288	* 196	199	158	168	1,810	229	304	207	408	204
22	269	* 269	* 189	175	* 176	180	2,560	224	260	234	291	258
23	315	* 268	193	139	* 155	138	2,230	226	256	294	305	252
24	230	* 287	186	* 119	235	335	1,470	178	248	360	353	281
25	225	* 328	176	* 118	209	717	968	135	262	473	389	258
26	236	298	184	* 134	* 180	648	879	71.6	231	291	377	294
27	270	251	207	* 109	* 156	456	1,180	53.7	223	245	388	302
28	300	278	* 414	* 100	* 137	992	1,000	71.7	215	227	421	300
29	280		* 520	* 91.0	* 141	1,840	934	86.9	190	257	373	315
30	274		* 499	* 135	178	2,260	450	91.2	175	247	376	350
31	281		* 335		* 176		252	114		239		344
Sum	7,339		* 8,805		7,288		30,704		29,616		9,236	
		* 7,505		* 7,574		11,335		4,307.1		7,648		7,883

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day	High	Day	Low		1938	Normal	Maximum	Minimum
Jan.	4.00	3.04	27	781	30	172	237	14,600	11,938	19,200	5,370
Feb.	3.78	2.64	7	418	27	174	268	14,900	12,763	30,400	3,510
Mar.	3.47	2.24	30	552	22	133	284	17,500	11,491	28,500	1,090
Apr.	3.58	1.88	17	624	29	66.4	* 252	* 15,000	13,843	34,700	1,200
May	3.23	* 1.87	10	582	2	* 95.2	235	14,500	16,878	50,700	880
June	5.71	* 1.73	30	2,450	8	* 67.5	378	22,500	16,268	31,000	3,630
July	5.60	2.17	22	2,750	31	210	990	60,900	21,347	61,500	4,300
Aug.	3.17	1.32	17	872	13	43.9	139	8,540	29,831	66,400	4,430
Sept.	6.12	1.82	8	3,180	1	128	987	58,700	33,501	59,500	9,050
Oct.	2.65	1.86	23	581	18	132	247	15,200	21,933	45,720	4,520
Nov.	2.80	1.90	10	685	18	110	308	18,300	15,281	20,900	4,990
Dec.	2.82	2.04	29	621	15	96.4	254	15,600	15,634	20,970	5,640
Yearly	6.12	1.32		3,180		43.9	382	276,240	220,708	373,500	102,420

δ Estimated from peak flow at El Paso and Upper Presidio Stations. ** Elephant Butte reservoir closed February 1915. * Partly Estimated.

RIO GRANDE AT LA NUTRIA STATION

DESCRIPTION: Water-stage recorder about 9-1/2 miles above Candelaria, Texas, 9-1/2 miles above San Antonio, Chihuahua, 64 miles above Presidio, Texas and 62 miles above Ojinaga, Chihuahua, and 201 river miles below the new American Dam at El Paso, Texas. Zero of gage is 2,871.42 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 23 meter measurements by wading during the year for stages below 650 second feet. Station rating curve extended above 650 second feet by means of areas and water surface slopes shown by maximum stage pipe gages. Computations by shifting channel methods. 1938 records good. Records available: January 1935 to December 31, 1938. Records estimated from January 1 to June 15, 1935. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: Reservoirs in the United States as well as many irrigation diversions in the United States and Mexico completely modify the river flow. Below San Marcial, New Mexico, during the irrigation season, diversions for irrigating about 155,265 acres in the United States and about 59,110 acres in Mexico occurred above this station. With all closed basins eliminated, the drainage area above this station is 33,832 square miles, 31,639 being in the United States and 2,193 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on August 31, 1935, when the peak discharge was 7,480 second feet. The river is sometimes dry. A careful survey of flood marks shows that about 30,000 second feet has passed this station in the past.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	223	237	246	407	156	76.8	1,800	* 453	41.5	185	187	269
2	251	222	259	314	72.6	103	1,660	* 370	45.4	177	192	248
3	240	222	246	321	81.7	98.1	1,470	* 298	53.4	163	165	260
4	237	225	201	271	191	74.1	1,070	* 241	988	147	159	209
5	249	208	210	214	193	59.8	851	471	1,720	162	247	203
6	229	205	228	285	181	49.0	803	594	2,850	187	209	221
7	253	201	205	418	229	51.0	864	211	2,230	173	202	208
8	264	186	257	294	236	63.5	894	233	2,160	168	201	219
9	240	186	325	201	220	65.4	677	284	2,190	148	201	232
10	232	183	351	192	501	53.7	527	210	2,490	635	247	216
11	242	190	431	207	357	68.9	480	85.6	2,120	293	256	214
12	237	181	418	403	379	79.6	429	65.3	1,530	284	232	224
13	223	175	323	320	302	69.2	473	117	1,520	250	224	209
14	221	170	238	226	240	68.4	477	82.1	3,600	215	255	210
15	238	137	249	210	194	75.7	417	98.1	3,230	190	213	203
16	233	250	220	162	147	93.9	468	60.5	2,140	166	197	207
17	237	258	184	166	132	130	313	48.5	1,230	165	192	208
18	232	220	180	167	112	156	434	201	1,020	218	180	193
19	210	262	169	279	98.2	146	797	148	826	185	149	170
20	208	309	155	262	107	111	626	130	743	162	131	171
21	200	286	134	278	96.3	76.0	1,220	92.1	642	126	130	220
22	211	357	123	333	96.0	73.1	2,420	84.7	566	114	228	228
23	239	468	129	177	90.7	112	2,310	91.2	441	122	343	210
24	328	517	128	96.6	100	776	1,930	98.5	352	191	291	280
25	355	437	115	73.2	109	390	1,480	111	320	272	236	216
26	270	373	99.5	64.7	110	575	1,100	99.3	264	355	199	191
27	239	323	98.5	48.5	156	553	821	82.6	254	421	234	206
28	260	295	104	38.5	133	512	653	65.6	243	304	221	198
29	256		91.2	59.6	113	443	621	56.5	220	234	232	161
30	256		293	45.0	97.2	1,850	522	51.2	200	216	264	188
31	256		458		85.8		580	45.4		188		193
Sum	7,569	7,283	6,868.2	6,533.1	5,316.5	7,053.2	29,187	5,279.2	36,229.3	6,816	6,417	6,585

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1935-1938		
	High	Low	Day	High	Day	Low			Average	Maximum	Minimum
Jan.	4.22	3.68	25	372	21	192	244	15,000	9,518	15,000	¤ 3,000
Feb.	4.61	3.50	24	337	15	132	260	14,400	7,772	14,400	¤ 2,500
Mar.	4.48	3.23	31	483	29	88.0	222	13,600	5,672	13,600	¤ 500
Apr.	4.47	2.83	1	477	28	34.0	218	13,000	4,885	13,000	¤ 0
May	5.27	2.83	10	909	1	38.0	172	10,500	6,518	10,900	¤ 0
June	8.50	2.63	30	3,650	7	45.0	235	14,000	9,675	14,000	* 5,290
July	8.28	4.15	23	3,370	17	306	942	57,900	18,418	57,900	2,780
Aug.	6.54	2.81	9	1,730	31	44.5	170	10,500	19,075	40,300	10,500
Sept.	10.00	2.76	14	5,670	1	40.0	1,210	71,800	56,325	71,800	35,300
Oct.	6.78	3.45	10	1,930	22	108	220	13,500	25,250	42,700	13,500
Nov.	4.40	3.43	23	436	21	120	214	12,700	12,900	15,400	11,100
Dec.	4.18	3.74	24	299	20	160	212	13,100	14,500	17,600	13,100
Yearly	10.00	2.63		5,670		34.0	359	260,000	190,508	260,000	157,570

¤ Estimated.

* Partly Estimated.

RIO GRANDE AT UPPER PRESIDIO STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located 7.7 river miles above the confluence of the Rio Conchos and about 10 miles northwest of the towns of Presidio, Texas, and Ojinaga, Chihuahua, and 272.6 river miles below the new American dam at El Paso, Texas. Zero of gage is 2,579.82 feet above mean sea level, United States Coast and Geodetic Survey datum. This elevation was erroneously reported as 2,575.82 in Water Bulletins Nos. 6 and 7.

RECORDS: Based on 63 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: April 1900 to March 1914; September 1919 to March 1920; August 1923 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: Reservoirs in the United States, as well as many irrigation diversions in the United States and Mexico, completely modify the river flow. Below San Marcial, New Mexico, during the irrigation season, diversions for irrigating about 155,265 acres in the United States and about 59,110 acres in Mexico occurred above this station. With all closed basins eliminated, the drainage area above this station is 35,028 square miles, 32,219 being in the United States and 2,809 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on June 12, 1912, when peak discharge was 15,200 second feet. The river is sometimes dry. See pages 71 and 72 herein for the magnitude and average frequency of floods during the past periods of record.

CORRECTION: On the basis of fuller data, it is now estimated that the peak discharge on August 31, 1932 reported as 4,380 second feet should have been 2,100 second feet. Geological Survey Water Supply Paper No. 508 and later Papers reported a mean daily discharge of 18,080 second feet at this station on September 15 and 16, 1919. The original measurement notes in I. B. C. files show that this was the flow at Lower Presidio instead of Upper Presidio. From other records it is estimated that the flow at Upper Presidio was about 2,000 second feet on these days.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	246	224	277	128	34.9	30.2	1,900	645	16.2	182	189	168
2	238	218	255	185	30.9	27.3	1,720	533	99.4	165	175	184
3	234	209	224	174	39.7	25.9	1,640	462	89.9	155	174	176
4	230	206	237	164	39.5	23.9	1,750	* 406	39.3	149	178	182
5	221	205	219	161	35.5	22.1	* 1,480	350	538	140	172	180
6	224	201	205	130	46.2	20.2	* 1,340	526	1,480	137	170	159
7	215	191	215	115	70.8	10.3	* 1,020	487	1,710	141	200	153
8	210	192	215	174	67.0	7.9	* 639	* 282	1,770	152	190	152
9	225	187	199	208	96.5	6.8	530	* 250	1,720	268	184	147
10	227	182	209	164	132	6.1	577	299	1,730	174	180	148
11	210	180	236	137	237	5.7	454	187	1,860	351	176	151
12	200	180	249	117	226	5.0	449	151	1,740 *	267	194	151
13	199	180	265	133	217	4.7	356	* 120	1,290	269	195	146
14	199	178	253	192	187	4.6	357	94.0	1,420	238	185	147
15	200	174	214	155	147	3.5	398	84.6	1,920	221	183	140
16	203	169	182	* 158	131	3.5	* 315	75.9	2,060	201	181	136
17	214	164	163	* 170	109	3.0	* 365	61.4	2,100	186	173	130
18	206	185	147	* 123	86.9	2.8	330	51.8	1,510 *	173	161	134
19	203	209	132	* 99.0	67.6	2.3	484	46.0	1,400	172	150	140
20	198	204	131	* 113	52.0	2.1	742	47.0	1,100	182	146	129
21	186	236	127	* 116	48.3	3.9	1,030	53.3	820	171	143	124
22	183	250	107	* 117	44.7	3.5	1,730	46.8	740	163	132	126
23	194	241	88.4	135	42.1	2.3	2,140	39.9	600	153	126	147
24	199	274	87.2	158	42.0	196	2,280	34.3	450	144	185	161
25	* 211	345	73.6	118	35.8	585	* 2,420	29.3	390	142	240	168
26	* 225	338	66.6	85.7	33.0	880	1,730	25.3	310	166	202	* 211
27	* 233	322	64.2	65.0	32.1	1,500	1,210	23.1	268	208	186	* 220
28	220	293	60.8	55.9	31.7	485	851	19.1	251	282	168	* 207
29	205		50.6	42.6	32.0	453	* 716	17.4	228	262	180	* 190
30	216		43.9	39.7	33.6	441	652	16.7	195	233	166	180
31	221		41.8		32.6		619	19.0		210		172
Sum	6,595		5,038.1		2,461.4		32,224		29,844.8		5,284	
		6,137		3,932.9		4,767.6		5,482.9		6,057		4,959

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	1.93	1.66	1	249	21	181	213	13,100	12,906	27,300	644
Feb.	2.36	1.50	25	360	17	162	219	12,200	11,788	29,400	1,420
Mar.	2.08	.73	1	283	31	37.1	163	9,990	11,080	41,500	285
Apr.	1.76	.71	9	222	29	31.9	131	7,800	10,613	39,900	0
May	2.14	.58	11	317	29	28.2	79.4	4,880	15,181	55,300	0
June	5.41	.14	27	2,000	20	1.9	159	9,460	15,290	62,100	830
July	* 7.36	2.27	25	* 2,520	18	276	1,040	63,900	19,941	68,800	13.3
Aug.	3.41	.58	6	760	30	14.7	177	10,900	35,647	81,700	2,170
Sept.	6.55	.57	17	2,160	2	14.2	995	59,200	40,446	82,500	3,140
Oct.	3.41	1.86	9	563	6	134	195	12,000	31,987	78,000	0
Nov.	2.37	1.74	25	247	23	123	176	10,500	16,281	26,800	0
Dec.	* 2.24	1.68	27	* 224	22	119	160	9,840	14,394	21,700	374
Yearly	* 7.36	.14		* 2,520		1.9	309	223,770	235,554	531,300	54,315

* Partly Estimated.

RIO GRANDE AT LOWER PRESIDIO STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car equipped for winch and heavy weights located about 2-1/4 miles above the international highway bridge between Presidio, Texas, and Ojinaga, Chihuahua, 1.6 miles below the confluence of the Rio Conchos with the Rio Grande, and 282.0 miles below the American Dam at El Paso, Texas. Zero of gage is 2,556.42 feet, U. S. C. & G. S. sea level datum.

RECORDS: Based on 68 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: May 1900 to July 1915; September 1919 to March 1920; August 1923 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: Station moved to its present location on June 14, 1932. Previously it was located 11.1 miles farther downstream and .4 mile above the Alamito Creek confluence. See Water Bulletin No. 1 for description of the old station. Reservoirs in the United States, also Boquilla, Colina and Rosetilla reservoirs on the Rio Conchos, as well as many irrigation diversions in the United States and Mexico, greatly modify the river flow. Below San Marcial, New Mexico, during the irrigation season, diversions for irrigating about 156,947 acres in the United States and about 165,310 acres in Mexico, occurred above this station. With all closed basins eliminated the drainage area above this station is 57,649 square miles, of which 32,240 are in the United States and 25,409 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow occurred in September, 1904, with a peak flow estimated at 162,000† second feet at the present station. The lowest recorded flow was 3.5 second feet in May, 1904. See pages 71 and 72 herein for the magnitude and average frequency of floods in the past 109 years.

Mean Daily Discharge in Second Feet 1938— Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,150	754	1,220	223	306	85.6	10,700	12,300	749	8,000	1,720	1,240
2	1,260	712	1,230	302	288	73.8	10,700	11,600	1,380	7,200	1,490	1,210
3	1,060	740	900	320	227	61.2	10,700	*9,500	2,600	*6,310	1,570	1,200
4	1,310	745	884	321	199	55.1	13,200	6,640	3,210	5,490	1,450	1,420
5	1,250	724	802	313	141	66.8	12,400	6,210	6,330	4,760	1,770	1,380
6	1,010	666	854	278	131	76.8	8,500	5,830	10,400	4,150	1,680	1,280
7	855	777	849	246	290	56.0	6,450	6,620	14,400	3,640	1,740	1,150
8	1,010	1,020	739	277	280	55.3	5,360	6,430	14,700	3,400	1,810	1,100
9	1,160	1,400	728	325	332	66.1	4,360	6,370	15,800	3,330	1,820	1,190
10	1,120	1,300	834	296	1,230	55.6	3,800	5,790	15,000	3,000	1,500	1,070
11	1,380	1,300	749	264	435	58.0	3,450	4,720	20,600	3,050	1,930	1,110
12	1,400	1,050	799	236	502	52.4	3,040	4,160	19,400	2,890	1,950	1,030
13	1,250	800	746	221	405	50.3	2,570	3,700	15,500	2,780	1,900	912
14	1,230	900	753	294	407	69.7	2,370	3,520	13,600	2,190	1,710	957
15	1,220	940	731	292	401	132	2,410	3,390	12,900	2,120	1,620	1,120
16	1,320	880	724	262	364	217	2,560	3,450	12,700	2,090	1,600	1,000
17	1,410	910	595	247	401	110	2,590	3,060	15,100	2,070	1,470	1,080
18	1,410	950	492	226	399	76.1	2,990	3,390	22,100	2,220	1,470	1,170
19	1,310	850	469	222	367	62.3	2,690	2,760	31,800	2,020	1,760	1,040
20	1,220	983	445	214	320	56.9	3,290	2,800	44,600	1,720	1,620	1,000
21	1,170	1,100	406	287	265	53.4	3,610	2,780	53,700	1,680	1,570	1,050
22	1,220	1,100	386	272	219	49.9	5,030	2,590	66,000	1,590	1,700	1,060
23	1,470	1,000	403	252	213	48.4	*10,500	1,850	58,200	1,550	1,410	1,170
24	1,350	896	385	284	178	356	*18,400	1,410	35,800	1,910	1,510	1,270
25	1,510	868	333	266	162	3,950	22,000	1,520	27,100	2,160	1,570	1,270
26	1,320	1,010	300	230	140	5,100	24,000	1,300	21,200	1,870	1,660	1,110
27	1,360	972	279	180	124	6,580	*28,600	1,370	17,600	1,620	1,690	911
28	1,160	946	265	166	114	5,670	18,100	1,110	12,900	1,710	1,510	1,030
29	1,010		236	226	100	9,420	*14,500	936	10,000	1,650	1,670	1,270
30	830		210	301	100	9,490	*12,800	947	9,500	1,940	1,320	1,140
31	788		193		95.2		*12,800	905		1,900		1,100
Sum	37,523	26,293	18,939	7,843	9,135.2	42,254.7	*284,470	*128,958	604,869	*92,010	49,190	35,040

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
				High		Low		Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	2.66	1.74	23	1,640	31	771	1,210	74,400	79,333	174,800	24,500
Feb.	2.65	1.51	9	1,680	7	603	939	52,200	67,447	77,900	26,300
Mar.	2.88	.56	1	1,970	31	181	611	37,600	61,147	76,300	21,200
Apr.	1.12	.40	30	375	27	146	261	15,600	50,011	66,500	4,460
May	3.68	.25	10	2,990	31	90.2	295	18,100	54,264	150,400	3,660
June	8.56	.03	30	14,000	23	46.4	1,410	83,800	69,103	106,000	9,250
July	15.20	3.07	27	33,100	15	2,180	9,180	564,000	121,100	564,000	23,900
Aug.	8.29	2.49	1	12,600	31	798	4,160	256,000	168,180	509,000	38,000
Sept.	16.69	2.32	22	68,100	1	698	20,200	1,200,000	251,453	1,200,000	16,000
Oct.	*7.40	3.34	1	*10,300	24	1,450	2,970	183,000	192,407	859,000	41,000
Nov.	3.64	3.00	11	1,990	30	1,180	1,640	97,600	82,547	105,300	30,500
Dec.	3.38	2.59	4	1,610	28	816	1,130	69,500	78,420	94,600	28,900
Yearly	16.69	.03		68,100		46.4	3,660	2,651,800	1,275,412	2,651,800	599,000

* Partly Estimated. † Revised on account of better data after the 1938 flood.

ALAMITO CREEK STATION NEAR PRESIDIO, TEXAS

DESCRIPTION: Water-stage recorder, about 1,800 feet above confluence with the Rio Grande, and six miles below Presidio, Texas and Ojinaga, Chihuahua. This creek enters the Rio Grande .4 river miles below the lower end of the Presidio Valley and 293.5 river miles below the American Dam at El Paso, Texas. Zero of gage is 2,541.42 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 4 meter measurements during the year and a rating curve, the high points of which are determined by slope-area calculations; also upon numerous estimates by the hydrographer at low flow. Computations by shifting channel methods. 1938 records good. Records available: January 1, 1932, to December 31, 1938. See table of Authenticated Discharge Records herein.

REMARKS: The flow of this spring-fed creek is modified by a small irrigation reservoir (San Estaban) 10-1/2 miles south of Marfa and by irrigation diversions for 1,065 acres of land below the reservoir. The low flow is steady, being from springs. The high flow is erratic, being from storms. The drainage area above this station is 1,504 square miles, all in the United States, 461 square miles of which are above San Estaban Dam and 1,043 square miles below it.

PREVIOUS EXTREME FLOWS: The greatest recorded flow occurred July 20, 1937 with a gage height of 5.33 feet and flow of 9,670 second feet. The lowest recorded flow was .87 second feet on several days in 1932. On July 30, 1936, a gage height of 5.93 was recorded with a flow of 3,900 second feet.

Mean Daily Discharge in Second Feet 1938— Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.0	3.0	3.0	3.0	3.0	*27.0	3.0	3.0	3.0	3.0	3.0
2	3.0	3.0	3.0	3.0	3.0	3.0	*28.0	3.0	960	3.0	3.0	3.0
3	3.0	3.0	3.0	3.0	3.0	3.0	*18.0	3.0	3.0	3.0	3.0	3.0
4	3.0	3.0	3.0	3.0	3.0	3.0	373	3.0	*201	3.0	3.0	3.0
5	3.0	3.0	3.0	3.0	3.0	3.0	*10.8	*30.0	*46.0	3.0	3.0	3.0
6	3.0	3.0	3.0	3.0	3.0	3.0	*5.4	*25.0	4.0	3.0	3.0	3.0
7	3.0	3.0	3.0	3.0	3.0	3.0	*6.6	*12.0	3.0	3.0	3.0	3.0
8	3.0	3.0	3.0	3.0	3.0	3.0	*4.6	*30.0	*20.0	3.0	3.0	3.0
9	3.0	3.0	3.0	3.0	7.5	3.0	3.0	*6.4	*12.0	3.0	3.0	3.5
10	3.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5
11	3.0	3.0	2.5	3.0	3.0	*9.8	3.0	4.0	3.0	3.0	3.0	3.5
12	3.0	3.0	2.5	3.0	3.0	3.9	3.0	3.0	3.0	3.0	3.0	3.5
13	3.0	3.0	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5
14	3.0	3.0	2.5	3.0	3.0	3.0	3.0	3.0	603	3.0	3.0	3.5
15	3.0	3.0	2.5	3.0	3.0	6.5	3.0	3.0	*8.0	3.0	3.0	3.5
16	3.0	3.0	2.5	3.0	7.7	4.8	3.0	3.0	3.0	3.0	3.0	3.5
17	3.0	3.0	2.5	3.0	3.0	3.0	3.0	6.0	3.0	3.0	3.0	3.5
18	3.0	3.0	2.5	3.0	3.0	3.0	3.0	6.0	3.0	3.0	3.0	3.5
19	3.0	3.0	2.5	3.0	3.0	3.0	124	5.0	3.0	3.0	3.0	3.5
20	3.0	3.0	2.5	3.0	3.0	3.0	46.6	3.0	3.0	3.0	3.0	3.5
21	3.0	3.0	2.5	3.0	3.0	3.0	191	3.0	3.0	3.0	3.0	3.5
22	3.0	3.0	2.5	3.0	3.0	3.0	960	3.0	3.0	3.0	3.0	3.5
23	3.0	3.0	2.5	3.0	3.0	9.4	140	3.0	3.0	3.0	3.0	3.5
24	3.0	3.0	2.5	3.0	3.0	345	320	3.0	3.0	3.0	3.0	3.5
25	3.0	3.0	2.5	3.0	3.0	*52.0	240	3.0	3.0	3.0	3.0	3.5
26	3.0	3.0	2.5	3.0	3.0	*40.0	340	3.0	3.0	3.0	3.0	3.5
27	3.0	3.0	2.5	3.0	4.2	*19.0	140	3.0	3.0	3.0	3.0	3.5
28	3.0	3.0	2.5	3.0	3.0	*12.0	3.0	3.0	3.0	3.0	3.0	3.5
29	3.0		2.5	3.0	3.0	*12.0	*3.0	3.0	3.0	3.0	3.0	3.5
30	3.0		2.5	8.0	3.0	*12.0	*8.0	3.0	3.0	3.0	3.0	3.5
31	3.0		2.5		3.0		7.0	3.0		3.0		3.5
Sum	93.0	84.0	82.5	95.0	104.4	*580.4	3,026.0	*190.4	1,920.0	93.0	90.0	104.5

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1932-1938		
	High	Low	Day		Day				Average	Maximum	Minimum
Jan.				3.0		3.0	3.0	184	186	265	123
Feb.				3.0		3.0	3.0	167	176	225	111
Mar.				3.0		2.5	2.7	164	182	226	123
Apr.	2.32		30	24.0		3.0	3.2	188	173	208	119
May	2.68		9	56.0		3.0	3.4	207	1,508	8,520	189
June	5.53		24	6,100		3.0	19.3	* 1,150	2,079	* 6,360	206
July	5.64		4	6,340		3.0	97.6	6,000	3,670	6,650	249
Aug.	4.17		5	160		3.0	6.1	* 378	5,304	*16,330	378
Sept.	4.92		4	4,000		3.0	64.0	3,810	6,406	19,600	179
Oct.	3.02		8	3.5		3.0	3.0	184	919	* 2,900	157
Nov.	2.97		1	3.5		3.0	3.0	179	253	524	119
Dec.	3.01		25	4.0		3.0	3.4	207	207	246	131
Yearly	5.64			6,340		2.5	17.7	*12,818	21,063	*39,964	6,497

* Partly Estimated

TERLINGUA CREEK STATION NEAR TERLINGUA, TEXAS

DESCRIPTION: Water-stage recorder and cable with sit down cable car, located about 12 miles south of Terlingua, Texas, 2-1/2 miles above the confluence with the Rio Grande at the lower end of Santa Helena Canyon. This creek enters the Rio Grande 356.4 miles below the American Dam at El Paso, Texas. Zero of gage is 2,191.04 .5 feet above mean sea level, United States Geological Survey datum.

RECORDS: Based upon 34 meter measurements and rating curve, the higher points of which are determined by slope-area calculations. Computations by shifting channel methods. 1938 records fair. Records available: January 1, 1932 to December 31, 1938. See table of Authenticated Discharge Records herein.

REMARKS: The flow of this spring-fed creek is modified by irrigation diversions on 610 acres of land above the station. The low flow is steady, being from springs. The high flows are erratic, being from storms. The drainage area above this station is 1,070 square miles, all in the United States.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on May 24, 1935, when the extreme gage height was 17.59 feet, with a discharge of 34,900 second feet. The lowest flow recorded was on January 27 and February 3, 1935, when the discharge was .20 of a second foot.

CORRECTIONS: Additional data make the following corrections necessary in the 1937 record: June 1, peak: 16.20 feet stage and 29,100 second feet. Mean daily second feet: June 1, 17,200; June 2, 5,650; September 14 to 21 inclusive, 92.6, 36.3, 17.6, 12.8, 10.6, 9.2, 8.0, 41.2, respectively.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.4	3.6	156	2.9	1.5	1.8	1,420	3.1	3.6	2.2	3.0	2.3
2	12.9	3.6	16.5	2.8	1.5	1.8	872	37.8	367	2.2	2.8	2.2
3	11.4	3.6	6.7	2.0	1.5	1.8	369	144	136	2.2	2.8	2.0
4	10.4	3.3	4.1	2.0	1.4	1.8	2,020	147	296	2.3	2.8	1.8
5	10.0	3.3	3.2	2.1	1.4	1.9	385	4.8	328	2.3	3.0	1.7
6	12.0	3.2	2.8	2.1	1.3	2.0	83.4	4.5	77.5	2.3	3.1	1.8
7	10.1	2.7	2.9	2.0	1.2	2.0	159	4.2	326	2.3	2.9	1.8
8	9.6	2.7	2.8	2.2	1.2	2.0	138	3.9	466	2.3	2.6	1.8
9	8.2	2.7	2.3	2.1	238	2.0	49.1	3.6	96.3	2.4	2.6	1.7
10	6.0	3.2	2.1	2.1	* 20.8	1.9	36.9	3.3	32.1	2.4	2.5	1.7
11	5.6	3.4	2.2	2.3	5.6	1.9	23.7	3.1	22.3	2.2	2.4	1.7
12	5.3	3.4	2.1	2.3	3.5	2.0	12.4	2.9	18.2	2.4	2.4	1.8
13	4.4	2.8	2.3	2.3	3.3	2.0	10.4	2.6	14.0	2.4	2.3	1.8
14	4.3	2.7	2.3	2.2	3.1	2.0	19.2	2.4	1,160	2.3	2.4	1.6
15	4.4	2.8	2.2	2.3	3.1	6.2	11.2	2.3	631	2.2	2.3	1.5
16	4.5	2.8	2.2	2.3	387	90.6	6.4	76.5	42.4	2.2	2.1	1.4
17	3.7	2.7	2.2	2.4	123	78.8	4.4	40.9	17.4	2.3	2.0	1.6
18	3.2	2.7	2.2	14.1	42.7	4.9	57.0	4.4	11.7	2.3	1.9	1.8
19	3.9	2.7	2.2	3.0	7.1	2.2	1,100	3.6	8.6	2.3	1.9	2.0
20	2.6	2.5	2.2	2.3	5.0	2.0	281	3.1	6.9	2.2	1.8	2.0
21	2.7	2.4	2.4	2.2	4.3	1.8	511	2.4	6.0	2.4	1.9	2.0
22	85.3	2.6	2.2	7.6	4.0	1.8	1,590	1.9	5.3	2.4	2.0	2.0
23	52.2	2.7	2.2	96.5	3.8	5.5	1,060	2.1	4.5	2.4	1.9	1.8
24	25.0	2.7	2.4	5.8	3.6	335	1,320	2.2	3.6	2.4	1.9	1.8
25	18.8	2.7	2.4	3.6	3.4	2,680	1,280	2.4	3.2	2.4	2.1	2.0
26	13.8	2.7	2.1	2.9	3.2	1,020	105	2.5	2.9	2.4	2.2	2.1
27	9.8	3.4	2.1	2.3	2.9	749	45.3	2.7	2.4	2.4	2.3	2.2
28	6.8	32.7	1.9	1.9	2.7	106	14.7	2.9	2.2	2.4	2.3	2.2
29	4.3		1.9	1.6	2.4	33.5	502	3.2	2.1	2.5	2.4	2.4
30	3.6		2.6	1.6	2.1	291	4.6	3.4	2.2	2.6	2.3	2.6
31	3.6		2.9		1.9		2.8	3.4		2.8		2.9
Sum	374.8	112.3	246.6	183.8	*887.5	5,435.2	13,493.5	527.1	4,095.4	72.8	70.9	60.0

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1932-1938		
	High	Low	Day		Day				Average	Maximum	Minimum
Jan.	1.60	-.38	22	321	20	2.6	12.1	743	234	743	82.7
Feb.	2.60	-.40	28	911	22	2.2	4.0	223	142	223	90.6
Mar.	2.53	-.44	1	870	15	1.6	8.0	489	224	489	74.4
Apr.	2.36	* -.46	23	750	30	* 1.6	6.1	365	228	514	55.1
May	5.86	-.46	9	3,870	8	1.2	28.6	1,760	7,383	* 26,000	117
June	12.55	-.21	25	17,800	11	1.6	181	10,800	11,001	39,100	431
July	12.60	* .01	19	17,900	18	* .3	435	26,800	7,237	26,800	621
Aug.	5.64	* .35	3	3,600	22	1.8	17.0	1,050	6,178	* 26,680	254
Sept.	8.16	.42	14	7,400	30	2.0	137	8,120	13,234	24,600	1,590
Oct.	.55	.51	31	2.8	2	2.0	2.3	144	3,420	8,100	50.8
Nov.	.56	.40	6	3.2	20	1.8	2.4	141	307	1,100	64.9
Dec.	* .58	.43	31	2.9	16	1.4	1.9	119	573	3,080	90.0
Yearly	12.60	-.46		17,900		.3	70.1	50,754	50,161	90,407	6,470.2

* Partly Estimated

RIO GRANDE AT JOHNSON RANCH STATION

DESCRIPTION: Water-stage recorder and cable with stand up cable car, with winch, located about 2 miles above Johnson Ranch, about 14 miles below Castolon, Brewster County, Texas and Santa Helena ranch, Chihuahua, Mexico, and 378.2 river miles below the American Dam at El Paso, Texas. Zero of the gage is 2,046.00 feet above mean sea level, United States Geological Survey datum.

RECORDS: Based upon 44 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: April 1936 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow at this station is greatly modified by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, during the irrigation season, diversions for irrigating about 162,825 acres in the United States and about 167,064 acres in Mexico occurred above this station from the Rio Grande and its tributaries. With all closed basins eliminated the drainage area above this station is 64,866 square miles, 36,253 being in the United States and 28,613 in Mexico.

PREVIOUS EXTREME FLOWS: From high water marks it was determined that a stage of 24.6 feet was reached October 3, 1932; the estimated discharge for this stage was 97,000 second feet.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	960	771	1,200	192	121	58.0	12,600	12,500	1,320	*10,200	2,100	1,510
2	969	766	1,060	175	240	57.3	12,100	12,000	1,820	8,110	1,890	1,260
3	1,150	734	1,160	152	233	49.3	11,400	10,000	3,140	6,780	1,680	1,270
4	1,150	721	912	186	225	44.5	13,800	9,000	2,970	6,150	1,650	1,280
5	1,080	725	799	237	185	39.7	13,500	8,000	*6,010	5,190	1,570	1,380
6	1,260	693	727	246	162	38.3	11,900	7,500	8,690	4,700	1,720	1,490
7	1,140	665	748	221	130	40.6	8,000	6,500	11,200	4,250	1,770	1,330
8	943	621	779	216	106	40.6	6,360	6,800	14,600	3,860	1,680	1,260
9	914	744	726	204	105	57.8	4,920	6,500	14,600	3,680	1,810	1,160
10	1,040	1,100	707	196	1,120	75.0	4,120	6,400	14,700	3,670	1,860	1,180
11	1,150	1,340	729	247	1,260	70.7	3,700	5,800	15,000	3,340	1,630	1,210
12	1,230	1,250	750	277	614	54.4	3,640	4,900	19,000	3,380	1,860	1,140
13	1,350	1,240	710	240	436	33.3	3,290	4,400	18,800	*3,200	2,010	1,140
14	1,220	939	720	189	434	27.2	3,090	3,900	14,700	*3,050	1,990	1,050
15	1,150	745	700	162	369	148	2,990	3,700	14,700	2,560	1,840	981
16	1,150	893	690	177	574	240	2,890	3,600	11,800	2,380	1,670	1,050
17	1,210	938	700	234	694	366	2,810	3,600	12,700	2,360	1,680	1,150
18	1,330	797	700	244	416	219	2,740	3,400	14,600	2,300	1,560	1,020
19	1,420	900	590	242	363	151	3,760	3,500	19,800	2,480	1,460	1,110
20	1,320	929	480	192	343	104	4,560	3,000	26,400	2,220	1,700	1,160
21	1,230	796	460	159	315	71.1	5,020	2,900	35,800	1,990	1,700	1,050
22	1,200	1,020	441	151	260	66.1	8,320	2,900	42,900	1,880	1,590	955
23	1,290	1,020	393	397	224	48.8	11,500	2,700	54,400	1,790	1,670	1,110
24	1,460	1,080	360	276	200	1,110	13,100	2,000	55,000	1,740	1,500	1,050
25	1,350	918	368	226	185	12,000	17,700	1,600	41,400	1,920	1,480	1,190
26	1,490	765	356	226	167	15,100	21,100	1,540	31,000	2,280	1,570	1,250
27	1,600	859	313	223	144	11,800	23,400	1,370	23,300	2,130	1,600	1,210
28	1,440	868	278	194	123	7,230	30,700	1,410	18,800	1,830	1,750	989
29	1,440		262	177	103	5,120	21,300	1,350	15,300	1,820	1,520	886
30	1,240		251	144	101	9,630	15,300	1,270	12,100	1,810	1,610	1,220
31	909		228		89.0		13,200	1,220		1,950		1,210
Sum	37,785		19,297		10,041		312,810		576,550		51,120	
		24,837		6,402		64,090.7		145,260		105,000		36,251

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day			1938	⊖Normal	⧺Maximum	⧺Minimum
Jan.	3.37	2.57	26	1,750	31	823	1,220	74,900	75,823	74,900	35,900
Feb.	3.21	2.36	11	1,410	9	578	887	49,300	59,227	52,400	39,400
Mar.	3.36	1.53	1	1,620	31	212	622	38,300	55,191	39,600	31,100
Apr.	2.39	1.26	23	734	30	118	213	12,700	42,156	12,700	8,990
May	3.82	1.15	10	2,380	31	58.7	324	19,900	61,450	61,300	19,900
June	13.90	.84	25	32,200	6	23.1	2,140	127,000	74,160	127,000	17,700
July	14.06	4.12	28	32,600	18	2,720	10,100	620,000	120,073	620,000	43,900
Aug.	8.19	2.49	1	13,000	31	1,180	4,690	288,000	176,611	288,000	52,100
Sept.	19.75	2.46	23	58,800	2	1,240	19,200	1,144,000	341,574	1,144,000	237,000
Oct.	*7.99	4.02	1	*11,100	25	1,680	3,390	208,000	195,922	208,000	131,000
Nov.	4.43	3.79	1	2,170	24	1,360	1,700	101,000	77,054	101,000	53,900
Dec.	4.11	3.26	1	1,720	29	855	1,170	71,900	71,391	75,800	71,900
Yearly	19.75	.84		58,800		23.1	3,810	2,755,000	⊖1,350,632	⊖2,755,000	⊖610,000

* Partly Estimated.

⊖ The monthly normals and the yearly normal, maximum, and minimum from January 1924 to March 1936 included in the above table were estimated from Boquillas and Lower Presidio.

⧺ The monthly maximums and minimums are for the period 1936 to 1938 only.

RIO GRANDE AT LANGTRY STATION, TEXAS

DESCRIPTION: Water-stage recorder and cable with stand up cable car and winch, located at Langtry, Texas, 78.4 miles above Villa Acuna, Coahuila and 597.2 river miles below the American Dam at El Paso, Texas. Zero of gage is 1,091.69 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 30 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: May 1900 to October 1914; December 1919 to March 1920; and January 1924 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: Large reservoirs and many irrigation diversions in the United States and Mexico, greatly modify the river flow. Below San Marcial, New Mexico, diversions for irrigating 163,345 acres in the United States and 167,139 acres in Mexico occurred above this station from the Rio Grande and its tributaries. With all closed basins eliminated, the drainage area above this station is 75,058 square miles; 42,769 square miles being in the United States and 32,289 in Mexico.

PREVIOUS EXTREME FLOWS: The highest recorded gage height was on June 18, 1922, when the extreme gage height was 56.9 feet; the estimated discharge for this stage from extension of the rating curve was about 200,000 second feet. The lowest flow ever recorded was in May 1904, with an extreme of 270 second feet. Numerous records of extremes may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,570	1,710	1,170	617	528	474	7,200	13,800	1,810	11,500	2,140	2,000
2	*1,630	1,500	1,190	579	802	452	11,500	12,500	1,650	10,700	2,130	1,920
3	*1,580	1,290	1,280	567	1,220	422	13,700	10,900	1,580	9,780	2,350	2,000
4	1,430	1,190	1,470	556	535	415	12,000	10,400	2,380	8,430	2,220	1,770
5	1,450	1,170	1,360	545	483	400	15,100	9,280	4,180	7,610	2,110	1,640
6	1,610	1,130	1,400	539	460	386	14,700	8,170	4,930	6,860	1,940	1,620
7	1,600	1,100	1,250	504	535	371	12,600	7,490	6,890	6,110	1,920	1,620
8	1,560	1,090	1,180	468	528	371	9,890	7,040	8,690	5,550	1,860	1,790
9	1,640	1,070	1,110	506	506	1,610	*7,110	6,800	12,300	*5,140	2,090	1,800
10	1,510	1,080	1,120	538	497	757	*5,950	7,100	14,500	*4,860	1,990	1,690
11	1,350	1,050	1,140	546	490	508	*5,320	6,570	15,400	*4,670	2,070	1,590
12	1,310	1,150	1,100	547	481	399	*4,790	6,370	15,900	*4,400	2,150	1,520
13	1,430	1,510	1,060	542	1,210	363	4,090	5,740	17,800	4,090	2,080	1,560
14	1,490	1,680	1,060	535	1,290	366	3,980	5,010	20,900	4,030	1,960	1,520
15	1,590	1,640	1,060	537	947	369	*3,660	4,710	20,300	3,850	2,270	1,510
16	1,680	1,570	1,010	560	767	364	*3,370	4,210	18,400	3,720	2,300	1,490
17	1,590	1,340	1,040	568	707	359	*3,080	4,000	14,200	3,280	2,260	1,410
18	1,530	1,160	1,020	541	713	645	*2,820	4,020	11,800	2,900	2,070	1,330
19	1,530	1,220	1,000	513	733	1,190	4,140	3,990	12,800	2,900	1,990	1,440
20	1,570	1,230	985	535	852	*712	4,120	3,600	16,200	2,750	1,990	1,470
21	1,670	1,170	979	690	791	*604	5,940	3,710	20,400	2,840	1,890	1,380
22	2,000	1,220	919	564	697	*535	10,800	3,260	25,700	2,730	1,930	1,460
23	2,610	1,250	848	542	744	*478	20,300	3,240	32,900	2,460	2,100	1,470
24	1,910	1,170	811	535	662	3,480	30,100	3,200	41,900	2,230	1,970	1,370
25	1,960	1,310	788	513	613	572	16,700	3,110	53,700	2,180	1,940	1,300
26	1,770	1,340	771	506	577	9,130	14,500	2,680	53,600	2,120	2,010	1,410
27	1,760	1,360	734	628	556	17,200	18,900	2,240	35,800	2,120	1,800	1,400
28	1,670	1,280	696	614	745	17,200	22,000	1,970	23,300	2,460	1,870	1,540
29	1,830		692	550	522	8,670	26,200	3,920	18,200	2,540	1,940	1,590
30	1,900		688	528	516	6,290	29,200	3,820	13,900	2,270	2,060	1,510
31	1,740		649		509		18,800	1,910		2,100		1,310
Sum	51,470	35,980	31,580	16,513	21,216	75,092	362,560	174,760	542,010	139,180	61,400	48,430

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
				High		Low		Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	3.25	1.35	23	3,810	12	1,270	1,660	102,000	103,519	*245,000	52,300
Feb.	1.81	1.12	1	1,730	11	1,020	1,280	71,400	83,637	*117,000	48,900
Mar.	1.66	.65	4	1,550	31	635	1,020	62,600	81,447	118,000	48,100
Apr.	.79	.43	21	731	8	460	550	32,800	68,520	105,000	30,100
May	2.64	.39	3	2,900	6	445	684	42,100	97,304	233,000	32,300
June	11.80	.29	28	21,300	18	355	2,500	149,000	104,565	160,000	37,310
July	18.36	2.42	24	39,600	18	2,750	11,700	719,000	155,882	719,000	56,100
Aug.	8.85	1.84	1	15,000	31	1,860	5,640	347,000	217,327	730,000	78,100
Sept.	24.78	1.54	26	57,300	3	1,560	18,100	1,075,000	409,671	1,100,130	35,700
Oct.	8.45	1.86	1	12,800	31	2,050	4,490	276,000	239,588	856,120	55,200
Nov.	2.25	1.54	3	2,410	27	1,770	2,050	122,000	104,192	147,000	56,600
Dec.	1.93	1.04	1	2,130	31	1,230	1,560	96,100	96,830	134,000	49,800
Yearly	24.78	.29		57,300		355	4,270	3,095,000	1,762,482	3,095,000	879,000

* Partly Estimated

PECOS RIVER STATION NEAR COMSTOCK, TEXAS

DESCRIPTION: Staff-gage and cable with sit down cable car and winch, located at the Pecos high bridge on the railroad 12 miles northwest of Comstock,Texas, 5-1/2 miles above the confluence with the Rio Grande. This river enters the Rio Grande 621.5 river miles below the American Dam at El Paso, Texas. Zero of the gage is 1,058.01 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 14 meter measurements during the year. Staff-gage read twice daily and more frequently during large changes of stage. Computations by shifting channel methods. 1938 records good. Records available: March 17, 1898 to December 3, 1898, and May 1900 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow is greatly modified at this station by many irrigation diversions and by the reservoirs of the Carlsbad irrigation project in New Mexico, and the Red Bluff reservoir in Texas. Below the Red Bluff reservoir and above this station diversions were made for irrigating approximately 57,000 acres of land, about 32,000 acres being from the Pecos River and about 25,000 from springs. With all closed basins eliminated, the drainage area above this station is 38,283 square miles, all in the United States.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on September 1, 1932, when the extreme gage height was 38.25 feet and the extreme flow was 116,000 second feet. An extreme gage height of 35.75 feet was reported on April 6, 1900; discharge based upon 1935 rating curve was 107,000 second feet. The lowest flow ever recorded was on August 31, 1930, when the extreme gage height was -0.15 foot and the extreme flow was 97 second feet. Numerous records of extremes may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	479	500	376	220	290	236	236	921	324	303	352	307
2	439	481	358	211	280	230	234	802	306	286	347	307
3	418	481	372	222	532	231	247	708	298	286	334	302
4	415	482	370	219	303	229	271	645	292	283	330	302
5	443	478	367	237	283	230	268	580	293	283	322	294
6	440	482	361	228	262	228	261	549	283	280	317	310
7	442	464	347	211	255	221	243	523	280	284	308	306
8	438	455	348	211	252	242	254	484	280	285	289	302
9	440	463	358	220	242	889	268	479	319	285	295	302
10	441	453	356	221	238	258	252	445	331	286	287	297
11	439	462	350	228	232	237	269	425	340	290	286	301
12	440	461	330	239	221	237	262	420	341	861	286	297
13	433	469	328	233	218	237	231	419	341	540	285	293
14	429	463	339	230	221	234	215	413	346	439	284	293
15	434	453	341	241	244	228	197	395	351	363	328	293
16	443	467	313	256	226	228	197	368	348	350	320	293
17	447	448	295	267	216	222	192	350	345	353	320	293
18	438	451	300	271	220	219	197	340	349	385	305	281
19	435	450	304	245	223	235	193	331	323	371	304	278
20	435	440	301	253	217	232	678	326	312	359	300	278
21	453	454	287	254	215	232	957	325	308	354	304	278
22	561	439	288	243	283	225	385	336	299	349	304	285
23	551	429	280	240	2,130	220	3,140	345	288	356	304	315
24	551	418	265	236	617	233	18,100	355	353	336	296	308
25	541	420	252	222	451	239	8,010	342	349	335	300	304
26	513	391	238	222	303	233	2,240	339	335	326	295	300
27	500	373	235	218	289	330	1,030	332	319	337	307	292
28	500	387	240	250	261	274	804	321	316	340	307	291
29	495		232	424	248	246	722	334	305	355	303	295
30	500		237	306	242	242	722	433	299	362	295	291
31	495		231		236		1,190	339		361		291
Sum	14,428		9,599		10,450		42,465		9,573		9,214	
		12,614		7,278		7,777		13,724		10,983		9,179

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	1.04	.76	22	561	3	413	465	28,600	23,697	55,880	12,900
Feb.	.92	.66	1	504	26	371	450	25,000	18,747	39,060	10,900
Mar.	.70	.38	1	380	29	229	310	19,000	18,387	32,870	11,100
Apr.	.92	.30	29	465	7	208	243	14,400	16,347	25,400	9,520
May	6.00	.26	23	5,570	22	208	337	20,700	41,111	156,000	10,800
June	3.90	.23	9	2,840	23	217	259	15,400	33,916	135,000	13,300
July	16.42	.13	24	31,500	17	189	1,370	84,200	23,649	84,200	7,620
Aug.	1.71	.56	1	934	28	317	443	27,200	19,075	50,400	7,620
Sept.	.62	.42	15	355	6	279	319	19,000	54,088	324,420	6,190
Oct.	2.07	.38	12	1,160	6	277	354	21,800	38,705	192,240	9,520
Nov.	.62	.45	1	356	14	280	307	18,300	22,799	73,260	10,300
Dec.	.60	.42	23	331	19	263	296	18,200	22,509	54,260	12,200
Yearly	16.42	.13		31,500		189	431	311,800	333,030	831,510	176,780

GOODENOUGH SPRING STATION NEAR COMSTOCK, TEXAS

DESCRIPTION: Water-stage recorder and light cable (winch operated), for carrying current meter and light weights only, located 4,000 feet above confluence with Rio Grande and 11-3/4 miles southwest of Comstock, Val Verde County, Texas. The stream from this spring enters the Rio Grande 647.2 river miles below the American Dam at El Paso. Zero of gage is 971.91 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 15 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: February 23, 1929 to December 1938. Annual discharges for the years 1924 to 1928, inclusive were estimated as were the monthly discharges for January and February 1929. See p. 52, Water Bulletin No. 6. See table of Authenticated Discharge Records herein.

REMARKS: The flow of this spring channel is very uniform and is not modified by diversions or storage. When the Rio Grande reaches a flow of about 35,000 second feet near this station, then back water from the Rio Grande reaches this gaging station. The surface drainage area above this station is one square mile, all in the United States.

PREVIOUS EXTREME FLOWS: The highest recorded gage height was on November 5, 1932, when the extreme gage height was 3.85 feet, discharge 742 second feet. The lowest flow ever recorded was on April 4, 1930 when the extreme gage height was 0.27 foot and the extreme flow was 93 second feet. Backwater from the Rio Grande reached gage height 13.86 on September 4, 1935, and 17.30 on September 1, 1932.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	113	116	107	103	121	111	129	180	218	145	129	123
2	111	116	109	102	121	111	127	175	216	145	129	122
3	109	114	108	103	119	111	127	171	205	144	128	122
4	107	114	109	103	117	110	126	164	186	143	128	122
5	108	114	107	104	116	110	125	161	176	143	129	119
6	106	112	107	105	116	112	123	159	167	142	128	119
7	104	112	106	110	113	112	123	156	159	141	126	119
8	103	112	107	110	111	112	123	152	155	141	127	119
9	103	112	107	110	111	111	123	150	150	140	128	119
10	104	112	106	111	112	113	122	150	147	139	128	119
11	104	113	107	111	110	113	123	149	146	139	128	118
12	103	113	108	111	110	114	122	148	143	139	127	117
13	104	112	108	112	110	115	121	147	142	138	126	116
14	104	112	108	112	109	117	121	146	141	137	126	116
15	104	112	106	112	108	115	121	144	139	137	126	117
16	106	113	105	110	108	114	120	142	139	136	127	116
17	106	111	106	112	108	113	120	141	144	136	127	116
18	105	109	106	122	108	113	120	140	142	135	124	115
19	107	109	104	124	108	112	119	139	143	133	124	116
20	107	109	105	128	108	111	144	138	144	133	125	116
21	107	109	105	127	108	111	151	137	144	133	125	115
22	108	108	105	125	112	112	153	137	144	133	124	116
23	113	108	104	127	116	112	186	136	146	132	123	115
24	113	108	104	127	118	119	* 238	136	152	131	123	116
25	114	107	104	127	119	146	* 237	136	153	131	124	118
26	115	108	104	127	118	152	239	135	151	131	123	118
27	116	108	105	124	116	140	228	135	151	130	123	115
28	116	107	106	123	114	135	216	135	148	130	123	116
29	117		106	122	114	132	206	152	146	130	123	117
30	116		106	121	114	132	195	204	146	129	122	115
31	114		104		113		188	221		129		115
Sum	3,367	3,110	3,289	3,465	3,506	3,541	4,716	4,716	4,683	4,225	3,773	3,642

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	⊖ Maximum	⊖ Minimum
Jan.	.40	.24	1	113	15	102	109	6,680	9,323	19,620	6,580
Feb.	.32	.21	2	117	25	106	111	6,170	8,346	17,030	5,890
Mar.	.28	.21	13	110	19	104	106	6,520	8,749	17,770	6,210
Apr.	.57	.20	20	128	2	101	116	6,870	8,138	16,580	5,850
May	.50	.31	1	122	21	107	113	6,950	8,714	16,840	6,950
June	.85	.32	26	156	4	108	118	7,020	9,014	16,040	7,020
July	2.54	.32	20	466	19	119	152	9,350	9,327	16,460	7,230
Aug.	1.98	.87	29	319	28	134	152	9,350	9,065	15,840	6,960
Sept.	1.52	.97	1	220	30	145	156	9,290	12,293	‼ 41,490	6,550
Oct.	.97	.75	1	145	31	129	136	8,380	10,689	* 25,870	6,950
Nov.	.76	.59	2	130	23	121	126	7,480	9,794	21,850	6,600
Dec.	.64	.53	1	124	27	114	117	7,220	9,585	20,470	6,730
Yearly	2.54	.20		466		101	126	91,280	113,037	192,840	86,420

* Partly Estimated ‼ Estimated ⊖ Maximum and minimum figures are for the period 1929 to 1938 only.

DEVILS RIVER STATION NEAR DEL RIO, TEXAS

DESCRIPTION: Water-stage recorder on main highway bridge, 12 miles northwest of Del Rio, Texas. Devils river enters the Rio Grande 662.8 river miles below the American Dam at El Paso, Texas. High stage measurements from highway bridge, low stage measurements by wading. Zero of gage is 951.80 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 10 meter measurements and 1 mutiple float measurement during the year. Computations by shifting channel methods. 1938 records good. Records available: May 1900 to March 1914, at a point .8 mile below Southern Pacific Railroad bridge; December 1923 to September 1, 1932, at a point .2 mile above Southern Pacific Railroad bridge; September 2, 1932 to December 31, 1938, at highway bridge 2 miles upstream from railroad bridge. See table of Authenticated Discharge Records herein.

REMARKS: The monthly flow of this spring-fed river is not modified, but the daily flow is modified by 2 power dams. There are no irrigation diversions from this river. The drainage area above this station is 4,060 square miles, all in the United States.

PREVIOUS EXTREME FLOWS: The highest recorded gage height was on September 1, 1932, when the extreme gage height was 41.0 feet at present station and the extreme flow was 597,000 second feet. (See Special Flood Report 1932 by American Section of this Commission.) This corresponds to a flow of 147 second feet per square mile of water shed. The lowest flow ever recorded was on November 18, 1935, when the extreme gage height was .84 foot for a fraction of a day and the extreme flow 0 second feet. Numerous records of extreme flows may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	383	394	360	344	327	257	279	663	435	413	386	365
2	335	390	358	331	321	251	289	637	435	415	379	376
3	329	389	362	331	321	226	286	611	448	438	390	363
4	358	391	377	330	318	292	289	576	440	427	361	367
5	341	378	396	330	313	282	279	553	427	423	375	374
6	336	396	375	330	309	255	277	565	440	420	390	371
7	339	403	345	351	322	254	276	565	414	411	403	368
8	364	390	346	319	318	270	259	540	414	411	382	366
9	333	374	356	339	318	260	224	522	407	409	377	368
10	339	386	352	322	318	277	244	503	415	416	384	359
11	339	369	366	322	316	285	244	445	444	428	379	359
12	334	383	365	327	299	283	270	469	411	414	381	373
13	331	389	355	316	242	256	270	518	405	405	379	367
14	341	386	353	321	320	263	252	438	411	409	367	373
15	316	359	363	331	318	262	252	476	397	396	382	363
16	331	403	356	315	313	261	261	488	410	413	388	366
17	341	384	320	312	310	269	274	436	417	403	393	369
18	342	390	459	315	308	277	270	465	436	420	415	367
19	335	371	438	306	307	268	270	441	423	404	381	363
20	333	355	345	325	308	283	270	445	426	406	367	330
21	342	363	347	333	307	264	339	435	425	415	365	361
22	345	362	306	312	304	263	8,190	479	410	414	381	357
23	363	364	347	312	303	271	56,600	451	414	409	369	361
24	428	358	346	318	300	279	47,700	428	412	412	374	370
25	388	353	344	332	289	314	23,000	436	418	408	363	365
26	546	346	343	330	286	314	34,200	428	418	404	369	366
27	500	346	326	325	289	296	7,170	431	404	340	367	353
28	379	353	347	409	298	279	3,000	414	436	387	368	360
29	376		339	360	294	270	1,920	468	434	392	370	365
30	399		323	321	208	261	1,370	456	415	385	369	357
31	411		337		220		994	445		386		364
Sum	11,277	10,525	11,052	9,869	9,324	8,142	189,818	15,227	12,641	12,633	11,354	11,286

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	1.56	.73	27	558	29	29.1	364	22,400	25,783	*45,250	14,500
Feb.	1.53	.84	16	531	15	60.0	376	20,900	23,073	*36,880	13,300
Mar.	1.52	.82	5	518	30	42.4	357	21,900	23,823	39,420	14,000
Apr.	1.56	.95	28	537	19	73.2	329	19,600	26,940	67,800	11,100
May	1.56	.84	31	515	31	9.0	301	18,500	50,563	301,000	10,500
June	1.44	.97	8	373	19	32.0	271	16,100	48,547	285,000	16,100
July	14.30	.93	23	107,000	9	10.4	6,120	377,000	55,667	377,000	20,200
Aug.	1.66	1.14	1	690	24	192	491	30,200	26,289	*51,000	15,500
Sept.	1.60	1.00	10	614	8	119	421	25,100	119,095	895,990	13,900
Oct.	1.60	.87	20	604	27	55.4	408	25,100	56,384	349,000	18,600
Nov.	1.59	1.12	6	578	24	141	378	22,500	27,363	56,350	15,900
Dec.	1.60	.70	24	569	20	8 0	364	22,400	26,918	49,520	15,900
Yearly	14.30	.70		107,000		8 0	859	621,700	510,445	1,284,080	237,400

* Partly Estimated
8 Estimated

RIO GRANDE AT DEL RIO STATION

DESCRIPTION: Water-stage recorder, located 900 feet upstream from international highway bridge between Del Rio, Texas and Villa Acuna, Coahuila, and 675.5 river miles below the American Dam at El Paso, Texas. High stage measurements from highway bridge, low stage measurements from boat on cable at gage well. Zero of gage is 864.80 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 25 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: December 1923 to December 1938. Records are also available for station 11 miles upstream from May 1900 to April 1915; and for station 7-1/2 miles upstream at McKee's Switch from December 1919 to March 1920. Several small springs but no important tributaries enter the river between the various sites. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow is greatly modified at this station by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, and below the Red Bluff Dam on the Pecos river, diversions for irrigating approximately 220,695 acres in the United States and 167,139 acres in Mexico occurred above this station from the Rio Grande and its tributaries. With all closed basins eliminated, the drainage area above this station is 120,704 square miles; 85,529 being in the United States and 35,175 in Mexico.

PREVIOUS EXTREME FLOWS: The highest recorded gage height was on September 1, 1932, when the extreme gage height was 34.5 feet, discharge 605,000 second feet. This is the greatest rate of discharge ever recorded at any point on the Rio Grande. (See Special Flood Report 1932 by American Section of this Commission). The lowest flow ever recorded was in May, 1930, when the extreme gage height was 1.42 feet and the extreme flow 938 second feet. Numerous records of extreme flows may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,800	2,840	2,290	*1,540	1,450	1,120	*6,510	19,700	2,940	15,300	3,180	3,030
2	2,800	2,810	2,200	*1,480	1,420	1,130	*9,090	16,300	2,750	13,100	3,230	3,020
3	2,600	2,700	2,180	*1,460	1,580	1,080	*12,800	15,000	2,600	11,700	3,190	2,910
4	2,600	2,540	2,270	*1,450	2,160	1,090	*13,000	13,100	2,490	10,400	3,370	2,970
5	2,500	2,450	2,380	*1,440	1,490	1,070	*14,300	12,100	3,730	9,320	3,240	2,770
6	2,450	2,380	2,320	*1,420	1,410	1,070	*14,700	11,200	4,100	8,650	3,150	2,690
7	2,700	2,300	2,300	*1,400	1,400	1,060	*14,500	9,630	5,560	7,790	3,000	2,680
8	2,700	2,230	2,200	*1,360	1,380	1,060	*12,600	9,270	7,860	6,970	2,970	2,680
9	2,600	2,170	2,110	*1,330	1,380	1,100	*9,150	8,250	10,300	6,360	2,920	2,770
10	2,700	2,150	2,070	*1,340	1,400	2,700	*7,720	8,670	13,800	5,840	3,080	2,780
11	2,610	2,120	2,050	*1,400	1,340	1,500	*6,600	8,270	14,600	5,470	3,020	2,720
12	2,500	2,080	2,110	*1,420	1,340	1,200	*5,610	7,900	15,100	5,500	3,110	2,640
13	2,400	2,130	2,060	*1,430	1,340	1,100	*5,190	7,620	15,500	5,510	3,190	2,580
14	2,500	2,460	2,010	*1,420	1,810	*1,130	*4,510	6,670	18,000	5,220	3,100	2,590
15	2,500	2,570	2,000	*1,440	2,040	*1,130	*4,430	6,140	19,400	5,030	3,020	2,580
16	2,600	2,730	2,000	*1,440	1,820	1,130	*3,910	5,680	19,800	4,810	3,270	2,550
17	2,700	2,560	1,950	*1,760	1,650	*1,100	*3,630	5,220	16,500	4,700	3,270	2,510
18	2,650	2,340	2,040	*1,520	1,610	*1,100	3,470	5,020	13,700	4,210	3,200	2,450
19	2,600	2,190	2,060	*1,430	1,600	*1,070	3,390	4,950	13,200	3,980	3,010	2,410
20	2,450	2,220	*1,940	*1,410	1,550	*1,400	5,680	4,740	15,300	3,890	2,980	2,440
21	2,490	2,260	1,930	*1,430	1,600	*1,480	6,130	4,510	18,700	3,740	2,980	2,490
22	2,750	2,230	1,880	*1,550	1,650	*1,300	10,700	4,500	22,500	3,830	2,880	2,440
23	3,370	2,250	1,840	*1,460	2,890	*1,220	78,700	4,000	27,200	3,690	2,880	2,490
24	3,420	2,270	1,790	*1,400	2,650	3,290	90,000	4,000	33,900	3,470	3,030	2,550
25	3,010	2,180	1,710	*1,390	1,960	3,820	77,200	3,970	43,800	3,310	2,940	2,480
26	3,130	2,290	1,670	*1,380	1,720	2,100	60,600	3,810	55,800	3,240	2,910	2,390
27	3,010	2,310	1,650	*1,380	1,500	14,000	29,800	3,460	51,200	3,110	2,960	2,480
28	2,880	2,340	1,610	*1,470	1,400	18,100	24,400	3,100	33,900	3,170	2,800	2,450
29	2,770		1,560	*1,590	1,460	14,500	*25,100	3,840	23,500	3,470	2,890	2,530
30	2,930		1,550	*1,570	1,300	8,140	*27,900	6,840	18,600	3,460	2,900	2,590
31	2,950		1,560		1,150		27,700	3,520		3,310		2,530
Sum	84,670	66,100	61,290	*43,510	50,450	92,290	*619,020	230,980	546,330	181,550	91,670	81,190

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	2.24	1.00	23	4,300	13	2,310	2,730	168,000	177,118	344,000	111,000
Feb.	1.46	.90	1	2,920	12	1,970	2,360	131,000	146,899	229,970	96,200
Mar.	1.20	.40	4	2,450	29	1,390	1,980	122,000	147,971	224,670	94,700
Apr.	2.47	.25	17	4,760	9	1,190	*1,450	*86,300	133,596	196,000	83,300
May	2.31	.14	23	4,550	31	950	1,630	100,000	213,870	*700,000	68,200
June	7.15	.08	28	20,000	17	1,000	3,080	183,000	220,869	704,000	110,200
July	20.22	1.61	24	118,000	19	3,300	*20,000	*1,228,000	259,094	*1,228,000	97,800
Aug.	7.68	1.45	1	23,200	28	2,900	7,450	458,000	285,225	865,000	124,000
Sept.	13.53	1.06	26	58,100	4	2,340	18,200	1,084,000	635,138	2,754,590	72,600
Oct.	*6.20	1.35	1	*16,700	28	3,030	5,860	360,000	380,931	1,409,020	110,000
Nov.	1.68	1.04	4	3,530	28	2,650	3,060	182,000	182,381	376,150	108,000
Dec.	1.47	.72	1	3,270	26	2,290	2,620	161,000	172,609	295,180	108,000
Yearly	20.22	.08		118,000		950	5,890	4,263,300	2,955,701	6,041,720	1,639,000

* Partly Estimated

ARROYO LAS VACAS NEAR VILLA ACUNA, COAHUILA

DESCRIPTION: Staff gage located 1.5 miles upstream from Villa Acuna, Coahuila, and 1.8 miles upstream from the confluence with the Rio Grande just above the Del Rio-Villa Acuna international bridge and 675.6 river miles above the American Dam at El Paso, Texas. Low stage measurements by wading, high stage flows estimated by extending the rating curve. Zero of the gage is 884.15 feet, United States Coast and Geodetic Survey sea level datum.

RECORDS: Based upon 32 meter measurements after March 20, 1938. Computations by shifting channel methods. 1938 records fair. Records available: Occasional estimates from June, 1935, to March 20, 1938, after which the present record extends to December 31, 1938. See table of Authenticated Discharge Records herein.

REMARKS: This is a new gaging station. It began operating March 20, 1938. Three staff gage readings were made daily during low flows and each hour during floods. The flow of this spring-fed stream was greatly modified by irrigation diversions for about 620 acres in Mexico. The drainage area above this station is 154 square miles, entirely in Mexico.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1				2.5	2.8	2.5	3.2	5.7	2.5	2.1	1.4	2.1
2				2.5	2.8	2.1	3.2	5.7	2.5	1.8	1.4	2.1
3				2.5	2.5	2.1	3.2	5.7	1.8	1.8	1.4	2.1
4				2.5	2.5	2.1	2.8	5.7	1.8	1.8	1.4	2.1
5			* 3.0	2.5	2.5	2.1	2.8	5.7	1.8	1.8	1.1	2.1
6		* 1.0		1.8	2.5	2.1	2.8	5.7	1.8	1.8	1.1	2.1
7				2.1	2.1	2.1	2.8	5.3	1.8	1.8	1.1	2.1
8				2.1	2.1	2.1	4.6	5.3	1.8	1.8	1.1	2.1
9			* 4.0	2.1	2.1	2.1	2.8	5.3	1.8	1.8	0.7	2.1
10				2.5	2.1	2.1	2.8	5.3	1.8	1.7	0.7	2.1
11				2.5	2.1	2.1	2.8	5.3	1.8	1.8	2.1	2.1
12				2.5	2.1	2.1	2.8	5.3	1.8	1.8	2.1	2.1
13		* 1.0		2.8	2.5	2.1	2.8	5.3	1.8	1.8	2.1	2.1
14				2.8	2.5	2.1	2.8	5.3	1.8	1.8	2.1	2.1
15				3.2	2.5	2.1	2.8	4.9	2.1	1.8	2.1	2.1
16				3.5	2.5	3.2	2.8	4.9	2.1	1.8	2.1	2.1
17		* 2.0		* 438	2.5	3.2	2.8	4.9	2.1	2.1	2.1	2.1
18	* 1.0			7.1	2.5	2.5	2.8	4.9	2.1	2.1	2.1	2.1
19			* 2.0	3.5	2.8	2.1	2.8	4.9	2.1	2.1	2.1	2.1
20			2.8	3.9	2.8	2.1	2.8	4.9	2.1	2.1	2.1	2.1
21			2.8	3.9	2.8	2.1	2.8	4.9	2.1	2.1	2.1	2.1
22			3.2	3.5	2.8	2.5	25.1	4.6	2.1	7.4	2.1	2.1
23			3.2	3.2	2.8	2.5	*3,810	3.9	2.1	3.9	2.1	2.1
24			3.2	3.2	2.8	3.2	* 44.1	3.9	2.1	2.8	2.1	2.1
25		4.4	2.8	3.2	2.8	3.2	6.4	3.9	2.1	2.8	2.1	2.1
26	* 2.0		2.8	3.2	2.8	3.2	5.7	3.9	2.1	2.1	2.1	2.1
27			2.5	2.8	2.8	3.2	5.7	3.9	2.1	2.1	2.1	2.1
28		* 3.0	2.5	2.8	2.5	3.2	5.7	4.2	2.1	1.8	2.1	3.2
29			2.5	2.8	2.5	3.2	5.7	* 611	2.1	1.8	2.1	3.2
30			2.1	2.5	2.5	3.2	5.7	6.7	2.1	1.8	2.1	3.2
31	* 1.0		2.5		2.5		5.7	4.9		1.8		3.2
Sum				524.0	78.4	74.5	3,981.6	761.8	60.2	67.8	53.4	69.5

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day		1938	1938	Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.#											
Apr.	5.91	1.02	17	* 10,400	6	1.8	17.5	1,040			
May	.98	.95	1	2.8	7	2.1	2.5	156			
June	1.02	.95	16	3.2	2	2.1	2.5	148			
July	6.56	1.02	23	* 16,100	4	2.8	128	7,900			
Aug.	4.86	1.08	29	* 4,590	23	3.9	24.6	1,510			
Sept.	1.02	.98	1	2.5	3	1.8	2.0	119			
Oct.	1.41	.98	22	18.4	2	1.8	2.2	134			
Nov.	.98	.98	11	2.1	9	.7	1.8	106			
Dec.	1.02	.98	28	3.2	1	2.1	2.2	138			
Period	6.56	.95		* 16,100		.7	20.6	11,251			

* Partly Estimated / and other days # Continuous record began March 20, 1938

SAN FELIPE CREEK STATION NEAR DEL RIO, TEXAS

DESCRIPTION: Water-stage recorder at Silos farm road bridge 1-3/4 miles south of Del Rio, Texas, 2 miles above the confluence with the Rio Grande and 4 miles below the Del Rio gaging station on the Rio Grande. This stream enters the Rio Grande 679.0 river miles below the American Dam at El Paso, Texas. Zero of gage is 875.05 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 13 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: September 1, 1931 to December 31, 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The flow of this spring-fed creek was greatly modified by municipal diversions at Del Rio of 1,160 acre feet and irrigation diversions for approximately 1,393 acres of land above this station. The drainage area above this station is 62 square miles, all in the United States.

PREVIOUS EXTREME FLOWS: The highest previous recorded flow was on June 14, 1935, when a flow of 45,000 second feet was reached with a gage of 23.20 feet. With spring flow eliminated this storm flow corresponds to 726 second feet per square mile of water shed. The lowest flow was 2.2 second feet on December 19, 1934. Backwater from the Rio Grande reaches this station whenever the Rio Grande stage at Del Rio station gets above 14 feet or a flow of about 60,000 second feet.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	68.2	68.6	39.8	38.4	54.0	40.5	29.5	*41.9	47.1	*40.0	42.5	*49.6
2	69.3	68.5	39.8	37.6	51.3	35.0	*31.6	*38.7	46.3	41.5	41.0	*49.6
3	69.4	68.4	40.5	39.2	47.9	35.0	*31.6	37.8	46.3	41.5	41.0	48.9
4	69.6	68.3	40.5	38.3	47.9	33.6	30.8	39.3	47.9	41.4	41.7	48.9
5	69.7	67.2	39.7	41.4	46.2	35.7	29.4	41.6	48.8	41.4	41.7	48.9
6	69.8	68.1	37.4	45.6	46.2	35.7	29.4	43.0	49.7	42.1	42.5	48.9
7	70.0	67.0	38.0	44.7	48.0	35.0	27.9	44.5	47.9	41.3	41.7	*50.5
8	71.2	68.1	36.5	45.6	48.1	36.5	27.9	44.4	48.0	41.3	42.5	*50.5
9	75.7	69.3	38.0	40.7	48.9	36.4	29.3	42.7	47.2	40.4	46.0	*51.4
10	74.7	69.4	38.0	43.9	51.5	37.2	29.2	42.0	47.2	39.6	46.0	*52.3
11	74.8	55.1	41.1	43.8	50.8	34.9	28.5	42.7	46.4	39.6	46.8	*53.2
12	70.6	51.3	40.3	46.4	51.6	35.6	28.4	42.0	46.4	41.2	47.7	*53.2
13	66.5	50.5	41.8	45.5	51.6	34.9	29.7	41.2	43.8	40.4	46.8	*53.2
14	66.4	47.2	42.6	42.9	49.0	34.9	28.2	39.7	42.3	40.4	46.0	*53.2
15	66.3	51.6	45.0	45.5	54.4	36.3	27.4	39.8	46.3	40.4	46.8	*52.3
16	67.2	50.8	41.7	47.7	52.5	33.4	26.8	*38.2	43.7	41.2	46.0	*52.3
17	67.1	47.5	45.9	99.8	47.2	30.7	26.7	*38.2	43.6	40.3	47.8	*51.4
18	68.1	44.9	45.9	69.1	48.9	29.2	26.0	*38.2	*43.6	42.6	46.9	*51.4
19	66.9	45.0	45.0	56.7	48.1	29.9	24.1	*38.2	*43.6	42.6	47.8	*51.4
20	65.7	44.3	43.2	55.7	48.1	30.6	23.4	40.5	*43.5	42.6	48.7	*51.4
21	66.6	46.0	43.2	52.8	44.6	32.5	24.5	41.3	*42.7	42.6	48.7	*51.4
22	75.8	44.4	44.1	51.0	48.1	31.2	37.7	41.3	*41.9	42.6	48.7	*51.4
23	83.7	44.5	42.4	48.4	44.6	32.5	*137	41.3	*41.1	44.3	49.5	*51.4
24	69.5	40.6	41.6	49.3	39.7	33.1	*857	42.1	*40.3	43.4	49.5	*51.4
25	69.4	39.1	43.2	48.5	37.4	32.4	*53.3	42.8	*40.2	43.4	49.6	*52.3
26	69.3	39.1	44.1	46.8	37.4	31.8	*63.5	43.6	*42.5	44.3	*49.6	*54.2
27	69.2	46.3	46.6	49.4	39.7	31.0	58.7	43.7	*45.8	45.2	*49.6	*55.1
28	69.1	42.9	43.1	49.4	38.1	29.6	59.5	44.5	*45.8	45.2	*49.6	*56.9
29	69.0		40.0	49.5	37.4	28.2	59.4	76.1	*43.9	44.3	*49.6	*56.9
30	68.9		41.5	47.8	36.6	28.9	55.7	51.3	*42.3	44.2	*49.6	*56.9
31	68.8		41.5		37.4		54.6	47.1		44.2		*56.9
Sum	2,166.5	1,514.0	1,292.0	1,461.4	1,433.2	1,002.2	2,026.7	1,329.7	*1,346.1	1,305.5	1,391.9	*1,617.3

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1932-1938 ⊖		
	High	Low	Day		Day				Average	Maximum	Minimum
Jan.	1.91	1.20	23	150	20	62.5	69.9	4,300	4,423	7,070	934
Feb.	1.28	.90	10	69.4	25	36.0	54.1	3,000	3,192	5,490	487
Mar.	1.08	.88	19	50.3	8	34.3	41.7	2,560	2,960	4,190	1,560
Apr.	3.85	.90	17	556	4	35.2	48.7	2,900	2,959	*6,120	566
May	1.17	.89	10	59.2	28	35.1	46.2	2,840	3,830	6,700	2,310
June	1.00	.75	1	43.6	28	25.2	33.4	1,990	9,356	*47,900	1,510
July	11.25	.71	24	5,320	20	21.6	65.4	4,020	3,540	*5,350	1,550
Aug.	2.24	*.93	29	198	16	*38.2	42.9	2,640	3,340	5,590	1,280
Sept.	1.54	*.95	14	98.1	25	*39.5	*44.9	*2,670	5,982	19,100	2,070
Oct.	1.11	.95	28	52.0	17	38.8	42.1	2,590	3,722	6,320	1,710
Nov.	1.09	.96	25	50.4	3	39.4	46.4	2,760	3,360	5,560	526
Dec.	1.16	1.05	28	56.9	6	47.1	*52.2	*3,210	3,538	5,820	496
Yearly	11.25	.71		5,320		21.6	49.0	35,480	50,202	98,137	22,202

* Partly Estimated

⊖ The average, maximum, and minimum discharges for September, October, November, and December are for the period 1931 to 1938

PINTO CREEK STATION NEAR DEL RIO, TEXAS

DESCRIPTION: Water-stage recorder, cable with sit down cable car equipped for winch and heavy weights, and concrete control dam, 500 feet above Del-Rio Eagle Pass highway and 5-1/2 miles above confluence with the Rio Grande. This creek enters the Rio Grande 697.1 river miles below the American Dam at El Paso, Texas. Zero of gage is 854.61 feet above mean sea level, United States Coast and Geodetic Survey datum. Also a series of pipe gages (high stage indicating gages) 750 feet upstream from the gage well.

RECORDS: Based upon 17 meter measurements and stable rating curve. 1938 records good. Records available: November 1928 to December 1938. See table of Authenticated Discharge Records herein.

REMARKS: The flow of this spring-fed creek is modified by small irrigation diversions on approximately 75 acres above and 25 acres below the gaging station. The drainage area above this station is 229 square miles, all in the United States.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on August 31, 1932, when the extreme gage height was 21.08 feet and the extreme flow 54,650 second feet. This corresponds to a flood flow of 239 second feet per square mile of water shed. This spring-fed creek is often dry.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.9	2.5	8.9	6.4	14.1	3.1	1.4	16.9	10.2	7.1	10.2	10.6
2	6.0	7.2	9.1	6.1	13.1	2.7	.9	14.2	9.6	7.0	10.5	10.6
3	5.2	7.1	9.0	7.0	12.9	2.2	.5	13.8	8.7	6.7	8.0	10.3
4	4.5	7.6	9.3	7.3	13.1	1.9	.1	13.0	8.1	6.6	6.7	9.7
5	3.9	7.2	8.5	7.9	14.1	1.7	.1	13.0	7.8	6.7	7.1	7.9
6	3.5	7.3	8.3	8.2	12.3	1.5	.1	12.2	7.5	6.7	7.3	7.9
7	3.2	6.9	8.3	7.0	12.0	1.4	.1	12.2	7.2	6.8	6.9	7.7
8	3.0	5.8	8.3	6.3	19.3	1.7	143	11.3	7.0	7.3	7.6	7.4
9	2.9	7.0	9.3	7.3	13.7	1.7	10.5	11.3	7.0	7.4	7.8	7.7
10	2.9	7.1	9.4	7.9	12.6	2.0	3.0	10.5	7.1	7.4	8.9	7.4
11	2.4	7.4	9.7	8.2	12.0	1.9	1.4	10.1	6.9	7.5	9.6	7.4
12	2.0	8.1	9.7	8.2	11.3	1.6	.5	9.5	7.0	7.9	9.6	7.5
13	1.5	8.2	10.2	7.6	10.7	1.4	.1	9.2	7.0	8.0	9.6	7.3
14	1.4	8.0	10.3	7.6	10.5	1.1	.1	8.2	7.1	7.7	9.2	7.3
15	1.8	7.8	9.6	7.3	9.4	.9	.1	7.6	7.1	7.4	9.2	7.3
16	3.3	8.0	9.5	131	8.9	1.0	.1	7.6	7.9	6.9	9.3	7.1
17	3.3	7.8	9.2	280	9.8	1.6	.1	7.0	9.2	6.8	10.3	7.4
18	2.4	6.9	8.5	12.3	9.6	1.7	.1	6.9	9.6	6.7	9.3	7.4
19	2.5	6.9	8.1	311	8.8	1.5	.1	6.9	9.4	6.9	7.4	7.4
20	4.2	7.6	7.0	118	8.3	1.4	.1	6.4	8.4	6.0	7.4	7.4
21	3.1	9.6	6.4	22.1	7.5	1.3	.6	6.4	7.7	6.1	7.9	7.6
22	13.4	9.6	5.9	18.4	6.5	1.3	7.2	6.0	7.7	6.7	9.7	7.6
23	30.5	9.4	5.5	18.8	6.0	5.4	2,430	5.8	9.2	8.3	8.4	8.0
24	9.2	8.9	5.0	18.2	7.7	11.1	6,940	5.6	7.3	9.2	8.1	8.2
25	5.7	8.9	5.0	17.2	5.6	4.1	4,070	5.3	7.4	8.9	8.4	8.7
26	4.4	9.0	4.5	16.5	3.0	2.7	108	5.1	7.5	9.2	9.3	9.6
27	5.8	9.2	5.2	15.8	2.9	2.4	24.0	5.1	7.3	9.9	10.0	9.3
28	4.7	9.1	4.9	15.2	3.0	2.3	17.5	4.9	7.2	10.5	10.0	8.8
29	4.7		4.7	15.0	2.9	2.1	15.2	22.5	7.2	10.8	10.3	8.3
30	4.1		4.8	14.4	2.7	1.7	1,330	19.9	7.3	10.8	10.3	8.1
31	2.2		5.4		2.7		30.7	12.3		10.2		7.8
Sum	154.6	216.1	237.5	1,134.2	287.0	68.4	15,135.6	306.7	235.6	242.1	264.3	252.7

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938 †		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	4.76	2.52	22	297	14	1.1	5.0	307	629	2,110	0
Feb.	3.50	3.05	22	9.6	1	.5	7.7	429	540	1,860	8.3
Mar.	3.52	3.31	14	10.7	27	3.9	7.7	471	739	2,500	4.3
Apr.	6.35	3.41	16	3,490	2	5.8	37.8	2,250	1,021	3,600	43.0
May	3.73	3.15	8	23.7	31	2.7	9.3	569	3,062	20,500	28.0
June	3.82	2.85	23	29.1	15	.9	2.3	136	3,522	30,000	0
July	11.05	1.44	24	14,200	21	.1	*488	*30,000	4,216	30,000	0
Aug.	4.11	3.29	29	73.7	27	4.7	9.9	608	5,166	48,700	0
Sept.	3.52	3.34	1	11.0	28	7.0	7.9	467	3,134	17,300	0
Oct.	3.49	3.29	29	10.8	21	5.7	7.8	480	1,294	4,000	0
Nov.	3.52	3.33	22	12.0	4	6.5	8.8	524	613	2,150	0
Dec.	3.50	3.35	3	11.2	16	7.1	8.2	501	723	2,180	0
Yearly	11.05	1.44		14,200		.1	50.8	36,742	23,380	76,259.3	2,651.4

* Partly Estimated. † The annual figures only (partly estimated) are for the period 1924 to 1938. The monthly figures are for the period 1929 to 1938, except December which is for the period 1928 to 1938.

RIO SAN DIEGO STATION AT JIMENEZ, COAHUILA

DESCRIPTION: Water-stage recorder and cable with sit down cable car. Masonry Cipoletti weir control for measuring discharges up to 617 second feet. The station is located 4.4 miles west of Jimenez, Coahuila, and five miles above the confluence with the Rio Grande. This stream enters the Rio Grande 702.2 river miles below the American Dam at El Paso, Texas. Zero of the gage is 828.90 feet above United States Coast and Geodetic Survey mean sea level datum.

RECORDS: Based upon 47 meter measurements and the weir discharge table. Records for 1938 good. Records available: 1924 to 1938. See table of Authenticated Discharge Records herein.

REMARKS: This station was constructed by the Mexican Section of the Commission and completed in November, 1932. In December 1938 the former double weir was changed to a single weir and the weir crest was raised. The capacity of the new weir is 700 second feet. From 1924 to 1932 there was a staff-gage at Paso del Salto, 3.1 miles upstream from the present station on which readings were made by agents of the Department of Agriculture, Monterrey, N. L. The flow of this spring-fed stream is modified by two small storage reservoirs, San Miguel and Centenario on the National Irrigation System No.6 at San Carlos, Coahuila and by irrigation of Dolores Hacienda just above this station. Water was diverted for a total of approximately 18,600 acres above this station. One-fourth mile downstream from this gaging station water was diverted for approximately 1,230 acres in the Jimenez Community. The drainage area above this station is 840 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: From reports by local inhabitants, the water level in 1905 reached a height of 20.67 feet on the present gage scale, the discharge being unknown. The lowest flow recorded was 4.9 second feet on November 26, 1937.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	58.6	66.7	44.1	31.4	37.8	25.8	25.8	174	103	84.0	44.1	51.2
2	51.2	66.7	51.2	31.4	44.1	25.8	37.8	188	114	66.7	51.2	51.2
3	58.6	66.7	51.2	25.8	44.1	20.5	37.8	188	137	66.7	51.2	37.8
4	66.7	66.7	44.1	25.8	37.8	20.5	37.8	202	137	66.7	51.2	37.8
5	75.2	66.7	51.2	25.8	37.8	25.8	37.8	202	125	66.7	51.2	51.2
6	75.2	58.6	44.1	31.4	37.8	25.8	37.8	202	125	66.7	66.7	58.6
7	75.2	66.7	44.1	31.4	37.8	25.8	44.1	231	125	66.7	51.2	*57.2
8	75.2	66.7	44.1	31.4	25.8	25.8	37.8	247	125	66.7	51.2	55.8
9	66.7	66.7	44.1	25.8	25.8	25.8	37.8	231	125	66.7	44.1	*54.4
10	66.7	66.7	44.1	25.8	25.8	25.8	37.8	188	114	66.7	44.1	*53.0
11	66.7	58.6	44.1	25.8	25.8	25.8	37.8	149	114	51.2	44.1	*51.6
12	66.7	58.6	44.1	25.8	25.8	25.8	37.8	149	104	44.1	44.1	*50.1
13	66.7	58.6	37.8	25.8	31.4	25.8	37.8	93.6	103	44.1	51.2	*48.7
14	75.2	58.6	37.8	25.8	31.4	25.8	37.8	75.2	103	51.2	51.2	*47.3
15	75.2	58.6	37.8	31.4	31.4	25.8	37.8	66.7	93.6	58.6	51.2	*45.9
16	66.7	58.6	37.8	44.1	37.8	25.8	37.8	58.6	93.6	58.6	51.2	*44.5
17	66.7	58.6	25.8	84.0	37.8	20.5	37.8	66.7	93.6	58.6	51.2	*43.1
18	66.7	58.6	20.5	66.7	25.8	20.5	37.8	44.1	93.6	58.6	51.2	42.0
19	66.7	58.6	25.8	66.7	25.8	20.5	31.4	58.6	93.6	51.2	51.2	42.0
20	66.7	51.2	25.8	66.7	25.8	20.5	25.8	66.7	93.6	51.2	51.2	42.0
21	58.6	58.6	25.8	58.6	25.8	25.8	25.8	58.6	93.6	51.2	51.2	42.0
22	161	58.6	25.8	51.2	25.8	20.5	31.4	58.6	93.6	51.2	51.2	32.5
23	84.0	58.6	31.4	44.1	25.8	20.5	4,730	51.2	93.6	44.1	51.2	32.5
24	84.0	51.2	25.8	37.8	31.4	20.5	1,920	44.1	93.6	44.1	51.2	24.4
25	75.2	51.2	31.4	25.8	25.8	25.8	699	37.8	93.6	51.2	51.2	32.5
26	75.2	51.2	31.4	25.8	25.8	25.8	327	37.8	84.1	66.7	51.2	32.5
27	66.7	51.2	37.8	31.4	25.8	20.5	262	37.8	84.1	66.7	51.2	32.5
28	66.7	51.2	31.4	31.4	25.8	20.5	231	37.8	84.1	66.7	51.2	32.5
29	66.7		25.8	31.4	25.8	25.8	217	37.8	84.0	66.7	51.2	32.5
30	66.7		25.8	37.8	25.8	25.8	231	114	84.0	58.6	51.2	32.5
31	66.7		25.8		25.8		202	125		58.6		32.5
Sum	2,224.8	1,669.3	1,117.8	1,124.1	942.8	715.7	9,608.1	3,521.7	3,103.9	1,837.5	1,516.0	1,324.3

Month	Extreme Gage Feet — 1938 High	Extreme Gage Feet — 1938 Low	Extreme Second Feet — 1938 High Day	High	Low Day	Low	Average Second Feet 1938	Acre Feet Total 1938	Acre Feet Period 1933-1938 ⊖ Average	Maximum	Minimum
Jan.	3.41	2.00	22	685	2	51.2	71.8	4,410	11,510	36,430	3,340
Feb.	2.10	2.00	8	75.2	†20	51.2	59.6	3,310	7,690	25,760	2,540
Mar.	2.00	1.84	†1	51.2	18	20.5	36.1	2,220	7,082	21,500	2,220
Apr.	2.89	1.87	16	403	† 3	25.8	37.5	2,230	7,473	16,800	2,230
May	1.97	1.87	†2	44.1	† 8	25.8	30.4	1,870	25,125	120,000	1,870
June	1.90	1.84	2	31.4	† 3	20.5	23.9	1,420	15,990	62,200	1,420
July	8.10	1.87	23	19,000	† 1	25.8	310	19,100	10,873	21,500	2,050
Aug.	2.56	1.94	8	247	†25	37.8	114	6,990	9,535	20,000	2,020
Sept.	2.30	2.10	†3	137	29	75.2	103	6,160	17,273	64,500	2,460
Oct.	2.13	1.94	1	84.0	13	37.8	59.3	3,640	29,107	146,640	1,950
Nov.	2.07	1.97	6	66.7	†1	44.1	50.5	3,010	16,401	68,290	2,110
Dec.	2.82	1.94	6	58.6	24	17.0	42.7	2,630	11,899	45,160	2,630
Yearly	8.10	1.84		19,000		17.0	78.7	56,990	169,958	381,320	33,270

* Partly Estimated. † And other days.

⊖ The Average, Maximum, and Minimum Discharges for October, November, and December are for the period 1932 to 1938.

RIO SAN RODRIGO STATION NEAR EL MORAL, COAHUILA

DESCRIPTION: Water-stage recorder and cable with sit down cable car, and masonry control weir located 11.2 miles west of the town of El Moral, Coahuila, 19.9 miles northwest from Piedras Negras and 11.8 miles above the confluence with the Rio Grande. This stream enters the Rio Grande 714.3 river miles below the American Dam at El Paso, Texas. Zero of gage was 884.22 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 49 meter measurements and weir discharge tables. 1938 records good. Records available: 1922 to 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: From 1922 to 1932 there were made daily 3 staff-gage readings at this station, the zero of this gage being the same as that mentioned above. This station was constructed by the Mexican Section of the Commission and completed in October 1932, at a point 1,640 feet upstream from Paso de las Mulas. In December 1938 its location was moved 3,300 feet downstream. The zero of the new gage is 873.85 feet on the above datum. Meter measurements began August 4, 1932. The automatic water-stage record began November 8, the same year. The flow of this spring-fed river was modified by irrigation diversions for approximately 6,400 acres of land at El Remolino, 27.3 miles upstream. At Casa Roja, 7.5 miles downstream water is diverted for partly irrigating about 1,480 acres of land, which is also partly irrigated from the Rio Grande. The drainage area above this station is 750 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on September 7, 1932, when the extreme gage height was 16.08 feet and the extreme flow 81,200 second feet. The lowest recorded flow since January, 1932, occurred in August 1937, when the river was dry for several days.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	20.5	17.7	26.1	8.5	2.1	0.0	1.1	64.6	24.7	19.8	30.4	*16.2
2	11.3	17.7	26.1	6.7	1.8	0.0	0.4	60.7	25.1	20.8	38.5	*16.2
3	14.1	17.7	17.0	4.9	1.8	0.0	0.4	56.5	23.7	21.9	36.7	*16.2
4	14.1	17.7	13.4	4.9	1.8	0.0	0.4	55.4	23.7	20.8	42.0	*16.2
5	17.7	17.7	10.6	5.3	1.8	0.0	0.4	54.7	20.1	23.3	40.6	*16.2
6	14.1	17.0	8.5	5.7	1.8	0.0	0.0	54.0	20.1	24.0	28.6	*16.2
7	14.1	17.0	8.5	6.0	3.9	0.0	0.0	49.8	20.1	24.7	26.8	*16.2
8	14.1	17.0	13.4	3.2	1.4	0.0	0.0	48.7	18.4	25.4	25.4	*16.2
9	17.7	17.0	13.4	3.2	0.7	0.0	0.0	48.0	19.8	26.1	24.0	*16.2
10	17.7	17.0	10.6	3.2	1.4	163	0.0	48.0	19.8	26.8	24.7	*16.2
11	17.7	16.9	10.6	3.2	1.4	55.1	0.0	44.5	21.9	27.2	23.7	*16.2
12	14.1	16.9	10.6	3.2	1.4	20.8	0.0	44.5	19.8	25.8	22.2	*16.2
13	14.1	16.9	10.6	2.1	1.4	6.4	0.0	40.6	19.4	25.8	20.8	*16.2
14	14.1	13.4	10.6	0.7	1.4	12.0	0.0	40.6	21.5	24.0	19.4	*16.2
15	14.1	13.4	8.5	0.0	1.1	8.1	0.0	40.6	23.0	22.6	18.0	*16.2
16	14.1	13.4	6.7	0.0	0.7	6.0	0.0	40.3	23.0	23.0	17.0	*16.2
17	14.1	13.4	6.7	23.3	1.1	3.9	0.0	39.6	22.6	22.6	15.5	*16.3
18	14.1	10.6	6.7	42.4	1.0	3.5	0.0	39.2	20.8	23.0	14.1	*16.3
19	14.1	13.4	6.7	8.8	0.7	2.8	0.0	38.5	18.4	23.3	14.1	*16.3
20	17.7	13.4	8.5	6.4	0.3	2.1	0.0	38.1	18.4	24.4	14.5	*16.3
21	17.7	16.9	8.5	5.7	0.0	1.4	0.0	37.4	18.0	24.7	14.5	*16.3
22	54.4	16.9	8.5	4.9	0.0	1.1	0.0	37.1	18.0	26.8	16.6	16.3
23	45.9	16.9	8.5	6.0	0.0	0.7	2,070	39.2	17.7	27.5	16.6	16.3
24	41.0	17.0	6.7	7.4	0.0	1.4	2,800	41.3	17.7	26.1	17.0	26.1
25	26.8	17.0	6.7	8.5	0.0	1.8	540	43.4	17.3	25.4	15.2	26.1
26	23.7	17.0	6.7	7.1	0.0	1.4	223	45.2	17.3	24.7	15.5	21.2
27	20.5	17.0	8.5	3.9	0.0	1.4	126	47.3	16.6	24.4	15.5	21.2
28	20.5	17.0	8.5	3.9	0.0	1.8	95.7	49.4	15.5	24.0	*15.9	26.1
29	20.5		10.6	3.9	0.0	2.1	79.5	51.6	16.6	23.0	*15.9	26.1
30	20.5		10.6	4.2	0.0	1.8	119	35.0	17.7	22.2	*16.2	26.1
31	17.7		8.5		0.0		75.6	24.4		21.9		26.1
Sum	612.8	450.9	326.1	197.2	29.0	298.6	6,131.5	1,398.2	596.7	746.0	655.9	572.3

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1932-1938		
	High	Low	Day		Day			1938	Average	Maximum	Minimum
Jan.	1.87	1.18	22	113	7	11.3	19.7	1,220	4,789	14,850	1,220
Feb.	1.25	1.15	†1	17.7	18	9.2	16.1	894	3,356	11,580	894
Mar.	1.31	1.05	1	32.1	17	4.9	10.5	647	3,274	9,900	647
Apr.	1.97	.95	18	111	†15	0.0	6.6	391	2,771	6,870	391
May	1.12	.39	7	9.9	†21	0.0	.9	57.5	8,561	42,300	57.5
June	3.02	.10	10	505	†1	0.0	10.0	592	7,408	37,600	526
July	8.10	.00	23	9,610	†5	0.0	198.0	12,200	5,116	12,200	133
Aug.	1.64	1.25	1	64.6	31	24.4	45.1	2,770	3,097	6,770	39.3
Sept.	1.25	1.08	2	25.1	28	15.5	19.9	1,180	40,739	*253,960	471
Oct.	1.08	.95	11	27.2	31	21.9	24.1	1,480	15,126	81,360	815
Nov.	1.35	1.25	4	42.0	9	24.0	21.9	1,300	6,312	24,450	584
Dec.	.23	.16	†24	26.1	†1	16.2	18.5	1,140	5,179	19,060	1,050
Yearly	8.10	0.00		9,610		00.0	33.0	23,871.5	105,728	414,310	12,199.3

* Partly Estimated

† And other days

RIO GRANDE AT EAGLE PASS STATION

DESCRIPTION: Water-stage recorder and cable with stand up cable car and winch located 1/2 mile above the international highway bridge between Eagle Pass, Texas and Piedras Negras, Coahuila, and 733.4 river miles below the American Dam at El Paso, Texas. Zero of gage is 682.91 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 29 meter measurements. Computations by shifting channel methods. 1938 records good. Records available: May 1900 to April 1916; November 1923 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow is greatly modified at this station by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, and below the Red Bluff Dam on the Pecos river, diversions for irrigating 230,779 acres in the United States and 198,854 acres in Mexico occurred above this station in the basin of the Rio Grande and its tributaries. With all closed basins eliminated, the drainage area above this station is 124,502 square miles; 87,033 being in the United States and 37,469 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on September 2, 1932,when the extreme gage height was 49.00 feet, discharge 569,000 second feet. (See Special Flood Report 1932 by American Section of this Commission.) The lowest flow ever recorded was on August 19, 1937 when the extreme gage height was 2.22 feet and the extreme flow 632 second feet. Numerous records of extremes may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,470	3,210	2,490	1,600	1,550	1,070	7,400	*24,100	*4,600	17,600	3,300	3,030
2	3,380	3,100	2,420	1,540	1,500	1,030	*6,290	*19,000	*3,500	14,400	3,190	3,160
3	3,330	3,070	2,300	1,480	1,450	1,040	*9,630	15,200	2,770	12,600	3,150	3,040
4	3,070	2,880	2,310	1,420	1,500	1,000	*14,400	13,400	2,590	11,100	3,050	2,980
5	2,860	2,700	2,330	1,410	2,200	992	*15,400	12,500	2,480	*9,760	3,170	3,010
6	2,660	2,590	2,500	1,460	1,630	1,040	*15,000	11,400	4,380	8,690	3,220	2,780
7	2,470	2,550	2,410	1,420	1,440	1,060	*15,000	10,500	4,780	8,190	3,180	2,730
8	2,850	2,480	2,440	1,340	1,340	1,110	15,500	9,470	6,550	7,460	3,030	2,690
9	2,790	2,430	2,390	1,350	1,390	1,050	*13,500	9,160	8,960	6,950	2,980	2,650
10	2,860	2,390	2,250	1,320	1,420	1,160	*8,840	8,180	12,200	6,210	2,980	2,830
11	2,890	2,380	2,180	1,310	1,410	2,810	*7,580	8,770	14,200	5,910	3,270	2,840
12	2,730	2,370	2,190	1,350	1,350	1,780	*6,440	8,080	14,000	5,620	3,080	2,770
13	2,580	2,340	2,260	1,320	1,340	1,380	*5,520	7,940	14,700	5,800	3,240	2,640
14	2,560	2,430	2,190	1,340	1,320	1,210	*4,980	7,330	16,400	5,460	3,280	2,570
15	2,670	2,780	2,050	1,340	1,780	1,100	*4,530	6,470	19,600	5,130	3,150	2,650
16	2,740	2,900	2,010	1,610	2,230	1,020	*4,210	6,110	19,400	4,950	3,170	2,580
17	2,860	3,030	2,020	3,200	1,900	1,010	*3,990	5,600	19,000	4,790	3,420	2,570
18	2,950	2,790	1,900	3,280	1,660	960	*3,600	5,220	15,800	4,560	3,390	2,530
19	2,830	2,500	2,050	2,200	1,620	1,000	*3,500	5,100	13,400	4,220	3,240	2,480
20	2,820	2,340	2,100	2,190	1,620	1,120	3,300	5,000	14,300	4,030	3,070	2,450
21	2,830	2,420	1,950	1,800	1,610	1,700	4,950	*4,810	16,900	3,950	3,050	2,530
22	3,220	2,440	1,900	1,630	1,630	1,500	6,460	*4,600	20,200	3,890	3,020	2,520
23	4,050	2,360	1,880	1,800	1,700	1,400	22,100	*4,500	24,000	4,050	2,910	2,480
24	4,280	2,330	1,810	1,760	2,830	1,300	91,400	*4,100	30,200	3,830	2,980	2,590
25	3,690	2,350	1,770	1,530	2,490	3,820	99,300	*4,080	37,800	3,590	3,120	2,680
26	3,460	2,230	1,680	1,470	2,000	2,840	66,400	4,100	47,000	3,430	3,020	2,640
27	3,540	2,420	1,830	1,460	1,790	*5,460	51,400	3,880	*53,100	3,350	3,040	2,470
28	3,320	2,450	1,800	1,480	1,590	*16,300	30,000	3,600	44,600	3,190	3,040	2,490
29	3,190		1,730	1,520	1,510	*16,900	*27,200	4,030	29,900	3,290	2,840	2,520
30	3,120		1,670	1,550	1,430	*9,920	*32,000	4,960	22,500	3,700	2,950	2,620
31	3,240		1,610		1,300		*33,000	*7,140		3,460		2,680
Sum	95,310	72,260	64,420	49,480	51,530	85,082	*632,820	248,330	539,810	193,160	93,530	83,200

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	4.71	3.50	24	5,100	14	2,430	3,070	189,000	198,181	365,000	116,000
Feb.	3.94	3.38	1	3,300	26	2,120	2,580	143,000	160,206	254,250	99,200
Mar.	3.60	2.85	8	2,620	31	1,460	2,080	128,000	159,801	247,440	95,900
Apr.	5.29	2.64	17	6,730	12	1,200	1,650	98,100	146,874	219,000	98,100
May	4.28	2.47	24	4,100	8	896	1,660	102,000	259,196	869,000	77,500
June	8.97	2.25	29	18,500	9	700	2,840	169,000	270,353	1,005,000	113,340
July	24.22	3.95	24	109,000	20	2,480	*20,400	*1,255,000	283,713	*1,255,000	125,000
Aug.	*11.30	4.24	1	*28,500	29	3,160	8,010	493,000	304,807	*969,000	136,000
Sept.	15.76	3.59	27	54,000	6	2,380	18,000	1,071,000	670,863	2,857,410	80,900
Oct.	8.94	3.55	1	19,300	29	3,040	6,230	383,000	434,114	1,603,480	121,000
Nov.	3.84	3.35	17	3,620	29	2,700	3,120	186,000	213,735	486,390	109,000
Dec.	3.70	3.13	2	3,350	20	2,310	2,680	165,000	195,355	369,760	112,000
Yearly	24.22	2.25		109,000		700	6,050	4,382,100	3,297,198	6,668,460	1,798,000

* Partly Estimated

RIO ESCONDIDO STATION AT VILLA FUENTE, COAHUILA

DESCRIPTION: Water-stage recorder and cable with sit down cable car, located 3.1 miles southwest of the City of Piedras Negras on the outskirts of Villa de Fuente, 5 miles above the confluence with the Rio Grande and 5.6 miles below the confluence of the Rio San Antonio. This stream enters the Rio Grande 737.4 river miles below the American Dam at El Paso, Texas. Zero of gage is 717.78 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 53 meter measurements. Computations by shifting channel methods. 1938 records fair. Records available: 1922 to 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: From 1922 to 1932 there were made daily 3 staff-gage readings 2,300 feet downstream from the present station. The elevation of the zero of this old gage was 0.79 foot above the zero of the gage at the present station, but the water surface is practically level between the two gages. During November and December 1938 a bridge under construction .6 mile downstream from this station modified the recorded discharge. The flow of this spring-fed stream is modified by irrigation diversions on approximately 2,800 acres in the drainage basins of the San Antonio and the Escondido. The drainage area above this station is 1,170 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow since January 1932 was May 14, 1935, when the extreme gage height was 17.06 feet and the extreme discharge was 17,700 second feet. The lowest recorded flow occurred November 4, 1934, when the extreme gage height was .75 foot and extreme flow was .35 second foot.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	33.9	26.1	8.8	4.9	17.7	3.2	3.2	52.3	7.4	1.8	1.8	1.8
2	33.9	14.5	14.8	3.9	20.1	3.2	2.5	48.4	7.4	1.8	1.8	1.8
3	33.9	14.5	14.8	3.9	20.1	3.2	2.5	44.5	8.5	1.4	1.8	1.8
4	33.9	13.1	12.7	3.2	20.1	3.2	4.9	42.4	8.5	1.4	1.8	3.2
5	38.1	9.5	7.4	3.2	20.1	3.2	2.5	33.9	7.4	1.8	1.8	3.2
6	38.1	10.2	6.7	3.2	11.3	3.2	2.5	29.7	6.4	1.8	1.8	4.9
7	33.9	10.2	6.4	3.2	17.7	15.5	2.5	26.1	4.9	1.8	1.8	4.9
8	33.9	11.7	6.7	3.2	7.4	3.2	2.8	23.7	4.9	1.8	1.8	4.9
9	33.9	10.2	6.7	3.2	7.4	139	2.8	23.7	4.9	1.8	1.8	6.4
10	33.9	13.1	6.4	3.2	7.4	27.9	2.5	18.4	4.9	1.8	1.8	6.4
11	33.9	10.2	6.4	3.2	7.4	11.3	3.9	12.7	4.9	1.8	1.8	6.4
12	33.9	11.7	6.7	3.2	5.3	17.7	2.5	12.7	3.2	1.8	1.8	6.4
13	33.9	11.7	10.6	*4.9	4.6	7.4	2.1	12.7	3.2	1.8	1.8	6.4
14	38.1	11.7	8.5	*7.1	4.6	5.3	2.1	10.2	1.8	1.8	1.8	6.4
15	38.1	11.7	8.5	*10.6	4.6	4.6	2.1	10.2	9.9	4.9	1.8	6.4
16	42.4	6.4	8.5	*15.2	4.6	4.6	2.1	10.2	4.9	3.2	1.8	6.4
17	38.1	6.0	7.1	*21.2	4.6	4.6	2.1	7.1	4.9	1.8	1.8	6.4
18	42.4	6.4	7.1	*26.1	4.6	4.6	2.1	3.9	3.2	1.8	1.8	6.4
19	42.4	6.7	5.6	*29.7	4.6	4.6	2.1	3.2	3.2	1.8	1.8	7.4
20	42.4	6.7	7.1	26.1	4.6	4.6	2.1	9.9	3.2	1.8	1.8	8.5
21	42.4	6.7	5.6	26.1	4.6	4.6	1.8	9.9	3.2	1.8	1.8	4.9
22	56.9	7.1	5.6	26.1	7.4	4.6	1.8	9.9	3.2	1.8	1.8	4.9
23	153	6.7	5.6	38.1	7.4	4.6	18.4	9.9	3.2	1.8	1.4	4.9
24	66.4	6.7	4.6	173	7.4	4.6	1,170	8.5	3.2	1.8	1.4	6.3
25	51.6	6.7	4.6	25.1	4.6	3.5	752	7.4	3.2	1.8	1.4	7.4
26	42.4	6.7	5.6	22.2	4.6	3.5	477	7.4	3.2	1.8	1.4	7.4
27	38.1	6.7	7.1	20.1	3.5	3.2	131	7.4	3.2	1.4	1.4	7.4
28	33.9	6.4	10.6	20.1	3.2	3.2	63.6	7.4	3.2	1.8	1.4	7.4
29	33.9		12.7	20.1	2.5	3.2	44.5	7.4	3.2	1.8	1.4	7.4
30	33.9		12.7	17.7	2.5	2.5	42.4	7.4	3.2	1.8	1.4	7.4
31	29.7		10.6		2.5		57.6	7.4		1.8		7.4
Sum	1,315.2	276.0	252.8	571.0	249.0	311.6	2,812.0	525.9	139.6	59.1	50.8	179.2

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938 ⊖		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	3.61	2.13	23	374	31	26.1	42.4	2,610	4,568	15,990	577
Feb.	2.20	1.77	1	33.9	17	5.7	9.9	547	2,710	9,990	547
Mar.	2.13	1.77	†2	14.8	24	3.9	8.2	501	2,037	6,910	219
Apr.	6.50	1.74	24	1,120	†4	3.2	19.0	1,130	2,724	5,360	739
May	2.26	1.90	24	27.9	†29	2.5	8.0	494	5,926	23,800	494
June	6.66	1.90	9	1,220	30	2.5	10.4	618	5,620	19,700	618
July	8.79	1.57	24	3,280	†21	1.8	90.7	5,580	3,584	9,290	368
Aug.	2.46	1.67	1	52.3	19	3.2	17.0	1,040	1,426	4,440	174
Sept.	2.46	1.54	15	53.3	14	1.8	4.7	277	4,275	14,340	277
Oct.	1.60	1.51	15	4.9	27	1.4	1.9	117	7,385	39,790	117
Nov.	1.57	1.48	15	3.2	†23	1.4	1.7	101	4,686	25,590	101
Dec.	1.87	1.54	20	18.0	†1	1.8	5.8	355	4,610	20,720	355
Yearly	8.79	1.48		3,280		1.4	18.5	13,370	47,541	126,090	8,350

* Partly Estimated. ⊖ The annual figures only (partly estimated) are for the period 1924 to 1938. The monthly figures are for the period 1929 to 1938, except December which is for the period 1928 to 1938.

† And other days.

RIO GRANDE AT LAREDO STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car. Cable and car located about 2-1/2 miles above the cities of Laredo, Texas, and Nuevo Laredo, Tamaulipas. Water-stage recorder is attached to north abutment of railroad bridge at Laredo, 863.9 river miles below the American Dam at El Paso, Texas. Zero of gage at the cable is elevation 353.15 feet. The water-stage recorder was first located near the cable using the above gage. The recorder was moved to its present location in October, 1925. Zero of this gage was at elevation 352.65 feet until August 25, 1930, when its elevation was changed to 351.50 feet. All gage elevations are on the United States Coast and Geodetic Survey sea level datum.

RECORDS: Based on 172 meter measurements. Computations by shifting channel methods. 1938 records good. Records available: May 1900 to March 1914; from October 1922 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow at this station is modified by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico and below the Red Bluff Dam on the Pecos river, diversions for irrigating approximately 236,422 acres in the United States and 202,554 acres in Mexico occurred above this station from the Rio Grande and its tributaries. With all closed basins eliminated, the drainage area above this station is 130,455 square miles, of which 88,506 are in the United States and 41,949 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest previous recorded flow was on September 3, 1932, when the peak gage reading was 52.20 feet, the flow being 402,000 second feet. On August 21, 1937, a minimum flow of 855 second feet was reached. Numerous records of extreme flows may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,050	2,990	2,530	1,840	1,430	1,430	12,000	34,300	7,130	24,400	3,530	3,110
2	4,340	3,180	2,610	1,730	1,610	1,430	7,420	25,500	4,730	17,400	3,360	3,030
3	3,780	3,130	2,590	1,670	1,610	1,130	6,140	18,900	3,480	14,500	3,340	3,080
4	3,710	3,070	2,500	1,670	1,360	1,070	9,750	16,800	3,180	12,600	3,330	3,150
5	3,710	2,980	2,400	1,610	1,240	1,010	13,200	15,000	3,080	10,900	3,310	3,220
6	2,970	2,770	2,300	1,500	1,430	1,010	11,900	13,500	2,860	10,000	3,380	3,120
7	3,830	2,560	2,370	1,500	2,090	961	14,600	12,200	3,080	9,320	3,480	3,130
8	2,700	2,550	2,530	1,500	1,780	961	15,500	11,200	4,630	8,580	3,320	3,090
9	2,770	2,590	2,470	1,360	1,430	1,070	20,300	9,250	6,000	7,730	3,150	2,940
10	2,830	2,540	2,510	1,360	1,430	1,130	13,200	8,900	8,160	7,030	3,220	2,830
11	2,770	2,500	2,390	1,360	1,500	1,010	8,120	8,300	11,700	6,530	3,160	2,820
12	2,830	2,450	2,240	1,360	1,500	1,500	7,200	8,800	14,600	5,720	3,260	2,860
13	2,830	2,450	2,200	1,360	1,430	2,310	6,140	8,200	15,200	5,400	3,290	2,980
14	2,700	2,400	2,100	1,300	1,360	1,870	5,160	8,000	16,200	5,440	3,200	2,970
15	2,580	2,330	2,170	1,360	1,500	1,610	4,730	7,400	18,500	5,540	3,260	2,890
16	2,580	2,360	2,020	1,360	3,110	1,240	4,170	6,600	20,700	5,190	3,330	2,650
17	2,580	2,730	1,910	1,730	2,050	1,130	4,030	6,200	20,400	5,000	3,200	2,610
18	2,580	3,060	1,860	7,240	2,120	961	3,710	5,800	20,000	4,800	3,330	2,570
19	2,830	2,920	1,890	9,460	1,860	862	3,350	5,500	16,400	4,660	3,430	2,590
20	2,830	2,590	1,860	3,810	1,730	862	3,230	5,300	13,500	4,520	3,390	2,650
21	2,770	2,350	1,940	2,400	1,640	819	3,100	5,200	14,500	4,200	3,300	2,650
22	2,770	2,370	2,000	2,140	1,600	1,010	4,380	5,000	18,000	4,130	3,150	2,600
23	3,600	2,480	2,310	1,970	1,560	1,300	6,430	4,800	21,200	3,850	3,120	2,660
24	3,600	2,470	2,150	2,190	5,010	1,610	31,300	4,700	25,500	3,810	3,090	2,580
25	3,850	2,340	2,010	5,690	2,160	1,360	89,700	4,300	31,600	3,920	2,980	2,870
26	3,920	2,420	1,900	2,650	2,660	1,300	105,600	4,240	35,300	3,710	3,100	3,080
27	3,460	2,430	1,890	1,780	2,310	3,420	79,800	4,240	42,700	3,520	3,140	2,850
28	3,250	2,390	1,780	1,610	1,860	2,790	48,400	4,240	48,400	3,420	3,110	2,850
29	3,180		1,800	1,500	1,640	13,600	28,300	3,960	41,700	3,290	3,110	2,840
30	3,180		1,820	1,500	1,430	16,700	26,300	3,710	29,900	3,160	3,110	2,890
31	3,110		1,780		1,360		33,200	3,880		3,460		3,030
Sum	98,490	66,830			56,800		630,360		522,330		97,480	
		73,400		69,510		68,466		283,920		215,730		89,190

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day			1938	Normal	Maximum	Minimum
Jan.	6.33	5.09	1	5,690	16	2,520	3,180	195,000	190,286	352,000	114,000
Feb.	5.45	5.02	18	3,190	15	2,330	2,620	146,000	154,268	237,380	99,400
Mar.	5.35	4.56	23	2,900	28	1,700	2,160	133,000	154,391	223,020	95,680
Apr.	8.14	4.33	19	12,100	14	1,240	2,320	138,000	155,429	401,000	95,640
May	7.81	4.23	24	10,900	5	1,070	1,830	113,000	274,997	906,000	113,000
June	9.42	4.04	30	17,500	20	777	2,280	136,000	309,914	1,357,000	89,190
July	27.40	5.38	26	106,600	21	3,030	20,300	1,250,000	291,345	1,250,000	128,770
Aug.	12.70	5.54	1	36,400	31	3,490	9,160	563,000	294,018	888,000	127,000
Sept.	17.10	5.25	28	49,400	7	2,790	17,400	1,036,000	716,124	3,116,670	87,260
Oct.	10.60	5.38	1	28,300	30	3,100	6,960	428,000	483,385	2,071,590	126,000
Nov.	5.64	5.25	1	3,600	12	2,980	3,250	193,000	218,784	570,800	122,000
Dec.	5.61	5.02	4	3,400	24	2,520	2,880	177,000	194,007	352,680	107,000
Yearly	27.40	4.04		106,600		777	6,230	4,508,000	3,436,948	7,310,310	1,873,000

RIO SALADO STATION AT CD. GUERRERO, TAMAULIPAS

DESCRIPTION: Water-stage recorder and cable with sit down cable car and two masonry Cipoletti weirs located at the place called "El Cable" about 6.2 miles above the confluence of the Rio Salado with the Rio Grande and 2 miles southwest of Ciudad Guerrero, Tamaulipas. This stream enters the Rio Grande 926.2 river miles below the American Dam at El Paso, Texas. Zero of gage is 265.74 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based on 218 meter measurements during the year and the weir discharge records. Computations by shifting channel methods. 1938 records good. Records available: 1901 to 1912; 1923 to 1938. See table of Authenticated Discharge Records herein.

REMARKS: This station was entirely rebuilt by the Mexican Section of this Commission in December 1932, when an automatic water-stage recorder was installed. The flow of the Rio Salado was greatly modified by the Don Martin reservoir, which forms a part of National Irrigation System No. 4, Coahuila-Nuevo Leon, and by irrigation on approximately 15,000 acres above this station. The drainage area above this station is 21,830 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow at this station was on September 7, 1933, when an extreme gage height of 18.86 feet was reached with a corresponding discharge of 43,800 second feet. The stream is sometimes dry. Numerous extremes may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	87.6	50.1	198	25.8	51.9	35.3	19.8	1,120	6,000	39.9	11.7	2.5
2	111	47.7	1,370	22.2	39.6	23.0	12.7	936	929	36.7	9.2	3.9
3	122	45.2	424	22.2	30.7	16.6	8.1	1,000	487	33.9	8.1	8.1
4	96.8	45.2	173	16.6	28.3	9.9	6.4	607	348	30.4	6.4	0.0
5	87.6	45.2	106	10.9	51.9	7.4	3.9	321	255	25.4	5.3	0.0
6	79.1	47.7	77.3	13.8	35.3	5.3	2.5	194	213	22.2	5.3	0.0
7	70.6	50.1	58.3	13.8	14.8	2.8	1.8	123	166	20.5	4.6	0.0
8	63.6	50.1	46.6	12.0	9.5	2.5	0.7	87.2	198	18.7	3.2	0.0
9	63.6	47.7	46.6	11.3	8.5	1.8	0.7	65.7	305	15.5	3.2	3.9
10	67.4	45.2	44.5	10.2	6.7	0.7	2,070	49.4	139	12.4	3.2	5.3
11	79.1	43.1	42.4	10.2	6.7	0.0	904	37.8	125	13.1	3.2	8.5
12	96.8	43.1	40.6	7.1	6.7	0.0	262	31.4	119	10.9	3.2	10.2
13	96.8	43.1	38.5	9.2	5.6	0.0	127	e4.7	79.8	14.8	3.2	10.2
14	74.9	47.7	36.4	11.3	5.6	0.4	80.9	18.4	63.2	80.2	3.2	10.2
15	60.0	60.0	34.6	11.3	5.6	94.6	51.6	14.1	2,400	77.3	3.2	10.2
16	60.0	55.1	32.8	10.6	5.6	87.6	35.3	10.2	6,670	54.7	3.2	10.2
17	67.4	47.7	32.8	10.6	6.7	116	26.5	7.4	5,400	36.7	3.9	8.5
18	63.6	45.2	30.7	10.6	675	124	16.6	5.3	1,490	29.0	3.9	8.5
19	60.0	41.0	29.0	611	392	62.9	11.7	3.9	629	22.6	3.2	8.5
20	57.6	38.8	29.0	1,060	222	35.3	7.4	2.5	357	18.0	3.2	8.5
21	57.6	41.0	27.2	441	141	94.6	4.6	1.8	233	13.4	3.2	8.5
22	57.6	43.1	30.7	237	91.1	60.0	2.5	1.8	166	9.5	3.2	8.5
23	67.5	43.1	49.4	194	145	42.0	1.8	0.7	130	6.4	3.2	8.5
24	63.6	45.2	155	367	706	21.2	1.1	0.7	103	22.6	3.2	8.5
25	57.6	43.1	73.8	147	131	106	0.7	0.7	83.3	47.7	3.2	26.1
26	55.1	43.1	44.5	83.3	71.3	150	2,640	0.4	73.5	40.6	3.2	53.7
27	57.6	43.1	36.4	57.6	83.3	94.3	3,490	0.4	63.2	33.2	3.2	50.1
28	67.5	41.0	40.6	76.6	57.9	62.9	1,270	593	54.4	25.4	3.2	61.1
29	63.6		40.6	79.8	79.1	82.3	607	4,340	48.7	21.2	2.5	50.1
30	55.1		36.4	66.7	57.9	28.6	321	13,500	41.0	15.9	2.5	61.1
31	50.1		30.7		38.1		262	10,800		13.1		53.7
Sum	2,218.4	1,281.7	3,456.4	3,660.7	3,210.4	1,368.0	12,250.3	33,898.5	27,369.1	861.9	124.2	507.1

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	2.26	1.57	2	139	31	50.1	71.6	4,400	23,315	144,110	335
Feb.	1.57	1.41	15	63.6	20	38.8	45.8	2,540	16,458	98,520	1,500
Mar.	6.40	1.18	2	2,010	21	27.2	111	6,860	10,609	31,400	52.0
Apr.	5.97	.95	20	1,470	12	6.0	122	7,260	15,832	54,500	56.4
May	5.58	.62	18	1,300	15	4.9	104	6,370	48,161	*253,000	5,120
June	2.66	.10	25	212	†11	0.0	45.6	2,710	41,927	192,000	2,710
July	8.27	.10	27	4,730	9	.4	395	24,300	24,676	100,000	2,360
Aug.	13.88	.07	30	18,800	27	0.0	1,090	67,200	19,176	67,200	81.0
Sept.	10.86	1.28	1	9,960	30	38.8	912	54,300	112,888	600,000	3,310
Oct.	1.90	.52	14	97.1	23	5.3	27.8	1,710	92,994	673,070	1,710
Nov.	.62	.30	1	11.7	†29	2.5	4.1	246	35,612	248,590	246
Dec.	2.26	.26	30	64.6	† 1	0.0	16.4	1,010	25,787	198,160	65.3
Yearly	13.88	.07		18,800		0.0	247	178,906	467,435	1,350,260	101,796

* Partly Estimated

† And other days

RIO GRANDE AT ZAPATA STATION

DESCRIPTION: Water-stage recorder and cable with stand up cable car and winch located about 3 miles below the town of Zapata, Texas, 7-1/2 miles northeast of Guerrero, Tamaulipas, 1.3 miles below the confluence of the Rio Salado with the Rio Grande, and 927.5 river miles below the American Dam at El Paso, Texas. Zero of the gage is at mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 59 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: January 1932, to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow is greatly modified at this station by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, and below the Red Bluff Dam on the Pecos River, there were approximately 239,766 acres in the United States and 218,764 acres in Mexico, irrigated by diversions from the Rio Grande and its tributaries above this station. With all closed basins eliminated, the drainage area above this station is 154,254 square miles; 89,603 being in the United States and 64,651 in Mexico.

PREVIOUS EXTREME FLOWS: The greatest recorded flow was on September 4, 1932, when the extreme gage height was 262.07 feet and the extreme flow was 261,160 second feet. See Special Flood Report 1932 by United States Section of this Commission. The lowest flow recorded was on August 24, 1937, when the extreme gage height was 219.82 feet and the extreme flow 889 second feet.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,000	3,150	2,490	1,760	1,440	1,390	15,200	33,700	11,200	26,600	3,720	3,090
2	4,920	*3,210	4,280	1,680	1,410	1,380	12,500	31,100	7,680	21,300	3,690	3,010
3	3,970	*3,300	3,080	1,630	1,460	1,380	9,000	24,100	4,440	17,100	3,560	3,060
4	3,530	*3,310	2,730	1,610	1,500	1,210	7,900	18,500	3,530	14,300	3,380	3,120
5	3,550	*3,290	2,540	1,610	1,440	1,110	*11,300	15,900	3,260	12,500	3,280	3,200
6	3,340	*3,210	2,370	1,570	1,370	1,050	*13,400	13,800	3,140	11,100	3,260	3,070
7	3,120	*3,000	2,310	1,530	1,400	1,020	13,900	12,700	3,020	9,570	3,350	3,090
8	2,940	2,740	2,340	1,460	1,930	970	14,200	11,400	3,750	8,750	3,430	3,040
9	2,830	2,640	2,420	1,430	1,720	948	14,900	10,300	5,470	8,190	3,270	2,880
10	2,840	2,600	2,370	1,400	1,410	976	18,200	9,160	7,340	7,460	3,130	2,780
11	2,900	2,550	2,390	1,380	1,360	1,090	13,400	8,650	10,300	7,040	3,040	2,780
12	2,910	2,470	2,330	1,380	1,400	1,030	8,830	7,980	14,500	6,270	2,970	2,810
13	2,940	2,440	2,250	1,360	1,390	1,290	7,100	8,440	16,100	5,870	3,130	2,930
14	2,920	2,440	2,240	1,330	1,330	2,040	6,120	7,930	16,900	5,440	3,220	2,910
15	2,780	2,420	2,290	1,320	1,270	1,700	5,400	7,730	23,000	5,490	3,170	2,840
16	2,640	2,410	2,300	1,310	1,540	1,470	4,980	7,270	26,000	5,370	3,250	2,740
17	2,660	2,510	2,230	1,320	3,310	1,310	4,600	6,540	23,000	5,060	3,280	2,720
18	2,760	2,820	2,080	3,940	2,620	1,240	4,260	6,160	21,000	4,910	3,140	2,750
19	2,780	2,970	2,040	10,500	2,580	1,050	3,930	5,760	20,000	4,800	3,250	2,730
20	2,900	2,940	2,030	8,750	2,020	930	3,610	5,400	15,500	4,660	3,360	2,690
21	2,970	2,840	1,970	4,160	1,680	924	3,560	5,240	15,000	4,410	3,330	2,690
22	2,940	2,660	1,970	2,740	1,440	1,050	3,390	5,180	15,300	4,190	3,210	2,620
23	3,700	2,540	7,830	2,320	3,110	1,140	6,280	4,960	19,000	4,130	3,110	2,600
24	4,710	2,560	3,820	2,210	14,100	1,200	11,600	4,740	23,500	4,150	3,080	2,660
25	4,000	2,560	2,500	3,100	11,200	1,390	53,200	4,720	27,700	4,180	3,040	4,100
26	4,170	2,490	2,250	5,530	3,040	1,380	93,800	4,250	32,900	4,140	2,910	3,820
27	4,150	2,470	1,920	2,740	2,940	1,350	102,000	4,120	39,900	3,970	3,050	3,400
28	3,610	2,440	1,820	1,720	2,460	3,560	66,500	6,370	45,000	3,820	3,130	3,030
29	3,530		1,720	1,480	1,930	5,020	36,900	9,890	50,000	3,730	3,060	2,870
30	3,470		1,740	1,450	1,570	16,300	25,600	17,700	37,500	3,620	3,110	2,720
31	3,280		1,820		1,450		28,800	15,600		3,450		2,720
Sum	104,760	76,980	78,470	75,720	78,820	57,898	624,360	335,290	544,930	235,570	96,910	91,470

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1932-1938		
	High	Low	Day		Day			1938	Average	Maximum	Minimum
Jan.	221.90	220.72	24	6,240	17	2,610	3,380	208,000	226,181	*484,450	119,000
Feb.	220.95	220.61	5	*3,420	16	2,390	2,750	153,000	180,026	*361,350	111,000
Mar.	225.38	220.22	23	21,400	29	1,640	2,530	156,000	176,581	252,080	138,000
Apr.	223.46	219.92	19	12,400	15	1,300	2,520	150,000	162,881	226,000	110,000
May	224.57	219.97	24	17,500	15	1,240	2,540	156,000	268,421	584,000	134,000
June	224.46	219.62	30	17,100	21	888	1,930	115,000	397,923	1,517,000	115,000
July	242.20	220.93	27	105,000	22	3,340	20,100	1,238,000	407,529	1,238,000	141,000
Aug.	228.19	221.43	1	33,900	28	4,050	10,800	665,000	275,626	665,000	163,000
Sept.	231.71	220.93	29	51,400	7	2,890	18,200	1,106,000	1,151,167	2,895,330	203,000
Oct.	227.05	221.00	1	30,000	31	3,390	7,600	467,000	708,963	2,396,440	165,000
Nov.	221.19	220.88	1	3,890	26	2,880	3,230	192,000	271,077	748,020	133,000
Dec.	221.78	220.72	25	5,640	23	2,550	2,950	181,000	241,737	591,380	119,000
Yearly	242.20	219.62		105,000		888	6,610	4,787,000	4,468,112	8,038,070	2,231,000

*Partly Estimated

RIO ALAMO STATION AT CD. MIER, TAMAULIPAS

DESCRIPTION: Water-stage recorder and cable with sit down cable car and weir for measurement of low flows located about 3 miles from the confluence of the Rio Alamo with the Rio Grande and 2/3 of a mile west of Ciudad Mier, Tamaulipas, Mexico, at a point called "Paso del Cantaro." This stream enters the Rio Grande 964.4 river miles below American Dam near El Paso, Texas. Zero of gage is 187.04 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 46 meter measurements during the year. Computations by shifting channel methods, except at low flows. 1938 records good. Records available: July 1923 to December 31, 1938. See table of Authenticated Discharge Records herein.

REMARKS: This station was constructed in December 1932. The flood of September 7, 1933 wrecked the tower on the left bank. In December, 1933, the cable was moved 980 feet upstream. The zero of its staff gage remained the same as before. The recorder and its gage were not moved. In September, 1934, a channel with a small weir of 12 second feet capacity was constructed for measuring low flows. In December, 1938 a new weir of 177 second feet capacity was built to replace the smaller weir. The flow of this spring-fed stream is modified by small storage and diversions for irrigating approximately 10,300 acres above this station. The drainage area above this station is 1,840 square miles, all in Mexico.

PREVIOUS RECORDED FLOWS: The greatest recorded flow occurred on September 7, 1933, with an extreme gage height of 26.9 feet and a corresponding flow of 76,600 second feet. The river is often dry. Numerous records of extreme flow may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	15.2	8.5	448	3.9	2.1	0.0	0.0	558	247	2.1	1.4	8.5
2	13.1	9.5	170	2.8	1.4	0.0	0.0	904	114	2.1	2.1	9.5
3	10.9	8.5	115	2.8	0.7	0.0	0.0	67.1	79.1	1.4	1.4	9.5
4	13.1	8.5	33.9	2.1	0.4	0.0	0.0	15.2	49.8	1.4	1.4	9.5
5	13.1	9.5	23.0	2.1	0.0	0.0	0.0	7.1	35.0	1.4	1.4	9.5
6	13.1	9.5	15.2	2.1	0.0	0.0	0.0	2.8	30.7	1.4	0.7	9.5
7	10.9	9.5	10.9	2.1	0.0	0.0	0.0	1.4	23.7	1.4	0.7	8.5
8	13.1	9.5	9.5	1.4	0.0	0.0	0.0	0.7	27.2	1.4	0.7	8.5
9	13.1	7.1	936	1.4	0.0	0.0	0.0	0.4	23.7	1.4	0.7	8.5
10	13.1	4.9	159	1.4	0.0	0.0	0.0	0.0	388	1.4	1.4	8.1
11	13.1	4.9	31.1	1.4	0.0	0.0	0.0	0.0	97.8	1.4	1.4	8.1
12	13.1	4.9	23.0	1.4	0.0	0.0	0.0	0.0	55.8	1.4	2.8	8.1
13	10.9	3.9	18.0	1.4	0.0	0.0	0.0	0.0	18.0	1.4	2.8	8.1
14	10.9	2.8	15.2	1.4	0.0	0.0	0.0	0.0	13.1	1.4	2.8	10.6
15	10.9	2.8	15.2	1.4	0.0	29.0	0.0	0.0	9.5	2.1	2.8	8.1
16	10.9	2.8	20.1	0.7	0.0	15.2	0.0	0.0	7.1	2.8	3.9	8.1
17	10.9	2.8	20.1	0.7	2.1	2.1	0.0	0.0	6.0	2.8	3.9	8.1
18	10.9	2.8	18.0	946	1.4	0.4	0.0	0.0	10.9	2.1	2.8	8.1
19	10.9	2.8	18.0	494	0.7	0.0	0.0	0.0	13.1	1.4	2.8	8.1
20	9.5	2.1	18.0	74.2	0.4	4.9	0.0	0.0	15.2	64.6	2.8	8.1
21	9.5	2.8	18.0	18.0	0.0	70.6	0.0	0.0	9.5	3.9	2.1	8.1
22	9.5	2.8	18.0	7.1	0.0	50.1	0.0	0.0	7.1	1.4	2.1	8.1
23	9.5	2.8	13.1	4.9	177	8.5	0.0	0.0	6.0	0.7	2.1	8.1
24	9.5	2.8	10.9	3.9	516	2.8	0.0	0.0	3.9	0.7	2.1	8.1
25	9.5	3.9	15.2	28.3	102	0.7	0.0	0.0	3.9	0.7	1.4	18.7
26	9.5	3.9	10.9	20.1	13.1	0.4	0.0	0.0	2.8	1.4	1.4	36.4
27	8.5	3.9	9.5	11.3	6.0	0.0	0.0	0.0	2.8	1.4	2.8	21.9
28	8.5	3.9	8.5	7.1	2.8	1.4	0.0	2,000	2.1	1.4	2.8	15.9
29	8.5		7.1	4.9	1.4	0.4	0.0	11,800	2.1	1.4	2.1	10.6
30	8.5		4.9	2.8	0.7	0.0	3.5	11,700	2.1	1.4	3.9	10.6
31	8.5		3.9		0.4		720	1,610		1.4		10.6
Sum	340.2	144.4	2,237.2	1,653.1	828.6	186.5	723.5	28,666.7	1,307.0	112.6	63.5	330.2

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day			1938	Normal	Maximum	Minimum
Jan.	.92	.79	1	15.2	†27	8.5	11.0	675	6,892	34,900	0
Feb.	.82	.59	†2	9.5	20	2.1	5.2	286	5,156	25,500	67.2
Mar.	4.69	.66	9	1,680	31	3.9	72.2	4,440	4,067	19,800	63.0
Apr.	5.05	.52	18	2,150	†16	0.7	55.1	3,280	7,310	26,700	443
May	4.99	.36	23	2,210	†5	0.0	26.7	1,640	18,757	*137,000	209
June	2.79	.00	15	367	†1	0.0	6.2	370	15,733	83,230	0
July	4.27	.00	31	1,360	†1	0.0	23.3	1,440	10,381	37,590	256
Aug.	17.62	.00	30	20,300	†10	0.0	925	56,900	9,162	56,900	0
Sept.	3.77	.59	10	883	†28	2.1	436	2,590	30,132	190,520	*135
Oct.	3.31	.52	20	590	†23	0.7	3.6	223	13,610	51,620	0
Nov.	.75	.52	30	7.1	†6	0.7	2.1	126	5,464	21,940	0
Dec.	1.94	1.48	26	57.6	†10	8.1	10.7	655	5,437	*15,000	124
Yearly	17.62	0.00		20,300		0.0	100	72,625	132,101	316,803	11,898.7

* Partly Estimated

† And other days

RIO GRANDE AT ROMA STATION

DESCRIPTION: Water-stage recorder at international bridge between Roma, Texas and San Pedro, Tamaulipas, and 972.0 river miles below the American Dam at El Paso, Texas. Zero of gage is 145.90 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 56 meter measurements during the year from bridge. Computations by shifting channel methods. 1938 records good. Records available: August 1900 to March 1914; November 1922 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow is greatly modified at this station by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, there were approximately 240,536 acres in the United States and 229,064 acres in Mexico irrigated by diversions from the Rio Grande and its tributaries above this station. With all closed basins eliminated, the drainage area above this station is 157,554 square miles; 90,635 being in the United States and 66,919 in Mexico. After March, 1929, the station was operated by the United States, and previously by Mexico. Datum of present gage is 1.1 foot lower than that used prior to 1922. Backwater from the Rio San Juan sometimes reaches this station. See Water Bulletin No. 3, page 50.

PREVIOUS EXTREME FLOWS: The greatest previous recorded flow was on September 5, 1932, when the extreme gage height was 35.4 feet and the extreme flow 203,000 second feet. See Special Flood Report 1932 by United States Section of this Commission. The lowest flow ever recorded was on August 25, 1937, when the extreme flow was 914 second feet, at a stage of -.32 feet. Records of other extreme flows may be found in previous Water Bulletins.

Mean Daily Discharge in Second Feet 1938— Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,970	3,160	2,880	1,730	1,680	1,540	16,600	34,300	*16,800	35,000	3,270	3,060
2	4,660	3,030	3,230	1,650	1,620	1,310	11,300	32,400	*9,620	25,100	3,610	2,950
3	4,560	3,100	3,710	1,650	1,550	1,280	7,200	24,200	6,280	20,000	3,470	2,920
4	3,640	3,140	2,820	1,620	1,560	1,280	5,780	18,200	4,380	14,100	3,320	2,990
5	3,510	3,050	2,570	1,600	1,580	1,120	11,000	15,500	3,790	12,300	3,170	3,050
6	3,440	2,990	2,460	1,580	1,490	1,040	12,500	13,400	3,530	10,900	3,170	3,060
7	3,230	2,890	*2,380	1,500	1,440	993	11,300	12,400	3,370	9,810	3,190	2,950
8	3,060	2,870	2,380	1,420	1,470	986	14,000	11,300	3,120	8,650	*3,370	2,990
9	2,930	2,640	3,300	1,400	1,890	974	14,300	10,800	4,850	8,260	*3,470	2,850
10	2,840	2,550	3,710	1,400	1,630	970	18,400	9,870	6,150	7,610	*3,230	2,730
11	2,940	2,500	2,400	1,400	1,440	966	16,500	9,590	*8,430	7,240	*3,030	2,720
12	2,950	2,460	2,500	1,390	1,390	960	10,000	8,520	*11,300	6,600	3,030	2,730
13	2,910	*2,420	2,400	1,340	1,480	994	7,580	8,910	*13,600	6,200	3,010	2,780
14	2,980	2,370	2,250	1,300	1,470	1,700	6,550	8,440	14,300	5,900	3,250	2,870
15	2,890	2,360	2,100	1,300	1,420	1,890	5,820	8,040	*16,900	5,760	3,150	2,810
16	2,740	2,370	2,040	1,310	1,430	1,610	5,220	7,770	*25,600	5,980	3,190	2,780
17	2,650	2,360	2,060	1,320	1,990	1,420	4,770	6,860	*28,300	5,560	3,270	2,710
18	2,720	2,520	1,960	1,550	2,730	1,240	4,400	6,250	26,000	5,310	3,210	2,690
19	2,800	2,830	1,860	7,710	2,460	1,160	4,160	5,990	22,200	5,110	3,120	2,680
20	2,830	2,910	1,850	10,600	2,170	1,060	3,700	5,450	18,500	5,080	3,320	2,630
21	2,940	2,860	1,840	*5,580	1,780	1,020	3,460	5,120	16,600	4,710	3,340	2,620
22	2,910	2,700	1,790	*2,800	1,540	1,030	3,300	5,010	16,000	4,440	3,350	*2,610
23	2,920	2,520	4,730	2,050	1,510	1,030	3,620	4,970	17,000	4,290	3,210	*2,660
24	4,430	2,450	6,940	1,980	10,000	1,140	6,220	4,770	20,400	4,160	3,110	*2,640
25	3,780	2,500	3,050	1,990	15,200	1,190	31,500	4,740	26,000	4,000	3,060	*2,870
26	4,030	2,480	2,300	4,280	7,000	1,370	77,700	4,800	30,000	4,050	2,990	4,040
27	4,060	2,400	2,240	4,420	3,480	1,380	97,500	4,650	35,900	3,880	2,940	3,700
28	3,750	2,380	1,800	2,540	3,070	1,420	88,400	8,320	44,900	3,690	3,100	3,300
29	3,420		1,760	1,930	2,750	2,850	54,000	29,000*	*47,500	3,530	3,080	3,000
30	3,440		1,700	1,760	2,200	9,740	28,900	25,000*	44,500	3,430	3,020	2,760
31	3,310		1,710		1,800		27,900	20,000*		3,290		2,680
Sum	105,240	74,810	80,720	74,100	84,220	46,663	613,580	374,570	*545,820	253,940	96,030	89,830

Month	Extreme Gage Feet — 1938 High	Extreme Gage Feet — 1938 Low	Extreme Second Feet — 1938 High Day	High	Low Day	Low	Average Second Feet 1938	Acre Feet Total 1938	Acre Feet Period 1924-1938 Normal	Maximum	Minimum
Jan.	3.79	1.13	1	6,570	17	2,630	3,390	209,000	233,219	467,370	119,000
Feb.	1.62	.85	1	3,210	16	2,330	2,670	148,000	188,955	349,000	108,000
Mar.	6.81	.22	23	14,200	31	1,660	2,600	160,000	182,112	260,610	99,000
Apr.	6.12	-.26	20	11,200	18	1,190	2,470	147,000	190,935	400,000	104,000
May	7.40	-.15	25	16,800	17	1,360	2,720	167,000	346,333	683,000	133,000
June	7.55	-.56	30	16,300	11	958	1,560	92,600	401,969	1,586,000	92,600
July	23.98	1.63	27	100,000	23	3,100	19,800	1,217,000	352,289	1,217,000	131,000
Aug.	13.15	2.87	1	36,300	28	4,590	12,100	743,000	310,521	743,000	157,000
Sept.	15.25	1.86	29	48,500	8	3,060	18,200	1,083,000	877,710	3,047,630	117,000
Oct.	12.28	1.71	1	38,000	31	3,230	8,190	504,000	596,576	2,371,870	163,000
Nov.	2.07	1.35	2	3,700	27	2,920	3,200	190,000	264,045	735,960	127,000
Dec.	2.69	1.07	26	4,690	22	2,510	2,900	178,000	233,621	565,140	114,000
Yearly	23.98	-.56		100,000		958	6,680	4,838,600	4,178,285	8,098,030	2,227,000

* Partly Estimated

RIO SAN JUAN STATION AT SANTA ROSALIA, TAMAULIPAS

DESCRIPTION: Water-stage recorder and cable with sit down cable car, located about 27-1/2 miles above the confluence with the Rio Grande and 15 miles south of Ciudad Camargo, Tamaulipas, at a ranch called Santa Rosalia, 3 miles west of Ochoa Railway Station. This stream joins the Rio Grande 987.2 river miles below the American Dam at El Paso, Texas. Zero of gage is 205.15 feet, U. S. C. & G. S. sea level datum.

RECORDS: Based upon 167 meter measurements and two float measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: May 1, 1900 to 1913; 1923 to 1938. See table of Authenticated Discharge Records herein.

REMARKS: This station has not always been at its present site. For detailed history of gage changes see previous Water Bulletins. When the river at this station rises above a gage height of 36.1 feet, water overflows the west river bank above the station and returns to the river below. It is estimated that a peak flow of 21,000 second feet thus by-passed this station in 1938. In the light of the 1938 flood, the peak flow of the 1932 flood is now estimated at 212,000 second feet including 18,000 second feet of by-pass to the west; also the mean daily discharge on Sept. 29 and 30, 1932 is now estimated at 182,000 and 117,000 second feet, respectively, which includes 11,300 and 3,530 second feet, respectively, of water which by-passed the station. These new amounts are included in the tabulated normals below. At a gage height of 42.6 feet, water submerges the right river bank at the station but follows the main river. The river flow was modified at this station by irrigation diversions on approximately 200,070 acres of land, and other uses along the San Juan River basin. The drainage area above this station is 13,000 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: For the flood of September 29, 1932, see preceeding paragraph. On August 30, 1909, there occurred a flood which reached a height of 49.21 feet, present scale, according to records of residents of the region. Slope-area computations and measurements during the 1932 and 1933 floods, show the 1909 flood peak to have been 353,000 second feet, without considering the water which overflowed the river channel to a width of nearly 2 miles. The river runs dry at times.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	667	286	180	79.8	22.2	112	381	4,730	18,000	2,000	812	678
2	565	279	193	67.8	19.4	98.2	220	3,050	9,960	1,890	826	678
3	477	272	215	62.2	14.5	91.1	166	1,560	6,990	1,790	833	664
4	459	256	357	52.3	12.7	66.7	146	1,580	6,000	1,740	809	646
5	477	251	403	52.3	10.9	61.8	118	713	4,980	1,660	791	618
6	477	251	330	47.7	10.9	52.6	105	470	4,450	1,600	777	607
7	477	244	279	47.7	9.2	44.5	91.1	406	3,960	1,550	759	597
8	512	237	253	39.9	9.2	41.0	79.1	274	3,640	1,490	720	597
9	547	230	237	36.7	86.9	33.5	118	223	3,340	1,450	710	600
10	530	223	230	32.8	43.8	24.7	118	193	3,440	1,420	735	586
11	530	212	643	36.7	25.4	17.7	80.2	168	3,640	1,450	745	576
12	547	205	480	39.9	17.0	17.7	66.7	150	3,500	1,430	745	572
13	547	205	330	39.9	25.4	12.7	52.6	118	3,470	1,370	742	558
14	547	198	269	36.7	39.9	12.7	44.5	94.6	3,460	1,320	742	565
15	530	194	237	36.7	47.7	12.7	37.4	78.0	2,930	1,260	735	551
16	512	187	215	36.7	2,240	10.6	33.5	57.2	3,150	1,210	717	561
17	494	180	201	42.0	869	12.7	24.7	52.3	5,760	1,180	703	558
18	477	180	193	1,190	445	102	20.8	43.8	4,410	1,120	678	558
19	445	157	180	558	258	61.8	17.7	39.6	3,250	1,080	667	558
20	431	168	180	547	200	61.8	14.8	30.4	6,320	1,050	660	558
21	413	168	175	337	172	267	12.7	24.0	6,140	992	653	547
22	385	157	168	249	155	212	10.6	19.1	5,230	946	650	533
23	374	146	175	168	234	79.1	9.2	16.2	4,170	946	660	537
24	360	146	162	119	4,410	52.6	8.1	14.5	3,440	904	653	526
25	360	157	148	86.9	1,370	79.1	6.7	14.5	3,020	901	650	523
26	332	157	138	57.2	773	80.2	2,860	12.7	2,740	897	646	512
27	307	157	129	43.8	327	237	1,980	12.7	2,550	879	646	540
28	307	157	111	36.7	212	195	1,890	2,170	2,390	858	664	558
29	307		102	32.8	176	374	685	91,800 ϕ	2,250	851	678	558
30	295		86.9	25.4	148	625	357	205,000 ϕ	2,120	840	678	597
31	295		86.9		129		1,530	91,100 ϕ		812		583
Sum	13,983	5,660	7,086.8	4,238.6	12,513.1	3,149.5	11,284.4	404,214.6	138,700	38,886	21,484	17,900

Month 1938	Extreme Gage Feet — 1938 High	Extreme Gage Feet — 1938 Low	Extreme Second Feet — 1938 High Day	High	Low Day	Low	Average Second Feet 1938	Acre Feet Total 1938	Acre Feet Period 1924-1938 Normal	Maximum	Minimum
Jan.	4.13	3.28	1	735	†30	295	451	27,700	35,675	93,500	9,230
Feb.	3.28	2.62	1	295	†23	146	202	11,200	23,080	92,810	3,740
Mar.	4.59	2.30	11	961	31	79.8	229	14,100	17,081	56,570	1,810
Apr.	7.38	1.90	18	2,390	30	25.4	141	8,410	18,311	98,500	1,670
May	13.48	1.67	24	6,360	†7	9.2	404	24,800	51,084	136,360	3,500
June	4.10	1.67	29	706	16	9.2	105	6,250	109,799	586,000	5,160
July	10.37	1.61	26	5,470	25	6.7	364	22,400	87,839	280,000	2,840
Aug.	42.65	1.77	30	ϕ 233,000	27	10.9	13,000ϕ	ϕ 802,000	ϕ 119,135	ϕ 802,000	2,120
Sept.	20.67	7.09	1	29,500	30	2,080	4,690	275,000	ϕ 262,383	1,411,080	22,790
Oct.	7.05	4.66	1	2,030	31	795	1,250	77,100	160,891	772,040	18,970
Nov.	4.66	4.17	3	833	†26	646	716	42,600	60,072	221,640	12,900
Dec.	4.27	3.77	†1	678	26	512	579	35,500	43,263	135,490	12,000
Yearly	42.65	1.61		233,000		6.7	1,860	1,347,060	988,613	3,387,480	328,180

† And other days. ϕ Includes the water which by-passed to the west of the station.

RIO GRANDE AT RIO GRANDE CITY STATION

DESCRIPTION: Water-stage recorder and cable with stand up cable car and winch, located about 4 miles by river below Rio Grande City, Texas, 3.7 miles northeast of Camargo, Tamaulipas, 7.3 miles below the confluence of the Rio San Juan with the Rio Grande and 994.5 river miles below the American Dam at El Paso, Texas. Zero of gage is at mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 64 meter measurements during the year. Computations by shifting channel methods. 1938 records good. Records available: January 1, 1932 to December 31, 1938.

REMARKS: When the water at this station rises above a gage height of about 151 feet, water overflows the left river bank beyond the station cable, but such water is measured.

When floods in the Rio San Juan exceed a gage height of about 38 feet or a flow of about 172,000 second feet at the Santa Rosalia station, water begins to overflow the right bank of that river at several places from El Azucar (20 miles below Santa Rosalia station) downstream. This overflow water cuts across country and reaches the Rio Grande about 9 river miles below Rio Grande City gaging station and is therefore not measured there. In the 1932 flood 411,000 acre feet and in 1938, 12,000 acre feet of water are estimated to have thus by-passed the Rio Grande City station and reached the Rio Grande, but these estimated amounts of by-pass water are included in the tabulation below. The river flow is greatly modified at this station by many irrigation diversions and by large reservoirs in the United States and Mexico. With all closed basins eliminated, the drainage area above this station is 171,748 square miles, 91,313 being in the United States and 80,435 in Mexico. Below San Marcial, New Mexico and below the Red Bluff Dam on the Pecos River, there were approximately 240,549 acres in the United States and 429,134 acres in Mexico irrigated by diversions from the Rio Grande and its tributaries above this station.

PREVIOUS EXTREME FLOWS: The highest reported gage height was in 1909, when the extreme gage height was 159.2 feet, present gage datum, as reported by residents and confirmed by extreme gage height at Rio Grande City Weather Bureau gage and other points in the vicinity, as found in Joint Report of International Boundary Commission 1910-11.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	6,690	3,500	2,790	1,910	1,750	1,850	15,700	*37,000	82,300	*36,000	4,140	3,680
2	5,960	3,350	3,020	1,840	1,640	1,650	14,500	38,700	44,700	*26,500	4,310	3,670
3	5,360	3,320	4,370	1,760	1,570	1,510	9,330	28,700	23,900	*21,600	4,440	3,580
4	4,450	3,440	3,620	1,650	1,520	1,500	7,310	21,500	16,500	*16,800	4,280	3,640
5	3,940	3,450	3,060	1,620	1,560	1,390	7,660	18,000	12,200	*15,000	4,120	3,700
6	3,890	3,390	2,840	1,590	1,540	1,230	*11,900	14,900	9,330	*13,400	4,060	3,810
7	3,730	3,370	2,650	1,470	1,460	1,140	13,700	12,500	8,320	*12,300	4,000	3,730
8	3,550	3,200	2,530	1,420	1,730	1,080	14,400	12,000	7,660	*11,500	4,080	3,730
9	3,470	3,000	3,950	1,380	1,860	1,060	*15,100	11,400	7,950	*10,900	4,190	3,750
10	3,350	2,930	3,460	1,340	1,970	1,020	*17,700	9,840	10,800	*10,100	4,100	3,580
11	3,390	2,870	2,690	1,330	1,650	1,000	*18,000	9,140	12,700	*9,030	3,980	3,460
12	3,480	2,800	2,930	1,330	1,510	1,040	12,200	8,530	16,000	*8,280	3,900	3,410
13	3,460	2,730	2,720	1,340	1,510	1,080	9,230	9,100	19,500	*7,680	3,840	3,380
14	3,490	2,680	2,510	1,350	1,560	1,090	7,930	8,510	19,600	7,300	3,890	3,430
15	3,500	2,640	2,380	1,340	1,610	1,540	7,250	8,030	20,600	6,920	4,020	3,410
16	3,330	2,550	2,300	*1,200	1,910	1,970	6,210	7,830	29,300	6,870	3,930	3,310
17	3,160	2,480	2,290	*1,420	3,270	2,280	5,500	7,280	34,600	6,660	4,010	3,250
18	3,110	2,420	2,250	4,100	3,660	1,420	4,730	6,660	30,100	6,370	3,990	3,220
19	3,170	2,710	2,140	*7,830	3,160	1,250	4,430	6,320	24,400	6,150	3,870	3,400
20	3,170	2,950	2,100	11,100	3,040	1,200	3,920	5,840	22,400	6,030	3,920	3,360
21	3,240	3,080	2,080	9,000	2,560	1,310	3,530	5,350	19,800	5,850	4,090	3,400
22	3,240	2,910	2,050	5,180	2,250	1,420	3,440	5,170	19,700	5,410	4,050	3,450
23	3,140	2,700	2,320	3,270	2,060	1,300	3,400	5,170	20,600	5,140	3,990	3,390
24	3,740	2,590	9,660	*2,640	8,480	1,270	5,220	4,990	23,200	4,980	3,870	3,310
25	5,000	2,600	5,220	*2,350	17,600	1,230	17,800	4,810	26,100	4,980	3,800	3,310
26	4,220	2,610	2,960	*2,320	10,900	1,330	61,300	4,690	29,400	4,950	3,720	4,280
27	4,460	2,520	2,440	*5,060	4,960	1,410	84,800	4,250	37,000	4,940	3,600	4,400
28	4,470	2,470	2,070	3,410	3,580	1,630	86,800	8,010	42,800	4,760	3,640	4,010
29	3,890		1,940	2,230	3,170	2,940	68,000	54,900	49,000	4,520	3,740	3,590
30	3,740		1,880	1,890	2,520	6,390	50,000	117,000	47,000	4,400	3,680	3,460
31	3,670		1,830		2,120		34,000	149,000		4,280		3,360
Sum	120,460	81,260	91,050	*85,670	99,680	47,530	624,990	645,120	767,460	*299,600	119,250	110,460

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.	129.82	127.25	1	6,930	18	3,070	3,890	239,000	274,671	521,000	140,000
Feb.	127.64	126.71	1	3,610	18	2,400	2,900	161,000	217,933	*368,690	125,000
Mar.	131.19	125.88	24	12,300	31	1,810	2,940	181,000	204,651	284,000	108,000
Apr.	131.86	*125.08	21	11,600	16	*1,150	*2,860	*170,000	211,915	395,000	118,000
May	133.85	125.53	25	18,400	7	1,400	3,220	198,000	405,138	603,000	153,000
June	132.08	124.95	30	13,100	11	984	1,580	94,300	514,121	1,737,000	94,300
July	149.41	127.31	28	89,000	23	3,320	20,200	1,240,000	449,966	1,240,000	160,000
Aug.	153.53	128.30	31	∮ 147,000	27	4,160	20,600	1,280,000	406,871	1,268,000	163,000
Sept.	151.72	130.58	1	122,000	9	7,160	25,600	1,522,000	1,125,819	3,723,800	147,000
Oct.	138.70	127.63	1	39,000	31	4,170	*9,660	*594,000	782,212	2,852,270	204,000
Nov.	127.83	127.08	3	4,520	28	3,550	3,980	237,000	332,435	829,260	156,000
Dec.	127.86	126.62	26	4,690	18	3,190	3,560	219,000	282,403	625,260	143,000
Yearly	153.53	124.95		∮ 147,000		984	8,460	6,135,300	5,208,135	9,537,640	2,642,000

* Partly Estimated. ∮ Passed the gaging station. In addition a peak estimated at 10,000 second feet of San Juan water by-passed the station.

RIO GRANDE AT HIDALGO STATION

DESCRIPTION: Water-stage recorder on the United States end of the Hidalgo-Reynosa international bridge near Hidalgo, Texas, and Reynosa, Tamaulipas, and 1,053.0 river miles below the American Dam at El Paso, Texas, and 144.6 river miles from the Gulf of Mexico. Zero of the gage was 79.28 feet above mean sea level, U. S. C. & G. S. datum. Meter measurements are from the bridge.

RECORDS: Based upon 41 meter measurements after April 26, 1938. Records available: July 1928 to December 1931; September and October 1932, and September 1933; peak flows in 1934; January to July, also September 1935; peak flows May and October, also full record July and September 1936; April 26 to December 31, 1938. 1938 record good. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: From 1931 to 1937 this station was operated only during flood periods. The river flow is greatly modified by irrigation diversions and large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, and below the Red Bluff Dam on the Pecos, and above the Lower Rio Grande Valley, there were approximately 240,549 acres in the United States and 429,134 acres in Mexico irrigated by diversions from the Rio Grande and its tributaries. Within the Lower Rio Grande Valley approximately 338,000 acres in the United States and 4,300 acres in Mexico were irrigated by diversions from the Rio Grande below Rio Grande City. Water begins to flow into Hackney Lake and Mission floodway inlets on the United States side when the river at this station reaches a stage of about 21.5 feet or a flow of about 60,000 second feet, but the river may begin to overflow at Granjeno and Jardin de Flores at stages about 3.5 feet lower. With all closed basins eliminated, the drainage area above this station is 172,650 square miles, 91,866 being in the United States and 80,784 in Mexico. The bottom of the river at this station is subject to considerable erosion during floods. See Water Bulletin No. 3, page 38.

PREVIOUS EXTREME FLOWS: The highest recorded stage was in 1909 when 27.89 feet on the present gage was reached. In 1910 24.82 was reached. These were before the present river bridge and highway embankments were constructed at this point. In 1932 the peak stage was 25.85 and the peak flow was 83,870 second feet. See previous Water Bulletins and Special Flood Report 1932 by the United States Section.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1					1,970	*1,770	8,720	38,800	77,000	45,600	3,990	3,610
2					1,670	*1,570	14,500	42,200	80,300	32,400	3,900	3,740
3					1,310	*1,370	13,400	39,600	58,100	23,800	4,050	3,730
4					1,220	*1,210	10,100	28,700	28,200	18,800	4,220	3,790
5					1,140	1,250	8,740	21,100	16,900	15,400	4,060	3,640
6					1,090	1,070	9,700	16,800	11,800	14,000	4,050	3,510
7					1,120	819	12,200	14,400	10,500	12,800	3,850	3,580
8					1,210	* 703	12,500	13,000	9,600	11,700	3,840	3,560
9					1,280	* 656	13,400	11,800	8,990	10,700	3,820	3,490
10					1,500	* 596	14,000	11,000	9,480	10,000	3,820	3,530
11					2,050	* 592	16,100	9,750	11,600	9,470	3,780	3,650
12					1,810	* 600	14,600	9,130	13,300	9,190	3,660	3,470
13					1,480	* 647	10,400	8,430	16,400	8,830	3,750	3,240
14					1,410	* 682	8,630	8,300	19,100	8,130	3,780	3,240
15					1,460	* 723	7,590	8,140	19,300	7,610	3,720	3,330
16					1,500	965	5,170	7,580	23,800	7,280	3,760	3,410
17					1,660	1,680	5,920	7,250	31,400	7,110	3,700	3,370
18					2,580	2,040	5,200	6,750	34,900	6,840	3,710	3,360
19					2,170	1,730	4,400	6,050	29,500	6,440	3,780	3,190
20					3,250	1,260	3,800	5,760	24,900	6,160	3,800	3,010
21					3,010	1,170	3,450	5,660	23,200	6,090	3,790	2,940
22					2,690	1,160	3,270	5,080	21,800	5,960	3,640	2,970
23					2,250	1,260	3,120	4,820	21,800	5,730	3,520	2,950
24					1,880	1,330	3,020	4,770	23,100	5,400	3,490	3,050
25					12,900	1,130	4,400	4,740	26,000	5,070	3,830	3,170
26				2,800	14,200	1,120	20,800	4,630	29,700	5,040	3,680	3,260
27				2,560	7,230	1,060	43,900	4,640	33,500	5,000	3,740	3,800
28				4,070	4,440	1,140	50,200	5,650	38,300	4,890	3,550	4,320
29				3,800	3,540	1,290	58,300	19,600	45,000	4,740	3,620	4,260
30				2,630	3,110	2,930	59,900	53,100	49,800	4,600	3,560	3,890
31					2,300		49,400	66,000		4,290		3,630
Sum				15,860	90,430	*35,523	498,830	493,230	847,270	329,070	113,460	107,690

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day	High	Day	Low			Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.											
Apr. /							3,170	31,500			
May	9.78	.71	26	14,900	5	1,070	2,950	181,000			
June	3.45	-.50	30	3,620	11	574	*1,180	*70,500			
July	21.75	4.24	30	60,700	24	3,000	16,100	989,000			
Aug.	22.50	5.60	31	71,400	25	4,540	15,900	978,000			
Sept.	24.00	9.21	2	83,200	9	8,580	28,200	1,681,000			
Oct.	19.58	4.78	1	49,900	31	4,130	10,600	653,000			
Nov.	4.90	*3.93	6	*4,120	28	3,520	3,780	225,000			
Dec.	4.65	2.98	29	4,380	21	2,740	3,470	214,000			
Period	24.00	-.50		83,200		574	10,100	5,023,000			

/ Record began April 26

* Partly Estimated

RIO GRANDE AT MERCEDES BRIDGE STATION

DESCRIPTION: Prior to January 8, 1938, a staff-gage located at Mercedes pumping plant, about 500 feet upstream from the international bridge between Mercedes, Texas and Rio Rico, Tamaulipas. Zero of this gage is 50.53 feet above mean sea level, United States Coast and Geodetic Survey datum. After January 8, 1938, a water-stage recorder located 380 feet downstream from the above mentioned bridge and 1,090.9 river miles below the American Dam at El Paso, Texas. Zero of this new gage is United States Coast and Geodetic Survey mean sea level datum. Meter measurements made from the bridge.

RECORDS: Based upon daily gage readings prior to installation of automatic recorder, also upon 47 current meter measurements during the year and the previous rating curve. Computations by shifting channel methods. 1938 gage height record good and discharge records fair. Records of discharge are available for September and October 1932; April 28 to October 3, 1935; July 1 to 31, September 1 to October 3, 1936; October 24 to December 31, 1937; June 7 to June 17, July 26 to August 7, August 29 to September 6, and September 12 to October 7, 1938. Unpublished records of daily river stage are available for each year from 1910 to 1938, except 1913.

REMARKS: The river flow at this station is greatly modified by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico, below the Red Bluff Dam on the Pecos, and above the Lower Rio Grande Valley, there were approximately 240,549 acres in the United States and 429,134 acres in Mexico, irrigated by diversions from the Rio Grande and its tributaries above this station. Within the Lower Rio Grande Valley approximately 338,000 acres in the United States and 4,300 acres in Mexico were irrigated by diversions from the Rio Grande below Rio Grande City. During floods only a portion of the river flow discharges past this station through the channel of the Rio Grande, as part finds outlet to the Gulf of Mexico through flood channels in both countries. With all closed basins eliminated, the drainage area above this station is 172,650 square miles; 91,866 being in the United States and 80,784 in Mexico.

PREVIOUS EXTREME FLOWS: The highest previous recorded stage was on September 11, 1935, when a stage of 76.60 feet was reached, with a flow of 40,000 second feet.

Mean Daily Gage Height in Feet -1938

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	57.39	56.39	55.13	*53.13	55.31	54.75	55.72	71.59	71.97	72.12	57.64	56.82
2	58.08	56.36	55.38	53.19	54.37	54.14	60.47	71.21	72.20	71.68	57.29	56.93
3	58.87	56.34	55.59	53.44	53.57	53.82	61.19	71.32	72.35	70.02	57.38	56.83
4	58.78	56.11	55.97	53.25	*52.80	53.36	59.56	70.11	71.35	68.06	57.68	57.11
5	58.54	56.05	56.51	52.91	*52.53	53.67	58.40	67.70	67.68	66.55	57.71	56.89
6	58.08	56.36	56.56	52.47	*52.43	53.10	*58.07	65.82	62.36	65.56	57.85	56.55
7	57.65	56.42	56.08	52.31	*52.14	52.33	*59.70	64.81	64.06	64.92	57.82	56.46
8	57.36	56.18	55.86	52.19	*52.93	51.48	*60.31	63.94	63.36	64.29	57.70	56.48
9	57.19	55.91	55.58	52.26	*53.22	*50.46	*60.55	63.31	62.80	63.76	57.49	55.98
10	56.99	55.93	55.50	52.57	*53.27	*50.46	*61.18	62.75	62.46	63.18	57.39	56.18
11	56.73	55.81	55.78	*53.39	53.56	*50.46	*62.15	62.22	63.14	62.68	57.23	56.60
12	56.52	55.60	56.15	52.01	54.41	*50.30	*62.53	61.66	63.75	62.29	57.07	56.52
13	56.52	55.77	55.88	*51.44	53.89	*50.00	60.61	61.29	64.69	62.08	57.32	56.18
14	56.58	55.49	55.56	*50.92	53.39	*50.00	59.25	61.25	*65.81	61.58	57.41	56.05
15	56.62	55.09	55.26	*50.50	53.58	*50.48	58.85	61.05	66.03	61.17	57.18	56.07
16	56.51	54.97	55.00	*50.42	53.49	51.59	58.57	60.61	66.65	61.10	57.02	56.15
17	56.39	55.01	54.86	*50.28	53.39	52.83	58.52	60.08	68.81	60.76	56.96	56.21
18	56.44	54.88	54.59	*51.39	53.66	54.04	58.15	59.85	*69.79	60.45	56.90	56.51
19	56.33	54.77	54.50	*53.43	54.82	54.32	57.64	59.43	*69.56	60.07	57.06	56.58
20	56.14	54.98	54.74	56.75	55.51	54.01	57.21	59.10	*68.35	59.74	57.41	56.26
21	56.25	55.47	54.48	59.64	55.57	54.07	56.95	59.10	67.52	59.54	56.83	55.77
22	56.33	55.84	54.16	59.37	55.57	53.85	56.70	58.85	66.76	59.42	56.39	55.63
23	56.39	56.07	53.92	58.10	55.02	53.87	56.41	58.20	66.60	59.51	56.34	55.66
24	56.39	55.78	54.20	57.26	53.62	54.17	56.53	58.03	66.85	59.20	56.79	55.42
25	56.35	55.48	56.54	56.44	55.55	54.21	56.63	58.00	67.62	58.60	56.76	56.46
26	56.56	55.40	57.85	55.62	61.17	53.77	61.76	57.93	68.53	58.38	56.63	56.56
27	56.98	55.46	57.12	55.11	59.88	53.78	69.10	58.04	69.62	58.32	56.76	56.60
28	57.00	55.41	55.92	55.35	57.47	53.47	*71.02	58.58	70.64	58.28	56.52	57.09
29	57.17		56.88	56.44	56.71	53.57	71.38	61.02	71.40	58.29	56.29	57.60
30	57.30		54.02	56.09	56.44	53.91	71.61	70.16	*71.88	58.41	56.25	57.43
31	56.85		*53.40		55.87		71.96	71.47		58.04		57.01

Mean Daily and Extreme Discharges in Second Feet – 1938

Date	Flow	Date	Flow	Date	Flow	Date	Flow	Date	Flow	Date	Flow
June 7	294	June 17	465	Aug. 4	29,700	Sept. 4	38,400	Sept.19	*28,400	Sept.29	37,400
" 8	69.7	July 26	9,100	" 5	20,500	" 5	21,900	" 20	*23,100	" 30	*39,700
" 9	* 15.0	" 27	27,400	" 6	14,900	" 6	13,500	" 21	20,300	Oct. 1	40,800
" 10	* 15.0	" 28	*35,800	" 7	12,600	" 12	12,200	" 22	18,000	" 2	38,600
" 11	* 15.0	" 29	37,000	" 29	10,400	" 13	14,100	" 23	17,700	" 3	30,800
" 12	* 10.0	" 30	37,600	" 30	34,300	" 14	*17,200	" 24	18,600	" 4	22,800
" 13	* 0	" 31	38,300	" 31	40,800	" 15	17,500	" 25	21,400	" 5	17,800
" 14	* 0	Aug. 1	35,500	Sept. 1	43,200	" 16	19,000	" 26	24,900	" 6	14,900
" 15	* 15.7	" 2	34,000	" 2	44,500	" 17	26,100	" 27	29,500	" 7	13,200
" 16	117	" 3	34,900	" 3	44,400	" 18	*29,800	" 28	33,900		

Extreme	June †	July e	August e	September e	October e
Gage Height in Feet	* 50.00	72.07	71.74	72.38	72.16
Second Feet	0	38,900	42,100	44,900	41,000

* Partly Estimated. † Extreme Low. e Extreme High.

RIO GRANDE AT MATAMOROS STATION

DESCRIPTION: Water-stage recorder and cable with sit down cable car and winch. The water-stage recorder is attached to the central pier of the railroad bridge over the Rio Grande between Matamoros, Tamaulipas and Brownsville, Texas, 53.1 miles upstream from the Gulf of Mexico and 1144.5 river miles below the American Dam at El Paso, Texas. The cable and car are located 0.3 mile upstream from the bridge. Zero of present gage is 15.26 feet above mean sea level, United States Coast and Geodetic Survey datum.

RECORDS: Based upon 179 meter measurements during the year. The river bottom shifts greatly at this station. Computations by shifting channel methods. 1938 records good. Records available: 1901 to 1913; 1923 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow at this station is greatly modified by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico and below the Red Bluff Dam on the Pecos river, and above the Lower Rio Grande Valley, there were approximately 240,549 acres in the United States and 429,134 acres in Mexico irrigated by diversions from the Rio Grande and its tributaries. Within the Lower Rio Grande Valley approximately 338,000 acres in the United States and 4,300 acres in Mexico were irrigated by diversions from the Rio Grande. During floods only a portion of the river flow discharges past this station through the channel of the Rio Grande as part finds outlet to the Gulf of Mexico through flood channels in both countries. With all closed basins eliminated, the drainage area above this station is 172,650 square miles, 91,866 being in the United States and 80,784 in Mexico. In May 1924 a recorder was established .6 mile upstream from the bridge. In September 1925 the recorder was moved to its present location. On October 3, 1930 the zero of the gage was lowered 5 feet.

PREVIOUS EXTREME FLOWS: The greatest previous flow recorded here was on June 22, 1903, when a mean daily flow of 36,200 second feet occurred with a gage height of 13.2 feet. The highest gage reading was on June 18, 1935, when a reading of 22.28 feet, present gage, was reached. In 1930 the river at this station was dry for a few days in March and April. On April 30, 1937, the minimum flow was 106 second feet with a stage of 1.8 feet.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,140	3,330	2,150	1,010	2,710	2,200	650	23,600	24,900	21,900	3,740	2,600
2	3,570	2,810	1,870	742	2,160	1,490	4,940	23,500	24,600	22,600	3,360	2,850
3	5,090	2,680	2,000	611	1,380	851	9,460	23,300	24,700	23,300	3,140	3,140
4	5,190	2,700	2,220	855	784	643	8,860	23,200	24,300	21,500	3,170	3,300
5	5,370	2,520	2,490	759	410	551	6,640	21,800	22,300	17,600	3,380	3,470
6	5,160	2,660	2,890	622	249	466	5,050	18,200	16,200	15,300	3,600	3,150
7	4,590	2,870	3,080	463	132	427	6,070	15,200	13,300	14,000	3,740	2,720
8	4,130	2,790	2,860	343	120	154	8,620	13,100	11,400	12,900	3,640	2,590
9	3,920	2,670	2,830	287	107	87.6	9,360	11,800	10,100	12,100	3,460	2,700
10	3,850	2,510	2,690	251	346	44.1	10,700	10,600	9,500	11,300	3,220	2,490
11	3,670	2,490	2,550	272	480	39.2	12,100	9,960	9,600	10,100	3,140	2,670
12	3,490	2,420	2,690	241	643	32.8	13,500	9,360	10,700	9,150	3,080	3,030
13	3,330	2,430	2,920	132	1,070	20.1	11,700	8,550	12,000	8,790	3,240	2,860
14	3,230	2,420	2,950	78.8	1,050	13.4	7,700	8,050	14,900	8,580	3,460	2,560
15	3,250	2,100	2,540	54.4	791	22.6	6,070	7,700	16,400	8,050	3,360	2,350
16	3,370	1,720	2,190	44.8	890	14.5	5,260	7,450	17,100	7,880	3,120	2,320
17	3,360	1,620	1,960	35.0	809	13.4	4,940	6,890	19,800	7,630	2,960	2,370
18	3,120	1,780	1,780	31.1	742	13.8	4,590	6,180	21,700	7,100	2,980	2,580
19	3,070	1,760	1,660	71.7	823	44.5	3,880	5,860	21,900	6,460	2,940	2,840
20	2,950	1,700	1,760	381	1,390	448	3,190	5,540	21,200	6,210	3,190	2,740
21	2,780	1,890	1,910	3,470	1,940	660	2,760	5,540	19,500	6,040	3,400	2,540
22	2,910	2,150	1,660	7,600	2,190	844	2,400	5,610	18,300	5,690	2,950	2,120
23	3,110	2,360	1,430	6,900	2,230	961	2,280	4,980	17,200	5,690	2,550	1,900
24	3,230	2,480	1,260	5,050	1,820	922	2,240	4,310	17,200	5,510	2,660	2,060
25	2,960	2,330	1,410	3,990	1,320	939	2,190	4,060	18,400	4,940	3,020	2,520
26	3,060	2,240	2,850	3,070	3,890	1,060	5,900	3,960	19,800	4,380	3,020	3,060
27	3,150	2,250	3,920	2,470	10,950	1,060	20,900	4,100	21,100	4,100	3,040	3,190
28	3,350	2,280	3,600	2,060	6,640	780	26,300	4,770	22,400	4,060	3,140	3,160
29	3,490		2,860	2,160	4,340	618	24,000	5,510	22,600	3,960	2,860	3,410
30	3,780		1,980	2,710	3,320	558	23,700	18,300	22,500	4,130	2,620	3,710
31	3,780		1,470		2,810		23,600	24,500		4,130		3,880
Sum	112,450	65,960	72,430	46,764.8	58,536	15,978	279,550	345,480	545,600	305,080	95,180	86,880

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	High	Low	Day		Day		1938	1938	Normal	Maximum	Minimum
Jan.	10.10	7.12	5	5,400	21	2,730	3,630	223,000	241,195	491,000	106,000
Feb.	8.17	5.31	1	3,640	17	1,580	2,360	131,000	168,463	328,330	71,350
Mar.	8.69	4.72	27	3,960	24	1,230	2,340	144,000	129,833	240,770	27,860
Apr.	11.45	1.28	22	7,700	18	20.8	1,560	92,800	128,091	318,000	56,900
May	13.16	2.07	27	11,500	9	101	1,890	116,000	285,105	483,000	99,400
June	6.99	1.44	1	2,450	17	9.5	533	31,700	387,135	1,180,380	31,700
July	20.67	3.48	28	27,000	1	572	9,020	554,000	340,477	629,000	54,400
Aug.	20.80	9.25	31	25,200	26	3,880	11,100	685,000	315,579	834,000	73,200
Sept.	21.26	13.85	1	25,100	11	9,320	18,200	1,082,000	650,339	1,259,620	124,060
Oct.	21.33	9.02	1	23,400	29	3,920	9,840	605,000	593,985	1,287,410	124,280
Nov.	9.12	7.09	1	3,920	23	2,500	3,170	189,000	305,177	827,490	99,600
Dec.	8.63	6.30	31	3,960	23	1,860	2,800	172,000	244,387	594,220	98,700
Yearly	21.33	1.28		27,000		9.5	5,560	4,025,500	3,789,766	5,745,160	1,969,900

RIO GRANDE AT LOWER BROWNSVILLE STATION

DESCRIPTION: Water-stage recorder and cable with stand up cable car and winch, located about 1,000 feet below the El Jardin pumping plant, about 8.5 river miles below Brownsville, Texas, and Matamoros, Tamaulipas, 46.6 miles upstream from the Gulf of Mexico and 1,151.0 river miles below the American Dam at El Paso, Texas. Zero of gage is on United States Coast and Geodetic Survey mean sea level datum.

RECORDS: Based upon 47 current meter measurements made during the year. Computations by shifting channel methods. 1938 records good. Records available: January 1934 to December 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The river flow at this station is greatly modified by many irrigation diversions and by large reservoirs in the United States and Mexico. Below San Marcial, New Mexico and below the Red Bluff Dam on the Pecos river, and above the Lower Rio Grande Valley, there were approximately 240,549 acres in the United States and 429,134 acres in Mexico irrigated by diversions from the Rio Grande and its tributaries. Within the Lower Rio Grande Valley approximately 338,000 acres in the United States and 4,300 acres in Mexico were irrigated by diversions from the Rio Grande. During floods only a portion of the river flow discharges past this station through the channel of the Rio Grande as part finds outlet to the Gulf of Mexico through flood channels in both countries. With all closed basins eliminated, the drainage area above this station is 172,650 square miles, 91,866 being in the United States and 80,784 in Mexico.

PREVIOUS EXTREME FLOWS: On June 10, 1935, a peak discharge of 31,000 second feet was reached with an estimated gage height of 32.10 feet. Additional data concerning peaks may be found in previous Water Bulletins. The river was dry at this station a few days in 1930 and March 25-28, 1935.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,000	3,370	2,090	962	2,640	2,450	480	22,900	22,600	22,700	3,580	2,390
2	3,350	2,780	1,880	640	2,270	1,820	2,130	22,900	23,600	23,400	3,160	2,600
3	4,250	2,630	1,930	498	1,530	1,110	8,350	22,800	23,900	23,900	2,880	2,910
4	5,040	2,650	2,130	742	907	698	9,040	22,600	23,800	22,600	2,920	3,070
5	5,330	2,510	2,420	739	423	603	6,940	21,700	21,900	18,400	3,190	3,270
6	5,260	2,570	2,820	544	208	509	5,430	19,100	17,300	15,400	3,400	3,080
7	4,890	2,790	3,060	391	133	418	5,160	15,900	13,200	13,600	3,550	2,710
8	4,350	2,730	2,890	270	123	143	6,960	13,800	11,300	12,600	3,490	2,410
9	4,030	2,610	2,800	232	88.6	59.0	7,600	12,200	10,400	11,800	3,360	2,420
10	3,910	2,430	2,660	191	196	28.6	8,440	11,000	9,840	10,800	3,100	2,270
11	3,690	2,420	2,530	*164	367	48.2	9,190	10,200	9,730	9,890	3,000	2,370
12	3,460	2,400	2,570	*125	522	30.9	11,500	9,520	10,800	9,140	2,910	2,740
13	3,230	2,300	2,760	72.2	894	11.1	11,600	8,880	11,900	8,710	2,960	2,700
14	3,170	2,300	2,780	26.5	1,130	5.1	8,790	8,480	13,800	8,390	3,110	2,470
15	3,120	2,090	2,460	7.3	834	1.0	6,480	8,320	15,700	7,740	3,050	2,240
16	3,180	1,700	2,160	7.1	891	0	5,460	8,040	16,800	7,380	2,840	2,160
17	3,210	1,500	1,900	39.5	797	0	4,920	7,470	19,000	7,180	2,660	2,210
18	3,020	1,550	1,730	8.7	634	0	4,370	6,700	20,600	6,770	2,660	2,380
19	3,000	1,540	1,590	47.3	652	*0.3	3,590	6,260	21,100	6,270	2,650	2,620
20	2,950	1,470	1,620	155	1,120	*187	3,000	5,820	20,500	6,200	2,860	2,630
21	2,930	1,580	1,730	2,570	1,760	*459	2,550	5,580	18,900	6,050	3,110	2,520
22	3,000	1,830	1,570	7,200	2,060	736	2,230	5,570	17,800	5,750	2,820	2,180
23	3,040	2,010	1,350	7,210	2,220	953	2,000	5,060	16,900	5,600	2,440	1,970
24	3,070	2,120	1,180	5,980	1,900	894	1,910	4,140	16,600	5,400	2,460	2,010
25	3,010	2,110	1,260	4,470	1,440	889	1,980	3,860	17,500	5,000	2,720	2,370
26	3,070	2,050	2,730	3,450	3,640	1,030	2,500	3,770	18,500	4,450	2,770	2,810
27	3,200	2,060	4,100	2,680	10,700	1,140	14,200	3,830	19,500	4,080	2,770	2,950
28	3,310	2,170	3,990	2,160	7,940	816	21,000	4,410	20,400	3,900	2,880	2,950
29	3,430		3,180	1,940	4,980	601	21,900	5,090	21,300	3,790	2,670	3,170
30	3,610		2,180	2,440	3,700	492	22,700	15,000	21,900	3,910	2,450	3,470
31	3,860		1,420		2,990		22,800	21,400		4,000		3,700
Sum	110,970	62,270	71,470	45,961.6	59,689.6	16,132.2	245,200	342,300	527,070	304,800	88,420	81,750

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1934-1938		
	High	Low	Day		Day				Average	Maximum	Minimum
Jan.	20.37	*17.47	5	5,380	20	2,910 *	3,580	220,000	222,000	299,000	106,000
Feb.	*18.60	15.25	1	*3,750	20	1,440	2,220	124,000	154,800	237,000	78,000
Mar.	18.92	14.70	27	4,260	24	1,150	2,310	142,000	127,140	183,000	29,700
Apr.	21.81		22	7,930	†15	0	1,530	91,200	117,180	242,000	50,700
May	23.55	11.94	27	11,300	10	54.6	1,930	118,000	288,600	*459,000	110,000
June	17.24		1	2,730	†14	0	538	32,000	364,000	*1,161,000	32,000
July	31.18	13.28	30	23,000	1	347	7,910	486,000	377,200	587,000	178,000
Aug.	31.28	19.26	1	23,100	27	3,730	11,000	679,000	271,180	679,000	77,900
Sept.	31.63	24.19	2	24,000	11	9,670	17,600	1,045,000	648,600	1,045,000	150,000
Oct.	31.50	19.73	3	24,500	29	3,710	9,830	605,000	467,000	‼ 629,000	200,000
Nov.	19.93	17.96	1	3,780	30	2,360	2,950	175,000	193,800	‼ 349,000	104,000
Dec.	19.48	17.09	31	3,720	23	1,930	2,640	162,000	193,160	‼ 302,000	99,800
Yearly	31.63			24,500		0	5,360	3,879,200	3,424,660	*4,877,700	1,911,600

* Partly Estimated

† And other days

‼ Estimated

RIO CONCHOS NEAR OJINAGA, CHIHUAHUA

DESCRIPTION: The Rio Conchos enters the Rio Grande about 4 miles above the international highway bridge between Presidio, Texas, and Ojinaga, Chihuahua, 1.6 miles above the Lower Presidio gaging station on the Rio Grande 7.8 miles below the Upper Presidio gaging station on the Rio Grande and 280.4 river miles below the American Dam at El Paso, Texas.

RECORDS: Based on discharge records of the Rio Grande at Upper Presidio and Lower Presidio stations, and estimated irrigation diversions and arroyo inflow between these two stations. The normals shown here correspond with the revisions in Rio Conchos discharge shown in Water Bulletin No. 7, page 44. Records fair. Records available: 1900 to 1913 and 1924 to 1938. See table of Authenticated Discharge Records elsewhere herein.

REMARKS: The Boquilla storage reservoir, as well as irrigation diversions for approximately 106,200 acres of land in the Rio Conchos basin greatly modify the river flow. The Colina reservoir with 21,900 acre feet capacity, located about 10.5 miles downstream from Boquilla dam and the Rosetilla reservoir located about 52.7 miles farther downstream, with a capacity of 15,400 acre feet are used for power development only. The daily river flow may be modified by these reservoirs but, except for evaporation, the monthly flow is not. The drainage area of the Rio Conchos above its confluence with the Rio Grande is 22,600 square miles, entirely in Mexico.

PREVIOUS EXTREME FLOWS: The greatest previous recorded flow occurred September 11, 1904, when the estimated peak was 162,000 second feet. See pages 71 and 72 hereof for the magnitude and average frequency of floods from the Rio Conchos in the past 109 years.

Month	Extreme Gage Feet — 1938		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day		Day				Normal	Maximum	Minimum
Jan.			23	1,460	31	547	998	61,300	54,624	147,500	14,410
Feb.			9	1,490	7	412	720	40,000	41,453	66,180	16,130
Mar.			1	1,690	31	141	448	27,600	39,414	70,240	20,870
Apr.			30	339	17	65.0	145	8,650	29,807	62,780	5,000
May			10	2,880	31	54.9	224	13,700	34,928	122,740	3,950
June			29	13,500	4	31.1	1,260	74,800	45,227	91,900	8,720
July			27	31,500	15	1,830	8,160	502,000	88,166	502,000	22,140
Aug.			1	12,000	31	773	3,990	246,000	119,766	435,400	18,900
Sept.			22	67,500	1	686	19,200	1,141,000	268,893	1,141,000	9,370
Oct.			1	10,100	24	1,300	2,770	170,000	147,548	798,000	41,000
Nov.			11	1,820	30	1,010	1,460	87,100	52,951	87,100	17,190
Dec.			4	1,430	28	594	970	59,700	50,639	76,000	15,280
Yearly				67,500		31.1	3,360	2,431,850	973,416	2,431,850	400,930

EL PASO SEWAGE OUTFALL

Into the Rio Grande at El Paso, Texas

The water supply for the City of El Paso, Texas, comes from wells located eastward and northeastward from the city. The flow of sewage is measured by Venturi Meter. The record was furnished by the Department of Water and Sewage of the City of El Paso. The present sewage treatment plant began operating in March 1936. This sewage outfall enters the Rio Grande 6.6 river miles below the American Dam at El Paso, Texas.

Month	1936		1937		1938		Period 1936 to 1938
	Mean Second Feet	Acre Feet	Mean Second Feet	Acre Feet	Mean Second Feet	Acre Feet	Average Acre Feet
Jan.	‼ 7.0	‼ 430	‼ 7.1	‼ 436	8.7	534	‼ 467
Feb.	‼ 8.0	‼ 460	‼ 8.0	‼ 445	‼ 9.3	‼ 516	‼ 474
Mar.	7.9	488	7.4	455	5.4	332	425
Apr.	9.5	567	‼ 7.7	‼ 460	7.5	448	492
May	9.0	551	‼ 8.0	‼ 491	8.5	525	522
June	9.7	575	9.3	552	9.1	543	557
July	9.8	605	9.4	576	7.8	482	554
August	8.8	544	8.9	550	9.0	555	550
Sept.	9.0	535	8.5	505	9.7	575	538
Oct.	8.1	495	7.7	474	9.9	611	527
Nov.	7.9	473	7.6	454	10.0	596	508
Dec.	7.0	430	8.7	538	9.3	574	514
Yearly	8.5	6,153	8.2	5,936	8.7	6,291	6,128

‼ Estimated

RIO GRANDE FLOODWAY DISCHARGES ON THE UNITED STATES SIDE

In The Lower Rio Grande Valley

There are three floodways on the United States side of the Rio Grande delta which carry excess Rio Grande flood waters to the Gulf of Mexico. Such floodway discharges are measured at the floodway gaging stations mentioned below.

The Mission inlet has no control gates. It is located 15.0 river miles above the Hidalgo gaging station and 9.9 floodway miles above the North Floodway gaging station on the floodway-highway bridge south of McAllen, Texas.

The Hackney Lake inlet has no control gates. It is located 4.2 river miles above the Hidalgo gaging station, and 3.4 floodway miles above the South Floodway gaging station on the floodway-highway bridge south of McAllen, Texas.

When the Rio Grande at Hidalgo gaging station on the Hidalgo-Reynosa international bridge reaches a stage of about 21.5 feet or a flow of about 60,000 second feet then water begins to enter the Hackney Lake and Mission inlets.

When the Rio Grande at the Matamoros gaging station on the Brownsville-Matamoros railroad bridge reaches a stage of 16.4 feet or 5 meters, or a flow of about 14,500 second feet, then water begins to flow into the Rancho Viejo floodway 18.4 river miles upstream, if the control gates are open. The Rancho Viejo gaging station is on the floodway-highway bridge 1.2 floodway miles below the floodway control gates on the river bank.

Descriptions of the North Floodway and the South Floodway stations south of McAllen, Texas, may be seen in Water Bulletin No. 2. Description of the Rancho Viejo Floodway station may be seen in Water Bulletin No. 6.

Mean Daily Discharge in Second Feet and Period Summary, 1938

North Floodway South of McAllen, Texas

Day	July	Day	Aug.	Day	Sept.	Day	Sept.	Day	Oct.
29	0	1	262	1	11,600				
30	487	2	109	2	19,200				
31	711	3	20.5	3	2,910				
		4	8.0	4	475				
		5	0	5	226				
				6	* 116				
		30	0	7	* 50.0				
		31	78.3	8	* 10.0				
				9	* 0				
Total	1,198		477.8		34,581.0				

South Floodway South of McAllen, Texas

29	0	1	90.0	1	10,400				
30	197	2	* 10.0	2	14,200				
31	270	3	0	3	3,300				
				4	20				
		30	0	5	0				
		31	601						
Total	467		701		27,920				

Rancho Viejo Floodway Near Brownsville, Texas

26	0	1	593	1	1,030	19	712	1	1,330
27	121	2	593	2	1,400	20	620	2	1,420
28	398	3	522	3	1,680	21	226	3	1,270
29	415	4	270	4	1,670	22	0	4	787
30	451	5	0	5	1,130			5	163
31	531			6	217	27	0	6	0
		29	0	7	0	28	347		
		30	126	17	0	29	945		
		31	706	18	375	30	1,190		
Total	1,916		2,810				11,542		4,970

	NORTH FLOODWAY Mission SOUTH OF McALLEN, TEXAS			SOUTH FLOODWAY Hackney SOUTH OF McALLEN, TEXAS			RANCHO VIEJO FLOODWAY NEAR BROWNSVILLE, TEXAS		
	Gage	Second Feet	Acre Feet	Gage	Second Feet	Acre Feet	Gage	Second Feet	Acre Feet
Period	Extreme Feet High	Extreme High	Total	Extreme Feet High	Extreme High	Total	Extreme Feet High	Extreme High	Total
July	13.32	1,070	2,380	15.33	550	926	43.24	573	3,800
Aug.	12.65	625	948	17.49	3,700	1,390	44.23	893	5,570
Sept.	20.07	26,000	68,600	22.52	15,300	55,400	45.80	1,690	22,900
Oct.							45.20	1,430	9,860
The Period	20.07	26,000	71,928	22.52	15,300	57,716	45.80	1,690	42,130

* Partly Estimated

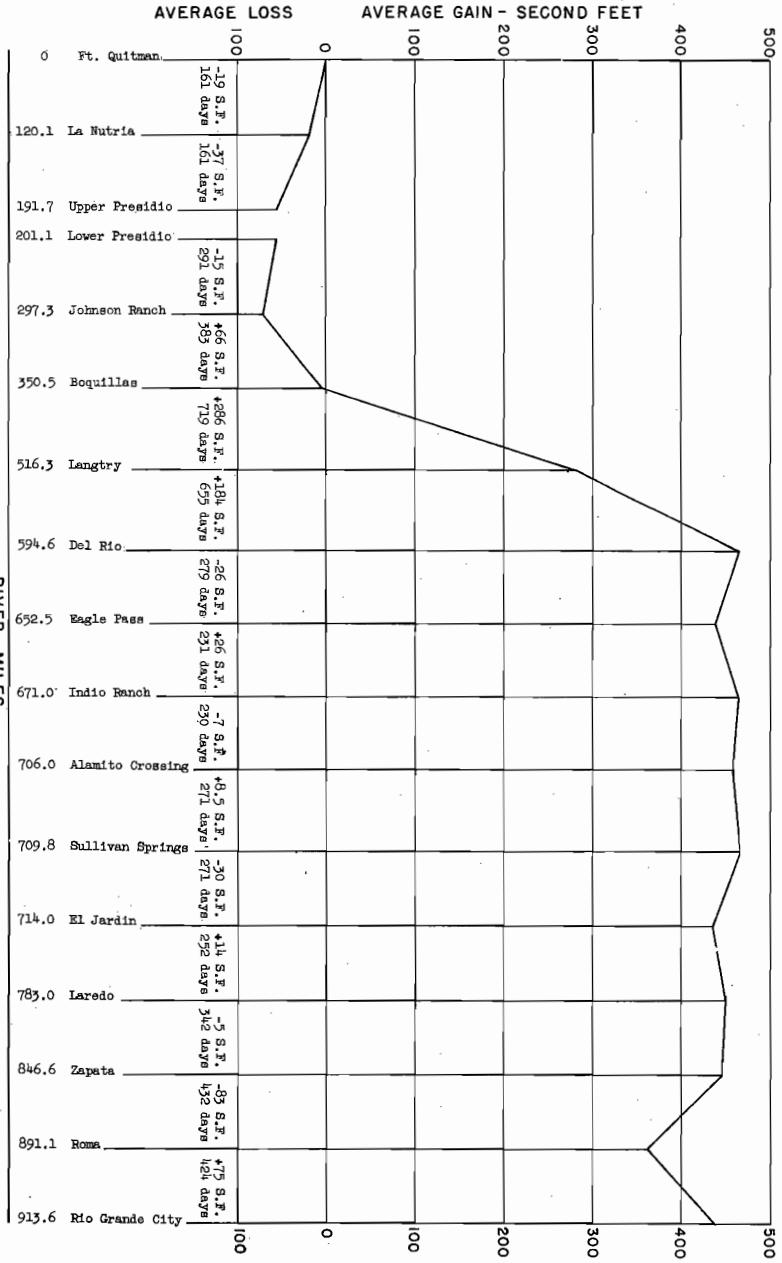
MEAN DRY WEATHER LOSSES AND GAINS IN RIVER CHANNEL

Along The Rio Grande Below Fort Quitman

1856 – 1938

In May 1856, Major Wm. H. Emory, Commissioner, Chief Astronomer and Surveyor of the International Boundary Commission, by means of spot measurements determined the gain in river flow from Presidio to Langtry, Texas to have been 400 second feet. Since that time, many measurements have been made to determine the losses or gains to the flow of the Rio Grande from Fort Quitman to Rio Grande City during dry weather periods, exclusive of tributary streams. Some of these have been only spot measurements and others have been continuous records of several or many days duration at both ends of a stretch of river channel. All of the existing data are brought together in the accompanying tabulation.

The data covering significant stretches of the river have been combined in the accompanying graph, giving the weight of one day to spot measurements. To continuous measurements a weight was given proportional to the number of days covered. The graph and the loss and gain figures thereon for each stretch therefore represent the weighted mean of all determinations of loss or gain in river channel within that stretch. Hence they show a significant characteristic of the river channel from Fort Quitman to Rio Grande City. There is shown to be an average net overall gain of 438 second feet from Fort Quitman to Rio Grande City, which corresponds to 317,000 acre feet per year.



MEAN DRY WEATHER LOSSES AND GAINS IN RIVER CHANNEL
Along The Rio Grande Below Fort Quitman
1856 – 1938

MEAN DRY WEATHER LOSSES AND GAINS IN RIVER CHANNEL

Along The Rio Grande Below Fort Quitman

1856 – 1938 --continued

LOCATION	RIVER MILES	DATA FROM	DATE	NO. OF DAYS	SECOND FEET: AVERAGE FLOW AT UPPER STATION	SECOND FEET: AVERAGE GAIN LOSS
Ft. Quitman to Upper Presidio	191.9	U. S. Sec. I.B.C.	Oct., Nov., Dec. 1934, Jan. 1935	48	89	- 78
Ft. Quitman to La Nutria	120.1	U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Feb., Mar. 1936 Oct.1936 to Feb.1937	39 122	120 200	- 28 - 14
		Total and Weighted Mean		161		- 17
La Nutria to Upper Presidio	71.6	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Feb., Mar. 1936 Dec. 1936 Feb.,Nov.,Dec. 1937 Nov.,Dec.1938-Jan.19	39 91 56	100 179 212	- 30 - 26 - 48
		Table and Weighted Mean		186		- 33
Lower Presidio to Langtry	315.2	W. H. Emory U.S.Sec.I.B.C.	May 1856 Apr., May 1904	Spot Mean. 23	50 10	400 287
		Total and Weighted Mean		24		292
		Alamito and Terlingua Creeks were not taken into account				
Lower Presidio to Boquillas	149.4	U.S.Sec.I.B.C.	Jan., Dec. 1935 Jan., Feb. 1936	101	613	84
		Alamito and Terlingua Creeks were taken into account				
Lower Presidio to Johnson Ranch	96.2	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Dec. 1936 - Jan. to Mar., Nov. 1937 June 1936 Jan., Feb. 1938 Mar., Apr., Nov., Dec. 1938 Jan. 1939	104 9 50 94 17	977 1,070	- 7 - 93 - 63 - 9 0
		Total and Weighted Mean		274		- 18
		Alamito and Terlingua Creeks were taken into account				
Lajitas to 2 miles below Santa Helena Canyon		U.S.G.S. (W.S.P. 608)	Feb. 7, 1925 at Lajitas Feb. 8, 1925 at Lower Location	Spot Meas.	1,060	- 20
		Terlingua Creek was taken into account				
1 mile below Santa Helena Canyon to Johnson Ranch		U.S.Sec.I.B.C.	June 12, 1938 10:30 A. M. at Upper location 6:00 P. M. at Lower location	Spot Meas.	29.5	14.5
2 mi. below Santa Helena Canyon to Mariscal Dam Station		U.S.G.S. (W.S.P. 608)	Feb. 8, 1925 at Upper location Feb. 9 at Lower location	Spot Meas.	1,040	0
Johnson Ranch to Langtry	219.0	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Dec. 1936; Jan., Mar., Nov. 1937 Jan., Feb., 1938 Mar., Apr., Nov., Dec., 1938	104 47 94	970 47 	373 356 320
		U.S.Sec.I.B.C.	Jan. 1939	19	1,120	296
		Total and Weighted Mean		264		346
Johnson Ranch to Boquillas	53.2	U.S.Sec.I.B.C.	April 1936	17	126	50
Johnson Ranch to 2 mi. above Mariscal Canyon		U.S.Sec.I.B.C.	June 12, 1938 6:00 P.M. at Upper Location June 13, 1938 10:30 A.M. at Lower Location	Spot Meas.	38	0
Mariscal Dam Station to Boquillas		U.S.G.S. (W.S.P. 608)	Feb. 9, 1925 at Upper location Feb. 11, 1925 at Lower location	Spot Meas.	1,040	50
Boquillas to Langtry	165.8	U.S.Sec.I.B.C. (W.W. Follett) U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Feb., Mar., Apr., May June, Sept. 1930 Nov. 1931 Jan.,Feb.,Oct.,Dec., 1934 - Jan. 1935 Jan., Dec. 1935 Jan., Feb. 1936	Spot Meas. 133 30 132 85	 460 1,160 930 818	329 265 224 282 379
		Total and Weighted Mean		431		292
Boquillas to Stillwell Crossing	27.2	U.S.G.S. (W.S.P. 608)	Feb. 11, 1925 at Upper location Febr.13, 1925 at Lower location	Spot Meas.	1,090	30
Stillwell Crossing to Reagan Canyon	30.7	U.S.G.S. (W.S.P. 608)	Feb. 13, 1925 at Upper location Feb. 15, 1925 at Lower location	Spot Meas.	1,120	100
Langtry to Del Rio	78.3	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Nov., Dec. 1931 Feb., Apr., June, Dec. 1934 Jan. 1934 - Jan., Feb.,Mar.,Dec. 1935 Jan.,Feb.,Mar.,Apr. Oct.,Nov.,Dec. 1936 Jan.,Feb.,Mar.,Nov. Dec. 1937 Feb. 1938 Mar., Apr., Nov., Dec. 1938 Jan. 1939	32 198 291 19 102 13	1,410 1,260 1,080 1,250 2,260	223 179 183 113 194 219
		Total and Weighted Mean		655		184
		Pecos, Goodenough and Devils were taken into account				
Del Rio to Eagle Pass	57.9	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Nov. 1934 Feb., Mar. 1934 Jan.,Feb.,Mar.,Nov., Dec., 1935 - Jan., Feb., Mar., Apr., Nov., Dec. 1936 Jan.,Feb.,Mar.,Nov., Dec. 1937 Feb. 1938 Mar. 1938	6 227 19 27	1,710 2,170 2,340 1,555	- 96 - 26 59 - 68
		Total and Weighted Mean		279		- 26
		San Felipe, Pinto, Las Moras, Rio San Rodrigo, Rio San Diego were taken into account				

LOCATION	RIVER MILES	DATA FROM	DATE	NO. OF DAYS	SECOND FEET: AVERAGE FLOW AT UPPER STATION	SECOND FEET: AVERAGE GAIN LOSS -
Comal to Eagle Pass	16	U.S.G.S. (W.S.P. 668)	Jan.,Feb.,Mar., 1928		2,855	30
Eagle Pass to Laredo	130.5	U.S.G.S. (W.S.P. 628) U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Feb., Apr. 1928 Jan., Feb., Mar., Apr., Nov. 1937 Feb. 1938 Mar. 1938	30 105 19 16	2,360 2,180 2,540 1,810	- 25 25 - 19 - 24
		Total and Weighted Mean		170		7
		Rio Escondido was taken into account				
Eagle Pass to Palafox (One mile below)	89.5	U.S.G.S. (W.S.P. 668)	Apr. 1928	20	2,105	- 25 a 35 b
		a) two ratings were developed for this station - upper rating 300 feet below gage, indicated 25 S. F. loss b) lower rating 500 feet below gage, indicated 35 S. F. gain. Note: Rio Escondido inflow was not taken into account				
Eagle Pass to Alamito Crossing	53.4	U.S.Sec.I.B.C.	Dec. 1934 Jan.,Feb.,Mar. 1935	88	1,788	40
Eagle Pass to Indio Ranch	18.5	U.S.G.S. W.S.P. 668	Jan., Feb., Mar., Apr., 1928	61	2,885	55
Eagle Pass to Rosita Pump	9	U.S.G.S. (W.S.P. 668)	Feb., Mar. 1928	42	2,870	40
Rosita Pump to Indio Ranch	9.5	U.S.G.S. (W.S.P. 668)	Feb., Mar. 1928	42	2,910	15
Indio Ranch to Palafox	71	U.S.G.S. (W.S.P. 668)	Feb.,Mar.,Apr. 1928	51	2,445	- 10 a 50 b
		a - b -- See footnotes Eagle Pass to Palafox				
Alamito Crossing to Sullivan Springs	3.9	U.S.Sec.I.B.C.	Dec. 1934 - Jan., Feb., Mar. 1935	94	1,828	18
Sullivan Springs to El Jardin	4.2	U.S.Sec.I.B.C.	Dec. 1934 - Jan., Feb., Mar. 1935	94	1,846	- 63.2
El Jardin to Laredo	69	U.S.Sec.I.B.C.	Dec. 1934 - Jan., Feb., Mar. 1935	83	1,775	89.3
Palafox to Lalitas	21	U.S.G.S. (W.S.P. 628)	Feb., Apr. 1928	20	2,445 a 2,505 b	- 60 a -120 b
		a - b -- See footnotes Eagle Pass to Palafox				
Darwins Ferry to Lalitas	8	U.S.G.S. (W.S.P. 608)	Apr. 1928	20	2,090	- 80
Lalitas to Laredo	20	U.S.G.S. W.S.P. 628	Feb., Apr. 1928	30	2,260	25
Palafox to Darwins Ferry	13	U.S.G.S. (W.S.P. 628)	Apr. 1928	20	2,080 a 2,140 b	10 - 50
Laredo to Zapata	65.6	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Dec., 1934 - Jan., Feb., Mar., 1935 Nov. 1936 Feb. 1938 Mar.,Apr.,May,June, Nov., Dec. 1938 Mar.,Apr.,May, 1933 Jan.,Feb.,Dec. 1934	85 30 19 101 107	1,800 3,280 2,530 1,700- 3,890	- 57 - 78 36 - 56 98
		Total and Weighted Mean		342		- 5
		Rio Salado was taken into account				
Zapata to Roma	44.5	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Jan.,Feb.,Mar.,Apr., May, July 1934 Jan. 1935 Mar. 1935 - Jan. Feb., Mar., Apr., Nov., Dec. 1936 Mar.,Nov.,Dec. 1937 Feb. 1938	156 31 226 19	3,270 1,970 2,780 2,610	- 80 - 45 - 91 - 77
		Total and Weighted Mean		432		- 83
		Rio Alamo was taken into account				
Roma to Rio Grande City	22.5	U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C. U.S.Sec.I.B.C.	Jan., Feb., Mar., Apr., May 1934 June, Aug. 1932 Jan. 1935 Feb., Mar., Dec. 1935 - Jan., Feb., Mar., Apr., Nov., Dec., 1936 - Jan., Feb., Mar., Nov., Dec. 1937 Feb. 1938 Mar., Apr., Nov., Dec. 1938	151 31 168 19 55	3,430 1,780 2,630 1,380- 3,000	92 61 89 - 17 83
		Total and Weighted Mean		424		75
		Rio San Juan was taken into account				

NOTE: In W. S. P. 608 results were also given for gains between Reagan Canyon, Langtry and Del Rio, all in 1925 - but the daily record at Langtry shows an increase in flow of 120 second feet at Langtry during this test. Because of this increase in flow results of this study are not considered valid.

STORED WATER IN LARGE RESERVOIRS OF THE RIO GRANDE BASIN

The following data for El Vado reservoir on the Rio Chama is from the Middle Rio Grande Conservancy District, Albuquerque, New Mexico. The data for Elephant Butte and Caballo reservoirs on the Rio Grande and for McMillan, Avalon and Alamogordo reservoirs on the Pecos in New Mexico, are from the United States Reclamation Bureau. The Red Bluff Water Power Control District, Pecos, Texas, furnished the data for Red Bluff reservoir on the Pecos river in Texas. The data for Boquilla reservoir on the Rio Conchos in Chihuahua, are from the Compania Agricola y Fuerza Del Rio Conchos, S. A. The data for San Miguel and Centenario reservoirs on the Rio San Rodrigo in Coahuila, as well as for Don Martin reservoir on the Rio Salado are from the National Irrigation Commission of Mexico.

The monthly figures below represent the acre feet of water in storage on the last day of each month, and the capacities represent the capacities on the last day of the year. Storage began in the new Caballo reservoir in February 1938. The figures below represent thousands of acre feet.

Month	El Vado (Capacity 198.8)				Elephant Butte (Capacity 2,230.4)				Caballo (Capacity 153.0)			
	Year 1938		Average 1935-38		Year 1938		Normal 1924-38		Year 1938			
	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change
January	32.7	2.8	55.0	3.2	1,195.6	29.6	1,107.4	27.9	0	0		
February	35.8	3.1	55.8	.8	1,195.8	.2	1,117.9	10.5	4.4	4.4		
March	62.6	26.8	64.2	8.4	1,145.9	-49.9	1,095.2	-22.7	8.9	4.5		
April	142.6	80.0	128.9	64.7	1,073.6	-72.3	1,093.2	-2.0	14.7	5.8		
May	188.6	46.0	171.8	42.9	1,206.7	133.1	1,213.1	119.9	13.1	-1.6		
June	195.4	6.8	164.8	-7.0	1,272.4	65.7	1,219.6	6.5	17.9	4.8		
July	143.7	-51.7	134.4	-30.4	1,267.1	- 5.3	1,139.4	-80.2	15.0	-2.9		
August	76.0	-67.7	93.3	-41.1	1,140.6	-126.5	1,055.1	-84.3	12.2	-2.8		
September	61.1	-14.9	73.2	-20.1	1,195.5	54.9	1,032.0	-23.1	1.9	-10.3		
October	56.5	- 4.6	67.6	-5.6	1,194.9	- .6	1,043.1	11.1	11.1	9.2		
November	56.6	.1	63.4	-4.2	1,184.4	-10.5	1,055.0	11.9	30.8	19.7		
December	58.7	2.1	66.5	3.1	1,166.7	-17.7	1,064.9	9.9	80.4	49.6		
Annual	* 92.5	28.8	94.9	14.7	*1,186.6	.7	1,103.0	-14.6	* 17.5	80.4		
Maximum	195.7	165.7	195.7		1,309.4	245.8	1,986.4		90.4	90.4		
Minimum	30.0		0		1,063.6		421.5		0			

Month	Boquilla (Capacity 2,116.0)				Alamogordo (Capacity 157.0)				McMillan and Avalon (Capacity 45.5)			
	Year 1938		Normal 1924-38		Year 1938		Average 1937-38		Year 1938		Normal 1924-38	
	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change
January	1,446.7	-43.3	1,311.4	-36.0	32.0	5.3			20.5	-1.7	36.7	.8
February	1,390.4	-56.3	1,280.6	-30.8	37.0	5.0			19.1	-1.4	36.0	-.7
March	1,331.7	-58.7	1,224.7	-55.9	19.8	-17.2			23.9	4.8	32.1	-3.9
April	1,253.4	-78.3	1,159.6	-65.1	20.0	.2			9.8	-14.1	20.1	-12.0
May	1,171.3	-82.1	1,085.4	-74.2	21.7	1.7			2.1	-7.7	29.0	8.9
June	1,164.3	- 7.0	1,027.9	-57.5	14.2	-7.5			20.9	18.8	23.4	-5.6
July	1,801.7	637.4	1,087.3	59.4	50.4	36.2			26.9	6.0	21.0	-2.4
August	1,952.6	150.9	1,222.3	135.0	29.8	-20.6			7.0	-19.9	19.1	-1.9
September	2,134.5	181.9	1,417.5	195.2	84.5	54.7			24.2	17.2	27.5	8.4
October	2,069.7	-64.8	1,411.0	-6.5	101.0	16.5			27.7	3.5	32.8	5.3
November	1,986.3	-83.4	1,359.8	-51.2	102.0	1.0	61.4	10.8	26.9	- .8	33.1	.3
December	1,932.7	-53.6	1,333.8	-26.0	99.3	- 2.7	63.0	1.6	23.1	-3.8	34.4	1.3
Annual	*1,636.3	442.7	1,243.4	-13.6	* 51.0	72.6			* 19.3	.9	28.8	-1.5
Maximum	2,134.5	970.2	2,152.0		102.0	87.8	102.0		27.7	25.6	85.5	
Minimum	1,164.3		54.0		14.2		0		2.1		0	

Month	Red Bluff (Capacity 300.0)				Centenario and San Miguel (Capacity 17.0)				Don Martin (Capacity 1,123.0)			
	Year 1938		Average 1936-38		Year 1938		Average 1936-38		Year 1938		Average 1930-38	
	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change	Storage	Change
January	235.8	0	125.8	-7.2	7.9	3.9	11.1	.7	4.2	- 3.1	536.9	-3.2
February	237.6	1.8	130.9	5.1	10.3	2.4	10.4	-.7	1.8	- 2.4	517.7	-19.2
March	228.8	- 8.8	130.6	-.3	8.1	- 2.2	9.6	-.8	1.8	0	494.0	-23.7
April	201.7	-27.1	108.8	-21.8	5.5	- 2.6	6.7	-2.9	4.8	3.0	477.6	-16.4
May	194.3	- 7.4	103.1	-5.7	2.6	- 2.9	6.5	-.2	1.4	- 3.4	456.7	-20.9
June	184.0	-10.3	229.8	126.7	1.1	- 1.5	5.0	-1.5	1.0	- .4	457.2	.5
July	175.6	- 8.4	211.6	-18.2	4.3	3.2	6.9	1.9	25.2	24.2	452.6	-4.6
August	138.8	-36.8	183.2	-28.4	9.7	5.4	7.9	1.0	33.6	8.4	440.0	-12.6
September	136.2	- 2.6	187.3	4.1	14.6	4.9	11.5	3.6	43.5	9.9	511.9	71.9
October	131.1	- 5.1	129.5	4.6	12.4	- 2.2	11.4	-.1	40.3	- 3.2	523.9	12.0
November	130.5	- .6	130.5	1.0	8.6	- 3.8	10.0	-1.4	36.7	- 3.6	540.8	16.9
December	136.2	5.7	134.1	3.6	9.7	1.1	10.5	.5	36.7	0	544.2	3.4
Annual	* 177.6	-99.6	150.4	63.5	* 7.9	5.7	9.0	.1	* 19.2	29.4	496.1	4.1
Maximum	237.6	107.1	275.5		14.6	13.5	19.9		43.5	42.5	1,163.4	
Minimum	130.5		0		1.1		.6		1.0		0	

* Average

SOURCES OF RIVER FLOW

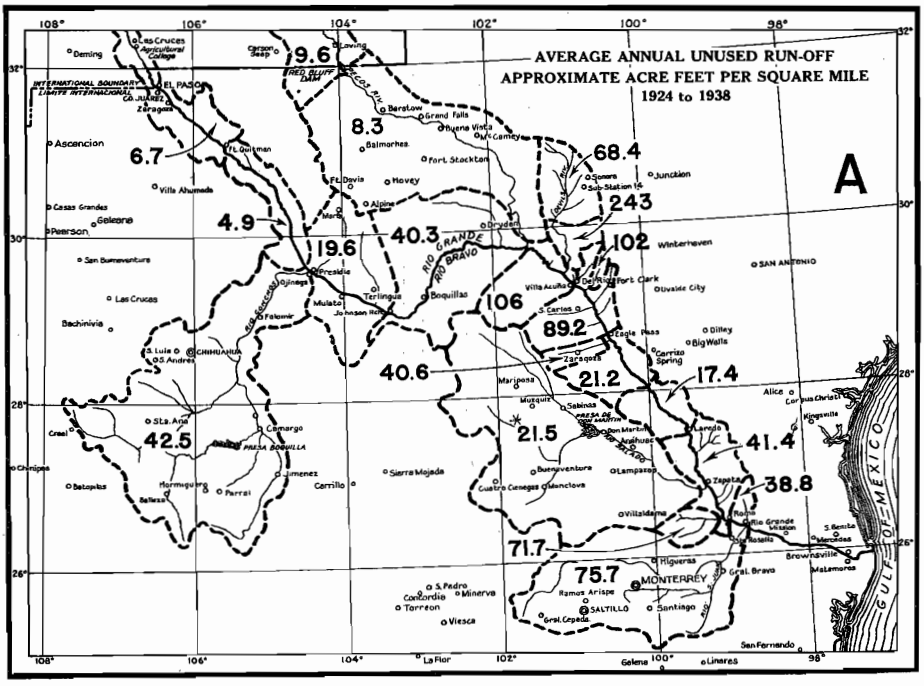
1924 to 1938

Subdivisions of the Rio Grande basin, especially below Fort Quitman on the main river, and below Red Bluff Dam on the Pecos River, are shown on the following three maps.

The large figures on the first map, "A" show in terms of acre feet per square mile, the approximate average annual unused run-off which originated on each water-shed subdivision during the 15-year period, 1924 to 1938, and which either flowed from or was reservoired within the subdivision.

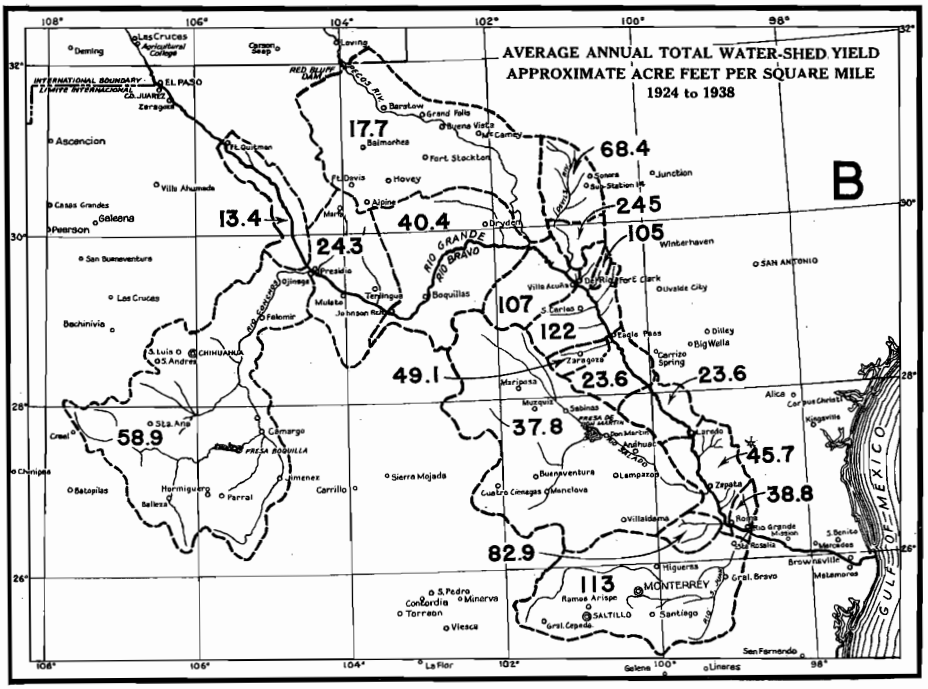
On the second map, "B" there is shown, for each subdivision, the average annual total water-shed yield, sometimes called the virgin yield, that is, the sum of the unused water as shown on the first map and the water estimated to have been consumed by irrigation and reservoir evaporation within each subdivision.

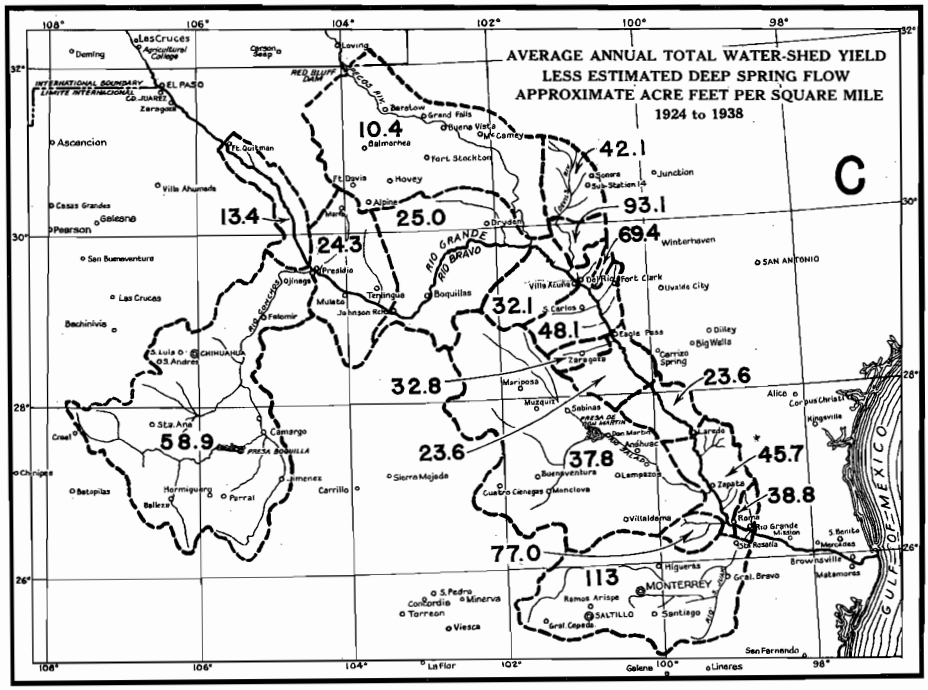
From the total water-shed yield figures, shown on the second map, there was deducted the estimated average annual flow from deep springs within each subdivision and the resulting figures appear on the third map, "C".



* In Water Bulletin No. 7, p. 54, this figure should have been 22.4.
ϕ In Water Bulletin No. 7, p. 54, this figure should have been 42.9.

SOURCES OF RIVER FLOW —continued

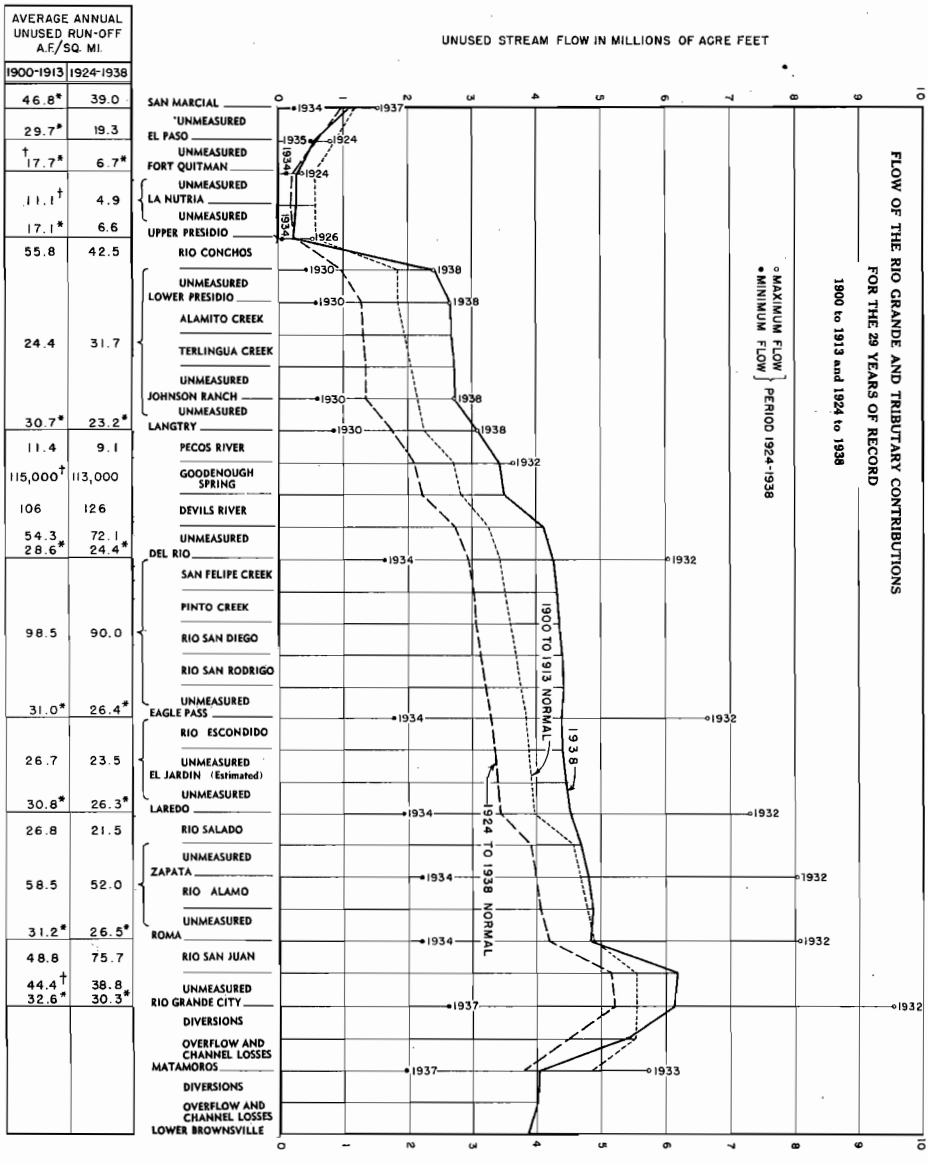




* In Water Bulletin No. 7, p. 55 and p. 56, this figure should have been 47.6.

SOURCES OF RIVER FLOW

A distinction must be made clear between the figures in the table at the lower or left side of this page showing average annual unused run-off and the graphical part of the page showing unused stream flow. As an illustration of this distinction, consider the unused stream flow at Upper Presidio. The amounts shown graphically above or to the right of the page are the millions of acre feet of water which actually flowed past this station, while the amounts shown by figures below or to the left of the page are acre feet per square mile of unused run-off which includes: (a) the water which actually flowed past the station and from which has been subtracted, (b) the water which ran off the water-shed into Elephant Butte reservoir in years prior to 1924 and was drawn from the reservoir during the period 1924 to 1938 and to which has been added, (c) the water which has been impounded since 1924 and remained in El Vado reservoir and Caballo reservoir at the close of the year 1938. This subtractive carry-over storage in Elephant Butte reservoir averaged 14,600 acre feet per year. The additive carry-over storage in El Vado reservoir and Caballo reservoir averaged 9,200 acre feet per year. Other carry-over storage figures are: Boquillas reservoir in the Rio Conchos, 13,600 acre feet per year, subtractive. Alamogordo, McMillan, Avalon, and Red Bluff reservoirs on the Pecos River, 14,200 acre feet per year additive. Centenario and San Miguel reservoirs on the Rio San Diego, 600 acre feet per year, additive. Don Martin reservoir on the Rio Salado, 2,400 acre feet per year, additive.



† ESTIMATED

* UNUSED RUN-OFF AT AND ABOVE GAGING STATION.

UNUSED STREAM FLOW IN MILLIONS OF ACRE FEET

DIVERSIONS FROM THE RIO GRANDE INTO THE AMERICAN CANAL AT EL PASO, TEXAS

This canal diverts water from the Rio Grande at the American Dam at El Paso, Texas, 2.1 river miles above the Mexican Dam at Ciudad Juarez, Chihuahua. The gaging station is an open channel rating station with water-stage recorder located 396 feet below the canal head-gates. The record is based upon 55 current meter measurements. Because of unsatisfactory conditions at this new station, much of the time the flow was deduced by taking the difference between the flow at the El Paso gaging station and that at the gaging station below the American Dam.

This is a new canal constructed by the United States Section in connection with the American Dam. Operation began June 2, 1938. Water from this canal discharges into the Franklin Canal from which some is returned to the Rio Grande at spillways 2.2, 2.7, and 3.6 river miles below the American Dam.

Mean Daily Discharge in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						80	8867	8919	1,100	8591	8266	8259
2						388	8874	8923	1,160	8649	83	8263
3						8963	8753	8892	1,150	8660	5	8231
4						8914	8890	8973	1,240	8602	5	8225
5						8818	8873	8940	1,260	8562	5	8218
6						8950	81,120	8941	1,150	8560	22	8202
7						915	81,060	81,080	1,190	8622	4	8211
8						932	8889	81,160	1,230	8572	2	8217
9						929	8915	81,050	885	8506	2	8219
10						897	81,020	8987	8708	8427	3	8215
11						8872	8977	8935	8657	8356	102	8196
12						8898	81,040	8986	8612	8347	8213	8189
13						81,050	81,180	8986	627	8340	8216	8191
14						8986	81,010	81,140	760	8327	8211	8195
15						8918	81,050	81,170	8783	8308	8201	8203
16						8923	1,100	81,060	8654	8288	8263	8219
17						8980	8897	8992	567	8275	8341	8283
18						8943	81,020	81,010	8534	8268	8339	8370
19						8901	1,090	81,070	8518	8360	8368	8399
20						81,000	1,020	8984	8429	8479	8469	8469
21						8831	1,090	81,030	8388	8507	8431	8442
22						8847	1,010	8975	8408	8538	8360	8328
23						81,020	81,020	81,010	8390	8558	8336	8269
24						81,160	8971	8925	8420	8540	8293	8237
25						81,170	8929	8936	8486	8388	8286	8227
26						8976	8903	8915	474	8316	8271	8218
27						1,030	8915	8900	517	8285	8273	160
28						990	81,010	8953	528	8279	8245	2
29						1,050	8939	81,020	534	8275	8254	2
30						1,040	8834	8922	551	8263	8262	2
31							8842	8957		8262		2
Sum						827,291	830,108	830,741	821,910	813,310	86,131	86,863

Month	Extreme Gage Feet — 1938		Extreme Second Feet * — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total 1938	Period 1924-1938		
	High	Low	Day	High	Day	Low			Normal	Maximum	Minimum
Jan.											
Feb.											
Mar.											
Apr.											
May											
June			25	81,170	1	80	8910	854,100			
July			13	81,180	3	8753	8971	859,700			
Aug.			15	81,170	3	8892	8992	861,000			
Sept.			5	1,260	21	8388	8730	843,500			
Oct.			3	8660	31	8262	8429	826,400			
Nov.			20	8469	†8	2	8204	812,200			
Dec.			20	8469	†28	2	8221	813,600			
Period				1,260		80	8637	8270,500			

8 Deduced Flow - El Paso minus Rio Grande below American Dam * Mean Daily Extreme

† And other days

DIVERSIONS FROM THE RIO GRANDE INTO THE ACEQUIA MADRE (MEXICAN CANAL)

Near Juárez, Chihuahua, Together With Corresponding ACREAGE IRRIGATED, WATER DUTY AND RAINFALL 1938

This canal diverts water from the Rio Grande at the Mexican Dam at Juarez, Chihuahua, 2.1 river miles below the American Dam at El Paso, Texas. The gaging station is an open channel rating station with water-stage recorder located between the head of the canal and the first spillway below that point, but no water passed from the spillway during this period.

The record is based upon frequent current meter measurements at the station. This record was furnished by the National Irrigation Commission of Mexico.

The water from the Acequia Madre was used primarily to irrigate approximately 16,902 acres lying under the first unit of this canal. Some of this water, as well as all drainage water, passed from this area to lands below.

The average annual evaporation from natural water surfaces in this region is approximately 66 inches per year. See Water Bulletin No. 5, page 58.

This record begins with June, 1939, as the American Dam, then, (June 2) began operating, constituting a new means of river regulation.

Mean Daily Diversions in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						308	0	80.5	123	11.7	0	0
2						308	0	44.8	189	13.1	0	0
3						305	9.9	43.1	154	18.7	0	0
4						301	43.1	44.8	128	25.4	0	0
5						298	91.1	47.0	151	20.5	0	0
6						285	119	66.0	131	20.5	0	0
7						262	96.1	68.5	93.2	15.9	0	0
8						255	133	136	0	8.1	0	0
9						262	154	51.9	0	6.4	0	0
10						272	111	47.0	0	2.8	0	0
11						262	108	49.4	0	0	0	0
12						252	136	47.0	0	0	0	0
13						275	181	51.9	0	0	0	0
14						275	139	44.8	0	0	0	0
15						272	147	63.6	0	0	0	0
16						250	177	68.5	0	0	0	0
17						239	147	68.5	0	0	0	0
18						255	177	71.3	0	0	0	0
19						223	193	161	0	0	0	0
20						250	200	272	0	0	0	0
21						184	177	272	0	0	0	0
22						206	0	181	0	0	0	0
23						193	243	139	0	0	0	0
24						122	193	127	0	0	0	0
25						0	157	127	47.0	0	0	0
26						0	158	130	38.1	0	0	0
27						0	151	142	27.2	0	0	0
28						0	139	144	17.3	0	0	0
29						0	136	147	15.9	0	0	0
30						0	136	144	13.1	0	0	0
31							136	144		0		0
Sum						6,114.0	3,988.2	3,224.6	1,127.8	143.1	0	0

Month	Rainfall *		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
	Average 1938	Normal 1924 to 1938	High		Low			Total 1938	Period 1924-1938		
			Day		Day				Normal	Maximum	Minimum
Jan.	1.44	.32									
Feb.	.16	.30									
Mar.	.46	.29									
Apr.	.02	.28									
May	.03	.46									
June	2.91	.54	9	321	†25	0	204	12,100			
July	1.14	1.45	23	296	†1	0	129	7,910			
Aug.	.38	1.46	21	308	2	32.8	104	6,400			
Sept.	2.52	1.20	3	223	†8	0	37.6	2,240			
Oct.	.24	.83	4	29.0	†11	0	4.6	284			
Nov.	.08	.38					0	0			
Dec.	.26	.41					0	0			
Period	9.64	7.92					111⊖	28,934			
Acreage Irrigated								16,902			
Mean Acre Feet Per Acre								1.71			
Average Rainfall in Inches								9.64	7.92	12.26	3.43

† And other days. ⊖ Average flow June 1 to October 10.

* Average of 3 stations.

DIVERSIONS FROM THE RIO GRANDE IN THE EL PASO VALLEY OF TEXAS
Together With Corresponding
ACREAGE IRRIGATED, WATER DUTY AND RAINFALL
1938

The diversions of water listed below were made for use on the 61,751 acres of irrigated land on the United States side lying between the American Dam and the Fort Quitman gaging station.

The diversions were measured for the 60,986 acres or 99% of the total area which lies above the lower end of the Hudspeth County Conservation and Reclamation District Number One. These water measurement and acreage records were furnished by the El Paso office of United States Bureau of Reclamation. For the 765 acres or 1% of the total area which lies below the Hudspeth District and above the Fort Quitman gaging station, the diversions were estimated.

From the gross diversions into the Franklin and Riverside canals there has been deducted the water spilled back to the river at 3 points, viz: 11.6, 19.0, and 26.4 river miles below the American Dam at El Paso. There is considerable re-use within this area of drainage and waste water from within the area. Final drainage water returns to the Rio Grande. This record begins July 1 when the rectification of the river channel through the El Paso-Juarez valley was completed for use throughout its length.

The average annual evaporation from natural water surfaces in this region is approximately 66 inches per year. See Water Bulletin No. 5, page 58.

Mean Daily Diversions in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1							187	796	818	485	245	258
2							90	876	129	562	210	233
3							108	838	514	568	206	219
4							384	879	448	555	213	210
5							368	826	494	536	210	192
6							461	862	269	539	210	191
7							545	949	323	605	206	74
8							708	999	244	591	181	186
9							785	1,046	235	490	171	162
10							862	1,037	226	382	187	187
11							879	1,028	56	324	194	173
12							816	904	306	308	219	143
13							747	956	234	301	191	168
14							822	944	138	367	173	164
15							922	860	297	286	140	122
16							1,007	958	432	241	160	117
17							843	917	469	225	170	17
18							743	981	446	227	211	252
19							956	960	476	270	234	360
20							1,039	942	430	295	221	415
21							631	998	375	466	168	379
22							859	935	379	425	263	296
23							890	958	423	418	261	292
24							734	897	412	415	249	263
25							784	871	431	374	244	253
26							838	844	419	296	192	226
27							845	856	448	292	177	199
28							896	1,012	506	243	172	73
29							921	913	481	275	217	55
30							838	922	489	250	185	0
31							775	1,036		234		0
Sum							22,283	28,800	11,347	11,845	6,080	5,879

Month	Rainfall *		Extreme Second Feet — 1938				Average Second Feet 1938	Acre Feet			
			High		Low			Total	Period 1924-1938		
	Average 1938	Normal 1924 to 1938	Day		Day			1938	Normal	Maximum	Minimum
Jan.	1.44	.32									
Feb.	.16	.30									
Mar.	.46	.29									
Apr.	.02	.28									
May	.03	.46									
June	2.91	.54									
July	1.14	1.45	20	1,039	2	90	719	44,200			
Aug.	.38	1.46	9	1,046	1	796	929	57,100			
Sept.	2.52	1.20	1	818	11	56	378	22,500			
Oct.	.24	.83	7	605	17	225	382	23,500			
Nov.	.08	.38	22	263	15	140	203	12,100			
Dec.	.26	.41	20	415	†30	0	190	11,700			
Period	9.64	7.92		1,046		0	469	171,100			
Average Irrigated Acreage								61,751			
Mean Acre Feet per Acre								2.77			
Average Rainfall in Inches								9.64	7.92	12.26	3.43

† And other days. * Average of 3 stations

DIVERSIONS FROM THE RIO GRANDE IN HIDALGO AND CAMERON COUNTIES, TEXAS

Together With Corresponding ACREAGE CULTIVATED, WATER DUTY AND RAINFALL

1938

Diversions from the Rio Grande for irrigation are made here almost entirely by pumping. For 91.6% of the irrigated area diversions were measured at the diversion points. For the remaining 8.4%, the diversions were estimated. A very small part of measurements were made by plant efficiency and power input; otherwise, measurements were by Venturi Meters, open channel rating stations, and Deflection Meters developed by this Commission. There is some re-use within the area of drainage water from the area. Drainage water from this area does not return to the Rio Grande. During the last half of the year about 33,700 acre feet (Not included in this tabulation) were diverted and used to prime the new Willacy County irrigation works.

The cultivated areas shown here are supplied with irrigation facilities. More than one crop per year is often grown on some of the land. The area actually irrigated this year was 80% of the cultivated area. The average annual evaporation from natural water surfaces in these counties is approximately 55 inches per year. See Water Bulletin No. 5, page 58.

For records of previous years beginning with 1922, see Water Bulletin No. 7, page 75.

Mean Daily Diversions in Second Feet 1938 — Annual and Period Summary

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	290	1,140	683	1,570	492	1,460	978	1,260	268	914	1,840	890
2	31.0	1,170	528	1,150	1,490	1,470	799	1,290	410	785	1,810	1,020
3	289	918	780	792	1,990	1,700	527	1,440	413	1,070	1,520	618
4	159	934	828	1,430	2,140	1,340	660	1,400	527	1,280	1,340	362
5	10.0	668	582	1,540	2,170	968	1,320	1,350	782	1,490	949	1,350
6	50.0	182	332	1,700	2,060	1,950	1,590	1,260	820	1,480	739	1,370
7	194	844	1,040	1,700	1,450	2,030	1,880	911	630	1,410	613	1,480
8	201	951	408	1,640	956	1,580	1,780	1,620	427	767	845	1,530
9	1.1	976	131	1,400	1,600	1,390	1,440	1,780	314	418	1,400	1,490
10	304	757	90.0	1,150	937	1,330	1,140	1,630	114	970	1,600	766
11	362	669	48.0	1,760	865	1,220	2,040	1,540	19.0	1,200	1,590	469
12	226	615	228	1,920	1,050	961	2,020	1,390	216	1,120	1,220	1,480
13	151	356	177	1,860	1,130	1,170	1,830	1,100	350	1,030	387	1,370
14	270	1,200	941	1,770	776	1,190	1,710	758	684	1,240	1,160	1,340
15	163	1,150	862	1,560	305	795	1,540	1,560	680	758	1,400	1,410
16	310	1,140	642	1,500	817	760	1,160	1,820	483	548	1,660	1,420
17	501	1,180	833	1,370	932	1,010	743	2,020	411	1,190	1,580	982
18	230	1,190	1,010	521	980	1,260	1,620	1,990	339	1,350	1,300	435
19	275	1,040	604	565	970	1,520	1,830	1,900	1,040	1,560	837	1,070
20	498	616	412	349	904	1,290	1,910	1,110	927	1,470	332	1,390
21	284	504	1,070	344	684	564	1,820	645	794	1,580	1,410	1,640
22	172	390	1,000	548	415	441	1,720	1,720	1,070	1,130	1,700	1,600
23	45.0	755	874	404	1,370	266	1,340	1,940	1,150	437	864	1,320
24	368	1,040	731	262	1,430	442	669	1,700	786	1,430	366	430
25	269	853	1,070	674	908	466	1,550	1,620	333	1,730	846	.8
26	611	494	825	815	1,000	230	1,820	1,390	991	1,640	556	71.5
27	870	287	537	692	780	828	1,970	499	1,170	1,850	229	434
28	681	951	1,120	981	586	776	1,870	2.2	913	1,790	949	392
29	265		1,220	1,160	277	790	1,850	10.7	1,020	1,190	987	440
30	210		1,360	795	845	691	1,520	169	1,140	796	871	488
31	1,150		1,640		1,320		966	182		1,770		281
Sum	9,440.1	22,970	22,606	33,922	33,629	31,888	45,612	39,006.9	19,221	37,393	32,900	29,339.3

Month	Rainfall* Average 1938	Rainfall* Normal 1922 to 1938	Extreme Second Feet ** 1938 High Day	High	Low Day	Low	Average Second Feet 1938	Acre Feet Total 1938	Period 1922-1938 Normal	Maximum	Minimum
Jan.	1.19	1.41	31	1,150	9	1.1	305	18,700	37,052	71,000	7,690
Feb.	.29	1.23	14	1,200	6	182	820	45,600	60,238	134,000	6,950
Mar.	2.50	1.09	31	1,640	11	48.0	729	44,800	80,394	156,000	23,900
Apr.	1.28	1.28	12	1,920	24	262	1,130	67,300	66,212	119,000	30,000
May	2.02	3.31	5	2,170	29	277	1,080	66,700	58,818	135,000	4,500
June	1.78	2.66	7	2,030	26	230	1,060	63,200	53,565	84,600	1,500
July	.01	2.30	11	2,040	3	527	1,470	90,500	47,447	103,000	10,000
Aug.	6.20	1.98	17	2,020	28	2.2	1,260	77,400	63,282	98,000	19,100
Sept.	2.04	6.10	27	1,170	11	19.0	641	38,100	42,648	110,000	8,010
Oct.	.31	2.44	27	1,850	9	418	1,210	74,200	50,765	75,000	21,400
Nov.	1.02	1.63	1	1,840	27	229	1,100	65,300	43,624	71,100	11,500
Dec.	1.30	2.01	21	1,640	25	.8	946	58,200	30,200	58,200	10,400
Yearly	19.94	27.44		2,170		.8	981	710,000	634,245	860,400	484,750
Average Acreage Cultivated - Hidalgo and Cameron Counties								338,000	320,588	388,000	216,000
Mean Acre Feet Per Acre - " " " "								2.10	1.98	2.68	1.29
Average Rainfall in Inches " " " "								19.94	27.44	41.56	18.40

* Average of 5 stations.

** Mean daily extreme.

SILT SAMPLING OF WATER FROM RIO GRANDE AND TRIBUTARIES, 1938

Gravimetric Percentages of Dried Silt in the Rio Grande at San Marcial, New Mexico as Determined from Water Samples During 1938

The gravimetric percentages of dry silt reported here were determined from water samples taken by the United States Section of the International Boundary Commission in small necked bottles by lowering the open bottle into the water at one or more verticals in the stream cross section, being careful to approach but not to strike bottom. The percentages of silt were determined at El Paso by the United States Section of the Commission by determining the silt in a single monthly composite sample which was composed by using from each daily sample an amount proportional to the river flow at the time the sample was taken.

For visualization and comparison, the assumption is indulged here that 1,452 tons of silt would occupy one acre foot in a reservoir bottom, which is equivalent to saying that one cubic foot of silt thus situated would weigh 66.7 pounds. See Water Bulletin No. 7 for average density of Rio Grande silt in Elephant Butte reservoir.

Month	Tons of Water 1938	SUSPENDED SILT					
		Tons 1938	Average Percent By Weight 1938	Acre Feet at 1,452 Tons Per Acre Foot			
				Total 1938	Period 1925 to 1938		
					Normal	Maximum	Minimum
January	56,150,000	40,400	.072	27.8	214.2	374.4	27.8
February	52,160,000	33,900	.065	23.3	315.9	1,027	23.3
March	52,030,000	66,100	.127	45.5	312.1	1,012	45.5
April	94,610,000	133,400	.141	91.9	865.5	3,780	23.7
May	379,160,000	712,800	.188	490.9	1,480	4,483	5.8
June	293,730,000	455,300	.155	313.6	1,401	9,322	3.2
July	157,160,000	1,854,500	1.18	1,277	1,252	6,672	0
August	26,440,000	121,100	.458	83.4	2,166	11,710	83.4
September	122,810,000	2,247,400	1.83	1,548	2,989	17,470	156.4
October	71,030,000	404,900	.570	278.9	829.0	6,520	0
November	59,320,000	86,600	.146	59.6	135.8	301.2	11.8
December	75,570,000	100,500	.133	69.2	171.9	346.4	30.3
The Year	1,440,170,000	6,256,900	.434	4,309.1	12,132.4	41,317.6	3,334.6

Silt Samples from Rio Grande at San Marcial During 1925

Date	% Silt	Date	% Silt	Date	% Silt	Date	% Silt	Date	% Silt
Jan. 8	.480	Apr. 3	.600	May 27	.100	Aug. 25	3.65	Oct. 13	1.07
" 26	1.44	" 6	.460	" 28	.950	" 28	8.53	" 14	5.47
" 29	.770	" 9	.510	" 31	.120	Sept. 1	1.42	" 19	1.75
Feb. 1	.760	" 12	.730	June 3	.160	" 2	6.49	" 28	.720
" 15	.630	" 15	.480	" 7	.060	" 6	9.71	Nov. 4	.460
" 20	.430	" 18	1.02	" 10	.040	" 9	5.59	" 7	.830
" 25	.550	" 24	.790	July 26	11.35	" 12	1.96	" 18	.700
Mar. 1	.400	May 3	.350	" 31	9.46	" 15	10.87	" 24	.740
" 9	.370	" 6	.330	Aug. 1	9.89	" 16	5.15	" 30	.560
" 13	.530	" 9	.300	" 4	5.64	" 19	.940	Dec. 20	.570
" 19	.410	" 12	.380	" 8	8.17	" 21	4.31	" 23	.370
" 22	.650	" 15	.330	" 10	2.64	" 24	3.33	" 29	.540
" 27	.350	" 18	.200	" 13	6.98	Oct. 3	.750		
" 28	.470	" 21	.200	" 16	2.13	" 6	.710		
" 31	.980	" 24	.150	" 22	.870	" 9	.560		

Acre Feet of Suspended Silt Passing San Marcial in the Rio Grande – 1925 to 1938

	1925	1926	1927	1928	1929	1930	1931	1932	1933
January	144.6	226.2	224.9	93.0	154.0	247.3	176.4	372.0	253.9
February	209.0	129.7	174.2	110.1	126.0	385.3	283.3	1,027	261.8
March	210.6	237.8	159.3	93.2	207.2	177.2	317.5	917.2	194.0
April	600.7	812.9	1,084	90.4	355.1	481.2	413.1	3,780	23.7
May	155.7	2,202	1,129	1,753	2,191	209.2	581.0	4,483	1,099
June	3.2	892.3	1,905	691.5	507.3	1,084	3.8	1,411	9,322
July	127.1	1,414	6,672	2.5	1,720	891.2	524.4	1,832	2,009
August	1,071	105.8	1,764	233.6	11,710	268.8	573.2	1,656	1,702
September	1,254	374.2	7,037	159.7	17,470	206.1	4,859	156.4	2,058
October	471.2	15.7	772.6	0	6,520	24.4	2,125	99.3	296.6
November	247.9	66.1	126.4	24.2	227.8	104.9	156.2	120.2	142.4
December	205.8	103.0	62.9	83.4	129.2	179.3	290.9	209.6	346.4
Total	4,700.8	6,579.7	21,111.3	3,334.6	41,317.6	4,258.9	10,303.8	16,063.7	17,708.8

	1934	1935	1936	1937	1938	Total 1925 to 1938	Normal 1925 to 1938
January	342.4	374.4	236.1	125.6	27.8	2,998.6	214.2
February	242.8	269.6	396.5	784.6	23.3	4,423.2	315.9
March	94.6	155.2	548.5	1,012	45.5	4,369.8	312.1
April	118.6	148.0	1,698	2,419	91.9	12,116.6	865.5
May	5.8	2,162	878.4	3,387	490.9	20,727.0	1,480
June	9.8	2,432	24.4	1,009	313.6	19,608.9	1,401
July	0	119.1	215.1	728.2	1,277	17,531.6	1,252
August	2,494	6,233	2,217	206.3	83.4	30,318.1	2,166
September	1,113	2,790	2,545	274.0	1,548	41,844.4	2,989
October	7.4	285.2	303.6	405.5	278.9	11,605.4	829.0
November	11.8	298.2	301.2	14.0	59.6	1,900.9	135.8
December	200.4	262.2	234.6	30.3	69.2	2,407.2	171.9
Total	4,640.6	15,528.9	9,598.4	10,395.5	4,309.1	169,851.7	12,132.4

SILT SAMPLING OF WATER FROM RIO GRANDE AND TRIBUTARIES, 1938 —continued

Gravimetric Percentages of Dried Silt in the Rio Grande at Eagle Pass, Texas as Determined from Water Samples During 1938

The gravimetric percentages of dry silt reported here were determined by the United States Department of Agriculture at Austin, Texas, from samples of Rio Grande water taken every day, except as noted below, by the Mexican Section of the International Boundary Commission. The samples were taken in small necked bottles at three points at the surface of the stream, viz: at the mid-point, and at each side, one sixth of the width from the edge of the stream. Numerous experiments have shown that the mean of three samples so taken gives 0.909 of the mean suspended silt in the stream within reasonable limits of accuracy.

The daily figures below were computed in accordance with the foregoing.

For visualization and comparison the assumption is indulged here that 1,452 tons of silt would occupy one acre foot in a reservoir bottom, which is equivalent to saying that one cubic foot of silt thus situated would weigh 66.7 pounds. On page 63 of Water Bulletin No. 7 there is given some data showing the average density of Rio Grande silt in Elephant Butte reservoir.

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.254	.019	.003	⁼ .006	⁼ .011	.013	2.044	.675	.101	.298	.010	.002
2	.250	.016	⁼ .002	.006	.018	.012	1.632	.648	.060	.216	.010	.002
3	.250	.009	.002	⁼ .006	⁼ .018	.012	1.514	.428	.058	.179	.022	.002
4	.244	.018	.000	⁼ .004	⁼ .018	.010	1.452	.307	.021	.185	.020	.000
5	.065	.028	⁼ .000	.004	⁼ .016	.016	1.223	.268	.025	.151	.015	.000
6	.063	⁼ .016	⁼ .001	.003	.016	.014	1.196	.268	.051	.153	.001	.001
7	.070	.006	.001	.026	⁼ .015	.015	1.221	.301	.147	.097	.004	.009
8	.056	.008	⁼ .001	.015	⁼ .014	.012	1.386	.192	.146	.097	.013	.003
9	.042	.006	⁼ .001	.006	⁼ .012	.016	1.077	.271	.903	.085	.016	.003
10	.030	.002	⁼ .002	⁼ .004	⁼ .011	.023	.673	.324	.868	.079	.000	.002
11	.038	.008	⁼ .002	.002	.010	.057	.515	.334	.734	.053	.010	.003
12	.046	.012	⁼ .003	.003	⁼ .010	.022	.383	.312	⁼ .735	.064	.009	.003
13	.034	.002	⁼ .003	.003	.010	.037	.453	.120	⁼ .559	.037	.008	.004
14	.023	.003	⁼ .004	.003	⁼ .010	.021	.295	.161	.480	.028	.008	.002
15	.070	.002	⁼ .004	.002	⁼ .057	.030	.251	.158	.487	.025	.004	.001
16	.087	.009	⁼ .006	⁼ .002	⁼ .057	.018	.199	.120	.521	.025	.002	.001
17	.019	⁼ .009	⁼ .006	⁼ .135	⁼ .057	.010	.138	.112	.672	.044	.001	.003
18	.014	⁼ .009	⁼ .007	⁼ .135	.057	.008	.140	.106	.571	.037	⁼ .002	.001
19	.015	.014	.007	.135	⁼ .022	.007	.131	.113	⁼ .503	.014	⁼ .002	.003
20	.016	⁼ .009	⁼ .006	.034	.011	.006	.107	.082	.433	.012	.002	.001
21	.053	.003	.004	.004	⁼ .016	.014	.260	.091	.448	.010	.029	.000
22	.058	.003	.011	⁼ .008	⁼ .022	.009	.506	.091	.571	⁼ .009	.003	.001
23	.059	⁼ .003	⁼ .009	.011	.028	.006	.939	.104	.722	⁼ .011	.037	.000
24	.045	.003	.006	⁼ .009	.089	.003	.360	.103	⁼ .597	⁼ .009	.003	.014
25	.043	⁼ .002	.004	.006	⁼ .068	.340	.399	.043	.473	⁼ .009	.003	.010
26	.037	.001	.004	.004	.046	.250	.572	.070	.462	.012	⁼ .002	.019
27	.033	⁼ .001	⁼ .008	.008	⁼ .044	1.113	.498	.072	.472	.007	.003	.000
28	.031	.002	.011	⁼ .007	.041	1.627	.779	.051	.461	.013	.004	.002
29	.032		⁼ .007	.004	.046	3.448	.879	.044	.448	.008	.003	.002
30	.019		.002	.006	.024	2.464	.607	.042	.312	.016	.004	.004
31	.013		.003		.028		.641	.138		.013		.003

Tons of Suspended Silt Passing Eagle Pass in the Rio Grande During 1938

Month	Tons of Water	SUSPENDED SILT					
		Tons of Silt	Average Percent by Weight	Acre-Feet at 1,452 Tons Per Acre Foot			
				Total Acre Feet	Period 1934 to 1938		
					Average	Maximum	Minimum
Jan.	257,420,000	179,980	.070	124.0	32.2	124.0	.1
Feb.	195,210,000	16,314.5	.008	11.2	8.0	14.6	2.6
Mar.	174,030,000	6,891.2	.004	4.7	58.6	187.9	4.7
Apr.	133,670,000	40,284.0	.030	27.7	24.2	37.6	9.6
May	139,210,000	45,269.0	.032	31.2	420.5	1,339.0	31.2
June	229,850,000	3,182,824.0	1.385	2,192.0	1,946.2	3,821.0	625.2
July	*1,709,580,000	11,377,530.0	.666	7,835.8	1,755.8	7,835.8	95.2
Aug.	670,870,000	1,924,100.0	.287	1,325.1	679.0	1,325.1	217.8
Sept.	1,458,310,000	7,365,080.0	.505	5,072.4	4,188.5	6,098.0	69.6
Oct.	521,830,000	547,152.0	.105	376.8	682.5	1,474.2	376.8
Nov.	252,670,000	20,823.2	.008	14.3	79.3	204.9	14.3
Dec.	224,770,000	7,276.9	.003	5.0	21.5	84.1	1.1
Total	5,967,420,000	24,713,524.8	.414	17,020.2	9,887.9	17,020.2	1,768.3

* From Partly Estimated Discharge.

⁼ % silt for day estimated. No samples taken.

SILT SAMPLING OF WATER FROM RIO GRANDE AND TRIBUTARIES, 1938 —continued

Gravimetric Percentages of Dried Silt in the Rio Alamo at Mier, Tamaulipas, as Determined from Water Samples During 1938

The gravimetric percentages of dry silt reported here were determined by the Mexican Section of the International Boundary Commission from samples taken by that section about every third day except at times of high flow when samples were taken more frequently. The samples were taken in small necked bottles at three points at the surface of the stream, viz: at the mid-point, and at each side, one sixth of the width from the edge of the stream. Numerous experiments have shown that the mean of three samples so taken gives 0.908 of the mean suspended silt in the stream within reasonable limits of accuracy. The daily figures below were made in accordance with the foregoing.

For visualization and comparison the assumption is indulged here that 1,452 tons of silt would occupy one acre foot in a reservoir bottom, which is equivalent to saying that one cubic foot of silt thus situated would weigh 66.7 pounds. See Water Bulletin No. 7, page 63, for data as to the average density of Rio Grande silt in Elephant Butte reservoir.

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	.5538	0	0	0	0	1.3572	.2040	0	0	0
2	0	0	.1480	0	0	0	0	1.1234	.1864	0	0	0
3	0	0	.1070	0	0	0	0	.2530	.0900	0	0	0
4	0	0	.0255	0	0	0	0	.1461	.0390	0	0	0
5	0	0	.0160	0	0	0	0	0	.0268	0	0	0
6	0	0	0	0	0	0	0	0	.0180	0	0	0
7	0	0	0	0	0	0	0	0	.0125	0	0	0
8	0	0	0	0	0	0	0	0	.0153	0	0	0
9	0	0	.7230	0	0	0	0	0	.0110	0	0	0
10	0	0	.0900	0	0	0	0	0	.4813	0	0	0
11	0	0	.0193	0	0	0	0	0	.2200	0	0	0
12	0	0	.0145	0	0	0	0	0	.1578	0	0	0
13	0	0	.0115	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	.0185	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	.7177	0	0	0	0	0	0	0	0
19	0	0	0	.3400	0	0	0	0	0	0	0	0
20	0	0	0	.0580	0	.0246	0	0	0	.0341	0	0
21	0	0	0	.0100	0	.0310	0	0	0	0	0	0
22	0	0	0	0	0	.0385	0	0	0	0	0	0
23	0	0	0	0	.5791	0	0	0	0	0	0	0
24	0	0	0	0	.5078	0	0	0	0	0	0	0
25	0	0	0	0	.1170	0	0	0	0	0	0	.0105
26	0	0	0	0	0	0	0	0	0	0	0	.0179
27	0	0	0	0	0	0	0	0	0	0	0	.0130
28	0	0	0	0	0	0	0	.5800	0	0	0	0
29	0		0	0	0	0	0	.7002	0	0	0	0
30	0		0	0	0	0	0	.8955	0	0	0	0
31	0		0		0		.9416	.2712		0		0

Tons of Suspended Silt Passing Cd. Mier in the Rio Alamo—1938

Month	Tons of Water	SUSPENDED SILT				
		Tons of Silt	Average Percent by Weight	Acre-Feet at 1,452 Tons Per Acre Foot		
				Total Acre-Feet	Period 1934 to 1938	
					Average	Maximum	Minimum
Jan.	919,000	0	.0000	0	4.4	* 21.8	0
Feb.	390,000	0	.0000	0	.1	* .6	0
Mar.	6,040,000	26,400	.4376	18.2	4.6	18.2	0
Apr.	4,463,000	23,000	.5150	15.8	23.1	99.2	0
May	2,237,000	10,200	.4541	7.0	24.7	38.4	7.0
June	504,000	130	.0257	.1	20.1	100.2	0
July	1,953,000	18,300	.9372	12.6	29.8	73.8	0
Aug.	77,400,000	574,800	.7427	396.0	128.1	396.0	0
Sept.	3,529,000	8,420	.2385	5.8	36.4	79.7	1.5
Oct.	304,000	59.6	.0196	.04	18.9	61.5	0
Nov.	171,000	0	.0000	0	2.5	5.2	0
Dec.	892,000	29.4	.0033	.02	1.2	5.8	0
Total	98,802,000	661,339	.6694	455.56	293.9	455.5	154.5

* Partly estimated.

SILT SAMPLING OF WATER FROM RIO GRANDE AND TRIBUTARIES, 1938 —continued

Gravimetric Percentages of Dried Silt in the Rio Grande at Roma, Texas as Determined from Water Samples During 1938

The gravimetric percentages of dry silt reported here were determined by the United States Department of Agriculture at Austin, Texas, from samples of Rio Grande water taken every day by the United States Section of the International Boundary Commission. The samples were taken in small necked bottles at three points at the surface of the stream, viz: at the mid-point, and at each side, one sixth of the width from the edge of the stream. Numerous experiments have shown that the mean of three samples so taken gives 0.909 of the mean suspended silt in the stream within reasonable limits of accuracy.

The daily figures below were computed in accordance with the foregoing.

For visualization and comparison the assumption is indulged here that 1,452 tons of silt would occupy one acre foot in a reservoir bottom, which is equivalent to saying that one cubic foot of silt thus situated would weigh 66.7 pounds. On page 63 of Water Bulletin No. 7, there is given some data showing the average density of Rio Grande silt in Elephant Butte reservoir.

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.176	.026	.095	.002	.035	.002	1.263	.965	.976	.390	.009	.000
2	.176	.026	.046	.003	.026	.001	3.048	.552	.238	.372	.009	.001
3	.126	.020	.051	.004	.029	.000	2.835	.637	.095	.338	.006	.001
4	.121	.030	.042	.002	.028	.001	2.556	.415	.065	.304	.003	.000
5	.143	.015	.006	.001	.024	.000	1.869	.398	.046	.263	.004	.001
6	.080	.035	.006	.001	.004	.000	1.814	.409	.059	.204	.006	.002
7	.090	.042	.004	.023	.000	.001	1.027	.277	.047	.190	.004	.000
8	.094	.030	.004	.033	.000	.000	1.130	.238	.044	.148	.006	.000
9	.076	.057	.559	.019	.002	.000	1.442	.208	.191	.123	.003	.000
10	.087	.031	.032	.009	.000	.001	1.472	.178	.154	.130	.002	.000
11	.098	.024	.011	.004	.000	.000	1.010	.179	.084	.091	.002	.000
12	.118	.020	.006	.006	.000	.000	1.213	.170	.165	.075	.002	.001
13	.038	.018	.006	.000	.002	.001	.805	.148	.704	.066	.002	.000
14	.032	.011	.007	.000	.001	.000	.600	.176	.706	.070	.002	.000
15	.037	.013	.007	.000	.000	.002	.474	.144	.882	.055	.002	.000
16	.043	.007	.007	.000	.000	.010	.419	.162	.678	.051	.002	.001
17	.055	.009	.006	.000	.004	.001	.326	.191	.475	.025	.003	.001
18	.066	.013	.006	.107	.023	.002	.263	.099	.394	.025	.004	.001
19	.065	.013	.003	.409	.004	.001	.263	.102	.431	.024	.000	.000
20	.045	.021	.004	.337	.007	.001	.180	.111	.317	.078	.000	.000
21	.042	.015	.003	.262	.006	.003	.146	.100	.785	.018	.000	.000
22	.022	.016	.003	.196	.011	.002	.133	.077	.737	.014	.001	.000
23	.018	.012	.485	.101	.003	.002	.122	.066	.463	.014	.001	.000
24	.081	.006	.534	.068	.836	.002	.186	.063	.402	.013	.000	.000
25	.108	.004	.218	.070	.592	.002	1.685	.067	.629	.009	.000	.025
26	.200	.004	.065	.109	.322	.001	.667	.038	.717	.045	.000	.032
27	.054	.004	.030	.103	.222	.003	.394	.179	.697	.012	.000	.121
28	.054	.006	.035	.058	.172	.008	.350	.894	.751	.012	.001	.037
29	.042		.028	.034	.044	.033	.395	.727	.579	.006	.002	.013
30	.048		.014	.052	.033	.410	.434	.918	.387	.008	.002	.015
31	.034		.007		.011		.713	.663		.008		.014

Tons of Suspended Silt Passing Roma in the Rio Grande During 1938

Month	Tons of Water	SUSPENDED SILT					
		Tons of Silt	Average Percent by Weight	Acre-Feet at 1,452 Tons Per Acre Foot			
				Total Acre Feet	Period 1929 to 1938		
					Normal	Maximum	Minimum
Jan.	284,310,000	244,920.0	.086	168.7	44.2	168.7	.4
Feb.	202,100,000	39,357.0	.019	27.1	33.7	121.0	.8
Mar.	218,070,000	267,907.0	.123	184.5	46.6	184.5	12.3
Apr.	200,180,000	290,604.8	.145	200.1	315.8	1,345.0	.7
May	227,520,000	580,545.6	.255	399.8	1,040.8	2,474.0	88.6
June	126,060,000	112,050.9	.089	77.2	1,405.4	7,216.0	52.7
July	1,657,600,000	13,169,700.0	.795	9,070.0	1,568.9	9,070.0	40.6
Aug.	1,011,910,000	4,720,760.0	.467	3,251.2	985.0	3,251.2	113.2
Sept.	*1,474,550,000	*8,045,010.0	.546	*5,540.6	4,978.8	17,998.0	42.8
Oct.	686,030,000	1,314,146.0	.192	905.1	2,067.0	9,241.0	133.0
Nov.	259,430,000	6,915.3	.003	4.8	120.0	293.0	4.8
Dec.	242,680,000	24,710.4	.010	17.0	72.3	319.0	1.0
Total	6,590,440,000	28,816,627.0	.437	19,846.1	12,678.5	30,839.0	2,314.0

* Partly Estimated

SILT SAMPLING OF WATER FROM RIO GRANDE AND TRIBUTARIES, 1938 — continued

Gravimetric Percentages of Dried Silt in the Rio San Juan at Santa Rosalia, Tamaulipas, Mexico, as Determined from Water Samples During 1938

The gravimetric percentages of dry silt reported here were determined by the Mexican Section of the International Boundary Commission from samples taken by that section about every third day except at times of high flow when samples were taken more frequently. The samples were taken in small necked bottles at three points at the surface of the stream, viz: at the mid-point, and at each side, one sixth of the width from the edge of the stream. Numerous experiments have shown that the mean of three samples so taken gives 0.908 of the mean suspended silt in the stream within reasonable limits of accuracy. The daily figures below were made in accordance with the foregoing.

For visualization and comparison the assumption is indulged here that 1,452 tons of silt would occupy one acre foot in a reservoir bottom, which is equivalent to saying that one cubic foot of silt thus situated would weigh 66.7 pounds. See Water Bulletin No. 7, page 63, data as to the average density of Rio Grande silt in Elephant Butte reservoir.

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	0	0	0	.0011	.0022	8.3000	.3400	.0310	.0009	.0002
2	0	0	0	0	0	.0010	.0019	3.1000	.2000	.0092	.0005	.0002
3	0	0	0	0	0	.0009	.0019	.1700	.1500	.0028	.0005	.0002
4	0	0	0	0	0	.0008	.0019	.1800	.1300	.0027	.0009	.0001
5	0	0	0	0	0	.0008	.0016	.0034	.1100	.0026	.0007	.0001
6	0	0	0	0	0	.0012	.0015	.0043	.1000	.0022	.0007	.0001
7	0	0	0	0	0	.0020	.0015	.0047	.0910	.0021	.0006	.0001
8	0	0	0	0	0	.0025	.0014	.0061	.0860	.0022	.0004	0
9	0	0	0	0	0	.0009	.0016	.0084	.0790	.0022	.0004	0
10	0	0	0	0	0	.0005	.0016	.0080	.0810	.0023	.0004	0
11	0	0	0	0	0	.0006	.0014	.0072	.0860	.0026	.0006	0
12	0	0	0	0	0	.0006	.0011	.0067	.0840	.0029	.0006	0
13	0	0	0	0	0	.0010	.0008	.0058	.0820	.0023	.0005	0
14	0	0	0	0	0	.0010	.0007	.0052	.0810	.0019	.0004	0
15	0	0	0	0	0	.0010	.0007	.0046	.0710	.0018	.0004	0
16	0	0	0	0	.0235	.0015	.0007	.0036	.0750	.0017	.0003	0
17	0	0	0	0	.0074	.0007	.0007	.0033	.1250	.0017	.0002	0
18	0	0	0	0	.0033	.0017	.0006	.0023	.1000	.0017	.0002	0
19	0	0	0	0	.0018	.0026	.0006	.0019	.0780	.0017	.0002	0
20	0	0	0	0	.0013	.0027	.0006	.0020	.1400	.0017	.0002	0
21	0	0	0	0	.0027	.0024	.0005	.0021	.1350	.0016	.0002	0
22	0	0	0	0	.0045	.0024	.0004	.0022	.1160	.0015	.0002	0
23	0	0	0	0	.0310	.0016	.0002	.0021	.0960	.0015	.0003	0
24	0	0	0	0	.4500	.0014	.0002	.0016	.0810	.0015	.0003	0
25	0	0	0	0	.1800	.0015	.0002	.0016	.0730	.0015	.0002	0
26	0	0	0	0	.1125	.0015	.0980	.0013	.0660	.0012	.0002	0
27	0	0	0	0	.0470	.0019	.2800	.0012	.0680	.0011	.0001	0
28	0	0	0	0	.0066	.0018	.3000	.0690	.0700	.0009	.0001	0
29	0		0	0	.0028	.0021	.1800	1.1500	.0650	.0009	.0001	0
30	0		0	0	.0012	.0028	.1300	1.0500	.0620	.0008	.0001	0
31	0		0		.0011		1.0300	1.1800		.0008		0

Tons of Suspended Silt Passing Santa Rosalia in Rio San Juan – 1938

Month	Tons of Water	SUSPENDED SILT					
		Tons of Silt	Average Percent by Weight	Acre-Feet at 1,452 Tons Per Acre Foot			
				Total Acre Feet	Period 1934 to 1938		
					Average	Maximum	Minimum
Jan.	37,750,000	0	.0000	0	8.2	26.9	0
Feb.	15,280,000	0	.0000	0	.4	1.8	0
Mar.	19,130,000	0	.0000	0	.5	2.7	0
Apr.	11,440,000	0	.0000	0	9.6	43.5	0
May	33,790,000	65,000	.1924	44.8	195.1	490.4	1.6
June	8,504,000	170	.0020	.1	132.5	617.2	0
July	30,470,000	85,100	.2793	58.6	236.3	857.8	18.2
Aug.	1,092,320,000	12,969,100	1.1873	8,932	1,800	8,932	.1
Sept.	374,490,000	518,300	.1384	357.0	674.9	2,148	3.3
Oct.	104,990,000	3,990	.0038	2.7	108.0	294.4	2.7
Nov.	58,010,000	232	.0004	.2	24.6	67.3	0
Dec.	48,330,000	193	.0004	.1	18.1	52.4	0
Total	1,834,504,000	13,642,085	.7436	9,395.5	3,208.2	9,395.5	246.6

CHEMICAL ANALYSES OF WATER SAMPLES FROM RIO GRANDE AND TRIBUTARIES— 1938

The chemical analyses reported here were made by the United States Department of Agriculture at Riverside, California, from composite water samples made up periodically from several independent samples taken by the United States Section of the International Boundary Commission, and by whom the specific electrical conductance of each sample as reported below was also determined.

Water samples from the stations at Eagle Pass, Rio Salado and Rio San Juan were gathered by the Mexican Section of the Commission, the others by the United States Section. The composite samples were composed by taking from each sample an amount of water proportional to the acre footage of river flow represented by that sample.

To convert "Milligram Equivalents" to parts per million by weight, multiply each ion by its appropriate conversion factor. These factors are: HCO_3, 61; CL, 35.5; SO_4, 48; Ca, 20; Mg, 12.16; Na, 23; NO_3, 62.

Conductance, reported in the tables as (K x 10^5 at 25° C), is a relative measure of the total salt concentration in the water samples. (See Circular No. 232 U. S. Dept. Agr., July 1932.) It is a definite statement of an important physical property of the solution.

Month	No. of Samples	Tons of Salts		Mean Kx10^5 @25°C	Boron p.p.m.	pH	% Na **	% Cl ***	Mean Milligram Equivalents per Liter						
		Per Acre Foot	Per Month						Ca	Mg	Na	CO_3 + HCO_3	SO_4	Cl	NO_3
Water Samples from Rio Grande at San Marcial Station															
Jan.	31	0.87	35,930	96.4	0.20	7.9	47	24	3.82	1.37	4.69	3.28	4.08	2.30	0.01
Feb.	28	0.81	31,020	92.0	0.10	7.9	48	24	3.48	1.33	4.51	3.21	3.92	2.25	0.01
Mar.	30	0.87	33,230	96.1	0.18	8.0	49	25	3.75	1.38	4.86	3.16	4.13	2.35	0.04
Apr.	30	0.69	47,960	77.7	0.16	8.0	48	24	3.03	1.12	3.77	2.55	3.37	1.85	0.03
May	31	0.47	131,130	53.5	0.10	8.2	40	20	2.37	0.83	2.14	2.21	2.13	1.07	0.04
June	30	0.44	95,040	49.1	0.09	7.9	36	17	2.31	0.79	1.75	2.16	1.95	0.81	0.03
July	31	0.90	103,500	95.5	0.16	7.9	45	17	4.04	1.33	4.35	2.41	5.68	1.63	0.04
Aug.	31	0.88	17,070	95.5	0.09	8.0	48	19	3.96	1.26	4.73	2.87	5.06	1.89	0.03
Sept.	30	1.10	99,220	114.0	0.14	7.9	42	14	5.35	1.82	5.09	2.52	7.94	1.63	0.05
Oct.	31	0.78	40,720	85.5	0.10	7.8	45	19	3.59	1.25	3.92	2.81	4.27	1.63	0.01
Nov.	30	0.80	34,880	90.6	0.14	7.9	46	22	3.65	1.25	4.10	3.11	3.81	1.98	0.02
Dec.	30	0.81	44,960	93.2	0.15	7.8	47	24	3.68	1.29	4.46	3.16	3.93	2.18	0.01
Total Mean[e]	363	0.68	714,660	74.5	0.12	8.0	42	20	3.19	1.11	3.28	2.51	3.59	1.45	0.03
									42**	15**	43**	33***	48***	19***	
Water Samples from Rio Grande at El Paso Station															
Jan.	29	1.93	21,040	214	0.24	7.9	58	40	6.66	2.51	12.81	4.90	8.53	8.77	0.01
Feb.	28	1.40	23,520	158	0.22	8.0	55	35	5.20	1.96	8.86	3.98	6.56	5.60	0.01
Mar.	31	1.08	47,410	120	0.18	8.0	50	29	4.51	1.60	6.10	3.32	5.27	3.55	0.02
Apr.	30	1.00	66,300	112	0.17	7.8	50	29	4.22	1.54	5.69	3.16	4.71	3.15	0.03
May	31	1.00	71,100	113	0.17	8.0	50	28	4.19	1.49	5.75	3.11	5.09	3.21	0.02
June	29	0.96	75,360	108	0.16	8.1	51	26	4.05	1.47	5.77	3.21	4.91	2.90	0.02
July	31	0.94	73,320	107	0.19	8.0	50	28	4.02	1.39	5.47	3.06	4.69	3.05	0.02
Aug.	31	1.02	70,380	114	0.09	8.1	52	28	4.25	1.48	6.10	3.37	5.09	3.21	0.01
Sept.	30	1.06	64,660	121	0.17	8.0	51	32	4.36	1.65	6.34	3.22	5.19	3.88	0.02
Oct.	31	1.38	37,670	155	0.25	7.9	54	34	5.32	1.89	8.58	3.91	6.67	5.33	Trace
Nov.	30	1.66	27,560	187	0.15	8.2	56	36	6.30	2.21	10.62	4.62	7.62	6.96	0.02
Dec.	30	1.64	25,420	186	0.25	8.0	56	35	6.22	2.30	10.68	4.62	7.81	6.76	0.01
Total Mean[e]	361	1.09	603,740	123	0.17	8.0	51	30	4.46	1.60	6.50	3.37	5.33	3.73	0.02
									35**	13**	52**	27***	43***	30***	
Water Samples from Rio Grande at Fort Quitman Station															
Jan.	6	2.96	43,220	335	0.33	8.0	60	55	10.03	3.71	20.60	4.79	10.58	18.84	0.03
Feb.	5	2.61	38,890	297	0.25	8.0	60	54	8.65	3.41	17.74	4.35	9.65	16.25	0.01
Mar.	9	2.65	46,380	303	0.30	8.2	60	56	8.93	3.56	18.51	4.04	9.58	17.30	0.01
Apr.	9	2.85	42,750	327	0.29	8.3	60	58	9.51	3.90	19.96	3.94	9.96	19.10	0.03
May	8	2.95	42,780	334	0.36	8.0	60	58	9.50	3.97	20.60	3.71	10.39	19.70	0.03
June	12	2.13	47,920	246	0.27	8.1	59	53	7.12	2.86	14.64	3.36	8.27	13.08	0.02
July	13	1.77	107,790	206	0.26	8.1	57	50	6.42	2.38	11.87	3.16	7.03	10.28	0.04
Aug.	18	3.29	28,100	380	0.30	8.2	62	62	10.22	4.33	24.09	3.32	11.13	23.77	0.01
Sept.	12	1.77	103,900	208	0.18	7.9	58	50	6.48	2.35	12.14	3.33	6.99	10.25	0.04
Oct.	7	3.34	50,770	382	0.39	7.8	62	60	10.65	4.26	24.06	3.66	11.72	23.32	0.01
Nov.	6	3.26	59,660	380	0.29	8.2	61	59	10.71	4.06	23.41	4.07	11.49	22.30	0.01
Dec.	8	3.01	46,960	348	0.31	8.0	61	57	9.83	3.92	21.56	4.01	11.19	19.86	0.01
Total Mean[e]	113	2.39	659,120	275	0.27	8.0	59	54	8.12	3.14	16.61	3.63	8.86	15.17	0.03
									29**	11**	60**	13***	32***	55***	

e Weighted Mean. ** Percent of Total Cations. *** Percent of Total Anions.

CHEMICAL ANALYSES OF WATER SAMPLES FROM RIO GRANDE AND TRIBUTARIES — 1938 — continued

Month	No. of Samples	Tons of Salts Per Acre Foot	Tons of Salts Per Month	Mean Kx10⁵ @25°C	Boron p.p.m.	pH	% Na **	% Cl ***	Mean Milligram Equivalents per Liter: Ca	Mg	Na	CO_3 + HCO_3	SO_4	Cl	NO_3
Water Samples from the Rio Grande at La Nutria Station															
Jan. Feb.	6	2.92	85,850	335	.33	8.0	62	57	9.00	3.82	20.81	3.94	10.73	19.25	.03
Mar. Apr.	8	2.63	69,960	300	.29	8.0	61	56	8.28	3.54	18.37	3.38	9.90	16.95	.03
May June July August	10	2.43	225,750	280	.16	8.1	62	57	7.70	3.07	17.49	3.12	9.09	16.06	.03
Sept.	6	1.31	94,060	154	.19	7.9	57	46	4.82	1.79	8.94	2.77	5.50	6.94	.04
Oct.	10	3.08	41,580	355	.39	7.8	63	60	9.24	4.00	22.36	2.76	11.28	21.34	.01
Nov.	7	3.22	40,890	375	.37	7.9	63	59	9.56	4.16	23.78	3.01	12.07	22.10	.01
Dec.	2	3.19	41,790	376		8.2	62	59	10.06	4.11	23.08	3.46	11.84	21.59	.01
Total Mean@	49	2.31	599,880	267	.23	8.0	61	55	7.40	3.00	16.44	3.14	8.76	14.84	.03
									28**	11**	61**	12***	33***	55***	
Water Samples from Rio Grande at Upper Presidio Station															
Jan. Feb.	3 5	3.10	78,430	351	.38	7.9	62	58	9.50	4.10	21.97	3.63	11.42	20.65	.01
Mar. Apr.	4 5	2.79	49,630	319	.38	7.9	60	57	9.06	3.90	19.36	3.37	10.65	18.20	.03
May	4	3.25	15,860	360	.24	8.2	60	60	10.45	4.25	21.87	2.81	11.81	21.84	.02
June	7	2.09	19,770	243		8.0	60	54	7.15	2.44	14.54	2.56	8.62	13.08	.04
July	15	1.46	93,290	170	.18	8.1	60	48	5.13	1.58	9.95	2.76	5.93	7.94	.05
Aug.	15	2.36	25,720	273	.23	8.1	59	57	8.22	2.85	16.24	2.82	8.97	15.50	.03
Sept.	9	1.13	66,900	134	.14	7.8	55	44	4.42	1.48	7.29	2.52	4.72	5.76	.04
Oct.	3	3.52	42,240	403	.41	7.9	62	62	11.03	4.28	25.24	2.81	12.79	25.10	.01
Nov.	4	3.24	34,020	377	.43	7.9	62	59	10.05	4.21	23.68	3.06	12.19	22.30	.01
Dec.	5	3.24	31,880	370	.38	8.1	62	58	10.21	4.19	23.24	3.41	12.12	21.64	.01
Total Mean@	79	2.05	457,740	236	.25	8.0	60	54	6.87	2.56	14.16	2.88	7.93	12.70	.03
									29**	11**	60**	12***	34***	54***	
Water Samples from Rio Conchos near Ojinaga, Chihuahua															
Jan. Feb.	2 4	0.68	68,880	71.1	.20	7.9	40	14	3.28	1.03	2.88	3.01	3.28	1.00	.01
Mar. Apr.	3 4	0.82	29,720	89.8	.16	8.2	45	21	3.88	1.21	4.10	2.81	4.39	1.85	.04
May	4	1.04	14,250	113.0	.18	8.1	49	23	4.40	1.41	5.64	2.91	5.95	2.60	.11
June	5	0.74	55,350	79.6		8.1	40	17	3.87	0.86	3.09	2.36	4.22	1.32	.07
July Aug.	1 5	0.39†	288,670†	†43.5	.07	8.0	35	15	3.07	0.74	2.06	2.67	2.33	0.82	.06
Sept.	11	0.38	433,580	42.4	.05	7.8	36	19	2.22	0.57	1.56	2.12	1.27	0.76	.03
Oct. Nov.	3 4	0.63	161,970	71.1	.08	8.1	37	15	3.60	0.87	2.65	2.91	3.05	1.02	.02
Dec.	4	0.85	50,740	95.6	.17	7.9	42	22	4.56	1.22	4.22	3.16	4.38	2.08	.01
Total Mean@	50	0.45	1,103,160	50.5	.07	7.9	37	16	2.82	0.71	2.06	2.46	2.11	0.89	.04
									50**	13**	37**	45***	39***	16***	
Water Samples from Pecos River Station															
Jan.	5	5.52	157,870	568	.35	7.8	57	58	16.25	10.43	34.81	2.63	23.05	34.72	.04
Feb.	4	5.51	137,750	579	.29	7.9	56	57	16.94	10.39	34.26	2.50	24.34	34.90	.02
Mar.	4	5.57	105,830	593	.30	8.1	58	59	15.46	11.10	36.96	2.05	23.38	37.30	.03
Apr.	4	5.34	76,900	576	.40	8.1	60	61	13.51	10.71	36.43	2.00	21.56	36.90	.03
May	7	3.04	62,930	332	.23	7.9	57	58	8.56	5.96	19.15	1.81	12.47	19.29	.04
June	6	3.20	49,280	353	.22	7.9	58	58	8.81	6.39	20.90	1.81	13.55	20.92	.04
July	6	1.73	145,670	193		8.1	53	54	5.67	3.22	9.88	2.26	6.49	10.08	.14
Aug.	4	3.05	82,960	338	.17	8.0	55	54	9.54	6.15	19.18	2.57	13.39	18.92	.04
Sept.	4	3.75	71,250	408	.31	7.8	57	58	10.74	7.72	24.30	2.52	15.41	24.43	.05
Oct.	5	3.44	74,990	379	.27	7.9	56	57	10.12	6.91	21.99	2.46	14.28	22.00	.04
Nov.	4	4.16	76,130	466	.31	7.9	56	57	12.77	8.63	27.38	2.61	18.16	27.53	.03
Dec.	5	4.71	85,720	517	.33	8.1	58	60	13.23	9.65	31.77	2.91	18.93	32.11	.04
Total Mean@	58	3.62	1,127,280	391	.29	8.0	57	57	10.67	7.10	23.00	2.35	15.01	23.16	.06
									26**	17**	57**	6***	37***	57***	

@ Weighted Mean. ** Percent of Total Cations. *** Percent of Total Anions. † This figure differs from figures reported by Rubidoux due to consideration given to the samples taken at Lower Presidio gaging station in July 1938.

CHEMICAL ANALYSES OF WATER SAMPLES FROM RIO GRANDE AND TRIBUTARIES—1938—continued

Month	No. of Samples	Tons of Salts		Mean Kx10⁵ @25°C	Boron p.p.m.	pH	% Na	% Cl	Mean Milligram Equivalents per Liter						
		Per Acre Foot	Per Month				**	***	Ca	Mg	Na	CO_3 + HCO_3	SO_4	Cl	NO_3
Water Samples from Rio Grande at Eagle Pass Station															
Jan.	4	1.43	270,270	166	0.17	7.9	49	44	5.63	2.95	8.30	3.07	6.12	7.27	0.06
Feb.	4	1.50	214,500	173	0.16	7.8	50	46	5.66	2.99	8.66	2.96	6.42	7.90	0.07
March	5	1.44	184,320	167	0.19	8.0	52	47	5.23	2.91	8.71	2.70	6.06	7.60	0.02
April	4	1.26	123,610	144	0.14	8.0	49	47	4.50	2.79	7.11	2.70	4.81	6.60	0.05
May	5	1.60	163,200	179	0.17	8.0	50	50	5.86	3.26	9.22	2.66	6.61	9.21	0.18
June	4	0.66	111,540	75.6	0.11	8.0	40	31	3.29	1.52	3.15	2.66	2.47	2.24	0.05
July	9	0.45	564,750	51.0	0.08	8.0	35	24	2.66	0.76	1.85	2.16	1.71	1.12	0.07
August	3	0.76	374,680	85.8	0.01	7.9	43	32	3.86	1.21	3.80	2.52	3.32	2.70	0.05
Sept.	6	0.49	524,790	57.4		7.9	38	24	2.82	0.88	2.23	2.47	1.74	1.28	0.04
Oct.	4	0.83	317,890	96.6	0.15	7.9	44	34	4.13	1.39	4.39	3.01	3.31	3.20	0.04
Nov.	1	1.22	428,220	141		8.3	47	41	5.21	2.41	6.63	3.16	5.15	5.74	0.04
Dec.	2														
Total	51		3,277,770												
Mean@		.75		86.0	.10	8.0	43	35	3.61	1.39	3.81	2.55	3.00	2.92	0.05
									41**	16**	43**	30***	35***	35***	
Water Samples from Rio Salado Station															
Jan.	4	4.70	20,680	410	1.59	7.8	44	30	17.85	10.74	22.12	2.40	32.31	14.95	0.06
Feb.	4	4.97	12,620	457	1.73	7.8	46	32	18.22	10.74	24.41	2.15	34.30	16.50	0.29
March	7	2.61	17,900	257	0.87	7.9	44	31	10.42	5.32	12.58	1.58	17.56	8.70	0.04
April	7	2.96	21,490	289	0.98	8.0	46	32	11.25	6.22	14.63	1.84	19.92	10.30	0.11
May	7	2.13	13,570	214	0.52	8.0	46	33	8.03	4.10	10.45	1.91	13.43	7.23	0.18
June	6	1.09	2,950	120		7.9	49	31	4.02	2.16	5.99	2.31	6.05	3.72	0.04
July	12	0.87	21,140	97.2	0.09	7.9	41	32	4.22	1.58	4.09	2.07	4.58	3.01	0.05
August	11	0.59	39,650	59.8	0.05	7.9	36	27	3.37	0.93	2.38	2.17	2.70	1.78	0.05
Sept.	7	0.48	26,060	56.2	0.19	7.7	29	23	3.14	0.84	1.60	1.86	2.26	1.17	0.07
Oct.	4	0.58	990	66.6	0.25	7.7	35	28	3.09	1.11	2.27	1.61	3.05	1.83	0.02
Nov.	4	0.80	200	93.7	0.20	7.8	39	34	3.96	1.62	3.55	1.86	4.27	3.10	0.02
Dec.	3	0.84	850	97.4		7.9	39	32	4.19	1.64	3.67	1.96	4.54	3.00	0.06
Total	76		178,100												
Mean@		1.00		102	0.25	7.8	40	29	4.75	1.89	4.41	2.02	5.72	3.14	0.07
									43**	17**	40**	18***	53***	29***	
Water Samples from Rio San Juan Station															
Jan.	4	0.97	26,870	101	0.20	8.1	35	22	4.56	2.58	3.79	2.97	5.45	2.36	0.05
Feb.	3														
Mar.	5	1.26	31,880	134	0.26	8.0	43	27	4.65	3.24	6.07	2.45	7.60	3.70	0.01
April	4	0.76	6,390	88.2		7.9	45	33	3.36	1.49	3.97	2.20	3.52	2.85	0.03
May	6	0.99	24,550	116	0.24	8.0	54	40	3.70	1.55	6.08	1.86	4.92	4.43	0.04
June	4	1.12	7,000	127		7.9	51	39	4.30	1.89	6.34	1.81	5.95	4.84	0.02
July	6	1.64	36,740	173	0.43	8.0	47	32	6.04	3.44	8.42	2.21	10.02	5.75	0.07
August	7	0.40	320,800	46.5	0.09	8.0	25	16	2.82	0.63	1.14	2.17	1.71	0.71	0.03
Sept.	6	0.60	165,000	69.6	0.06	7.8	37	24	3.52	0.98	2.65	2.62	2.63	1.63	0.07
Oct.	3	0.54	41,630	60.1	0.07						1.24				
Nov.	4	0.61	25,990	66.6	0.07	7.9	20	11	3.98	1.56	1.38	2.56	3.57	0.71	0.04
Dec.	5	3.24	115,020	370	0.38	8.1	62	58	10.21	4.19	23.24	3.41	12.12	21.64	0.01
Total	57		801,870												
Mean@		0.60		68.0	0.10	8.0	36	26	3.38	1.01	2.44	2.33	2.70	1.79	0.04
									49**	15**	36**	34***	40***	26***	
Water Samples from Rio Grande at Rio Grande City															
January	4	1.25	298,750	142	0.17	7.8	47	42	4.99	2.60	6.84	2.66	5.64	6.04	0.05
Feb.	4	1.46	235,060	166	0.22	7.8	51	45	5.27	3.08	8.58	2.50	6.68	7.40	0.07
March	5	1.49	269,690	170	0.20	7.9	52	46	5.00	3.05	8.82	2.20	6.95	7.65	0.03
April	9	1.09	185,300	125	0.23	7.8	50	46	4.12	2.13	6.14	2.15	4.79	5.70	0.11
May	8	1.07	211,860	125	0.25	8.0	54	44	3.83	1.90	6.70	1.91	4.94	5.34	0.07
June	4	1.41	132,960	162	0.21	7.6	53	48	4.68	2.84	8.64	1.91	6.40	7.48	0.04
July	8	0.57	706,800	65.2	0.11	8.1	38	28	3.23	0.78	2.46	2.26	2.40	1.73	0.07
August	9	0.54	684,720	61.7	0.07	8.0	37	26	3.12	0.78	2.26	2.42	2.16	1.53	0.06
Sept.	8	0.47	715,340	53.8	0.13	7.8	33	21	2.86	0.84	1.86	2.47	1.75	1.02	0.11
Oct.	5	0.71	421,740	80.5	0.09	7.9	40	29	3.65	1.25	3.27	2.76	2.92	2.29	0.04
Nov.	3	0.96	227,520	113		7.9	44	36	4.28	1.86	4.92	2.61	4.56	3.96	0.03
Dec.	5	1.02	223,380	119	0.25	8.3	46	37	4.57	1.74	5.36	2.81	4.57	4.37	0.04
Total	72		4,313,120												
Mean@		0.70		80.7	0.13	7.9	42	32	3.49	1.22	3.40	2.43	2.98	2.55	0.07
									43**	15**	42**	31***	37***	32***	

@ Weighted Mean. ** Percent of Total Cations. *** Percent of Total Anions.

ELECTRICAL CONDUCTANCE OF WATER SAMPLES

San Marcial Station—1938

Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C	Date	$Kx10^5$ @25°C
Jan. 1	91.9	Feb. 11	87.9	Mar. 24	94.4	May 5	98.4	June 15	39.1	July 26	108	Sept. 5	134	Oct. 16	82	Nov. 26	80.7
Jan. 2	104	Feb. 12	92.5	Mar. 25	96.2	May 6	50.3	June 16	76.9	July 27	78.7	Sept. 6	131	Oct. 17	81	Nov. 27	81.5
Jan. 3	104	Feb. 13	90.0	Mar. 26	99.5	May 7	51.0	June 17	55.0	July 28	83.9	Sept. 7	129	Oct. 18	69	Nov. 28	110
Jan. 4	85.4	Feb. 14	86.5	Mar. 27	104	May 8	50.7	June 18	55.8	July 29	76.7	Sept. 8	120	Oct. 19	67	Nov. 29	91.8
Jan. 5	95.5	Feb. 15	87.0	Mar. 28	110	May 9	49.0	June 19	55.6	July 30	93.7	Sept. 9	121	Oct. 20	74	Nov. 30	93.2
Jan. 6	95.7	Feb. 16	87.3	Mar. 30	109	May 10	48.3	June 20	50.0	July 31	146	Sept. 10	134	Oct. 21	72	Dec. 1	94.3
Jan. 7	95.8	Feb. 17	87.4	Mar. 31	111	May 11	50.6	June 21	49.8	Aug. 1	144	Sept. 11	135	Oct. 22	72	Dec. 2	82.4
Jan. 8	93.5	Feb. 18	86.7	Apr. 1	110	May 12	50.4	June 22	44.0	Aug. 2	119	Sept. 12	118	Oct. 23	92	Dec. 3	142
Jan. 9	90.3	Feb. 19	93.2	Apr. 2	105	May 13	50.3	June 23	44.5	Aug. 3	95.6	Sept. 13	118	Oct. 24	68	Dec. 4	144
Jan. 10	90.5	Feb. 20	92.6	Apr. 3	103	May 14	50.7	June 24	44.2	Aug. 4	84.9	Sept. 14	114	Oct. 25	68	Dec. 5	89.5
Jan. 11	90.3	Feb. 21	92.9	Apr. 4	121	May 15	51.6	June 25	44.4	Aug. 5	88.2	Sept. 15	97.8	Oct. 26	64	Dec. 6	87.0
Jan. 12	91.2	Feb. 22	100	Apr. 5	112	May 16	51.9	June 26	51.0	Aug. 6	88.1	Sept. 16	99.1	Oct. 27	99	Dec. 7	86.7
Jan. 13	90.6	Feb. 23	93.2	Apr. 6	124	May 17	51.6	June 27	46.9	Aug. 7	106	Sept. 17	78.6	Oct. 28	71	Dec. 8	86.4
Jan. 14	92.4	Feb. 24	85.1	Apr. 7	117	May 18	46.3	June 28	47.1	Aug. 8	102	Sept. 18	86.5	Oct. 29	74	Dec. 9	85.2
Jan. 15	93.2	Feb. 25	85.3	Apr. 8	113	May 19	53.8	June 29	64.7	Aug. 9	102	Sept. 19	95.5	Oct. 30	72	Dec. 10	103
Jan. 16	92.7	Feb. 26	89.5	Apr. 9	113	May 20	53.3	June 30	73.6	Aug. 10	96.3	Sept. 20	88.1	Oct. 31	74	Dec. 11	93.8
Jan. 17	95.6	Feb. 27	89.0	Apr. 10	113	May 21	54.7	July 1	104	Aug. 11	84.5	Sept. 21	90.0	Nov. 1	95.6	Dec. 12	90.9
Jan. 18	105	Feb. 28	88.6	Apr. 11	119	May 22	54.4	July 2	99.8	Aug. 12	105	Sept. 22	87.2	Nov. 2	72.8	Dec. 13	77.1
Jan. 19	106	Mar. 1	90.8	Apr. 12	111	May 23	55.1	July 3	97.1	Aug. 13	90.3	Sept. 23	87.6	Nov. 3	114	Dec. 14	77.0
Jan. 20	98.9	Mar. 2	90.2	Apr. 13	117	May 24	47.2	July 4	71.5	Aug. 14	88.6	Sept. 24	77.0	Nov. 4	114	Dec. 15	78.2
Jan. 21	92.8	Mar. 3	89.5	Apr. 14	117	May 25	48.7	July 5	74.0	Aug. 15	77.8	Sept. 25	89.4	Nov. 5	110	Dec. 16	95.6
Jan. 22	98.4	Mar. 4	89.2	Apr. 15	117	May 26	49.6	July 6	62.5	Aug. 16	79.2	Sept. 26	78.4	Nov. 6	118	Dec. 17	88.8
Jan. 23	99.7	Mar. 5	115	Apr. 16	111	May 27	48.4	July 7	62.2	Aug. 17	78.4	Sept. 27	79.6	Nov. 7	118	Dec. 18	87.7
Jan. 24	101	Mar. 6	101	Apr. 17	113	May 28	46.6	July 8	78.0	Aug. 18	104	Sept. 28	81.8	Nov. 8	108	Dec. 19	97.5
Jan. 25	100	Mar. 7	101	Apr. 18	133	May 29	47.3	July 9	67.3	Aug. 19	101	Sept. 29	92.9	Nov. 9	77.1	Dec. 20	94.5
Jan. 26	97.2	Mar. 8	101	Apr. 19	133	May 30	46.3	July 10	71.4	Aug. 20	102	Sept. 30	88.4	Nov. 10	77.8	Dec. 21	87.3
Jan. 27	96.0	Mar. 9	99.3	Apr. 20	96.8	May 31	42.2	July 11	78.5	Aug. 21	103	Oct. 1	88	Nov. 11	84.6	Dec. 22	86.9
Jan. 28	98.1	Mar. 10	98.4	Apr. 21	84.1	June 1	45.3	July 12	79.5	Aug. 22	102	Oct. 2	110	Nov. 12	82.0	Dec. 23	97.9
Jan. 29	92.5	Mar. 11	97.5	Apr. 22	97.4	June 2	44.3	July 13	79.8	Aug. 23	104	Oct. 3	111	Nov. 13	81.7	Dec. 24	83.2
Jan. 30	94.2	Mar. 12	95.1	Apr. 23	97.8	June 3	41.9	July 14	78.8	Aug. 24	91	Oct. 4	116	Nov. 14	82.7	Dec. 26	91.1
Jan. 31	94.7	Mar. 13	85.1	Apr. 24	96.8	June 4	40.7	July 15	83.9	Aug. 25	95	Oct. 5	103	Nov. 15	85.2	Dec. 27	83.5
Feb. 1	94.1	Mar. 14	86.5	Apr. 25	97.7	June 5	40.9	July 16	146	Aug. 26	105	Oct. 6	117	Nov. 16	75.1	Dec. 28	86.5
Feb. 2	98.7	Mar. 15	86.7	Apr. 26	71.1	June 6	42.0	July 17	119	Aug. 27	103	Oct. 7	119	Nov. 17	75.0	Dec. 29	91.9
Feb. 3	98.8	Mar. 16	93.1	Apr. 27	58.0	June 7	41.7	July 18	146	Aug. 28	111	Oct. 8	112	Nov. 18	81.8	Dec. 30	87.1
Feb. 4	98.7	Mar. 17	86.6	Apr. 28	75.1	June 8	41.8	July 19	118	Aug. 29	114	Oct. 9	110	Nov. 19	83.1	Dec. 31	87.6
Feb. 5	94.2	Mar. 18	87.6	Apr. 29	75.1	June 9	41.8	July 20	73.5	Aug. 30	117	Oct. 10	112	Nov. 20	74.4		
Feb. 6	91.2	Mar. 19	86.4	Apr. 30	74.4	June 10	39.8	July 21	73.6	Aug. 31	99	Oct. 11	94	Nov. 21	83.4		
Feb. 7	92.3	Mar. 20	89.7	May 1	75.9	June 11	45.2	July 22	79.2	Sept. 1	80.7	Oct. 12	80	Nov. 22	77.4		
Feb. 8	89.9	Mar. 21	91.1	May 2	54.4	June 12	41.3	July 23	109	Sept. 2	83.5	Oct. 13	89	Nov. 23	80.9		
Feb. 9	87.7	Mar. 22	91.1	May 3	53.6	June 13	39.7	July 24	110	Sept. 3	75.4	Oct. 14	90	Nov. 24	80.0		
Feb. 10	88.7	Mar. 23	94.6	May 4	59.6	June 14	41.2	July 25	106	Sept. 4	147	Oct. 15	80	Nov. 25	99.1		

El Paso Station—1938

Jan. 1	205	Feb. 13	147	Mar. 26	114	May 6	113	June 17	112	July 28	113	Sept. 7	107	Oct. 18	192	Nov. 28	201
Jan. 2	208	Feb. 14	151	Mar. 27	112	May 7	111	June 18	109	July 29	114	Sept. 8	80.0	Oct. 19	190	Nov. 29	192
Jan. 3	209	Feb. 15	150	Mar. 28	105	May 8	113	June 19	111	July 30	120	Sept. 9	104	Oct. 20	161	Nov. 30	192
Jan. 4	208	Feb. 16	139	Mar. 29	108	May 9	112	June 20	110	July 31	116	Sept. 10	120	Oct. 21	144	Dec. 1	192
Jan. 5	208	Feb. 17	140	Mar. 30	96.2	May 10	115	June 21	114	Aug. 1	119	Sept. 11	132	Oct. 22	133	Dec. 2	191
Jan. 6	210	Feb. 18	123	Mar. 31	106	May 11	113	June 22	113	Aug. 2	119	Sept. 12	140	Oct. 23	138	Dec. 3	198
Jan. 7	214	Feb. 19	122	Apr. 1	112	May 12	112	June 23	109	Aug. 3	123	Sept. 13	142	Oct. 24	144	Dec. 4	200
Jan. 8	217	Feb. 20	118	Apr. 2	115	May 13	119	June 24	105	Aug. 4	116	Sept. 14	133	Oct. 25	124	Dec. 5	201
Jan. 10	218	Feb. 21	117	Apr. 3	114	May 14	118	June 25	108	Aug. 5	120	Sept. 15	110	Oct. 26	171	Dec. 6	207
Jan. 11	219	Feb. 22	126	Apr. 4	106	May 15	121	June 26	112	Aug. 6	117	Sept. 16	122	Oct. 27	180	Dec. 7	205
Jan. 12	218	Feb. 23	142	Apr. 5	106	May 16	111	June 27	105	Aug. 7	118	Sept. 17	138	Oct. 28	191	Dec. 8	205
Jan. 13	215	Feb. 24	152	Apr. 6	111	May 17	111	June 28	152	Aug. 8	124	Sept. 18	148	Oct. 29	188	Dec. 9	206
Jan. 14	216	Feb. 25	156	Apr. 7	121	May 18	112	June 29	105	Aug. 9	109	Sept. 19	149	Oct. 30	200	Dec. 10	205
Jan. 15	215	Feb. 26	165	Apr. 8	110	May 19	111	June 30	98.7	Aug. 10	108	Sept. 20	159	Oct. 31	199	Dec. 11	210
Jan. 17	211	Feb. 27	161	Apr. 9	122	May 20	112	July 1	122	Aug. 11	111	Sept. 21	168	Nov. 1	191	Dec. 12	204
Jan. 18	217	Feb. 28	159	Apr. 10	114	May 21	111	July 2	117	Aug. 12	112	Sept. 22	157	Nov. 2	192	Dec. 13	209
Jan. 19	217	Mar. 1	177	Apr. 11	111	May 22	112	July 3	130	Aug. 13	114	Sept. 23	154	Nov. 3	198	Dec. 14	212
Jan. 20	221	Mar. 2	139	Apr. 12	110	May 23	110	July 4	114	Aug. 14	109	Sept. 24	166	Nov. 4	198	Dec. 15	212
Jan. 21	215	Mar. 3	137	Apr. 13	115	May 24	106	July 5	117	Aug. 15	106	Sept. 25	146	Nov. 5	201	Dec. 16	208
Jan. 22	205	Mar. 4	140	Apr. 14	105	May 25	111	July 6	105	Aug. 16	112	Sept. 26	147	Nov. 6	198	Dec. 17	207
Jan. 23	215	Mar. 5	135	Apr. 15	119	May 26	113	July 7	104	Aug. 17	113	Sept. 27	144	Nov. 7	199	Dec. 18	199
Jan. 24	216	Mar. 6	129	Apr. 16	116	May 27	118	July 8	107	Aug. 18	114	Sept. 28	141	Nov. 8	204	Dec. 19	147
Jan. 25	216	Mar. 7	105	Apr. 17	121	May 28	115	July 9	111	Aug. 19	108	Sept. 29	140	Nov. 9	206	Dec. 20	134
Jan. 26	218	Mar. 8	121	Apr. 18	107	May 29	108	July 10	108	Aug. 20	111	Sept. 30	147	Nov. 10	205	Dec. 21	125
Jan. 27	219	Mar. 9	122	Apr. 19	106	May 30	112	July 11	107	Aug. 21	110	Oct. 1	138	Nov. 11	202	Dec. 22	145
Jan. 28	222	Mar. 10	121	Apr. 20	112	May 31	112	July 12	110	Aug. 22	117	Oct. 2	138	Nov. 12	202	Dec. 23	175
Jan. 29	222	Mar. 11	116	Apr. 21	107	June 1	107	July 13	102	Aug. 23	115	Oct. 3	134	Nov. 13	204	Dec. 24	174
Jan. 30	223	Mar. 12	121	Apr. 22	114	June 2	109	July 14	108	Aug. 24	117	Oct. 4	176	Nov. 14	204	Dec. 25	186
Jan. 31	227	Mar. 13	127	Apr. 23	116	June 3	110	July 15	107	Aug. 25	117	Oct. 5	135	Nov. 15	207	Dec. 26	190
Feb. 1	224	Mar. 14	122	Apr. 24	114	June 5	112	July 16	95.6	Aug. 26	118	Oct. 6	136	Nov. 16	206	Dec. 27	196
Feb. 2	224	Mar. 15	123	Apr. 25	112	June 6	109	July 17	113	Aug. 27	117	Oct. 7	135	Nov. 17	203	Dec. 28	199
Feb. 3	223	Mar. 16	124	Apr. 26	114	June 7	108	July 18	111	Aug. 28	118	Oct. 8	138	Nov. 18	198	Dec. 30	200
Feb. 4	223	Mar. 17	127	Apr. 27	112	June 8	109	July 19	102	Aug. 29	116	Oct. 9	136	Nov. 19	159	Dec. 31	205
Feb. 5	220	Mar. 18	127	Apr. 28	115	June 9	109	July 20	99.9	Aug. 30	111	Oct. 10	134	Nov. 20	150		
Feb. 6	232	Mar. 19	124	Apr. 29	112	June 10	109	July 21	99.2	Aug. 31	113	Oct. 11	142	Nov. 21	143		
Feb. 7	234	Mar. 20	124	Apr. 30	107	June 11	111	July 22	88.8	Sept. 1	114	Oct. 12	180	Nov. 22	164		
Feb. 8	231	Mar. 21	121	May 1	108	June 12	113	July 23	98.2	Sept. 2	108	Oct. 13	179	Nov. 23	172		
Feb. 9	228	Mar. 22	124	May 2	110	June 13	110	July 24	112	Sept. 3	99.5	Oct. 14	186	Nov. 24	181		
Feb. 10	229	Mar. 23	117	May 3	108	June 14	107	July 25	116	Sept. 4	116	Oct. 15	183	Nov. 25	193		
Feb. 11	232	Mar. 24	120	May 4	112	June 15	110	July 26	117	Sept. 5	114	Oct. 16	188	Nov. 26	192		
Feb. 12	193	Mar. 25	113	May 5	110	June 16	110	July 27	110	Sept. 6	114	Oct. 17	195	Nov. 27	190		

County Line Station—1938

Jan. 7	469	Feb. 25	203	Apr. 15	216	June 3	442	July 6	185	Aug. 12	376	Sept. 30	398	Nov. 18	268		
Jan. 17	289	Mar. 4	251	Apr. 22	257	June 10	289	July 8	196	Aug. 19	392	Oct. 7	236	Nov. 25	329		
Jan. 21	314	Mar. 11	223	Apr. 29	314	June 17	268	July 15	324	Aug. 26	409	Oct. 14	372	Dec. 2	334		
Jan. 28	323	Mar. 18	336	May 6	211	June 24	168	July 21	259	Sept. 3	307	Oct. 21	851	Dec. 9	368		
Feb. 4	279	Mar. 25	407	May 13	300	June 28	208	July 22	111	Sept. 9	139	Oct. 28	369	Dec. 16	317		
Feb. 11	293	Apr. 1	193	May 20	334	June 29	132	July 29	269	Sept. 16	259	Nov. 4	341	Dec. 23	293		
Feb. 18	197	Apr. 8	296	May 27	441			Aug. 5	446	Sept. 23	420	Nov. 10	320	Dec. 30	357		

Fort Quitman Station—1938

Jan. 3	340	Mar. 8	246	Apr. 22	413	June 8	356	July 10	266	Aug. 4	405	Aug. 26	454	Sept. 30	451	Nov. 30	356
Jan. 7	320	Mar. 11	251	Apr. 26	410	June 10	331	July 14	307	Aug. 5	369 M	Aug. 31	417	Oct. 3	342	Dec. 2	365
Jan. 17	357	Mar. 16	319	Apr. 29	391	June 15	288	July 15	287	Aug. 6	380	Sept. 2	141	Oct. 7	393	Dec. 7	360
Jan. 21	253	Mar. 18	358	May 4	322	June 17	299	July 19	182	Aug. 7	461	Sept. 3	158	Oct. 11	341	Dec. 9	384
Jan. 26	347	Mar. 22	380	May 5	316	June 23	392	July 21	137	Aug. 8	424	Sept. 4	156	Oct. 14	407	Dec. 13	376
Jan. 28	349	Mar. 25	381	May 12	319	June 24	324	July 22	154	Aug. 9	368	Sept. 6	167	Oct. 18	416	Dec. 16	375
Feb. 4	359	Mar. 31	274	May 13	319	June 28	215	July 26	244	Aug. 10	372	Sept. 7	118	Oct. 21	444	Dec. 23	264
Feb. 11	361	Apr. 1	278	May 19	381	June 28	173	July 29	215	Aug. 11	354	Sept. 9	160	Oct. 28	339	Dec. 29	331
Feb. 18	261	Apr. 7	304	May 20	408	June 29	176	July 30	273	Aug. 12	352 M	Sept. 14	242	Nov. 4	374	Dec. 30	330
Feb. 20	225	Apr. 8	342	May 25	310	June 30	168	July 31	331	Aug. 19	334	Sept. 16	252	Nov. 10	374		
Feb. 25	260	Apr. 13	321	May 27	361	July 1	166	Aug. 1	352	Aug. 16	286	Sept. 20	311	Nov. 15	366		
Mar. 1	297	Apr. 15	332	June 1	346	July 6	272	Aug. 2	432	Aug. 19	381	Sept. 25	380	Nov. 18	459		
Mar. 4	298	Apr. 20	252	June 3	436	July 8	252	Aug. 3	385	Aug. 24	394	Sept. 27	406	Nov. 25	332		

La Nutria Station—1938

Jan. 13	341	Mar. 6	320	Apr. 18	300	June 19	345	Sept. 5	191	Oct. 1	382	Oct. 18	359	Nov. 19	380	Dec. 22	376
Jan. 20	356	Mar. 14	254	Apr. 19	344	July 17	218	Sept. 10	135	Oct. 2	388	Oct. 20	386	Nov. 20	388		
Jan. 25	337	Mar. 21	326	May 5	401	July 28	244	Sept. 14	85.0	Oct. 4	394	Oct. 27	287	Nov. 22	380		
Feb. 10	370	Mar. 23	346	May 22	396	Aug. 3	261	Sept. 16	63.1	Oct. 8	448	Oct. 29	286	Nov. 24	366		
Feb. 17	380	Apr. 6	276	May 27	380	Aug. 7	176	Sept. 19	250	Oct. 11	314	Nov. 5	356	Nov. 26	366		
Feb. 24	347	Apr. 9	260	June 2	375	Aug. 21	301	Sept. 27	360	Oct. 16	341	Nov. 8	378	Dec. 7	374		

M - Mean of 2 samples

ELECTRICAL CONDUCTANCE OF WATER SAMPLES
continued

Upper Presidio Station — 1938

Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C	Date	Kx10⁵ @25°C
Jan. 7	344	Mar. 14	278	May 13	166	June 30	265	July 20	211	Aug. 3	269	Aug. 16	298	Sept. 19	197	Nov. 19	397
Jan. 14	347	Mar. 18	294	May 20	374	July 2	159	July 21	152	Aug. 4	270	Aug. 19	375	Sept. 24	64.7	Nov. 27	376
Jan. 22	370	Mar. 31	458	May 28	474	July 4	175	July 22	93.8	Aug. 5	292	Aug. 26	428	Sept. 26	297	Dec. 6	366
Feb. 1	361	Apr. 4	271	June 3	459	July 9	232	July 23	115	Aug. 6	213	Aug. 29	441	Sept. 30	366	Dec. 9	376
Feb. 4	372	Apr. 8	321	June 10	486	July 15	270	July 25	95.7	Aug. 9	353	Sept. 7	84.4	Oct. 14	368	Dec. 16	390
Feb. 12	392	Apr. 15	360	June 13	520	July 16	274	July 27	148	Aug. 10	143	Sept. 9	102	Oct. 25	398	Dec. 23	405
Feb. 18	396	Apr. 24	312	June 17	547	July 17	274	July 29	218	Aug. 11	168	Sept. 11	145	Oct. 28	428	Dec. 30	307
Feb. 25	284	Apr. 29	405	June 24	339	July 18	236	Aug. 1	297	Aug. 13	217	Sept. 14	182	Nov. 4	340		
Mar. 5	308	May 6	495	June 27	70.1	July 19	234	Aug. 2	292	Aug. 14	256	Sept. 16	74.0	Nov. 11	372		

Lower Presidio Station — 1938

July 26	31.0	July 26	30.4	July 27	32.1	July 27	35.0								

Rio Conchos near Ojinaga, Chihuahua — 1938

Jan. 14	71.9	Mar. 5	71.9	Apr. 30	111	June 10	118	Aug. 10	54.9	Sept. 9	26.9	Sept. 22	29.8	Nov. 2	72.7	Dec. 24	76.5
Jan. 24	65.6	Mar. 21	87.2	May 6	110	June 17	125	Aug. 16	52.4	Sept. 11	27.8	Sept. 25	30.9	Nov. 6	64.9	Dec. 31	79.5
Feb. 1	77.7	Mar. 31	101	May 13	114	June 25	90.4	Aug. 25	66.0	Sept. 16	130	Sept. 29	40.2	Nov. 21	69.7		
Feb. 12	65.0	Apr. 9	109	May 25	111	June 28	60.8	Aug. 29	73.6	Sept. 19	30.1	Oct. 7	70	Nov. 26	66.7		
Feb. 19	75.6	Apr. 15	115	May 31	113	July 15	59.9	Sept. 3	63.2	Sept. 20	51.0	Oct. 14	64	Dec. 13	81.9		
Feb. 26	68.7	Apr. 22	120	June 7	122	Aug. 5	51.8	Sept. 6	49.4	Sept. 21	28.6	Oct. 21	72	Dec. 19	135		

Pecos River Station — 1938

Jan. 3	549	Feb. 18	572	Apr. 9	534	May 21	437	June 25	448	July 30	216	Sept. 17	474	Nov. 5	471	Dec. 24	505
Jan. 8	539	Feb. 26	587	Apr. 16	558	May 23	127	June 30	443	Aug. 7	367	Sept. 24	399	Nov. 12	438	Dec. 31	512
Jan. 14	598	Mar. 5	563	Apr. 24	687	May 28	357	July 9	512	Aug. 13	292	Oct. 1	387	Nov. 19	467		
Jan. 22	580	Mar. 12	638	May 1	492	June 4	415	July 16	546	Aug. 20	292	Oct. 8	380	Nov. 26	469		
Jan. 29	596	Mar. 17	607	May 3	392	June 9	248	July 22	62.8	Aug. 27	372	Oct. 15	208	Dec. 3	479		
Feb. 5	600	Mar. 26	594	May 6	284	June 11	86.1	July 23	81.6	Sept. 3	402	Oct. 22	422	Dec. 10	536		
Feb. 12	566	Apr. 2	526	May 15	540	June 18	462	July 24	101	Sept. 10	374	Oct. 29	478	Dec. 17	539		

Eagle Pass Station –1938

Jan. 5	161	Feb. 16	172	Mar. 30	174	May 11	109	June 28	51.2	July 24	33.8	Aug. 12	78.9	Sept. 21	62.8	Nov. 9	136
Jan. 13	174	Feb. 24	181	Apr. 7	145	May 18	146	June 29	69.4	July 25	30.1	Aug. 24	86.8	Sept. 27	42.5	Dec. 15	141
Jan. 21	173	Mar. 3	163	Apr. 13	138	May 26	325	July 6	73.7	July 27	92.6	Sept. 1	70.4	Oct. 5	67	Dec. 21	136
Jan. 25	155	Mar. 7	161	Apr. 20	116	May 31	91.5	July 13	76.8	July 28	53.5	Sept. 9	75.6	Oct. 12	81		
Feb. 1	165	Mar. 19	166	Apr. 30	169	June 15	73.4	July 22	64.1	Aug. 4	90.6	Sept. 14	49.9	Oct. 21	129		
Feb. 7	174	Mar. 24	177	May 6	169	June 24	107	July 23	47.3					Oct. 26	119		

Rio Salado Station — 1938

Jan. 7	531	Mar. 3	234	Apr. 19	148	May 24	338	July 8	148	July 28	38.8	Aug. 28	60.1	Sept. 23	49.2	Nov. 25	98.9
Jan. 14	478	Mar. 4	333	Apr. 20	594	May 25	65.9	July 10	160	July 29	42.6	Aug. 29	40.4	Sept. 30	53.5	Dec. 9	99.2
Jan. 21	470	Mar. 5	321	Apr. 21	219	June 3	110	July 11	122	Aug. 1	54.2	Aug. 30	44.6	Oct. 7	55	Dec. 23	95.0
Jan. 28	448	Mar. 11	264	Apr. 22	124	June 10	110	July 12	129	Aug. 2	54.3	Aug. 31	76.4	Oct. 14	57	Dec. 30	89.8
Feb. 4	485	Mar. 18	272	May 6	222	June 13	195	July 13	128	Aug. 3	86.5	Sept. 8	54.4	Oct. 21	69		
Feb. 11	451	Mar. 25	277	May 9	229	June 17	112	July 15	125	Aug. 4	97.9	Sept. 9	55.8	Oct. 28	80		
Feb. 18	437	Apr. 1	125	May 19	132	June 18	154	July 22	129	Aug. 12	70.1	Sept. 16	55.8	Nov. 4	87.0		
Feb. 25	461	Apr. 8	97.6	May 20	248	June 24	98.0	July 26	133	Aug. 19	70.1	Sept. 17	55.8	Nov. 11	87.8		
Mar. 2	188	Apr. 15	105	May 21	344	July 1	124	July 27	55.1	Aug. 26	70.8	Sept. 18	59.2	Nov. 18	95.1		

Rio San Juan Station –1938

Jan. 4	71.4	Mar. 2	98.9	Apr. 18	91.3	May 25	48.0	July 26	313	Aug. 24	66.2	Sept. 20	60.4	Nov. 9	65.9		
Jan. 10	131	Mar. 9	215	Apr. 20	82.6	June 9	126	July 27	119	Aug. 29	49.3	Sept. 21	54.1	Nov. 16	66.3		
Jan. 18	92.1	Mar. 16	306	May 4	424	June 10	210	July 28	87.0	Aug. 30	40.7	Sept. 29	53.0	Nov. 23	65.7		
Jan. 27	106	Mar. 23	115	May 11	349	June 22	156	July 30	101	Aug. 31	39.8	Oct. 12	58	Dec. 7	69.9		
Feb. 10	81.8	Mar. 30	91.3	May 16	176	June 29	74.8	Aug. 3	68.6	Sept. 1	44.5	Oct. 19	58	Dec. 15	72.6		
Feb. 17	79.4	Apr. 6	89.3	May 18	113	July 7	220	Aug. 10	80.5	Sept. 2	46.3	Oct. 26	61	Dec. 21	73.2		
Feb. 21	79.0	Apr. 12	89.4	May 24	101	July 21	158	Aug. 17	61.0	Sept. 12	126	Nov. 3	63.0	Dec. 28	73.3		

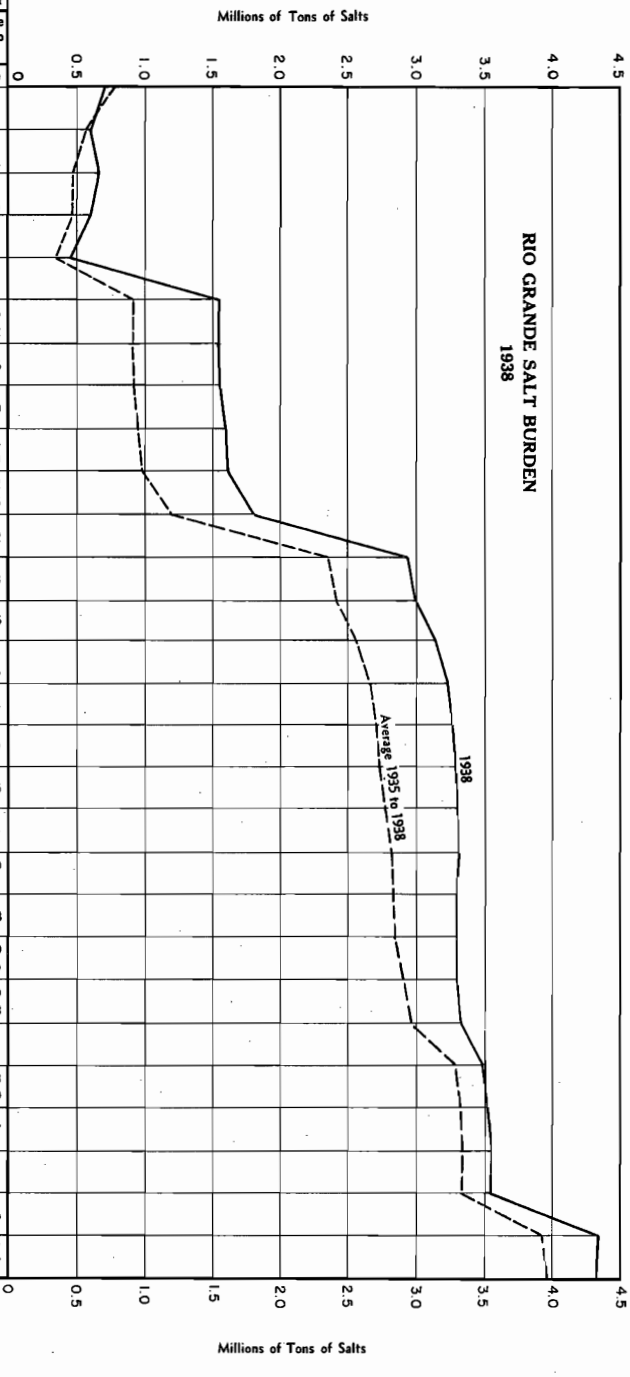
Rio Grande City Station — 1938

Jan. 6	112	Mar. 3	168	Apr. 18	80.2	May 17	179	June 23	113	July 28	43.2	Aug. 29	52.6	Sept. 22	55.4	Nov. 5	108
Jan. 18	153	Mar. 11	157	Apr. 19	101	May 23	92.5	June 28	217	July 31	54.8	Aug. 30	48.7	Sept. 28	42.6	Nov. 10	113
Jan. 25	154	Mar. 15	202	Apr. 20	83.3	May 27	107	July 1	76.9	Aug. 1	60.5	Aug. 31	42.2	Sept. 30	41.7	Nov. 23	113
Jan. 31	146	Mar. 21	162	Apr. 21	112	May 28	96.7	July 5	72.9	Aug. 2	60.8	Sept. 5	66.4	Oct. 10	62	Dec. 1	115
Feb. 7	154	Mar. 27	152	Apr. 22	155	May 29	63.8	July 7	80.5	Aug. 4	61.2	Sept. 16	54.9	Oct. 12	67	Dec. 9	117
Feb. 14	159	Apr. 2	164	Apr. 27	87.8	May 30	97.6	July 9	71.7	Aug. 5	60.1	Sept. 18	50.2	Oct. 17	74	Dec. 16	118
Feb. 19	171	Apr. 8	172	May 4	103	June 9	224	July 18	68.2	Aug. 9	91.3	Sept. 19	50.3	Oct. 25	100	Dec. 27	123
Feb. 25	152	Apr. 14	171	May 12	158	June 15	95.4	July 24	91.9	Aug. 26	75.4	Sept. 21	29.2	Oct. 31	98	Dec. 31	114

RIO GRANDE SALT BURDEN

The graphical and tabular results below are based upon the chemical analyses shown on the preceding pages as well as upon similar data in previous Water Bulletins. For some tributaries the results are based upon curves showing the relationship between salt concentration and amount of stream flow. For other stations and tributaries the results are arrived at by secondary deductions.

	Concentration Tons/Acre Foot	
	1938	Average 1935 to 1938
SAN MARCIAL	.68	.69
UNMEASURED		
EL PASO	1.09	1.16
UNMEASURED		
FORT QUITMAN	2.39	2.55
UNMEASURED		
LA NUTRIA	2.31	2.35
UNMEASURED		
UPPER PRESIDIO	2.05	2.01
RIO CONCHOS	.45	.52
UNMEASURED	.50	.75
LOWER PRESIDIO	.59	.72
ALAMITO CREEK	.34	.53
TERLINGUA CREEK	.59	.49
UNMEASURED	.59	.43
JOHNSON RANCH	.59	.69
UNMEASURED	.58	.52
LANGTRY	.59	.65
PECOS RIVER	3.62	3.02
GOODENOUGH SPRING	.58	.58
DEVILS RIVER	.26	.26
UNMEASURED	.58	.52
DEL RIO	.76	.85
SAN FELIPE CREEK	.59	.58
PINTO CREEK	.59	.59
RIO SAN DIEGO	.45	.33
RIO SAN RODRIGO	.26	.74
UNMEASURED	1.00	.30
EAGLE PASS	.75	.81
RIO ESCONDIDO	.53	.58
UNMEASURED	.31	.39
EL JARDIN (Estimated)	.74	.79
UNMEASURED	.31	.39
LAREDO	.74	.78
RIO SALADO	1.00	1.21
UNMEASURED	.31	.38
ZAPATA	.74	.80
RIO ALAMO	.31	.37
UNMEASURED	.50	.72
ROMA	.73	.79
RIO SAN JUAN	.60	.66
UNMEASURED	.50	.37
RIO GRANDE CITY	.70	.77



RESULTS OF BACTERIOLOGICAL EXAMINATION OF WATER SAMPLES FROM THE RIO GRANDE NEAR EL PASO, TEXAS

The bacteriological examinations reported below were made by the City-County Health Unit, El Paso, Texas, from samples of Rio Grande water taken by the United States Section of the International Boundary Commission.

At El Paso Gaging Station

Date 1938	Hour 1938	Water Temperature °C. 1938	Mean Daily Second Feet River Flow 1938	Total Bacteria per c. c. in Agar-Agar at 37.5° C. 1938	Total Bacteria per c. c. in Agar-Agar at 37.5° C. Average 1937 and 1938	Escherichia Coli (B. Coli) Per 100 c. c. 1938	Escherichia Coli (B. Coli) Per 100 c. c. Average 1937 and 1938
January 10	12:00 Noon	10.6	175	1,600		790	
January 24	10:40 A.M.	7.6	181	702	Jan. † 1,151	45	Jan. † 418
February 14	1:50 P.M.	16.0	382	2,900		790	
February 28	9:55 A.M.	17.0	281	900	Feb. § 47,933	1,700	Feb. § 863
March 16	9:35 A.M.	12.8	625	1,200		330	
March 29	7:15 A.M.	10.1	1,130	990	March. † 1,095	340	March † 335
April 11	9:50 A.M.	13.0	1,250	2,400		1,100	
April 25	10:00 A.M.	18.8	1,140	1,100	April § 2,833	490	April § 563
May 9	10:05 A.M.	17.5	1,230	9,300		790	
May 23	9:40 A.M.	18.6	1,180	2,200	May † 5,750	490	May † 640
June 13	10:05 A.M.	22.2	1,360	3,200		700	
June 27	10:05 A.M.	22.2	1,810	280,000	June 95,309	270	June 757
July 13	9:30 A.M.	26.3	1,470	1,100		490	
July 27	8:40 A.M.	26.0	1,060	5,200	July 12,600	490	July 845
August 18	7:45 A.M.	23.0	1,070	2,100	Aug. 17,933	1,700	Aug. 1,433
September 7	10:55 A.M.	24.1	2,470	15,600		2,800	
September 21	4:50 P.M.	25.1	431	2,400		2,200	
September 28	10:50 A.M.	22.9	544	700	Sept. 17,980	110	Sept. 3,422
October 12	12:10 P.M.	24.6	352	858		790	
October 26	8:35 A.M.	17.5	332	1,400	Oct. 1,642	490	Oct. 1,432
November 14	10:00 A.M.	12.2	221	312		220	
November 21	12:30 P.M.	11.5	439	4,300	Nov. 5,153	790	Nov. 650
December 21	9:20 A.M.	9.4	446	2,100		700	
December 28	9:10 A.M.	6.8	215	235	Dec. 2,737	110	Dec. 430
Monthly Average		17.3		10,117	17,676	780	982

Just Above Ysleta-Zaragoza Bridge*

January 10	10:15 A.M.	6.1	‡ 175	78,000		220,000	
January 24	11:50 A.M.	6.4	‡ 86	94,600	Jan. † 86,300	1,600,000	Jan. † 910,000
February 14	3:15 P.M.	16.4	‡ 260	42,000		170,000	
February 28	11:30 A.M.	18.6	‡ 158	540,000	Feb. † 43,500	920,000	Feb. † 545,000
March 16	9:35 A.M.	12.6	‡ 358	109,200		920,000	
March 29	6:15 A.M.	9.2	‡ 861	9,500	March † 59,350	70,000	March † 495,000
April 11	11:15 A.M.	12.3	609	480,000		130,000	
April 25	11:20 A.M.	22.6	510	61,000	April † 270,500	170,000	April † 150,000
May 9	11:45 A.M.	18.9	638	60,000		120,000	
May 23	11:15 A.M.	21.6	548	7,000	May † 33,500	33,000	May † 76,500
June 13	2:25 P.M.	27.9	710	179,400		170,000	
June 27	4:55 P.M.	21.6	1,445	85,800	June 253,933	79,000	June 163,000
July 13	12:25 P.M.	29.6	940	2,300		70,000	
July 27	11:30 A.M.	29.1	649	19,600	July 275,975	110,000	July 137,500
August 18	8:35 A.M.	23.2	696	4,400	Aug. 194,800	49,000	Aug. 109,667
September 7	12:25 P.M.	26.4	1,893	35,100		49,000	
September 21	4:50 P.M.	26.0	245	163,800		79,000	
September 28	12:10 P.M.	21.9	339	109,200	Sept. 264,820	540,000	Sept. 361,600
October 12	1:10 P.M.	24.9	176.6	93,600		79,000	
October 26	9:35 A.M.	18.0	169.8	109,200	Oct. 169,950	110,000	Oct. 204,750
November 14	1:20 P.M.	16.9	81.5	12,870		33,000	
November 21	2:30 P.M.	12.0	427	13,400	Nov. 25,768	110,000	Nov. 70,575
December 21	10:15 A.M.	8.7	378	13,000		140,000	
December 28	11:20 A.M.	7.2	224	6,200	Dec. 41,300	49,000	Dec. 79,250
Monthly Average		18.3		76,407	143,308	250,833	275,237

DISSOLVED OXYGEN IN RIO GRANDE WATER NEAR EL PASO

The following determinations of dissolved oxygen in Rio Grande water near El Paso, Texas, were furnished by the Department of Water and Sewerage of the City of El Paso. The outfall into the river from El Paso City Sewage Disposal plant is 7.6 river miles below the El Paso Gaging Station.

Date 1938	Dissolved Oxygen Immediately above El Paso Sewage Outfall: Parts per Million	Dissolved Oxygen Immediately above El Paso Sewage Outfall: Percent Saturation	Dissolved Oxygen: Parts per Million	Dissolved Oxygen: Percent Saturation	Miles Below El Paso Sewage Outfall	Dissolved Oxygen: Parts per Million	Dissolved Oxygen: Percent Saturation	Miles Below El Paso Sewage Outfall	Water Temperature °C.
May 11	7.3	82.9	6.5	73.9	3.0	7.3	82.9	9.0	21.0
July 29	5.95	79.4	5.5	73.3	3.7	5.9	78.7	9.0	30.0
October 25	7.8	83.0	7.3	77.6	4.6	7.3	77.6	9.0	18.0
November 30	10.05	92.3	7.6	69.7	1.8	9.85	90.3	5.0	11.5
3 Year Average 1936 -- 1938		75.1		‡ 67.6	4.5		75.4	9.0	22.9

* The Ysleta-Zaragoza Bridge is 9.0 river miles below the El Paso Sewage outfall.
‡ Interpolated. † 1938 only. § 1935 and 1938.

RESULTS OF BACTERIOLOGICAL EXAMINATION OF WATER SAMPLES FROM THE RIO GRANDE AT NUEVO LAREDO, TAMAULIPAS

The chemical and bacteriological analyses of water shown here were made by the Federal Board of Public Improvements at Nuevo Laredo, Tamaulipas, Mexico, from samples of water taken from the Rio Grande by means of the pumps of the city water service, under the supervision of such Board.

Period	Chemical Analysis — Parts per Million					Bacteriological Analysis	
	Turbidity	Total Alkalinity	Phenolphthalein Alkalinity	Total Hardness	Magnesia	Total Bacteria Per c. c. in Agar-Agar at 37.5° C.	Bacilus Coli Per 100 c. c.
Average — 1938							
January	594	139	5.0	371	45	665	40.5
February	200	139	5.5	400	52	468	9.4
March	171	126	5.5	387	55	1,035	24.8
April	661	121	5.0	321	41	20,234	762.2
May	339	117	5.7	343	52	1,791	85.1
June	966	111	6.2	313	48	1,059	18.6
July	8,195	117	5.7	186	19	20,474	1,580.6
August	1,771	138	6.8	212	24	6,581	1,921.3
September	3,417	129	6.3	209	25	6,145	2,440.0
October	766	150	6.9	249	28	3,961	843.9
November	87	155	5.0	336	40	224	117.0
December	58	170	5.0	359	42	253	121.3
Total	17,225	1,612	68.6	3,686	471	62,890	7,964.7
Average	1,435	134	5.7	307	39	5,241	663.7
Minimum	58	111	5.0	186	19	224	9.4
Maximum	8,195	170	6.9	400	55	20,474	2,440.0
Minimum — 1938							
January	124	65	5.0	280	12	665	5.0
February	68	125	3.0	357	16	70	1.0
March	84	115	3.0	345	46	65	5.0
April	100	80	3.0	130	8	190	1.0
May	38	85	5.0	190	24	65	5.0
June	65	95	5.0	190	16	100	5.0
July	943	95	5.0	120	4	1,300	100.0
August	417	100	5.0	130	12	300	1.0
September	460	110	5.0	140	8	400	100.0
October	142	115	5.0	155	16	250	10.0
November	49	140	5.0	305	36	45	5.0
December	23	150	5.0	300	28	15	.0
Maximum — 1938							
January	1,733	165	8.0	440	64	5,700	100.0
February	752	160	8.0	440	68	1,212	100.0
March	703	135	8.0	425	64	14,200	100.0
April	3,510	160	8.0	497	72	272,000	10,000.0
May	3,241	140	8.0	400	75	24,800	1,000.0
June	21,450	140	8.0	515	102	15,000	100.0
July	31,666	140	8.0	280	37	56,000	10,000.0
August	5,920	155	8.0	260	36	24,000	10,000.0
September	8,500	165	10.0	315	36	54,500	10,000.0
October	2,545	170	10.0	335	44	29,000	10,000.0
November	140	175	5.0	360	62	1,325	1,000.0
December	407	175	8.0	385	60	4,200	1,000.0
Annual Averages — 1932 to 1938							
1932	1,434	132	4.4	340	22.7	7,878	2,357.0
1933	644	133	5.0	297	23.4	2,193	499.0
1934	494	132	5.5	262	25.9	4,717	947.0
1935	1,298	128	5.7	245	30.0	7,978	1,858.0
1936	1,292	135	5.1	275	34.6	1,373	409.0
1937	1,920	127	5.0	330	40.0	2,670	581.0
1938	1,435	134	5.7	307	39.0	5,241	663.7
1932 - 1938	1,217	132	5.2	294	30.8	4,564	1,045.0
Extremes							
Maximum	32,700	241	15	768	108	272,000	100,000
Dates	Sept.1937	Aug. 1934	Dec. 1937	July 1935	Dec. 1935	Apr. 1938	Sept. 1932 /
Minimum	19	48	0	80	0.0	4	0
Dates	Jan. 1933	Apr. 1935	Nov. 1934 /	May 1935	Sept.1932 /	Jan. 1937	Jan. 1936 /

/ And other days.

OCCURRENCE OF FLOOD PEAKS ON THE RIO GRANDE

Since 1828, Above Presidio, Texas

By tables and graphs there is shown below the results of exhaustive research as to the peak discharge of Rio Grande floods at the gaging stations at Fort Quitman, Upper Presidio, and Lower Presidio, with some information at intervening and related points. In Water Bulletin No. 6 similar results were shown for the San Marcial and El Paso gaging stations. Flood data are less plentiful for this stretch of river than for the San Marcial-El Paso stretch.

Each tabulation is represented by an "Occurrence Curve". They show the average number of years between (average frequency of) floods having peak discharges equaling or exceeding various magnitudes. The dates and magnitudes are known, of other moderately large floods, not shown in the tables below, because their "order of magnitude⊛" and "period**" are not known.

At Fort Quitman and Box Canyon flood conditions are shown as they were before Elephant Butte Dam was built in 1915, and as it is estimated they would have been thereafter if the dam had not been built. This is made possible by the San Marcial and El Paso records of great floods which extend back to 1828 (see W. B. 6, p.p. 79-81). Some uncertainty remains at Fort Quitman as to flood peaks from 9 to 14 thousand second feet, because of arroyo inflow below El Paso. The great ponding effect for large floods (prior to channel rectification) over the valley floor above Box Canyon removes this uncertainty at Box Canyon. This is the reason for showing the estimated "Occurrence Curve" for Box Canyon 10.5 miles below Fort Quitman station.

Careful investigations particularly of old flood marks show that flood peaks of as much as 51,000 second feet have entered the Rio Grande from Van Horn arroyo 38.6 miles above La Nutria gaging station on the Rio Grande, also that as much as 30,000 second feet passed La Nutria station sometime prior to 1903.

At Upper Presidio, 2 curves and 2 tabulations show by contrast the decrease in flood peak magnitude in the latter of two short periods of record; that is, since Elephant Butte Dam was constructed. The two upper points of the highest of these two curves (1900-1914) undoubtedly belong to a longer period of time, i.e. the true curve in this region lies to the right of the dashed line.

John R. Freeman reported in Trans. Am. Soc. Civil Engrs., Vol. LXXX, Dec. 1916, p. 2,060, very large floods in 1829, 1868, and 1904 on the Rio Conchos near Boquilla Dam.

Concerning floods at the present Lower Presidio station prior to 1900 when hydrographic records began there, and for the periods March 1914 to September 1, 1919 and March 31, 1920 to August 1923, when no such regular records were kept, reliance has been placed upon files of this office and the word of citizens of Presidio, and upon flood marks shown by them. Evidence indicates that the peak of the flood of 1829 at the Lower Presidio station was about 150,000 second feet, but some uncertainty remains and therefore the 1829 flood is excluded from the record here.

The building of Boquilla Dam in 1914 on the Rio Conchos interposed important modifications in the peak flow characteristics of that stream at its confluence with the Rio Grande 224 miles below the Dam. The building in 1915 of Elephant Butte Dam 422 river miles on the Rio Grande above Presidio modified, only slightly, the peak flow characteristics at Lower Presidio station. The curves and tables for Lower Presidio represent differing sets of conditions as follows:

a - Assuming that Boquilla and Elephant Butte Dams had not been built and;

b - Assuming Boquilla and Elephant Butte Dams operating the entire period 1830 to 1938, inclusive.

Considerations indicate that the building of Caballo Dam in 1938 on the Rio Grande 395 miles above Presidio, and the rectification of the river channel in the El Paso-Juarez Valley will have but very slight effect (probably negligible) upon the flood occurrence curve at Lower Presidio station.

Rio Grande at Fort Quitman Station

Assuming Elephant Butte Dam Not Built

No.	Date	Peak ∮ Discharge In Second Feet	⊛ Order of Magnitude	** Period	*** Average No. of Years
1	June 19,*1905	17,000	1	110	110
2	June 9,*1905	16,000	2	110	55
3	June 12,*1920	14,000	3	110	36.7
4	June 3,*1897	13,000	4	110	27.5
5	June 9,*1937	12,500	5	110	22.0
6	June 30, 1903	11,400	6	110	18.2
7	Oct. 22,*1904	10,700	7	110	15.7
8	May 24,*1891	10,000	8	110	13.8
9	Oct. 5,*1929	9,800	9	110	12.2
10	June 10,*1912	9,800	10	110	11.0
11	June 1-10*1884	9,200	11	110	10.0
12	Sept. 25,*1927	3,900	10	16	1.6
13	Aug. 17,*1935	3,600	11	16	1.5
14	June 4,*1929	3,500	12	16	1.3
15	May 9,*1932	3,400	13	16	1.2
16	May 11,*1926	3,300	14	16	1.1
17	May 21,*1927	3,200	15	16	1.05
18	May 16,*1928	3,200	16	16	1.00
19	Sept. 8, 1938	3,180	17	16	.94
20	June 6, 1923	3,100	18	16	.89
21	Oct. 12, 1937	3,100	19	16	.84
22	Sept. 11, 1937	3,040	20	16	.80
23	Sept. 2,*1935	2,800	21	16	.76
24	June 3,*1935	2,800	22	16	.73
25	Sept. 11, 1925	2,800	23	16	.70
26	Sept. 28, 1926	2,780	24	16	.67
27	July 22, 1938	2,750	25	16	.64
28	Aug. 20, 1929	2,720	26	16	.62
29	Aug. 26, 1923	2,600	27	16	.59

Rio Grande at Box Canyon

Assuming Elephant Butte Dam Not Built

1	June 20,*1905	16,500	1	109	109
2	June 10,*1905	15,700	2	109	54.5
3	May 17,*1928	3,000	16	16	1.0

Rio Grande at Upper Presidio Station–1900 to 1914

No.	Date	Peak ∮ Discharge In Second Feet	⊛ Order of Magnitude	** Period	*** Average No. of Years
1	June 12, 1912	15,200	1	14	14
2	June 13, 1905	14,400	2	14	7
3	Oct. 17, 1904	9,800	3	14	4.3
4	July 2, 1907	9,700	4	14	3.5
5	Aug. 31, 1907	8,900	5	14	2.8
6	June 7, 1907	8,260	6	14	2.3
7	July 10, 1911	8,000	7	14	2.0
8	June 3, 1906	7,800	8	14	1.8
9	Sept. 8, 1907	7,600	9	14	1.6
10	Aug. 3, 1911	7,500	10	14	1.4
11	May 28, 1911	7,500	11	14	1.3
12	June 13, 1911	7,450	12	14	1.2
13	July 22, 1911	7,200	13	14	1.1
14	May 15, 1910	7,100	14	14	1.0
15	June 26, 1906	7,000	15	14	.94
16	July 13, 1907	6,900	16	14	.88
17	July 28, 1911	6,900	17	14	.81
18	Oct. 22, 1911	6,700	18	14	.78
19	July 8, 1903	6,600	19	14	.74

Rio Grande at Upper Presidio Station–1923 to 1938

1	Aug. 18, 1928	6,400	1	16	16
2	Sept. 10, 1929	5,500	2	16	8.0
3	Sept. 25, 1931	4,850	3	16	5.3
4	Aug. 26, 1928	4,700	4	16	4.0
5	Oct. 4, 1926	4,100	5	16	3.2
6	Aug. 28, 1923	4,000	6	16	2.7
7	Aug. 12, 1925	3,800	7	16	2.3
8	Aug. 9, 1925	3,600	8	16	2.0
9	Oct. 7, 1930	3,600	9	16	1.8
10	Aug. 23, 1926	3,600	10	16	1.6
11	Oct. 1, 1926	3,300	11	16	1.5
12	Oct. 2, 1932	3,200	12	16	1.3

∮ These are extreme peak discharges and not mean daily discharges.

* Approximate Date.

⊛ "Order of Magnitude" with reference to all other floods within the same period.

** Period of years during which all floods are known which had peak discharges equaling or exceeding the lowest flood under consideration in the period.

*** Average number of years between floods having a peak discharge equaling or exceeding any given magnitude, i.e., "Period" divided by "Order of Magnitude".

OCCURRENCE OF FLOOD PEAKS ON THE RIO GRANDE
Since 1828, Above Presidio, Texas
continued

Rio Conchos at Boquilla
Assuming Boquilla Dam Not Built

No.	Date	Peak ∮ Discharge In Second Feet	Order of Magnitude ⊛	Period **	Average No. of Years ***
1	1829	335,000	1	110	110
2	1868	230,000	2	110	55
3	1917	180,000	3	110	37
4	1904	161,000	4	110	28
5	Sept. 1932	150,000	5	110	22

Rio Grande at Lower Presidio Station
Assuming Boquilla and Elephant Butte Dams Operating

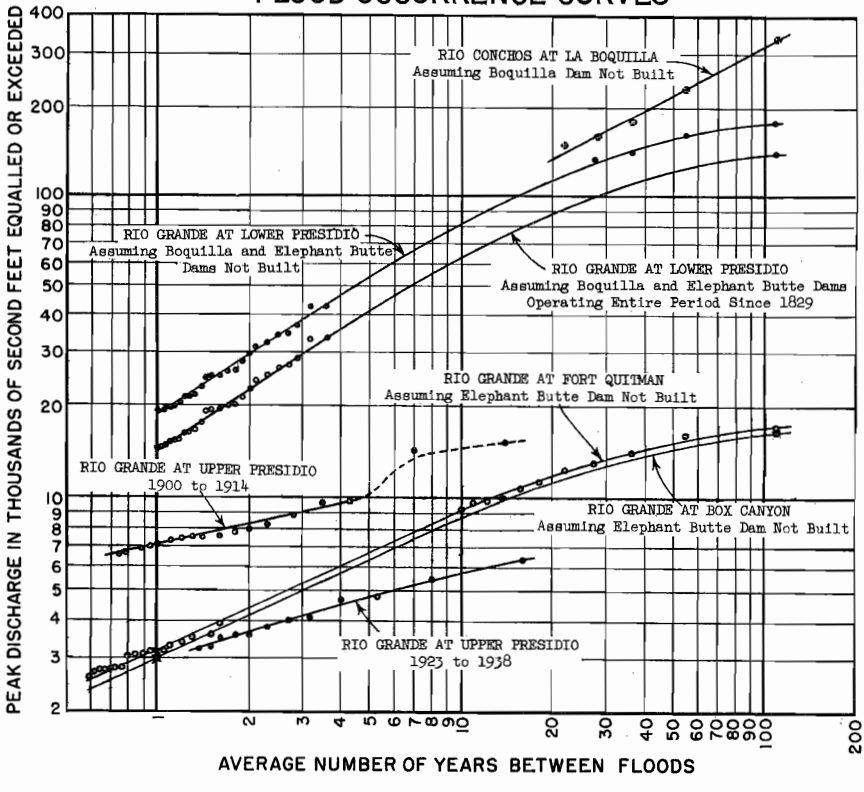
No.	Date	Peak ∮ Discharge In Second Feet	Order of Magnitude ⊛	Period **	Average No. of Years ***
1	Sept.22-23,1917	140,000	1	109	109
2	Aug. 28, 1906	33,400	9	32	3.6
3	July 27, 1938	33,100	10	32	3.2
4	Aug. 11, 1908	28,700	11	32	2.9
5	Sept. 17, 1933	27,030	12	32	2.7
6	Sept. 26, 1936	26,700	13	32	2.5
7	June 15, 1911	25,300	14	32	2.3
8	Sept. 11, 1938	24,200	15	32	2.1
9	Aug. 9, 1906	22,800	16	32	2.0
10	Sept. 7, 1925	21,500	17	32	1.9
11	Sept. 25, 1905	20,000	18	32	1.8
12	Aug. 15, 1906	20,000	19	32	1.7
13	Sept. 15, 1912	19,200	20	32	1.6
14	Sept. 1, 1908	19,200	21	32	1.5
15	Nov. 7, 1907	19,200	22	32	1.45
16	July 26, 1906	17,700	23	32	1.39
17	Aug. 26, 1928	16,700	24	32	1.33
18	Aug. 11, 1925	16,500	25	32	1.28
19	Aug. 27, 1926	16,500	26	32	1.23
20	Oct. 16, 1904	15,700	27	32	1.19
21	July 4, 1938	15,500	28	32	1.14
22	Dec. 1, 1907	15,200	29	32	1.10
23	Sept. 24, 1937	14,900	30	32	1.07
24	Sept. 26, 1935	14,800	31	32	1.03
25	Aug. 23, 1912	14,800	32	32	1.00

See footnotes on preceding page

Rio Grande at Lower Presidio Station
Assuming Boquilla and Elephant Butte Dams Not Built

No.	Date	Peak ∮ Discharge In Second Feet	Order of Magnitude ⊛	Period **	Average No. of Years ***
1	Sept.22-23,1917	178,000	1	109	109
2	Sept. 11, 1904	162,000	2	109	54.5
3	1868	140,000	3	109	36.3
4	Sept. 12, 1932	133,000	4	109	27.2
5	Aug. 28, 1906	43,000	9	32	3.6
6	July 27, 1938	42,600	10	32	3.2
7	Aug. 11, 1908	37,000	11	32	2.9
8	Sept. 17, 1933	34,930	12	32	2.7
9	Sept. 26, 1936	34,500	13	32	2.5
10	June 15, 1911	32,600	14	32	2.3
11	Sept. 11, 1938	31,400	15	32	2.1
12	Aug. 9, 1906	29,600	16	32	2.0
13	Sept. 7, 1925	27,900	17	32	1.9
14	Sept. 25, 1905	26,000	18	32	1.8
15	Aug. 15, 1926	26,000	19	32	1.7
16	Sept. 15, 1912	25,000	20	32	1.6
17	Sept. 1, 1908	25,000	21	32	1.5
18	Nov. 7, 1907	25,000	22	32	1.45
19	July 26, 1906	23,000	23	32	1.39
20	Aug. 26, 1928	21,900	24	32	1.33
21	Aug. 11, 1925	21,600	25	32	1.28
22	Aug. 27, 1926	21,600	26	32	1.23
23	July 4, 1938	20,400	27	32	1.19
24	Oct. 16, 1904	20,000	28	32	1.14
25	Dec. 1, 1907	20,000	29	32	1.10
26	Sept. 24, 1937	19,700	30	32	1.07
27	Aug. 23, 1912	19,500	31	32	1.03
28	Sept. 26, 1935	19,500	32	32	1.00

FLOOD OCCURRENCE CURVES



RAINFALL ON UNITED STATES SIDE OF RIO GRANDE WATERSHED — 1938

The rainfall records shown below have not been published elsewhere. The source of the record, the type of rain gage used, and the approximate elevation of each gage above mean sea level, is shown below with each record. The automatic rain gages record by a float operated attachment on the water stage recorder of regular stream gaging stations. The rain gathering cone at these stations forms the roof of the instrument house, being some twelve feet in area. The rain tanks into which the rain is gathered, and on which the float rests, is automatically emptied by a syphon when full. Thus these gages may record unlimited amounts of rain. The graphic record shows the time and rate of the rainfall.

American Dam Near El Paso

Automatic recording rain gage. Record by U.S. Section I.B.C. Elev. 3,730 ft. Record began July 1, 1938 *

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January			.01	.05																	.44	.58										1.08
February				.10			.15										.09		.01									.12				.22
March																																.23
April								.01					T								.02											0
May																						.61	.02				1.56	1.28	.05	T		.03
June																																3.52
July	.04				T	.03		.02			.36			.27	.03		.06	.01		.70	.20						T			T		1.68
August																	.21															.25
September	1.29			.36	.37	.14	.07	.05	.04	.01	T		.01									.04	.02			T					T	2.34
October						.02	T																									.08
November																		.02	.09	.02												0
December																																.13
																															Yearly	9.56

Ft. Bliss, Texas

Standard 8 inch rain gage. Record by U. S. Army Elev. 3,890 ft. Record began Jan. 15, 1924

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal 1924-1938
January		T	.07	.04	.02										T				.18	.31	.53											1.19	.35
February												T	T				.07		.02							T	.03	.02				.14	.36
March				.28				.30																								.58	.29
April						T								T															.02	.01		.03	.30
May							T	T	T									T			T											T	.56
June						T	T					.05	.13									.20	.28		T		2.63	.73	.10	.02		4.14	.58
July	.24										.12						T	T		T	T	T						.36				.83	1.45
August					.08			T				T		T	T		.05	.03			.16								T	T		.32	2.05
September	1.20		.62	.09	.35	.47						.03				T					T	.03				T						2.69	1.31
October					T															T										.03	.06	.72
November																																0	.40
December																.03			.09	.03					.03							.18	.42
																															Yearly	10.12	8.79

County Line Station

Automatic Recording Rain Gage. Record by U. S. Section I. B. C. Elev. 3,550 ft. Record began Jan. 1, 1938

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January					.05				T							T										T		T				1.50
February			T	.01													.02		T	T	.60	.80	.05			T	.23					.26
March				.18			.08					T														T						.26
April				T						T																			.10	T		.10
May		T					T			T																						T
June													.13									.14	.12	T	.14		.10	.60	.16			1.39
July	.11				T	T		.10					.01	.13				.20	T	.94		.14	.01	.01	T				.01			1.66
August													.41					.35	.03													1.05
September	.64	.02	.22	T	.02	.22	.87	.06	.01			.14	.02	T			.26															2.22
October		.03																			T	.08								.05	.13	.27
November																																.03
December															.08				.06						.04							.18
																															Yearly	8.78

Fort Quitman Station

Automatic Recording Rain Gage. Record by U. S. Section I. B. C. Elev. 3,450 ft. Record began Jan. 1, 1937

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1937-1938
January					.50				.02											.12	.68	.32						T				1.64	.94
February														.18			.11			.08	.01	T					.16	T				.48	.29
March				.03		.01		.01									T															.05	.08
April						T				T																			T	.05		.05	.40
May					.01				.57	T		T	T																T			.38	.27
June																							.10	T	T		.01		.16	.32		.56	.40
July												T	.36	.06	.09		.05	.12		.14	.72	.37							.25			2.12	1.20
August				.01						.33		.10		.04		.01													.02		.01	.48	.36
September	.10			.21	.99					T	.01	.18	.08	.84								.09										2.41	2.46
October							.03				.22																					.34	1.20
November		.02																														.02	.05
December																.08			.02					.07		.03						.20	.70
																															Yearly	8.76	8.50

Candelaria, Texas

Standard 8 inch rain gage. Record by U. S. Section I. B. C. Elev. 2,850 ft. Record began Nov. 2, 1935

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1935-1938
January				.05										.10		.02						.45					.03					.50	.26
February																																.15	.13
March							.35																									.55	.71
April																													.14			.14	.07
May									.23																							.23	.63
June							.02																1.18	.25		.98			.12	.18		2.73	1.17
July	.52		.18			.05												.53		.14	1.05	.56	.06		.11			.61				3.61	2.81
August				.14		.27		.24				.38								.27										.50		1.53	1.89
September					.16									.77																		1.20	2.91
October																																0	.43
November																																0	.33
December																								.28								.28	.72
																															Yearly	10.72	11.46

* Records prior to July 1 and for November and December are from automatic gage at A. S. & R. Company smelter 1/2 mile distant. † Partly Estimated. ∮ Estimated.

RAINFALL ON UNITED STATES SIDE OF RIO GRANDE WATERSHED

Crosson Ranch 27 Miles South of Alpine, Texas.

1933

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total*
January																																0
February																																.08
March																																0
April																																.09
May																																.60
June																																1.36
July																																1.36
August																																2.64
September																																1.10
October																																1.10
November																																.17
December																																0
																															Yearly	8.50

1934

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total*
January																																0
February																																0
March																																0
April																																.77
May																																.32
June																																.02
July																																.63
August																																.37
September																																.09
October																																.12
November																																0
December																																0
																															Yearly	2.32

1935

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January						.13											.03	.85													.15	.56
February	.05					.35						.55																				.75
March																																.15
April																																.00
May																						.03		.15			.05					.83
June		.10		.14		.04				1.90	1.75		.13	.65										.23	.16	.35						5.45
July	.13																.05	.96			.07	3.95	.15	.05								5.41
August		.02		.03		.05																										.54
September	1.36		2.15	.49	.16								.37			.07	.24	.44				.20	.08		.62	.57				.05		5.63
October																						.07										.65
November																									.45							.55
December																			.21	.14												.35
																															Yearly	20.17

1936

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January																											.08		.12			.20
February																																.00
March	.11	.46																														.57
April																			.07													.07
May		1.25			.10					.10			.13	.04	.03					.63	.52		.04	.47	.10							3.21
June																																.20
July	.05						.15	.16							.05	.07						.45			1.11	.05						2.32
August		.55		1.00									.07				.03	.12	.10			.74		.06	.29	.10	.20	.08	.23			2.18
September														1.25					.03		.97	.45	.85	.15	.04	.85			.24		.18	6.17
October																												.20				.24
November																	.07							.07			.37		.09			.60
December	.16		.02																								.08			.04		.26
																															Yearly	16.02

1937

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
January																																.00
February	.33	.15			.24			.19											.07													.74
March																																.24
April																			.08													.08
May					.05			.34					.10	.55	.07	.97												1.20			.10	1.45
June	1.25		.18																													3.36
July	.43				.03				.14		.05	.45			.24		1.61	.18	.65	.36	1.00	.25										1.59
August	.14			.70		.28					.46									.03	.07	.59		.04								4.39
September												.58	.42	.03								.12										1.84
October																																1.03
November	.33							.28																								.61
December		.15		.10									.90							.41								.61				2.17
																															Yearly	17.50

1938

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1933-1938
January					.18										.08							.33						.13				.51	.21
February		.09																										.04				.21	.30
March																.09																.13	.18
April																.13				.25										.09		.34	.22
May	.09								.24		.24																					.66	.08
June													.03									.15	.40	.84	.85			.18		.08		2.66	2.18
July	.28	.05	.67		.48	.51		.14									.04	.04	.75	.80	.90	.11	.10						.45		5.32	2.77
August		.33		.84	.06	.25	.03	.65	.04				.11			.32												.42	.20		1.85	2.00
September								.03														.19		.30	.13					.05	1.31	2.69
October								.12																							.36	.58
November																															.43	.38
December																															.00	.46
																															Yearly	13.78	13.05

* Annual totals measured. Monthly breakdown estimated.

RAINFALL ON UNITED STATES SIDE OF RIO GRANDE WATERSHED — 1938 —continued

Marfa, Texas

Standard 8 inch rain gage. Record by U. S. Army. Elev. 4,670 ft. Record began March, 1928

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal 1928-1958
January				.02	.15					T				.06			T		.02			.18										.37	.37
February																																.21	.66
March		.15					.18										T										T	.15				.33	.19
April																	T	.09											.16			.25	.68
May									.19				T																			.19	.88
June							.26								.02								1.40	2.42		.27		.09	.05			4.55	1.61
July			.52		.34		.27	.03		.02			.49			.26		.53		2.25	2.75	.15	.53	.07					.24	.12		7.95	2.55
August		1.05		.41	.08		.14		.21		.05		.05	.13						.45												1.42	2.92
September							.11																									1.88	2.42
October									.03																			T				.03	.81
November			T																													T	.51
December																									.25							.25	.43
																															Yearly	17.41	13.83

Johnson Ranch, Texas

Standard 8 inch rain gage. Record by U. S. Section I. B. C. Elev. 2,050 ft. Record began July 1, 1933

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1933-1938
January															.78																	.78	.26
February																												.45				.45	.22
March																																0	.10
April																			.19											.31		.50	.26
May																																0	1.10
June																.30								.65	.15	.18						1.28	2.06
July	.33	.25	1.25						.14											.26	2.01	.16	.12									4.52	1.73
August																																0	.44
September		.35		.56										.14		.45																1.28	1.56
October																																0	.41
November																																0	.07
December																																0	.46
																															Yearly	6.81	7.67

Big Bend State Park---Green Gulch

Standard 8 inch rain gage. Record by Park Custodian. Elev. 5,150 ft.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
January					.33					T									T		.52	.34										1.19	
February					T		T	T																			.02	.50				.52	
March																																T	
April																	T							.01					.01			.02	
May		T							T	.38				T																		.38	
June							.01							.10		.56				T	T		.37	.55	3.15	.81	.20	.70	T	T		6.45	
July		T	.20	T	.10			.25		T				T				.22	T	1.10	.50	.86	1.17	.18					.30	.16	T	4.58	
August			.47		.25	.40		T		T									T													1.58	
September	.19		.81	.51	.12		T	T						3.21	T	.14			T													4.96	
October														T										.11								.11	
November	.21																								.15							.21	
December																																.15	
																															Yearly	20.17	

Dryden, Texas

Standard 8 inch rain gage. Record by U. S. Army. Elev. 2,140 ft. Record began Jan. 1, 1931

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1931-1938
January					.17					T					.01	T			T		.01		1.46					.14				1.63	.58
February																												T				.16	.49
March							T	.02																								.02	.43
April			T						.10			T				T					.15	.12			.20		T				T	.90
May							T																1.00	.15	.62							.57	2.04
June																																1.77	.92
July								T												.20	.16	.50	.72	1.60	.12				T	T		5.30	1.51
August																												.01	1.79	T		1.80	1.72
September				.03										.04									T									.07	2.65
October										.01																						.01	.71
November	.03		T		T																											.03	.37
December																							.02	.09	.08							.19	.82
																															Yearly	9.55	13.14

Pecos River Station

Standard 8 inch rain gage. Record by U. S. Section I. B. C. Elev. 1,060 ft. Record began Feb. 23, 1938

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	
January																																	
February																																	
March																												.07				.07	
April																																0	
May			.15							.33		T							.10													.58	
June																								.48								.48	
July																				.60	.30		.68	2.10				.45	.60			3.68	
August																																1.05	
September														T																		T	
October																																0	
November																																0	
December																									.34	.10						.44	

Zapata, Texas

Standard 8 inch rain gage. Record by U.S. Section I.B.C. Elev. 270 ft. Record began April 22, 1932

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average 1932-1937
January				.74	.09			.30												.45		.60										1.66	.94
February																																.45	.75
March	.90	.17																					1.93									3.00	1.06
April																			.20													.20	1.03
May										.11														1.38								1.49	2.53
June																				.21	.17						.12					.50	1.01
July																														.93		.93	1.04
August																													2.60	.12		2.72	1.38
September								.22	.53																							.99	3.79
October										.07																						.07	.75
November						.10																	T									.10	.40
December																								1.45	.45		.08			.31		2.23	1.33
																															Yearly	14.37	16.01

RAINFALL ON MEXICAN SIDE OF RIO GRANDE WATERSHED

INCHES

1938

The rainfall records shown here have not been published elsewhere. The records are from the Meteorological Service of Mexico. The records are kept by standard eight-inch rain gages. Monthly and annual records for many years back and for most of the stations listed below may be seen in Water Bulletin No. 7, pages 72 and 73.

Juarez, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1925-1938
January			.03	.09											T		.11		T	.31	.75	.12				T	.14					1.30	.32
February																T				T												.25	.36
March				.33			.24																									.57	.32
April						T							T																T			T	.27
May								.08										T														.08	.54
June					T						.06	.03							T			.55	.09		.12	.61	.91	.66	.12	.04		3.21	.64
July	.04							T		.02	.02			.29			T		T			T						.22	.02			.63	1.05
August				T										T			.47	.08											.04		T	.59	1.40
September	1.35			.02	.50	.29	T					.23										.10			.02							2.39	1.25
October						T	T																								.11	.23	.95
November		T				T																										T	.47
December															.08			.08	.02					.16	T							.34	.40
Yearly																																9.59	7.93

Villa Gonzalez, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1921-1938
January				T																.87	.86					T						1.73	.24
February																	T	T														T	.22
March			.08	.04			T																									.12	.22
April																													.33			.33	.30
May								T																								T	.32
June													T									.49			.02	T	T		T	.49		1.00	.32
July	.52											.36		.30	.83			.15		.69	T	.54						.44				3.83	1.71
August						.20	.49			.16		.08																			.18	1.11	1.70
September	T					.03	.96					.04		T																		1.03	1.56
October							T															T			.10					T	.15	.75
November		.06																														.06	.45
December															T						T	T	T	T								T	.44
Yearly																																9.31	8.83

Chihuahua, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal 1921-1938
January										.27	T	T			.08	T		T			.37	.45			T	.02	T	.06				1.09	.19
February																																.28	.18
March							.16																									.16	.25
April						T																.23	T					.18				.41	.34
May																					.02											.02	.47
June					T		.32								T						.54	.89	.39	.17	.35	.02	T	.27	.37	1.27		4.39	1.08
July	.30	.37	T					T	T		.14	T		T	.04	.02	.16	.24	.08	1.38	.63	2.49	.88	.27		.02	.39		T	.02	.02	6.89	3.08
August		T	T	T				T	.02			T		.08	.07		.49				T				.04	.06	.10		.09	.24		1.71	3.39
September	1.54	.13	.29	T	.68								1.86	.60	1.56	.55	T															7.71	3.90
October					.33	.38	.47												T	.07	.08			T							.06	.21	1.15
November																																.00	.29
December																										T						T	.74
Yearly																																22.73	15.06

Delicias, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average ∮ 1932-1938
January								T	.15			.06									.14	.14										.49	.20
February																											T	.30				.30	.15
March																																.00	.05
April																						.79								.04		.83	.28
May								.35																								.35	.25
June					T									T								1.46	.26	T	1.40	.31	T	.47	.73	1.81		6.44	1.29
July	.84	.23	T	.12				T				T		.14			.33			1.00	.94	.65	2.03	.02	T	.04	.04			.19		6.57	2.42
August			.04	T	.84		.10	.22		.31	.16				1.22	.19	T							T				.47	.06	.06	2.38	2.57
September	.79	T		.29		T	T			.06			T	.24		.31																2.21	2.58
October					.02			.02												T	.08										T	.12	.34
November																																.00	.30
December																								Data not available for December								.30
Yearly																																20.39	10.69

Hormiguero, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average ∮ 1924-1938
January									.02	.02	.01	.39									T	.02										.46	.70
February							T																		T	T	.06	.08				.14	.22
March																																T	.06
April																						.47							.04			.51	.07
May								T								T																T	.49
June						T								T	.37	T					.24	.14	.63	.43	.41	.02	.02	1.06	.83	.06		4.21	2.34
July	.55	.79	.98						1.57	.06			.16	.95	.79	.02	.08	.51	T	T	.02	.39	.10	.67	.51	.95					.39	.09	9.51	6.14
August			.04	.04	.12					T	.22	.12	T	T	1.95								T		.04		.59		.94	.24	.31	4.11	5.10
September	.41	.89	.08		.18	T							T	.25	1.08	.71	.16	.55	T	.06	T											4.57	4.52
October																				.10	T			.08							.12	.50	1.79
November					T																											T	.38
December																																.00	.35
Yearly																																33.81	22.16

* Some Months Missing. ∮ Some Years Missing.

RAINFALL ON MEXICAN SIDE OF RIO GRANDE WATERSHED

INCHES

1938—continued

El Mulato, Chih.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1926-1937
January					.13	T			.01	.08	T										.05	.12	T				.02	.04				.39	.89
February																												.05				.06	.29
March	.02																					.07										.05	.14
April																																.07	.32
May									.20					.06																		.26	.65
June											T			T	T							.08	.51	.06	.04	.40	T	.04	1.38	.12		2.65	.97
July	.20	.02	T														.02			.09	.47	.04	T									.84	1.06
August													T															.09	.12		.21	1.32
September	.09	.83	.09	.39	.20	.43	.08	T	.17		T	.04	.08	.13	T																2.36	1.43
October																					T							T		.02	.19	.93
November																																.00	.29
December																								.11								.11	.60
Yearly																																7.19	8.23

Palestina, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Averaged 1931-1938
January				.08	T			T	.28											T	.08	.43										.87	.48
February			.04	T			T	T	T	T	T	T	T	T		T				T	.21						.16				.43	.76
March	T		T					.06			T															T						.06	.84
April																.39	.39	.38	T						.08		.12					1.36	1.28
May		T					.08		.28			.08									.31					.04						.79	2.74
June							.04																.31									.35	2.84
July																				T	2.01	1.89	1.42	.20				.23			5.75	2.67
August		.20												.51		.08											.20	.21	.08			.69	1.84
September										.08	T																					.67	4.47
October																						.08										.08	.72
November																													T			T	.51
December	T																		T				.04	.39	.40							.83	1.08
Yearly																																11.86	19.65

Zaragoza, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Averaged 1926-1938
January																																.00	.98
February																				.39							T					.39	.79
March	.47															.59																1.06	.59
April																		.79					.11			.60					1.50	.82
May							.11	.60	.58					.81	1.86			.28					.62									4.86	3.50
June								.46		.19										.51	.97	1.02	.21	.12		.11	.67					4.26	2.79
July	.62			.98	.39	.59			.83		.21	.34							.17		T	.15	.23					T			.47	3.98	3.87
August									.41														T				1.38	6.89	5.91			15.21	4.69
September			.47					.11	.71	.64	.23				.09		.59	.42	.72		T											2.98	4.43
October																							.29									.29	1.40
November						T																	T	T	.23	.48						.71	.64
December																														.47		.47	.57
Yearly																																36.71	25.07

Nueva Rosita, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1925-1938
January		.79	.32	.12					T	T					.33						.12	.16	.94						.59			3.37	.90
February			T																								.53					.53	.48
March														T																		T	.56
April																						2.76				1.02						3.78	1.45
May									.20						.51						.10											.81	2.71
June																							.41									.41	1.96
July						.41																2.20	.79	1.10			1.57		.32			4.82	2.27
August																																1.57	1.42
September														1.97	.31		.16															2.44	1.90
October																																.00	1.54
November																																.00	.81
December																																.00	.92
Yearly																																17.73	16.94

Nueva Laredo, Tamps.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1924-1938
January				.22	.08			.14														1.06										1.50	.85
February																					.02	.33						.19				.54	.75
March							.05															.41										.46	.70
April																	.55	.24														.79	1.05
May							.01		.12						.49								.81									1.43	3.09
June															.06							.54					.08					.68	1.48
July								.34																						.25	.08	.67	1.13
August	T	.01																									.10	.99	.09			1.19	1.10
September								.03	.03	.24	.02			.48			.32															1.07	2.63
October																																.05	.99
November																																.00	.93
December																								1.38	.83					.06		2.27	1.38
Yearly																																10.65	15.98

La Mariposa, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1921-1938
January				.09					.11				.27								.30	.30		.09								.80	.78
February																				.11												.47	.57
March	.60						.01	.09																								.70	.81
April																.51	.09					.29										.69	1.06
May		.27						.11	.03			.30		1.07											.18							1.96	3.00
June															.30						.03	.65	.32		.02		.04				.27	1.62	3.74
July																					.43	.45	.14		.96	.64			.22			2.84	3.01
August													.66	.01														1.49				2.16	2.38
September										.03			2.26		.31	.04																2.64	6.84
October																			.21		.58											.59	2.06
November																									Data	not	available	for	November				1.21
December																					.01		.20	.33								.54	.72
Yearly																																15.01*	25.52

Muzquiz, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1923-1938
January			.20	.19		T			.08		.04	T										1.18										1.69	.89
February											.20	T																	.59			.79	.43
March																						1.57										1.57	1.11
April																	.39	.20	T			.79										1.38	1.03
May			.20	T										.98																		1.18	3.56
June	.59															.39					.79	.59	.99	T								3.35	2.81
July																							.20	T			.22		T	.39		.59	2.41
August																														.59		.81	2.74
September														.98	.59	.34																1.91	6.12
October																					.59	.79										1.38	2.66
November																																.00	1.28
December																				T		T			.79	.59	T				.19	T	1.57	1.38
Yearly																																16.22	28.42

* Some Months Missing. ♯ Some Years Missing.

RAINFALL ON MEXICAN SIDE OF RIO GRANDE WATERSHED

INCHES

1938- continued

Don Martin, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1927-1938
January				.27	T	.01		.03												.09	.01	.46										.78	.91
February						.11																		.01	.02			.38				.61	.65
March	.02	.09					.22	.02														.10										.45	.72
April																	.44	.01					.68									1.13	1.42
May									.05	T					.37						T		.04									.46	2.16
June									.20												.05		.04				.54					.83	1.67
July								.02														2.58	.55					.76	.18	.46	4.55	1.68
August										.01	.01			1.28	.07		.33									.13	.27	3.76				4.16	1.67
September																																1.70	3.15
October																						.05										.05	1.60
November																																.00	.78
December																							.03	1.01	.23					.01		1.28	1.14
Yearly																																16.00	17.55

Anahuac, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Averaged 1933-1938
January			T	.35	.03	.20		.09													.04	.14										.85	1.08
February						.15	T								T		.04			.24	T	.45		T	T			.17				.60	.52
March	.26						.09	T	.02								.56	.03			.04	.01	.07								.11	.93	.65
April									.06						.78							.51										.71	1.04
May									.23											.23	.04	.31					.04	.04				1.35	2.44
June																																.89	.99
July								3.49																.73								4.22	1.73
August									.02	T																.02	1.44	.46		T	T	1.92	1.47
September										.21	.01			2.46	T		.20															2.68	3.97
October														T						.68		.06										.96	.91
November																																T	.51
December																							.06	.33	.66			.02		.10		1.17	1.18
Yearly																																16.28	16.45

Monclova, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1921-1938
January			T	.28																		.21										.49	.53
February						.12								T						T	T				T			.10				.22	.52
March	.28																T	.04					.08			T		T				.28	.54
April															.98													T				.12	.60
May								T	T	T	T										.75										T	1.75	1.71
June							.73			T										T	T	.98	.08	T			T	T				1.79	1.56
July	.20		T	T							.04											T	1.57	.79	1.57	T						4.13	2.23
August					T						T			.48	.98	T	.08								T		1.97	1.93				3.94	1.56
September																						.40										1.54	3.88
October																																.40	1.18
November																																.00	.47
December																									Data	not	available	for	December				.78
Yearly																																14.64*	14.96

Ramos Arizpe, Coah.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1926-1938
January				.02							T											T										.02	.57
February																									.04			.04				.08	.53
March	.49						.12	T									T															.61	.35
April																		.04					.16									.20	.33
May								.06	T					T	.06																	.12	1.16
June										.04						.02				.13	.06	.12	.02	1.73		.08	.12	.04				2.36	1.13
July	.06		.75	.63		.02					T							T					.37	.01	.59	.08			.84		3.35	1.87
August	.04	T	T	T						T	T	T															.22	2.71	.06			3.03	.95
September											.02						.12	.04	T	.04												.22	1.80
October																						T	T									T	.54
November							T																		.59							.59	.48
December																								1.10	T		.20		.47			1.77	.74
Yearly																																12.35	10.45

Monterrey, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1896-1938
January	T		.02	.51	.08		T	.08			T											T										.69	.71
February						T	T		T		T				T					T				.04	.04			.16				.24	.66
March	.43						.08	T													.03											.54	.77
April	.20	.06															T	.43			.06	.08	.07					T				.80	1.18
May	T						.04	.47	.14	T	T			.02	T								1.83	T									2.50	1.61
June								.10	T						T	.30			T	1.26	.73	T	T				.54	T				2.93	2.67
July	1.61	.04	.12																			T	1.02									1.20	2.50
August			T				T		.02		.55	T			4.02	.04	.02	T	1.40				.02	3.05		.28	11.48	1.39		.06	T	17.87	3.02
September										T												T	.01									5.85	5.90
October															T	.01									.45		.04	T				.01	3.25
November																																.50	1.49
December																							.01	.79	.25		.18			.35	.01	1.59	.88
Yearly																																54.72	24.66

Rayones, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Averaged 1926-1938
January											.05											.03					.09					.05	.84
February					.04									.08										.06								.30	.74
March	.12					.18																										.30	.22
April		.04															.05															.38	.41
May	.03	.01					.39			.09			.04	.28			.06		.01			.07	.11		.03		.22	.02	.02			1.09	1.38
June								.24			T			.36					.27	1.04	.37	.09				.06	1.09	.02				3.54	2.70
July															.20	T						.02	.33					.07	.44	.12		1.18	1.22
August	.38																						.07			1.26	6.91	1.60				10.22	2.63
September							.13		.01	.25			.23	.06	.17	.49	.24																1.58	3.22
October									.07													.10										.17	2.67
November																								.07	.52							.59	.92
December																							.11	.83		.26				.34		.54	.54
Yearly																																20.34	17.36

Villa de Santiago, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1925-1938
January	T	.03	.06	.26	.01		.17	.06		T		.04										.17	T		.01							.81	1.00
February												T	T		T					.05		T	T	.03	.14		.10					.32	1.29
March	.51						.04																			T	.04					.59	1.04
April	.19	.15															.15	.16			.03	.01	.09									.78	1.35
May	T	T	.01				.13	.69	.39	.09	.03			.54	.10								.31	.21								2.56	3.76
June								.88				.10		.94	1.38	.18				2.26	1.08	.39				.07	1.17					7.85	5.32
July			.48														.01						T	.83	.02	.06		1.12	10.57	.38	.53	2.29	3.84
August	.39	.02					.01	.25	.03	T	.10	.01			4.68	.02	.14	.16	1.15				T	T	.40								12.68	4.45
September			.02						.45																							6.57	9.94
October																						.27	.18									.90	5.22
November																											.02	.02	T	T		.04	1.77
December																							T	.51	.27		.22			.18		1.18	1.30
Yearly																																36.51	40.28

* Some Months Missing. ∮ Some Years Missing.

RAINFALL ON MEXICAN SIDE OF RIO GRANDE WATERSHED

INCHES

1938– continued

Montemorelos, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average ∮ 1926-1938
January	.09	.06	.18	.01	T	.02	.04	.02	.01	T	.02	.01	.01	.01	T	T	T	.01	T	.02	.07	T		T	T	.01	.01					.60	.95
February			T	.01		T				T				.11				.03	.20	.06			.03	.13	.05	.01	.31	.21				1.13	.46
March	T	.01	.01	T	.01	.07	T	.01	.08	.01	.01	T	.01		T	T					T	.02	T	T	.01		T	T	.01	T	.07	.34	.69
April	.02	T	.01	T												.20	.36	.01	T	.01	.02	.03	.01	.01	.02	.28	.05	T	T	.03		1.07	.90
May	T			T	.01	.54	.50	.24	.22	.02	.01	T	.40	.35	T		T	.01				.03	.43	.08	T	.13	.01					2.92	3.26
June							.04	T		T	T	.01		1.10	1.49				.10	.50	.01	T			.25	.69	.07					4.19	3.32
July							.05																1.81		.48			.31	.07	.38	3.13	1.42
August	.56	T	.39	T																	T	.03					.79	10.42	1.39	.04		13.39	2.00
September			.01		.01					.01	.07				.85		.06		1.98													2.97	2.50
October																							.14									.14	1.75
November																									.04	.28		.07	.04	.02		.45	1.20
December																								.30	.05		.20		.16			.71	.82
Yearly																															31.04	18.77

Cadereyta, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average ∮ 1926-1958
January	.01	.03	.59			.12	.11				.01				.02				.35	.01	.04		.06	.17			.79	.70				.91	1.33
February					.04	.15																										2.14	1.00
March									.02																						.03	.20	.91
April																2.37	T															2.37	1.27
May						.34	.32	.27	.27	.06			.39	.05	.02							.15	.08									1.95	3.20
June				.01										1.59					.12	.02	T					.04						1.78	6.03
July																							.96		.01	not	available		for	.14	.43	1.54	4.15
August																									Data					August			2.82
September									.02	1.18				.59	.20	1.10																3.09	4.01
October																				.12												.12	3.56
November																									.02		.01	T				.03	1.39
December																							.40	.01	.02			.01				.44	.91
Yearly																																14.57*	31.08

Las Enramadas, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1926-1958
January			.31	.33	.20			.14	T					T				T		.35	T	.12										1.10	1.16
February						T	T	T	T	T					.02						.07			.14	.11	.02	T	.49					1.20	.65
March	.22	.04					.02	T			T																					.28	.64
April																	.57	.07	T													.64	1.27
May																									Data	not	available	for	May				3.68
June																									Data	not	available	for	June				2.95
July																									Data	not	available	for	July				3.76
August	.32																										.79	4.76	.39			6.26	3.58
September				.30			.29	.26	.20	.10								1.04														2.19	5.44
October																																.00	1.49
November																										.03		.02	.02			.07	.89
December																									Data	not	available	for	December				.97
Yearly																																11.74*	26.58

Higueras, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1926-1958
January				.49				.12				.10																.83				.71	1.11
February						.35		.28												.33					.18							1.69	.79
March	.90																															1.18	.53
April																	.45	1.06				.06	.61									2.18	1.08
May								.22	.25														.26	.08			.13					.94	2.03
June																.25				.31	.71	.69					1.00					2.96	2.36
July					.24																		.24	1.73					1.14		3.35	2.96
August	.09																							.06			.69	3.07	2.95			6.86	3.16
September											.11				.85				.27													1.23	5.59
October																																.00	1.74
November																											.06	.08				.14	1.14
December																							.02	.69	.12	.08				.30		1.21	1.11
Yearly																																22.45	23.60

Gral. Bravo, N. L.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal* 1926-1958
January			.05	.02			.03								T				.83		T			T								.10	.93
February																																.83	.49
March	T						T															T									T	T	.51
April			T												.17	.01						T										.18	.88
May						T		.31	.12			T							.47	.12		1.10	.16		T	.31	T					1.69	3.38
June															.16																	1.06	2.63
July																																.00	2.99
August																									T		6.50	T				6.50	2.85
September					T	T	.98	.87	T						T			1.10														2.95	4.14
October									T										T			T										T	1.17
November																									T	T						T	.63
December												T					T											T	.71			.71	3.11
Yearly																																14.02	21.11

Matamoros, Tamps.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal∮ 1913-1938
January			T	.17	.11		.01	.14	.07	T	T	T								T	.16	.01	.02						.06			.77	1.46
February							T	T															.23									.19	1.05
March	.06						.02	1.57							T								T									1.78	1.04
April	T	.01			T													.43	.34					4.18		T						.78	1.64
May				.03			T	.01	.04	.32		T	T	.01	1.54					.29	1.35	.83	.05			.06	.03					6.13	3.27
June													T	.02	.22	.23			.03													3.11	2.88
July																					.01					.06						.07	2.67
August	T			T							T										T		T		.28		.72	2.81		T	T	3.81	1.86
September					T	T	T	T	.46	.19	.95		2.34					T							T								3.24	5.55
October					T		T		T	T	.29			T								.30										.49	2.89
November			.06				.15											T					.46			.06	.18			.01		.92	1.77
December	T													.30					T		.02	.04	.11	.54	.08					24		1.33	1.93
Yearly																																22.62	27.99

* Some Months Missing. ∮ Some Years Missing.

EVAPORATION FROM FREE WATER SURFACES IN THE RIO GRANDE BASIN

Five types of pans are used for determining evaporation from free water surfaces in the Rio Grande basin below San Marcial, New Mexico. The results reported below are inches evaporation from such pans.

1. Circular land pan 4 feet in diameter and 10 inches deep, made of 22 gage galvanized iron, set on wooden platform on top of ground. Water in pan kept at about 7 to 8 inches depth. Measurements by micrometer hook gage. This type of pan was used at Elephant Butte, State College, Dilley and all Mexican stations.

2. Circular land pan 6 feet in diameter and 2 feet deep, made of 20 gage galvanized iron, set with top of pan 4 inches above ground. Water in pan kept at about 16 to 18 inches deep. Measurements by micrometer hook gage. This type of pan was used at Balmorhea and Weslaco.

3. Circular land pan 10 feet in diameter and 22 inches deep, set with the top edge of the pan about 1-1/2 inches above ground. Water in the pan is kept about 17 inches deep. Measurements by micrometer hook gage. This type of pan is used at Winterhaven.

4. Thirty-six inch square floating pan 18 inches deep kept filled to about 15 inches deep. Made of 20 gage galvanized iron with metal floats of the same material at each end. The top of the pan is kept about 3 inches above the water outside the pan. The pan floats in a metal water tank 5 feet deep and about 45 feet in diameter which is kept full within a few inches of the top. Measurement by fixed point gage in center of pan and a dipper of known volume for refilling the pan up to the gage point. This type of pan was used at Jornada, New Mexico.

5. An evaporometer developed by the United States Section of the International Boundary Commission. This evaporometer was calibrated against a standard Weather Bureau pan, and was used at American Dam, Texas.

The United States Weather Bureau furnished the records for Elephant Butte, Jornada, Mesilla Park, Dilley and Balmorhea. From Texas A & M College comes records for Winterhaven and Weslaco. Records for all Mexican stations are from the Meterological Service of Mexico.

	Elephant Butte Dam, N. M.		Jornada, N. M.		State College, N. M.		American Dam, Texas	
	1938	Normal 1924 to 1938	1938	Normal 1929 to 1938	1938	Normal 1924 to 1938	1938	
Jan.	3.56	2.82	2.89	2.91 *	3.02	2.99	3.96	
Feb.	5.71	4.34	4.07	4.17 *	4.60	4.43	3.83	
Mar.	10.27	7.70	7.08	7.49 *	8.49	7.58	8.64	
April	13.14	10.30	9.82	9.83 *	10.28	9.63	10.28	
May	15.60	12.49	13.25	12.36 *	13.06	11.39	¤ 14.00	
June	16.82	14.41	14.73	13.15 *	12.72	12.52	13.87	
July	12.87	12.52	10.67	11.70	10.72	11.48	10.70	
Aug.	14.16	10.98	12.64	10.24	11.88	10.01	12.48	
Sept.	7.71	8.63	7.76	8.59	7.70	7.97	6.94	
Oct.	8.32	6.85	6.99	6.56	6.84	6.05	6.88	
Nov.	5.79	4.27	4.23	3.99	4.51	3.88	6.37	
Dec.	3.61	2.62	2.85	2.47	3.20	2.62	4.62	
Yearly	117.56	97.93	96.98	93.46	97.02	90.55	102.57	

	San Buenaventura, Chih.		Balmorhea, Texas		Winterhaven, Texas		Palestina, Coah.		Dilley, Texas	
	1938	† Normal 1928 to 1938	1938	Normal 1926 to 1938	1938	Average 1931 to 1938	1938	Average 1935 to 1938	1938	Normal 1928 to 1938
Jan.	3.51	3.83	2.30	2.59	2.04	1.87	7.23	5.44	2.49	2.65
Feb.	4.60	4.74	2.52	3.51	2.16	2.61	5.95	5.24	3.08	3.49
Mar.	7.90	7.32	5.46	5.35	4.74	4.78	7.13	8.05	5.17	5.93
Apr.	9.94	9.19	6.37	6.46	4.85	5.59	9.76	9.60	5.82	7.12
May	11.80	10.76	7.93	7.51	6.44	6.48	10.12	10.43	7.40	8.00
June	9.68	10.98	7.08	8.12	8.59	8.05	10.74	10.94	9.48	9.59
July	8.35	8.93	6.05	7.79	9.21	8.41	11.55	11.52	11.49	10.43
Aug.	7.97	7.49	6.72	7.03	9.01	8.54	11.22	12.31	10.88	10.51
Sept.	6.30	6.86	4.93	5.37	6.92	6.14	10.24	9.16	8.43	7.36
Oct.	6.44	6.00	4.31	4.26	5.51	4.80	9.95	8.62	7.56	5.92
Nov.	4.67	4.21	3.50	3.04	3.74	3.12	8.16	7.32	4.73	3.55
Dec.	3.22	3.18	2.10	2.08	2.36	1.83	5.62	5.99	3.31	2.50
Yearly	84.38	83.49	59.27	63.11	65.57	62.22	107.67	104.62	79.84	77.05

	Don Martin, Coah.		Cd. Anahuac, N. L.		Linares, N. L.		Weslaco, Texas	
	1938	† Normal 1927 to 1938	1938	† Average 1933 to 1938	1938	Average 1935 to 1938	1938	Average 1932 to 1938
Jan.	3.75	3.67	2.56	2.57	2.51	2.70	1.97	2.43
Feb.	4.45	4.71	2.69	3.42	2.62	3.42	2.94	2.94
Mar.	8.67	8.24	6.06	6.17	4.92	5.13	4.28	4.44
Apr.	9.44	9.92	7.34	7.85	5.41	5.69	5.22	5.42
May	11.91	11.40	10.17	8.95	6.33	6.19	5.90	5.98
June	13.24	13.27	13.25	11.19	6.82	7.37	6.71	6.90
July	13.68	13.40	11.62	10.75	7.95	7.03	8.50	6.61
Aug.	8.28	13.20	10.98	10.87	7.79	7.52	6.64	6.84
Sept.	8.04	9.24	6.49	6.97	4.22	4.97	4.80	4.43
Oct.	7.51	7.04	5.68	5.21	4.27	4.35	4.77	4.65
Nov.	5.49	4.68	4.07	3.50	3.48	2.92	3.49	3.34
Dec.	3.87	3.26	2.71	2.28	2.16	2.06	2.54	2.34
Yearly	98.33	102.03	83.62	79.73	58.48	59.35	57.76	56.32

* 9 year average. ¤ Estimated. † Some months' records are missing, see previous Water Bulletins