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WATER BULLETIN NUMBER 3

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Flow of the Rio Grande  
and  
Tributary Contributions

*From San Marcial, New Mexico to the Gulf of Mexico*  
For the Year 1933

*And at Certain Mexican Gaging Stations For the Years*  
1929 and 1930

ANALYSES OF WATER SAMPLES

*for*

*Silt, Chemical Constituents and Bacteria*

*and*

STORED WATER IN LARGE RESERVOIRS OF THE  
RIO GRANDE BASIN

1933

EVAPORATION FROM FREE WATER SURFACES

1924 - 1933

## CONTENTS

	Page
Map of Rio Grande Basin.....	2
Foreword .....	3
Stream Flow Records - 1933	
Rio Grande at San Marcial Station.....	4
El Paso Station .....	5
Tornillo Bridge Station.....	6
Fort Quitman Station .....	7
Upper Presidio Station .....	8
Lower Presidio Station .....	9
Alamito Creek Station.....	10
Terlingua Creek Station.....	11
Rio Grande at Boquillas Station.....	12
Lozier Creek Station.....	13
Rio Grande at Langtry Station.....	14
Pecos River Station.....	15
Goodenough Spring Station.....	16
Devils River Station.....	17
Cienegas Creek Station.....	18
Rio Grande at Del Rio Station.....	19
San Felipe Creek Station.....	20
Sycamore Creek Station.....	21
Pinto Creek Station.....	22
Rio San Diego Station.....	23
Las Moras Creek Station.....	24
Rio San Rodrigo Station.....	25
Rio Grande at Eagle Pass Station.....	26
Rio Escondido Station.....	27
Rio Grande at Laredo Station.....	28
Dolores Creek Station.....	29
Rio Salado Station.....	30
Rio Grande at Zapata Station.....	31
El Tigre Arroyo Station.....	32
Rio Alamo Station.....	33
Rio Grande at Roma Station.....	34
Rio San Juan Station.....	35
Los Olmos Creek Station.....	36
Rio Grande at Rio Grande City Station.....	37
Hidalgo Station .....	38
North and South Floodway Stations.....	38
Rio Grande at Matamoros Station.....	39
Diversions from Rio Grande between Upper and Lower Presidio Stations.....	40
Chemical Analyses of Water Samples from Rio Grande and Tributaries - 1933	
Rio Grande Water at San Marcial Station.....	41
El Paso Station .....	41
Fabens, Texas .....	41
Fort Quitman Station .....	42
Roma Station .....	42
Rio Grande City Station .....	42
Springs on American Side of Rio Grande.....	42
Springs on Mexican Side of Rio Grande.....	43
Chemical and Bacteriological Analysis of Rio Grande Water at Nuevo Laredo.....	44
Silt Sampling of Rio Grande Water at San Marcial Station.....	45
Roma Station .....	46
Stored water in Large Reservoirs of the Rio Grande Basin.....	47
Evaporation from Free Water Surfaces - 1924 to 1933	
at Santa Fe, New Mexico.....	47
Elephant Butte, New Mexico.....	48
Mesilla Park, New Mexico.....	48
Balmorhea, Texas .....	48
Winterhaven, Texas .....	48
Dilley, Texas .....	48
Don Martin, Nuevo Leon.....	49
Monterrey, Nuevo Leon.....	49
Saltillo, Coahuila .....	49
Weslaco, Texas .....	49
Back Water at Roma Station 1929 to 1933 incl.....	50
Stream Flow Records 1929 and 1930.....	50
Rio Grande at Upper Presidio Station.....	51 and 52
Lower Presidio Station.....	53 and 54
Laredo Station .....	55 and 56
Rio Salado Station .....	57 and 58
Rio Alamo Station .....	59 and 60
Rio San Juan Station .....	61 and 62
Rio Grande at Matamoros Station.....	63 and 64



## FOREWORD

This compilation of stream discharge and related data is the third 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 certain 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 1933.

International stream gaging was begun in 1897, 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. 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.

This cooperative arrangement for obtaining hydrographic 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 Laredo, Texas, and Matamoros, Tamaulipas, were operated in 1933 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

Data published herein relative to chemical and bacteriological analyses, silt, stored water, and evaporation, as well as stream flow records for 1929 and 1930, have been furnished by the following agencies within the two countries. Specific acknowledgment is made herein where the data appears. United States Department of Agriculture, United States Bureau of Reclamation, Agricultural and Mechanical College of Texas, 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., and the Mexican Department of Agriculture and Development.

## STREAM GAGING STATION RECORDS - 1933

The records of the various gaging stations appear in this publication in the same sequence as they naturally occur in passing down the river.

There is here reported the results of measurements at sixteen points along the Rio Grande and the contributing flow from twenty tributaries. The flow of the Rio Conchos was not measured directly, but its flow may be calculated by taking the difference in flow at the Upper Presidio and Lower Presidio stations and adding thereto the diversions between the Upper and Lower Presidio stations. These diversions are reported herein. Flood flows in the North and the South Floodways on the American side near McAllen, Texas, are also reported here.

## CHEMICAL ANALYSES OF WATER SAMPLES FROM RIO GRANDE AND TRIBUTARIES - 1933

Collected here are the available data with reference to the quality of the water of the Rio Grande and tributaries near their confluence for the year 1933, with reference to its use particularly for irrigation.

## CHEMICAL AND BACTERIOLOGICAL ANALYSES OF RIO GRANDE WATER

For the year 1933 there is shown the chemical and bacteriological analyses of water from the Rio Grande at Nuevo Laredo, Tamaulipas, with reference to its use for domestic water supply purposes.

## SILT SAMPLING OF RIO GRANDE WATER

Silt sampling data are presented here for the year 1933. They are of particular value when considering the probable life of storage reservoirs on the river.

## STORED WATER IN LARGE RESERVOIRS OF THE RIO GRANDE BASIN

There is shown here the quantity of water in storage on the last day of each month of 1933 in the large reservoirs of the Rio Grande basin.

## EVAPORATION FROM FREE WATER SURFACES

For estimating evaporation losses from reservoirs, there are collected here experimental results from pertinent evaporation stations in and adjacent to the Rio Grande basin from 1924 to 1933 inclusive.

## STREAM GAGING STATION RECORDS - 1929 and 1930

Discharge records for certain Mexican maintained gaging stations on the Rio Grande and tributaries are published here covering the years 1929 and 1930.

## RIO GRANDE AT SAN MARCIAL STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located at new railroad bridge about one mile below San Marcial, New Mexico. Zero of gage is 4,455.38 feet above United States Coast and Geodetic Survey sea level datum.

**Records:** Based upon 207 current meter measurements at cable about 1,000 feet above new railroad bridge. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** January, 1895, to December, 1933.

**Remarks:** January 25, 1895, gage at A. T. & S. F. railroad bridge  $\frac{3}{4}$  mile below San Marcial with gage zero at 4,444.75. May 28, 1920, dike broke above gage resulting in establishment of gage June 14, 1929, on highway bridge  $\frac{1}{2}$  mile above San Marcial with gage zero 4,452.33. Beginning July 23, 1920, old gage at railway used again. May 6, 1921, same dike broke and from May 10, 1921, two channels were metered until February 16, 1922, after which a new gage with zero at 4,461.53 on highway bridge  $\frac{1}{2}$  mile above San Marcial was used. The zero of this gage changed to 4,463.33 on May 3, 1922, and to 4,462.33 on December 29, 1923. Gage zeros reported here are all in feet above United States Coast and Geodetic Survey mean sea level datum. March 13, 1932, gaging station moved to its present location.

There are many irrigation diversions above this station in New Mexico and Colorado which modify the river flow. With all closed basins eliminated the drainage area above this station is 27,806 square miles, all in the United States.

**Previous Extreme Flows:** The greatest flow ever recorded occurred September 24, 1929, when the peak gage reading was 7.80 and the peak flow was estimated to have been 47,000 second feet. The river is sometimes dry. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	*290	864	642	370	163	3,810	1,380	292	156	168	211	509
2	*310	760	652	390	148	3,810	1,240	378	146	146	214	525
3	*409	703	627	423	835	3,670	956	683	*76.5	110	217	649
4	*438	712	709	405	640	3,940	788	953	*40.4	100	234	832
5	*474	757	666	369	815	4,180	*631	1800	*20.1	92	250	894
6	*511	754	704	287	673	3,600	*704	2940	*13.6	182	271	640
7	*694	715	942	326	648	3,170	856	2980	*7.0	206	307	650
8	*1010	*260	940	289	866	2,930	1,020	2260	*4.3	275	429	580
9	*926	*225	814	272	1,680	2,520	1,120	1390	*1.6	583	526	628
10	835	*520	808	325	1,100	2,280	*764	1460	*17.7	472	432	547
11	762	*396	739	355	722	1,870	*443	896	1710	424	437	612
12	*761	*380	791	264	670	1,630	274	615	1380	351	440	734
13	819	478	776	182	687	1,910	465	351	1000	307	426	776
14	900	726	984	173	695	1,800	273	240	4670	294	435	708
15	821	893	1,180	191	630	2,880	229	175	2260	*280	439	684
16	825	883	1,280	197	517	3,060	545	132	1030	280	433	691
17	802	875	1,100	239	508	3,040	925	121	1260	*280	466	821
18	793	835	1,060	179	477	4,210	2,360	94.5	1060	*283	447	862
19	747	904	842	154	358	4,000	2,080	87.0	683	287	427	879
20	792	945	867	187	282	7,340	932	58	709	*290	430	775
21	899	730	884	204	213	9,540	*648	24.1	437	278	478	810
22	778	691	890	174	2,380	16,250	*373	16.8	302	*265	401	919
23	816	667	857	231	3,310	10,400	*310	5.63	1230	268	338	748
24	810	645	667	382	4,090	6,470	*883	6.17	1220	*270	358	731
25	805	669	587	531	3,920	5,450	2,040	18.8	695	265	398	746
26	761	739	571	472	3,350	4,280	2,110	47.7	*420	260	441	685
27	870	858	*584	351	3,410	2,890	1,400	58	*244	225	394	826
28	848	867	*520	251	3,200	2,630	604	227	195	190	368	931
29	809	.....	*455	166	3,350	2,360	*784	239	189	190	440	896
30	723	.....	*391	157	3,590	1,880	*470	319	166	189	520	915
31	719	.....	*398	.....	3,700	.....	*242	229	.....	204	.....	1090

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	ICE	5.05	1,010	635	734	45,140	
February.....	5.67	4.23	1,100	*145	695	38,580	
March.....	5.88	*4.86	1,480	359	772	47,460	
April.....	5.38	4.66	660	122	283	16,850	
May.....	6.95	4.64	4,530	112	1,536	94,470	
June (22).....	8.87	5.00	20,640	1,510	4,260	253,490	
July.....	7.35	3.52	5,110	127	898	55,240	
August (23).....	7.66	2.66	5,930	1	616	37,880	
September.....	8.69	.....	14,180	1	711	42,330	
October.....	4.94	3.73	698	59	259	15,900	
November.....	5.36	4.62	606	190	387	23,020	
December.....	6.20	5.09	1,530	425	751	46,200	
Yearly.....	8.87	2.66	20,640	1	990	716,560	25.77

\*Partly Estimated

## RIO GRANDE AT EL PASO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located in the pass opposite Courchesne quarry, four miles northwest of El Paso, Texas. Zero of gage is 3,720.65 feet above United States Coast and Geodetic Survey mean sea level datum.

**Records:** Based upon 141 current meter measurements during the year by wading and from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May, 1897 to December, 1933. Records are also available for station at old Fort Bliss, 1,500 feet above International Dam and three miles below present station, from May, 1880 to June, 1893, and for station at pump house of Smelter Company, one mile below present station, from January, 1895 to May, 1897.

**Remarks:** There are many irrigation diversions above this station in Texas, New Mexico and Colorado. The river flow is regulated at Elephant Butte reservoir. With all closed basins eliminated the drainage area above this station is 32,819 square miles, all in the United States.

**Previous Extreme Flows:** The greatest flow ever recorded was on June, 12, 1905, when the mean daily flow reached 23,700 second feet. Prior to 1916 the river sometimes was dry. Numerous records of extremes may be found in Water Bulletin No. 1.

*Mean Daily Discharge in Second Feet and Annual Summary, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	263	162	575	1,050	945	1,050	1,290	1,050	1,600	715	263	238
2	243	159	450	1,110	890	986	1,330	1,140	1,640	820	240	233
3	234	147	425	1,170	827	974	1,120	1,360	2,290	697	251	222
4	217	176	420	1,090	948	1,160	1,120	2,770	1,580	723	218	273
5	218	415	444	1,090	960	1,100	1,250	3,550	1,280	737	395	405
6	239	666	445	1,160	889	1,060	1,170	2,010	1,170	764	481	524
7	241	693	558	1,100	946	1,050	1,040	1,930	1,120	844	513	667
8	233	701	518	1,100	972	1,120	1,020	1,590	1,100	874	657	775
9	220	567	516	1,050	760	1,140	970	1,260	1,340	645	597	582
10	213	599	476	1,400	722	1,130	1,230	1,190	1,550	576	372	394
11	208	610	496	1,170	712	1,160	1,050	1,310	1,310	530	349	327
12	201	582	498	1,120	898	1,160	913	1,440	1,070	496	302	288
13	199	543	500	1,160	961	1,300	970	1,560	1,200	465	275	298
14	201	394	537	1,230	1,120	1,410	1,100	1,700	1,130	456	262	263
15	174	310	594	1,220	1,300	1,480	1,210	1,370	1,200	459	260	242
16	185	325	562	1,340	1,220	1,510	1,160	1,270	1,000	474	237	255
17	194	324	561	1,230	1,170	1,580	1,550	1,240	1,190	488	242	263
18	188	330	596	1,030	1,140	1,630	4,010	1,040	1,070	593	230	403
19	170	268	673	1,050	1,020	1,510	2,610	1,080	879	568	424	516
20	161	311	708	1,140	971	1,470	1,350	1,220	806	609	435	527
21	150	517	847	1,130	1,150	2,010	1,560	1,480	900	627	497	593
22	148	413	771	1,000	1,250	1,910	1,440	1,240	921	620	583	617
23	155	496	739	1,210	1,210	2,270	1,390	1,190	836	550	356	721
24	159	557	728	1,130	1,180	1,260	1,500	1,290	854	425	302	639
25	155	592	742	1,040	1,200	1,240	1,370	1,330	942	393	297	447
26	159	595	775	1,160	1,110	985	1,260	1,490	705	339	281	395
27	158	559	888	1,120	1,020	997	1,160	2,150	753	314	266	354
28	162	525	968	950	1,120	1,470	1,140	2,040	726	290	261	305
29	166	...	926	868	1,160	1,410	1,160	1,750	748	290	248	246
30	175	...	954	893	1,100	1,350	1,060	1,570	706	290	222	240
31	171	...	1,100	...	1,140	...	1,140	1,610	...	285	...	230

Month	Gage Height		Second Feet		Acre Feet		
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January (22).....	1.66	1.27	389	148.	192	11,820	
February.....	2.41	1.28	735	148	448	24,870	
March.....	2.84	1.86	1,200	359	645	39,650	
April.....	3.17	2.32	1,610	848	1,117	66,470	
May.....	2.85	2.13	1,380	645	1,030	63,490	
June.....	3.98	2.41	2,830	918	1,329	79,110	
July.....	5.78	2.60	4,940	864	1,343	82,600	
August (5).....	5.78	2.43	5,010	937	1,555	95,640	
September.....	4.18	2.31	2,870	650	1,121	66,680	
October.....	2.61	1.65	960	277	547	33,630	
November.....	2.43	1.44	709	180	344	20,460	
December.....	2.48	1.53	885	198	403	24,760	
Yearly.....	5.78	1.27	5,010	148	841	609,180	18.6

## RIO GRANDE AT TORNILLO BRIDGE STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located at highway bridge 2 miles west of Tornillo, El Paso County, Texas. Zero of gage is 3,578.63 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 83 current meter measurements during the year by wading and from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** October, 1927 to December, 1933. Station maintained for several years prior to October, 1927, by United States Bureau of Reclamation.

**Remarks:** The river flow is greatly modified at this station by irrigation diversions into Mexico and the United States and by Elephant Butte reservoir in the United States.

**Previous Extreme Flows:** The greatest flow ever recorded was on August 14, 1929, when the extreme gage height was 14.72 feet and the extreme flow was 3,440 second feet. The river is sometimes dry. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	225	153	230	146	223	182	404	197	668	119	208	190
2	133	148	215	183	221	99.6	476	120	722	155	189	191
3	200	146	169	210	183	115	423	208	835	173	200	203
4	208	145	122	194	228	153	281	341	1,040	169	206	204
5	212	130	97.2	102	386	174	219	492	819	217	218	195
6	174	131	111	57.6	316	98.4	262	719	466	332	248	237
7	194	319	101	94.1	240	77.9	193	1,450	350	333	146	134
8	189	399	114	76.1	184	88.1	168	1,310	260	338	45.1	128
9	178	367	133	177	113	120	225	514	329	389	52.4	377
10	171	330	86.9	187	*25.2	124	142	227	627	462	62.8	458
11	199	335	56.2	272	*10.2	235	147	178	785	422	150	303
12	197	350	55.4	253	*2.1	201	66.5	230	544	370	246	149
13	188	321	103	266	*0.7	160	28.5	498	349	478	263	232
14	185	275	51.1	380	120	389	16.4	610	333	440	261	232
15	185	232	9.2	388	232	582	37.9	585	257	394	207	226
16	178	137	7.9	425	255	667	208	412	334	375	186	202
17	174	156	15.8	507	197	722	195	246	402	359	179	179
18	171	124	19.6	345	210	844	319	305	354	317	174	148
19	177	98.3	38.8	238	198	904	749	182	254	381	177	143
20	174	119	121	210	116	759	1,200	171	156	386	250	234
21	158	89.1	129	267	138	867	1,460	281	98.9	302	335	451
22	145	181	194	279	179	1,010	862	341	158	220	79.0	331
23	136	199	176	318	197	1,100	561	227	161	219	41.5	164
24	137	210	59.0	373	217	1,270	561	238	178	219	50.3	314
25	151	244	7.2	319	218	1,530	622	302	202	95	10.7	408
26	149	274	28.2	315	249	1,110	592	308	262	64.8	46.4	263
27	149	295	106	371	242	503	502	528	149	92.3	57.1	158
28	149	268	65.2	370	294	436	431	756	136	284	11.9	202
29	150	.....	113	264	325	617	378	770	89.1	255	148	206
30	152	.....	29.2	236	246	494	355	768	96.3	215	196	176
31	153	.....	18.6	.....	186	.....	262	660	.....	213	.....	173

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	10.84	10.35	251	103	172	10,590	
February.....	11.94	9.93	506	70.7	221	12,250	
March.....	11.02	9.28	250	0.2	89.8	5,520	
April.....	11.65	9.38	597	33.6	261	15,520	
May (13).....	11.27	9.10	469	0.2	192	11,800	
June.....	13.13	9.93	1,620	73.7	521	31,010	
July.....	13.28	9.18	1,590	10.6	398	24,490	
August (8).....	13.36	9.74	1,680	64.2	457	28,110	
September.....	12.42	9.92	1,110	61	380	22,640	
October.....	11.47	9.90	505	40.2	283	17,430	
November.....	11.38	9.50	423	*10	155	9,250	
December.....	11.69	10.40	548	62	233	14,300	
Yearly.....	13.36	9.10	1,680	0.2	280	202,910	

\*Partly Estimated

## RIO GRANDE AT FORT QUITMAN STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located at lower end of El Paso Valley, 1½ miles below Old Fort Quitman and 1½ miles south of Finlay, in Hudspeth County, Texas. Zero of gage is 3,454.06 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 54 current meter measurements during the year by wading and from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** January, 1923 to December, 1933.

**Remarks:** There are many irrigation diversions above this station in New Mexico, Colorado, Texas, and Mexico. The river flow is regulated at Elephant Butte reservoir. With all closed basins eliminated the drainage area above this station is 34,450 square miles; 33,616 being in the United States and 834 in Mexico.

**Previous Extreme Flows:** The greatest flow ever recorded was on September 11, 1925, when the extreme mean daily gage height was 7.02 feet and the mean daily flow was 2,600 second feet. The smallest daily flow was 20 second feet. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	232	177	431	112	252	218	606	243	675	201	211	181
2	248	174	406	99.8	237	169	477	179	695	205	208	208
3	259	171	358	120	246	173	435	176	717	202	202	212
4	204	167	328	126	*222	158	429	162	793	221	210	214
5	214	159	305	158	*196	144	341	111	866	251	210	213
6	236	154	264	160	190	134	283	153	933	308	220	215
7	233	148	220	150	221	135	302	336	815	338	217	209
8	224	152	209	133	249	127	314	680	506	412	226	230
9	223	241	212	140	203	115	257	906	347	508	281	300
10	229	391	194	160	179	123	207	744	355	599	230	259
11	211	468	236	156	139	139	193	335	521	575	210	382
12	202	425	254	168	112	136	157	203	688	559	218	428
13	210	409	232	178	95.3	148	122	197	777	684	187	376
14	206	406	199	175	95.3	177	112	233	668	429	211	331
15	208	383	176	162	100	166	74	393	497	391	234	269
16	212	358	167	260	114	289	76	453	495	366	237	264
17	216	326	143	315	150	426	129	346	462	351	215	247
18	215	300	125	361	*185	574	110	242	483	350	222	246
19	206	281	126	328	*167	706	112	183	482	336	216	240
20	205	264	121	*269	154	766	271	191	387	304	212	233
21	205	253	124	*211	166	824	584	181	297	354	206	232
22	204	240	128	203	173	906	793	159	258	364	223	234
23	196	213	130	241	147	871	918	176	221	410	277	347
24	187	231	173	248	146	949	559	222	225	374	276	337
25	175	291	194	302	163	1,100	390	405	247	355	218	310
26	171	309	163	300	169	1,300	399	259	245	353	205	368
27	176	388	112	268	163	1,360	416	212	231	308	187	407
28	188	398	99.4	239	185	1,100	384	243	279	276	187	355
29	193	...	111	301	193	589	330	376	*215	227	203	305
30	191	...	101	326	184	605	296	447	197	224	209	250
31	177	...	107	...	229	...	274	476	...	233	...	246

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.13	1.63	264	169	208	12,810	
February.....	3.04	1.38	487	116	281	15,620	
March.....	2.83	1.05	449	90.2	198	12,200	
April.....	2.47	1.10	379	98.4	212	12,630	
May.....	2.17	0.96	299	91.8	175	10,760	
June.....	5.24	1.14	1,390	108	488	29,010	
July (15).....	4.38	1.26	978	57	334	20,530	
August.....	4.57	1.49	1,000	90	310	19,090	
September.....	4.35	1.77	963	181	486	28,910	
October (13).....	6.19	1.81	1,850	191	357	21,950	
November.....	2.60	1.86	305	165	219	13,030	
December.....	3.14	1.90	442	171	281	17,250	
Yearly.....	6.19	0.96	1,850	57	295	213,790	6.21

\*Partly Estimated

## RIO GRANDE AT UPPER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located 1 mile from Hazienda, Texas, 8 miles above the confluence of the Rio Conchos and about 10 miles northwest of the towns of Ojinaga, Chihuahua, and Presidio, Texas. Zero of gage is 2,579.40 feet above mean sea level, International Boundary Commission datum.

**Records:** Based on 24 current meter measurements during the year from cable car and by wading. Computations by shifting channel methods. 1933 records considered fair.

**Records Available:** 1900 to 1912; August, 1923 to 1926; 1928 to 1933.

**Remarks:** River flow is greatly modified at this station by Elephant Butte reservoir and diversions for irrigation in both the United States and Mexico. With all closed basins eliminated, the drainage area above this station is 37,488 square miles, of which 35,229 are in the United States and 2,259 in Mexico.

**Previous Extreme Flows:** The greatest flow ever recorded was in August, 1928, with a peak of 11,250 second feet. The river is sometimes dry. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	320	195	246	82.3	134	*22.5	*551	*223	*240	*209	414	204
2	304	197	254	76.4	*126	*29.5	*542	216	*350	*199	402	203
3	308	200	291	79.6	*132	*33.5	*902	213	*1,900	*174	391	205
4	292	197	305	77.3	141	*54.2	563	232	*972	175	375	211
5	273	194	325	73.3	147	*89.2	491	*280	*554	*176	364	223
6	269	197	333	64.2	138	*65.4	413	255	*507	*181	359	233
7	270	189	310	*58.6	131	44.7	374	173	*483	*208	357	227
8	259	177	291	*58.2	135	36.3	182	164	*505	*238	352	231
9	250	176	*271	*56.0	135	*32.9	164	161	*1,010	*284	350	228
10	248	173	*249	*53.9	113	31.2	165	160	718	*316	347	227
11	243	180	*226	*50.2	*92.9	25.1	*166	155	*880	*359	345	225
12	236	175	*214	*41.6	*85.8	*22.2	*162	319	*606	391	346	231
13	228	171	*191	32.0	*82.4	*20.7	*132	400	*874	531	336	228
14	226	288	*185	27.0	*66.6	*19.3	*102	279	*640	576	314	267
15	226	353	178	22.2	*53.2	*19.3	*89	*204	*468	615	281	312
16	219	352	177	26.1	*40.4	*19.1	*85	*145	*386	*579	245	308
17	217	365	170	*33.1	*33.1	*20.5	*91	124	*347	*460	222	297
18	214	374	161	*38.9	*33.2	*19.1	*100	125	*357	*435	208	285
19	210	368	154	40.7	*34.9	*19.1	198	133	*469	*431	221	260
20	208	349	161	44.2	36.4	*95.7	674	162	*467	*429	237	249
21	202	321	156	44.8	33.1	*369	297	147	*468	*425	236	236
22	203	295	138	89.7	29.7	*421	207	127	*478	*420	226	230
23	203	287	128	112	29.2	*436	183	*124	*558	*415	226	226
24	204	272	121	*112	31.8	*595	180	*113	*675	414	219	222
25	201	265	120	*109	26.9	*695	407	134	*311	413	214	212
26	199	250	115	*81.4	26.5	*700	498	124	*282	415	208	213
27	195	242	122	*69.0	*34.9	*671	395	176	*267	411	226	212
28	197	225	106	*80.0	25.6	*632	*324	195	*251	413	247	223
29	197	...	96.6	*92.8	20.8	*607	*282	227	*234	411	232	249
30	194	...	103	114	20.4	*581	*257	218	*216	413	217	272
31	193	...	97.1	...	*19.9	...	*234	*245	...	*412	...	307

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	5.70	5.09	327	189	233	14,300	
February.....	5.88	4.95	376	169	251	13,940	
March.....	5.80	4.60	340	93.0	193	11,890	
April.....	4.80	4.20	126	20.7	64.7	3,850	
May (31).....	4.96	4.18	157	17.3	70.6	4,340	
June.....	7.50	4.11	886	17.8	214	12,750	
July.....	8.50	4.68	*1,580	*89	304	18,660	
August.....	6.14	4.83	458	*110	192	11,810	
September (3)....	9.61	5.36	*2,570	*205	*549	*32,670	
October.....	6.93	5.04	794	174	372	22,870	
November.....	*5.86	5.17	417	204	291	17,290	
December.....	5.70	5.18	320	199	241	14,790	
Yearly.....	9.61	4.11	*2,570	17.3	247	179,160	4.78

\*Partly Estimated

## RIO GRANDE AT LOWER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car located about 2¼ miles above the international highway bridge at Presidio, Texas, and 1½ miles below the confluence of the Rio Conchos with the Rio Grande. The 60-foot mark on the gage is 2,560 feet above mean sea level, International Boundary Commission datum.

**Records:** Based on 28 current meter measurements during the year by wading and from cable car. Computations by shifting channel methods. 1933 records considered fair.

**Records Available:** 1900 to 1912; August, 1923 to 1926; 1928 to 1933.

**Remarks:** Station moved to its present location on June 14, 1932. The river flow is greatly modified by irrigation diversions and Elephant Butte reservoir in the United States, and by Boquilla reservoir on the Rio Conchos, as well as by irrigation diversions in Mexico. With all closed basins eliminated, the drainage area above this station is 60,109 square miles, of which 35,250 are in the United States and 24,859 in Mexico.

**Previous Extreme Flows:** The greatest flow ever recorded occurred October, 1904, with a mean daily flow of 149,210 second feet. The lowest recorded flow was 3.5 second feet in May, 1904. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,120	887	999	*726	*834	1,010	2,540	802	† 4,500	4,800	1,470	1,470
2	1,120	968	1,070	684	*780	687	2,170	789	†12,500	4,550	1,440	1,470
3	1,120	823	952	696	*796	636	*2,560	*815	*17,290	4,240	1,400	1,400
4	1,120	849	1,050	702	*771	780	*2,450	*824	18,300	4,030	1,390	1,400
5	1,120	929	1,080	679	*814	831	*2,590	*834	12,740	3,900	1,420	1,430
6	1,120	906	1,120	768	*741	893	2,220	*939	9,330	4,340	1,370	1,390
7	1,120	877	1,260	608	*717	1,200	1,760	*816	6,590	6,030	1,430	1,320
8	1,120	862	981	652	*681	1,070	1,440	826	5,660	5,690	1,430	1,350
9	1,120	927	1,040	668	*664	1,030	1,200	835	6,310	5,220	1,470	1,360
10	1,120	876	919	668	*640	841	1,160	815	8,280	4,730	1,520	1,300
11	1,150	826	944	669	*623	688	1,160	810	9,130	4,510	1,520	1,350
12	1,100	846	887	648	*600	715	*978	*804	8,110	4,540	1,530	1,450
13	1,010	1,150	905	766	*593	782	*836	*861	7,860	4,600	1,590	1,420
14	1,110	1,140	871	623	*576	1,120	*765	*1,980	10,880	4,300	1,660	1,380
15	1,060	1,070	837	763	*559	1,070	*698	*938	12,940	4,100	1,630	1,330
16	1,070	1,090	985	951	*546	1,070	*630	*1,090	19,770	4,010	1,690	1,260
17	1,090	924	790	1,110	*520	909	*592	6,050	21,260	3,780	1,710	*1,310
18	999	982	769	1,130	*479	892	*566	4,200	15,130	3,640	1,580	*1,490
19	1,050	1,100	811	1,470	*421	1,250	*601	2,670	12,560	3,410	1,510	*1,330
20	996	1,100	*814	1,160	432	1,720	*2,870	2,310	10,030	3,210	1,580	*1,330
21	987	982	*839	1,060	492	2,430	*1,360	2,330	8,400	3,020	1,590	*1,410
22	1,010	949	*784	1,060	528	2,440	935	2,500	6,490	2,910	1,550	*1,400
23	1,020	1,080	*794	1,040	478	2,450	879	1,520	6,770	2,730	1,520	*1,390
24	1,010	879	*790	*1,000	689	3,710	952	1,400	5,980	2,480	1,540	*1,380
25	1,000	898	*788	*1,000	836	4,530	1,020	1,400	5,100	2,310	1,530	*1,370
26	996	976	*786	*980	593	4,600	1,070	1,340	4,560	2,330	1,470	*1,360
27	988	966	*782	*946	584	4,210	969	*1,420	4,630	2,150	1,470	*1,340
28	964	964	*780	*939	634	3,610	897	*2,150	4,650	1,920	1,630	*1,330
29	971	...	*733	*918	686	3,350	857	*1,610	4,730	1,680	1,550	*1,320
30	1,000	...	*891	*860	610	3,060	838	†1,400	4,880	1,600	1,450	*1,310
31	992	...	*897	...	1,160	...	819	†1,500	...	1,520	...	*1,300

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	*63.05	*62.50	1,220	841	1,060	65,010	
February.....	63.16	62.45	1,300	748	958	53,210	
March.....	63.23	62.30	1,400	683	902	55,430	
April.....	63.26	61.90	1,550	564	866	51,460	
May (20).....	63.14	61.72	1,480	388	648	39,820	
June.....	65.98	62.03	6,240	601	1,786	106,280	
July.....	65.05	61.80	4,230	530	1,303	80,100	
August.....	66.27	62.23	7,260	789	*1,567	*96,350	
September (17).....	72.43	.....	27,030	12,500	9,512	566,010	
October.....	65.90	62.84	6,230	1,500	3,622	222,710	
November.....	63.05	62.74	1,760	1,360	1,521	90,530	
December.....	62.77	62.28	*1,670	*1,230	*1,369	*84,200	
Yearly.....	72.43	61.72	27,030	388	2,087	1,511,110	25.1

\*Partly Estimated  
†Estimated

## ALAMITO CREEK STATION NEAR PRESIDIO, TEXAS

**Description:** Automatic water-stage recorder, about 1,000 feet above confluence with the Rio Grande, and 6 miles below Presidio, Texas. Zero of gage is 2,545.00 feet above mean sea level, International Boundary Commission datum.

**Records:** Based upon 4 current meter measurements by wading during the year and by numerous estimates by the hydrographer at low flow. 1933 records considered poor.

**Records Available:** January 1, 1932 to December 31, 1933.

**Remarks:** The flow of this spring fed creek is modified by a small irrigation diversion  $\frac{1}{4}$  mile above the station. 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.

**Previous Extreme Flows:** The greatest flow recorded occurred Sept. 6, 1932, with a gage height of 5.93 feet and a flow of 5,680 second feet. The lowest recorded flow was .87 second foot on several days in 1932. On Oct. 2, 1932, backwater from the Rio Grande caused a gage height of 8.33 feet.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.74	*2.86	*2.75	*3.83	2.60	7.00	3.0	6.2	4.0	6.0	5.0
2	2.5	2.69	*2.86	*2.31	*3.26	2.60	6.00	*36.5	6.0	4.0	6.0	5.0
3	2.5	2.69	*2.86	*2.31	*3.26	2.60	5.00	*6.5	111.0	4.0	6.0	5.0
4	2.5	2.69	*2.86	*2.31	*3.26	2.60	5.00	5.0	371.0	5.0	6.0	5.0
5	2.5	3.40	*2.86	*2.31	*3.26	2.60	5.00	5.0	125.0	5.0	6.0	5.0
6	2.5	3.40	*3.00	*2.31	*3.26	2.60	5.00	5.0	14.0	5.0	6.0	5.0
7	2.5	3.40	*3.00	*2.31	*3.26	2.60	5.00	5.0	12.0	5.0	6.0	5.0
8	2.5	3.40	*3.00	*2.31	*3.26	2.60	5.00	5.0	327.0	5.0	6.0	4.0
9	2.5	3.40	*3.00	*2.31	*3.26	*54.20	5.00	5.0	255.0	7.0	6.0	4.0
10	2.5	3.40	*3.00	*2.31	*3.00	3.50	4.75	5.0	185.0	47.0	6.0	4.0
11	2.2	3.40	*3.14	*2.31	*3.00	3.00	4.50	5.0	14.6	15.0	6.0	4.0
12	2.3	3.00	*3.14	*2.31	*3.00	2.60	4.25	5.0	7.0	10.0	5.0	4.0
13	2.4	3.00	*3.14	*2.31	*3.00	2.00	4.00	4.0	95.0	10.0	5.0	4.0
14	2.5	3.00	*3.14	*2.31	*3.00	1.60	4.00	4.0	75.5	24.0	5.0	4.0
15	2.6	3.00	*3.14	*3.26	*3.00	1.60	4.00	4.0	7.0	10.0	5.0	4.0
16	2.7	3.00	*3.14	*3.26	*3.00	1.60	4.00	*24.8	7.0	9.0	5.0	4.0
17	2.69	3.00	*3.14	*3.26	*3.00	1.60	4.00	*11.9	7.0	8.0	5.0	4.0
18	2.69	3.00	*3.14	*3.26	*3.00	1.60	4.00	5.0	7.0	6.0	5.0	4.0
19	2.69	3.00	*3.06	*3.26	*3.00	1.60	4.00	5.0	6.0	6.0	5.0	4.0
20	2.69	2.86	*3.06	*3.26	*3.00	1.60	3.00	5.0	6.0	6.0	5.0	4.0
21	2.69	2.86	*3.06	*3.26	*3.00	1.75	3.00	4.0	5.0	6.0	5.0	14.0
22	2.69	2.86	*3.06	*3.26	*3.00	1.85	3.00	4.0	5.0	6.0	5.0	13.0
23	2.69	2.86	*3.06	*3.00	*3.00	1.95	3.00	4.0	4.0	6.0	5.0	13.0
24	2.69	2.86	*3.06	*3.00	*3.00	1.95	3.00	*5.5	4.0	6.0	5.0	13.0
25	2.74	2.86	*2.75	*3.00	*3.00	*84.50	3.00	*11.0	4.0	6.0	5.0	13.0
26	2.74	2.86	*2.75	*3.00	*3.00	12.00	3.00	*145.0	4.0	6.0	5.0	13.0
27	2.74	2.86	*2.75	*3.00	*3.00	12.00	3.00	*220.0	4.0	6.0	5.0	3.0
28	2.74	2.86	*2.75	*3.00	*3.00	10.00	3.00	*111.0	4.0	6.0	5.0	3.0
29	2.74	.....	*2.75	*3.83	*3.00	9.00	3.00	20.0	4.0	6.0	5.0	3.0
30	2.74	.....	*2.75	*3.83	*3.00	8.00	3.00	8.6	4.0	6.0	5.0	3.0
31	2.74	.....	*2.75	.....	*2.60	.....	3.00	7.0	.....	6.0	.....	3.0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.96	1.90	2.74	2.20	2.59	159	
February.....	1.92	1.91	3.40	2.69	3.01	167	
March.....	.....	.....	*3.14	*2.75	*2.97	*183	
April.....	.....	.....	.....	*3.83	*2.31	*168	
May.....	.....	.....	.....	*383	*2.60	*189	
June.....	4.06	.....	*3,600	*1.60	80.1	477	
July.....	.....	.....	7.00	3.00	4.05	249	
August (27).....	4.45	1.52	*4,490	3.00	22.4	1,380	
September.....	4.22	.....	3,650	4.00	56.2	3,340	
October.....	2.29	.....	249	4.00	8.42	518	
November.....	.....	.....	6	5.00	5.37	319	
December.....	.....	.....	5	3.00	3.90	240	
Yearly.....	.....	.....	*4,490	1.60	10.21	7,389	4.91

\*Partly Estimated  
†Estimated

## TERLINGUA CREEK STATION NEAR TERLINGUA, TEXAS

**Description:** Automatic water-stage recorder and cable with sit down cable car located about 12 miles south of Terlingua, Texas, and 2½ miles above the confluence with the Rio Grande at the lower end of Santa Helena Canyon. Zero of gage is 2,191.04±.5 feet above mean sea level, United States Geological Survey datum.

**Records:** Based upon 2 current meter measurements, and several estimates by the hydrographer at low flows. 1933 records considered poor.

**Records Available:** January 1, 1932 to December 31, 1933.

**Remarks:** The flow of this spring fed creek is modified by small irrigation diversions 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 previous flow recorded was on May 28, 1932, when the extreme gage height was 15.30 feet, with a discharge of 24,080 second feet. The lowest flow recorded was in May, 1932, when the discharge was 1.0 second foot for several days.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	↑	↑	↑	*3.75	3.50	3.25	*43.3	6	*28.6	4.0	4.0	4.0
2				*3.75	3.50	3.25	*12.9	5	10	4.0	4.0	4.0
3				*3.75	3.50	3.25	*54.9	5	800	4.0	4.0	4.0
4				*3.75	3.50	3.25	9	5	75	4.0	5.0	4.0
5				*3.75	3.50	3.25	8	5	20	4.0	5.0	4.0
6				*3.75	3.50	3.25	8	5	10	4.0	5.0	4.0
7				*3.75	3.50	3.25	8	5	6	4.0	5.0	4.0
8				*3.75	3.50	*51.9	8	5	6	4.0	5.0	4.0
9				*3.75	3.75	*26.7	8	5	6	*24.3	5.0	4.0
10				*3.75	3.75	5.00	7	5	50	*270.0	4.0	4.0
11				*3.75	3.50	5.00	7	5	125	*364.0	4.0	4.0
12			3	*3.75	3.75	5.00	7	10	20	*139.0	5.0	4.0
13				*3.75	4.50	5.00	7	7	20	*176.0	5.0	4.0
14				*3.75	3.75	*5.43	7	7	600	*241.0	5.0	4.0
15				*3.70	3.50	4.00	7	7	75	*679.0	5.0	4.0
16	3	3		*3.70	4.50	4.00	7	7.7	23.3	*27.9	5.0	3.0
17				*3.60	3.50	4.00	7	7	*13.8	5.0	4.0	3.0
18				*3.50	3.25	4.00	7	7	8	5.0	4.0	3.0
19				*3.50	3.50	*6.28	7	8.6	6	5.0	4.0	3.0
20				*3.50	3.25	4.00	7	7	6	5.0	4.0	3.0
21				*3.50	3.25	4.00	7	7	6	5.0	4.0	3.0
22				*3.50	3.25	4.00	7	7	6	4.0	4.0	3.0
23				*3.50	3.25	4.00	7	7	6	4.0	4.0	3.0
24				*3.50	3.25	4.00	7	*36.2	5	4.0	4.0	3.0
25				*3.50	3.25	4.00	7	*15.1	5	4.0	4.0	3.0
26				*3.50	3.25	*12.3	7	7.4	5	4.0	4.0	3.0
27				*3.50	3.25	*8.21	7	*14.7	5	4.0	4.0	3.0
28		↓		*3.50	3.25	4.00	7	*121.0	5	4.0	4.0	3.0
29		..		*3.50	3.25	4.00	7	*126.0	4	4.0	4.0	3.0
30		..		*3.50	3.25	*15.8	7	*332.0	4	4.0	4.0	3.0
31	↓	..	↓	..	3.25	..	6	*68.9	..	4.0	..	3.0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	....	....	....	....	† 3.00	† 184	
February.....	....	....	....	....	† 3.00	† 167	
March.....	....	....	....	....	† 3.00	† 184	
April.....	....	....	*3.75	*3.50	* 3.63	* 216	
May.....	....	....	*4.50	*3.25	3.49	215	
June.....	....	....	458	*3.25	7.25	431	
July.....	4.55	1.99	339	4.00	10.1	621	
August.....	5.95	....	1,120	5.00	28.0	1,720	
September.....	10.2	....	†8,430	4.00	† 65.3	†3,890	
October (10).....	14.8	....	22,090	4.00	*130	*7,970	
November.....	....	....	5.0	4.00	4.37	260	
December.....	....	....	4.0	3.00	3.48	214	
Yearly.....	14.8	....	22,090	....	22.2	16,072	15.0

\*Partly Estimated

†Estimated

## RIO GRANDE AT BOQUILLAS STATION

**Description:** Automatic water-stage recorder and cable with stand up cable car located 4 miles below mouth of Tornillo Creek and a quarter of a mile east of Boquillas, Brewster County, Texas. Zero of gage is 1,802.73 feet above mean sea level United States Geological Survey datum.

**Records:** Based on 12 current meter measurements during the year from cable car. Computations by shifting channel methods. During first 4 months and at other short periods daily flow estimated from Lower Presidio and Langtry daily discharges. 1933 records considered fair to poor.

**Records Available:** From June, 1928 to December, 1933.

**Remarks:** Station not operated during first 3 months on account of sand bar at the gage well. The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte reservoir in the United States, and by irrigation diversions and Boquilla reservoir in Mexico. With all closed basins eliminated the drainage area above this station is 69,373 square miles; 39,734 being in the United States and 29,639 in Mexico.

**Previous Extreme Flows:** The greatest previous flow ever recorded was on Oct. 4, 1932, when the extreme gage height was 24.50 feet and the extreme flow was 95,030 second feet. An extreme gage height of 32.4 was reported by local residents to have occurred in September, 1904, discharge unknown. The lowest flow ever recorded was on September 29, 1930, when the extreme gage height was 0.35 feet and the extreme flow was 123 second feet. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	†1.150	†1.030	†1.010	† 840	*940	560	3,500	1,100	2,140	5,200	2,030	1,400
2	†1.100	†1.020	†1.000	† 850	*890	605	2,900	1,170	1,720	5,570	2,100	1,350
3	†1.140	† 940	†1.020	† 770	*860	1,030	2,700	1,060	8,760	5,260	2,080	1,350
4	†1.150	† 920	†1.030	† 710	*820	797	2,500	1,160	14,480	5,010	1,950	1,320
5	†1.140	† 870	†1.020	† 720	*820	608	2,300	980	18,680	4,960	1,840	1,320
6	†1.130	† 890	†1.030	† 730	*800	566	2,100	837	11,310	4,800	1,700	1,340
7	†1.160	† 900	†1.050	† 720	*860	683	2,200	791	8,440	4,790	1,860	1,340
8	†1.140	† 920	†1.070	† 730	*780	794	1,950	860	6,440	6,630	1,920	1,300
9	†1.130	† 910	†1.140	† 650	*750	1,110	1,760	948	5,790	6,830	1,880	1,370
10	†1.150	† 900	†1.060	† 675	*720	1,380	1,600	798	7,000	7,450	1,940	1,300
11	†1.150	† 900	†1.050	† 680	*700	1,110	1,350	720	9,210	7,700	1,810	1,350
12	†1.140	† 900	† 950	† 680	*670	1,020	1,220	1,090	9,090	9,000	1,770	1,360
13	†1.130	† 880	† 970	† 680	*650	794	1,120	642	7,780	8,500	1,740	1,300
14	†1.130	† 870	† 930	† 670	*620	756	1,080	608	11,130	9,780	1,700	1,350
15	†1.050	†1.050	† 930	† 730	*610	751	960	1,190	10,600	6,000	1,700	1,350
16	†1.080	†1.050	† 920	† 660	*590	797	920	902	12,460	4,800	1,710	1,330
17	†1.080	†1.020	† 880	† 730	561	1,100	900	837	18,100	4,300	1,690	1,260
18	†1.080	†1.050	† 920	† 900	886	992	850	1,370	25,410	4,050	1,670	1,310
19	†1.070	†1.000	† 850	†1,040	478	857	800	4,000	16,950	3,800	1,620	1,470
20	†1.020	† 960	† 800	†1,100	442	764	900	2,910	13,290	3,650	1,520	1,380
21	†1.020	†1.050	† 820	†1,300	436	870	1,340	2,390	11,500	3,500	1,520	1,360
22	†1.020	†1.050	† 830	†1,200	414	1,350	2,700	2,200	10,500	3,200	1,590	1,270
23	†1.020	†1.050	† 820	†1,100	415	2,170	1,650	2,200	9,000	3,050	1,460	1,280
24	†1.030	†1.000	† 815	†1,080	652	2,410	1,350	2,230	7,000	2,850	1,560	1,310
25	†1.040	†1.050	† 810	†1,070	610	2,650	1,050	1,630	6,300	2,650	1,520	1,400
26	†1.030	† 960	† 805	†1,030	450	4,830	1,150	1,460	5,500	2,550	1,400	1,380
27	†1.020	† 960	† 800	†1,020	639	4,870	1,200	1,530	5,200	2,350	1,400	1,460
28	†1.050	†1,020	† 800	†1,000	662	4,470	1,140	1,730	4,800	2,300	1,400	1,410
29	†1.020	.....	† 800	† 970	537	4,410	1,060	4,000	4,900	2,170	1,400	1,450
30	†1.000	.....	† 790	† 970	498	4,000	970	3,350	5,000	2,100	1,450	1,450
31	†1.010	.....	† 770	.....	539	.....	950	2,880	.....	2,100	.....	1,440

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.....	.....	.....	.....	†1,083	† 66,610	
February.....	.....	.....	.....	.....	† 969	† 53,790	
March.....	.....	.....	.....	.....	† 919	† 56,510	
April.....	.....	.....	.....	.....	† 867	† 51,580	
May.....	2.21	.45	2,100	397	* 655	* 40,260	
June.....	4.40	.60	6,000	502	†1,637	† 97,400	
July.....	.....	.....	.....	.....	*1,554	* 95,500	
August.....	4.50	.67	5,750	545	†1,599	† 98,330	
September (18).....	11.55	1.88	27,030	1,610	9,616	572,200	
October.....	7.60	2.30	13,550	1,810	*4,739	*291,380	
November.....	2.58	.....	2,320	†1,400	*1,698	*101,020	
December.....	1.99	1.77	1,530	1,260	*1,357	* 83,430	
Yearly.....	11.55	.....	27,030	.....	2,221	1,608,060	23.2

\*Partly Estimated  
†Estimated

### LOZIER CREEK STATION NEAR LANGTRY, TEXAS

**Description:** Automatic water-stage recorder and cable with sit down cable car located 21 miles west of Langtry, Texas, and about 1 mile above the confluence with the Rio Grande.

**Records:** Based upon 3 current meter measurements and previous rating curve. 1933 records considered poor.

**Records Available:** January 1 to December 31, 1933.

**Remarks:** This creek is dry except during storms. The drainage area above this station is 1,728 square miles, all in the United States.

#### Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	0	0	0	0	0	0	0.91	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	7.68	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	7.96	0	0
13	0	0	0	0	0	0	0	0	0	18.8	0	0
14	0	0	0	0	0	0	0	0	0	140	0	0
15	0	0	0	0	0	0	0	0	0	1.78	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	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	*143	0	0	0	0	0	0	0	0
23	0	0	0	*93.7	0	0	0	0	0	0	0	0
24	0	0	0	*2.7	0	0	0	0	0	0	0	0
25	0	0	0	*337	0	0	0	0	0	0	0	0
26	0	0	0	*115	0	0	0	8.98	0	0	0	0
27	0	0	0	*8.6	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	658	0	0	0	0
31	0	0	0	0	0	0	0	451	0	0	0	0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.....	.....	0	0	0	0	0
February.....	.....	.....	0	0	0	0	0
March.....	.....	.....	0	0	0	0	0
April.....	7.20	.....	900	0	23.3	1,390	0
May.....	.....	.....	0	0	0	0	0
June.....	.....	.....	0	0	0	0	0
July.....	.....	.....	0	0	0	0	0
August (30).....	13.82	.....	11,150	0	36.1	2,220	0
September.....	5.53	.....	6.6	0	.03	2	0
October.....	6.95	.....	478	0	5.68	350	0
November.....	.....	.....	0	0	0	0	0
December.....	.....	.....	0	0	0	0	0
Yearly.....	13.82	.....	11,150	0	5.47	3,962	2.29

\*Partly Estimated

## RIO GRANDE AT LANGTRY STATION

**Description:** Automatic water-stage recorder and cable with stand up cable car, located at Langtry, Val Verde County, Texas. Zero of gage is 1,091.69 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 33 current meter measurements from cable car during the year. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May, 1900 to October, 1914; December, 1919 to March, 1920; and January, 1924 to December, 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte reservoir in the United States, also by irrigation diversions and Boquilla reservoir in Mexico. With all closed basins eliminated the drainage area above this station is 77,518 square miles; 45,779 being in the United States and 31,739 in Mexico.

**Previous Extreme Flows:** The greatest flow ever recorded was on September 16, 1919, when the extreme gage height was 46.9 feet and the extreme flow was estimated by float measurement to be 152,000 second feet. An extreme gage height of 56.9 feet was reported on June 18, 1922, discharge unknown. The lowest flow ever recorded was in May, 1903 with an extreme of 270 second feet. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,670	1,350	1,330	1,190	1,140	888	3,840	*1,180	*3,250	5,300	2,370	1,650
2	1,710	1,390	1,350	1,210	1,280	878	3,780	*1,180	*2,780	5,640	2,350	1,650
3	1,590	1,420	1,380	1,200	1,120	904	3,550	*1,170	*2,200	5,750	2,220	1,630
4	1,510	1,420	1,380	1,220	1,020	900	3,160	*1,180	*4,660	5,690	2,220	1,580
5	1,560	1,370	1,350	1,160	1,020	1,120	3,200	1,250	*14,970	5,350	2,180	1,560
6	1,640	1,420	1,430	1,140	1,030	1,120	2,950	1,180	21,990	5,350	2,080	1,540
7	1,570	1,370	1,360	1,130	1,010	989	2,600	1,100	13,560	4,940	1,920	1,530
8	1,550	1,300	1,380	1,140	1,010	908	2,400	994	10,530	4,880	1,910	1,570
9	1,610	1,320	1,430	1,150	1,080	914	2,530	1,000	8,170	*6,210	2,030	1,600
10	1,490	1,360	1,460	*1,150	1,060	971	2,240	1,020	6,620	*7,380	2,050	1,600
11	1,480	1,350	1,550	*1,160	1,020	1,140	1,980	1,110	7,300	7,900	2,020	1,660
12	1,510	1,330	1,460	*1,120	1,000	1,490	*1,800	1,090	9,140	8,490	2,030	1,550
13	1,500	1,390	1,420	1,120	980	1,290	1,560	1,100	11,270	*7,480	1,860	1,600
14	1,520	1,380	1,340	1,130	930	1,320	*1,440	1,340	9,980	*10,240	1,890	1,620
15	1,510	1,340	1,300	1,120	918	1,240	*1,390	1,000	10,930	*9,640	1,840	1,520
16	1,580	1,320	1,280	1,130	908	1,010	*1,320	952	11,280	*7,310	1,870	1,570
17	1,480	1,460	1,280	1,140	920	957	*1,260	1,360	13,040	5,300	1,900	1,590
18	1,550	1,550	1,280	1,170	888	987	*1,220	1,210	17,630	4,950	1,880	1,510
19	1,500	1,520	1,240	1,170	893	1,230	*1,260	1,120	26,050	4,660	1,860	1,460
20	1,480	1,540	1,260	1,160	1,150	1,250	*1,280	2,830	*20,680	4,270	1,850	1,490
21	1,500	1,440	1,240	1,270	1,030	1,200	*1,280	3,630	*16,040	4,030	1,750	1,570
22	1,450	1,400	1,180	1,860	838	1,120	*1,200	*2,680	*12,800	3,830	1,720	1,660
23	1,490	1,500	1,170	1,590	800	1,140	*1,890	*2,270	*11,090	3,680	1,770	1,870
24	1,420	1,540	1,190	1,580	764	1,540	2,500	*2,200	*9,960	3,380	1,760	1,610
25	1,360	1,480	1,170	1,460	752	2,220	1,960	*2,310	*9,850	3,220	1,700	1,600
26	1,350	1,420	1,170	1,400	970	2,420	1,770	*2,230	*7,740	3,140	1,820	1,530
27	1,370	1,480	1,170	1,380	1,230	3,250	*1,320	*1,760	*6,700	2,910	1,690	1,580
28	1,370	1,410	1,240	1,370	892	4,160	*1,460	*1,680	*5,740	2,750	1,640	1,590
29	1,390	....	1,210	1,310	869	4,350	1,480	*1,840	5,380	2,590	1,650	1,630
30	1,480	....	1,190	1,270	1,060	3,960	*1,220	*5,060	5,280	2,490	1,650	1,650
31	1,410	....	1,200	....	962	....	*1,190	*6,460	....	2,440	....	1,710

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.75	1.26	1,730	1,340	1,503	92,430	
February.....	1.63	1.23	1,570	1,290	1,413	78,490	
March.....	1.67	1.07	1,580	1,160	1,303	80,110	
April.....	3.55	0.83	3,890	1,100	1,253	74,580	
May (24).....	1.68	0.54	1,680	750	985	60,580	
June.....	4.11	0.73	4,750	865	1,562	92,960	
July.....	3.80	*1.03	4,570	*1,140	2,001	123,040	
August.....	7.05	0.77	*10,680	915	1,822	112,040	
September (19).....	14.23	1.90	27,220	1,950	10,554	628,000	
October.....	8.70	2.33	*14,630	2,360	5,200	319,720	
November.....	2.37	1.69	2,410	1,590	1,916	114,010	
December.....	1.88	1.53	1,750	1,420	1,590	97,750	
Yearly.....	14.23	0.54	27,220	750	2,588	1,873,710	24.2

\*Partly Estimated

## PECOS RIVER STATION NEAR COMSTOCK, TEXAS

**Description:** Staff-gage and cable with sit down cable car located at the Pecos high bridge of the Southern Pacific Railroad 12 miles northwest of Comstock, Val Verde County, Texas, and 5½ miles above the confluence with the Rio Grande. Zero of gage is 1,058.01 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 18 current meter measurements during the year from cable car and by wading. Staff-gage read twice daily and more frequently during large changes of stage. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May, 1900 to December, 1933.

**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. 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 previous flow ever recorded was on September 1, 1932, when the extreme gage height was 38.25 feet and the extreme flow was 101,800 second feet. An extreme gage height of 35.75 feet was reported on April 6, 1900, discharge based upon 1932 rating curve was 95,200 second feet. The lowest flow ever recorded was on August 31, 1930, when the extreme gage height was -0.15 feet and the extreme flow was 97 second feet. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	958	844	620	443	361	360	278	259	432	303	292	279
2	966	801	601	438	361	344	281	262	349	296	309	279
3	946	764	593	443	364	329	277	252	334	286	340	272
4	947	754	599	434	352	328	277	246	323	286	318	272
5	947	737	611	426	348	320	277	247	317	279	307	282
6	946	739	598	418	348	319	276	247	317	279	295	279
7	945	765	594	409	345	304	270	244	313	279	305	280
8	931	743	616	413	345	296	273	244	313	279	297	280
9	923	744	618	418	344	295	272	241	314	279	285	280
10	942	746	636	405	344	298	275	244	336	282	279	297
11	928	736	626	393	344	294	275	247	351	279	281	300
12	927	726	623	393	344	289	271	246	322	279	277	308
13	908	695	614	393	337	285	268	252	315	396	272	301
14	933	659	590	382	341	305	268	246	340	2,460	277	312
15	938	648	566	382	338	299	262	246	338	548	273	315
16	924	640	538	385	348	296	261	246	442	486	271	326
17	904	631	525	382	341	297	267	240	383	416	271	315
18	896	628	507	385	338	297	270	245	380	368	272	316
19	908	639	489	378	339	298	269	239	346	357	273	320
20	894	691	476	370	339	299	275	242	332	345	276	334
21	906	693	468	374	339	297	272	245	317	349	277	337
22	905	688	451	385	331	288	278	245	377	349	281	333
23	891	684	447	405	324	282	278	239	537	349	275	336
24	877	676	434	408	329	290	291	239	466	338	276	362
25	882	687	434	433	381	286	277	238	415	326	276	346
26	875	651	426	412	451	287	270	238	371	325	277	369
27	862	643	443	400	432	285	273	238	348	317	277	371
28	764	639	447	388	371	279	267	241	331	307	278	375
29	841	...	469	380	374	279	258	544	317	292	278	374
30	892	...	465	372	380	278	262	407	306	288	278	373
31	865	...	447	...	373	...	265	1,060	...	297	...	366

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.76	1.45	972	758	909	55,880	
February.....	1.60	1.16	844	628	703	39,060	
March.....	1.14	.78	641	426	535	32,870	
April.....	.82	.64	443	368	402	23,900	
May.....	.99	.52	519	324	355	21,830	
June.....	.64	.40	364	278	300	17,860	
July.....	.46	.34	291	255	272	16,730	
August (27).....	3.52	.30	2,390	238	286	17,590	
September.....	1.06	.48	547	306	356	21,180	
October (14).....	5.25	.40	4,500	279	397	24,430	
November.....	.62	.42	348	271	285	16,950	
December.....	.70	.40	379	272	319	19,610	
Yearly.....	5.25	.30	4,500	238	425	307,890	8.04

\*Partly Estimated

## GOODENOUGH SPRING STATION NEAR COMSTOCK, TEXAS

**Description:** Automatic water-stage recorder located  $\frac{1}{2}$  mile above confluence with Rio Grande and  $11\frac{1}{4}$  miles southwest of Comstock, Val Verde County, Texas.

**Records:** Based upon 11 current meter measurements during the year by wading. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** February, 1929 to December, 1933.

**Remarks:** The flow of this spring channel is very uniform and is not modified by diversions or storage. The surface drainage area above this station is one square mile, all in the United States.

**Previous Extreme Flows:** The highest previous gage height ever recorded was on Sept. 1, 1932, when the extreme gage height was 17.30 feet, discharge unknown. The lowest flow ever recorded was on April 4, 1930, when the extreme gage height was 0.27 feet and the extreme flow was 93 second feet.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	320	313	298	280	277	268	271	262	251	247	238	229
2	323	313	296	280	277	268	271	262	248	247	236	227
3	321	312	296	282	277	268	271	262	248	245	238	227
4	321	313	295	282	277	270	270	262	248	244	238	226
5	322	312	295	279	275	270	270	261	247	241	236	224
6	322	312	294	279	276	271	271	260	248	241	236	224
7	322	310	294	279	276	271	271	260	248	240	236	224
8	323	310	293	279	276	269	269	260	247	241	236	223
9	322	311	293	279	276	269	269	260	247	240	235	222
10	323	311	292	279	276	269	268	260	247	240	235	220
11	323	310	292	279	276	272	268	263	247	238	234	220
12	321	310	292	277	274	270	268	263	248	238	235	219
13	318	310	291	280	274	270	267	261	247	240	233	219
14	318	308	291	278	279	270	267	260	246	244	233	219
15	318	305	291	280	274	268	268	258	247	241	233	218
16	318	307	290	278	274	269	268	258	246	240	230	218
17	318	306	290	278	274	269	268	258	246	240	232	217
18	319	306	288	280	274	269	268	258	246	242	232	217
19	319	305	288	280	273	269	268	258	244	242	230	215
20	317	302	286	277	273	270	267	256	246	242	230	215
21	319	301	285	277	273	269	265	256	246	242	230	215
22	317	302	285	277	273	269	265	254	243	241	230	215
23	317	300	284	277	273	270	264	254	242	241	229	215
24	317	301	284	278	273	269	264	254	242	239	232	215
25	317	299	283	278	272	269	267	253	242	239	230	214
26	317	299	283	278	271	270	267	253	242	239	229	214
27	316	298	284	278	271	270	267	252	241	239	228	213
28	316	298	283	278	270	270	266	252	239	239	228	213
29	317	...	282	278	270	270	266	252	238	238	228	212
30	315	...	282	277	268	271	266	251	236	238	229	212
31	315	...	280	...	268	...	264	251	...	238	...	212

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January (2).....	1.93	1.85	323	315	319	19,620	
February.....	1.85	1.77	315	297	307	17,030	
March.....	1.78	1.72	298	280	289	17,770	
April.....	1.75	1.68	284	274	279	16,580	
May.....	1.93	1.62	315	265	274	16,840	
June.....	1.67	1.61	274	265	270	16,040	
July.....	1.63	1.55	272	262	268	16,460	
August.....	1.57	1.48	265	249	258	15,840	
September.....	1.50	1.41	252	236	*345	*14,580	
October.....	1.78	1.41	290	236	241	14,810	
November.....	1.43	1.33	239	226	233	13,840	
December (31).....	1.35	1.20	230	209	218	13,430	
Yearly.....	1.93	1.20	323	209	266	192,840	192,840

\*Partly Estimated

DEVILS RIVER STATION NEAR DEL RIO, TEXAS

**Description:** Automatic water-stage recorder on main highway bridge, 12 miles northwest of Del Rio. Zero of gage is 951.80 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 19 current meter measurements during the year by wading. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May, 1900 to March, 1914, at a point .8 mile below Southern Pacific R. R. Bridge; December, 1923 to Sept. 1, 1932 at a point .2 mile above S. P. R. R. Bridge; Sept. 2, 1932 to Dec. 31, 1933 at highway bridge 2 miles upstream from R. R. bridge.

**Remarks:** The monthly flow of this spring fed river is not modified, but the hourly flow is modified by 2 power dams. The drainage area above this station is 4,060 square miles, all in the United States.

**Previous Extreme Flows:** The highest previous gage height ever recorded was on Sept. 1, 1932, when the extreme gage height was 48.40 feet and an extreme flow was 557,500 second feet. This flood flow of 138 second feet per square mile of water shed is the greatest ever recorded in North America for drainage areas of from 1 to 10 thousand square miles.\*\* The lowest flow ever recorded was on September 2, 1930, when the extreme gage height was 1.17 feet and the extreme flow 82 second feet. Numerous records of previous extreme flows may be found in Water Bulletin No. 1.

Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	*741	*702	655	625	558	589	421	491	480	431	398	392
2	*741	*703	*592	603	587	589	439	491	441	416	412	372
3	*767	*702	658	600	605	593	535	479	441	428	389	372
4	*760	*667	660	578	594	597	551	466	441	427	389	373
5	*795	*690	662	585	582	600	552	479	483	389	414	384
6	*774	*690	*644	583	572	554	567	479	511	425	441	364
7	*726	*649	666	571	572	538	567	466	544	398	480	343
8	*781	*719	668	578	572	562	523	479	505	410	430	313
9	*779	*677	660	576	551	566	524	452	480	395	393	313
10	*768	*616	662	573	541	580	537	426	481	459	394	355
11	*766	*616	663	571	467	583	515	439	481	432	395	357
12	*735	*615	675	558	455	627	478	452	468	462	405	378
13	*741	*614	687	566	581	651	499	490	455	443	416	400
14	*772	*683	689	594	621	645	499	503	468	749	467	399
15	*749	*692	667	563	591	629	486	490	441	767	440	424
16	*727	*681	664	571	551	633	487	452	422	594	400	410
17	*725	*680	662	580	540	646	500	452	†414	562	387	435
18	*736	*670	639	568	540	620	500	465	†427	439	376	408
19	*738	*659	637	557	540	624	500	478	†413	388	354	373
20	*735	*638	624	328	580	620	501	490	†425	367	383	372
21	*713	*640	632	574	600	626	501	490	†412	441	393	381
22	*721	*642	610	562	550	622	501	431	†424	493	392	370
23	*711	*644	607	571	540	608	502	455	†411	391	380	380
24	*713	*665	605	569	514	594	541	543	†423	371	378	359
25	*693	*657	602	557	580	600	502	504	†409	308	377	378
26	*704	*659	610	546	550	577	477	590	†409	320	368	367
27	*696	*661	627	564	579	583	376	574	408	383	402	366
28	*697	*663	625	563	609	569	426	559	408	380	416	399
29	*698	...	623	541	619	535	478	479	420	385	404	398
30	*699	...	590	550	619	531	478	491	406	435	404	461
31	*710	...	608	...	619	...	479	491	...	410	...	372

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.33	.77	*836	*322	*736	*45,250	
February.....	1.24	.90	*740	*421	*664	*36,880	
March.....	1.17	.70	697	*282	641	39,420	
April (20).....	1.18	.35	625	* 25	564	33,570	
May.....	1.57	1.09	741	288	567	34,870	
June.....	1.47	1.30	686	484	596	35,490	
July.....	*1.56	.89	803	96	498	30,630	
August.....	1.62	.91	930	113	485	29,800	
September.....	1.51	.94	720	129	445	26,480	
October (12).....	1.75	1.10	1,210	207	442	27,170	
November.....	1.43	1.13	579	225	403	23,950	
December.....	1.47	1.07	622	186	379	23,300	
Yearly.....	1.75	.35	1,210	* 25	534	386,810	95.3

\*Partly Estimated

†Estimated

\*\*See Special Flood Report 1932 by American Section of this Commission.

## CIENEGAS CREEK STATION NEAR DEL RIO, TEXAS

**Description:** Staff-gage 900 feet above confluence with Rio Grande, 3 miles southwest of Del Rio, Texas, and 1½ miles above the Del Rio gaging station on the Rio Grande.

**Records:** Based upon 17 current meter measurements during the year and gage readings at other times. Computations by averaging discharge between measurements and gage readings. 1933 records considered fair.

**Records Available:** September 1, 1931 to December 31, 1933.

**Remarks:** The flow of this spring fed creek is modified by diversions for irrigation above this station. The drainage area above this station is 18 square miles, all in the United States.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	↑	↑	11.75	↑	6.14	↑	↑	↑	↑	↑	↑	↑
2	↑	↑	↓	7.92	6.14	↑	↑	↑	↑	↑	↑	↑
3	↑	↑	↓	↑	6.14	↑	↑	↑	↑	↑	↑	↑
4	↑	↑	↓	↑	↑	6.38	5.14	↑	↑	↑	8.91	↑
5	↑	↑	9.48	↑	↑	↑	↑	2.72	↑	↑	↑	↑
6	11.9	↑	↑	↑	↑	↑	↑	↑	7.10	9.58	↑	8.17
7	↑	12.35	↓	↑	↑	↑	↓	↑	↑	↑	↑	↑
8	↑	↑	↓	↑	↑	↑	↓	↑	↑	↑	↑	↑
9	↑	↑	↑	↑	5.74	↑	↑	↑	↑	↑	↑	↑
10	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
11	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
12	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	8.56	↑
14	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
15	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
16	↑	↑	↑	6.14	↓	5.75	3.71	3.56	↑	↑	↑	8.82
17	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
18	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
20	↑	↑	7.92	↑	↑	↑	↑	↑	↑	↑	↑	↑
21	↑	↑	↑	↑	↑	↑	↑	↑	9.58	↑	↑	↑
22	12.35	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
23	↑	11.75	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
24	↑	↑	↑	↑	6.38	↑	↑	↑	↑	8.91	↑	↑
25	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
26	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	8.17	↑
27	↑	↑	↑	↑	↑	5.14	↓	↑	↑	↑	↑	↑
28	↑	↑	↑	↑	↑	↑	2.72	7.10	↑	↑	↑	↑
29	↑	↑	↑	↑	↑	↑	2.72	↑	↑	↑	↑	9.48
30	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	9.48
31	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	9.48

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.....	.....	.....	.....	12.1	747	
February.....	.....	.....	.....	.....	12.0	669	
March.....	.....	.....	.....	.....	8.47	521	
April.....	.....	.....	.....	.....	6.32	376	
May.....	.....	.....	.....	.....	6.09	374	
June.....	.....	.....	.....	.....	5.75	342	
July.....	.....	.....	.....	.....	4.02	247	
August.....	.....	.....	.....	.....	4.0	246	
September.....	.....	.....	.....	.....	8.67	516	
October.....	.....	.....	.....	.....	9.28	570	
November.....	.....	.....	.....	.....	8.52	507	
December.....	.....	.....	.....	.....	8.72	536	
Yearly.....	.....	.....	.....	.....	7.81	5,651	314

## RIO GRANDE AT DEL RIO STATION

**Description:** Automatic water-stage recorder, located 900 feet upstream from international highway bridge at Del Rio, Val Verde County, Texas. Zero of gage is 864.80 feet above mean sea level United States Coast and Geodetic Survey datum.

**Records:** Based upon 21 current meter measurements during the year from the highway bridge. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** December, 1923 to December, 1933. Records are also available for station 11 miles upstream from May, 1900 to April, 1915; and for station 7½ miles upstream at McKees Switch from December, 1919 to March, 1920. Several springs but no important tributaries enter the river between the various station sites.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla reservoir in Mexico. With all closed basins eliminated the drainage area above this station is 123,318 square miles; 88,539 being in the United States and 34,779 in Mexico.

**Previous Extreme Flows:** The highest previous gage height ever recorded was on Sept. 1, 1932, when the extreme gage height was 34.5 feet, discharge 604,590 second feet. 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 previous extreme flows may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4,730	4,390	3,910	3,450	2,920	2,790	5,580	2,820	7,430	6,740	3,760	2,830
2	4,770	4,270	3,720	3,410	2,840	2,640	5,310	2,700	4,880	6,830	3,720	2,760
3	4,830	4,290	3,760	3,400	2,930	2,600	5,140	2,650	3,180	6,850	3,640	2,770
4	4,730	4,300	3,840	3,380	2,820	2,600	5,150	2,550	3,690	7,120	3,940	2,750
	4,630	4,270	3,830	3,360	2,750	2,590	4,730	2,590	9,700	6,880	3,580	2,680
6	4,670	4,200	3,730	3,210	2,700	2,710	4,840	2,590	20,050	6,670	3,560	2,610
7	4,740	4,280	3,810	3,170	2,700	2,740	4,500	2,580	21,160	6,500	3,480	2,600
8	4,720	4,230	3,740	3,140	2,690	2,580	4,180	2,600	14,760	6,170	3,270	2,580
9	4,660	4,160	3,740	3,120	2,700	2,450	4,060	2,410	10,930	6,110	3,220	2,620
10	4,750	4,030	3,820	3,120	2,730	2,400	4,080	2,410	8,420	8,400	3,280	2,670
11	4,580	4,070	3,900	3,080	2,650	2,470	3,850	2,440	7,490	8,690	3,280	2,670
12	4,510	4,010	4,070	3,090	2,500	2,660	3,610	2,570	9,380	9,680	3,240	2,740
13	4,600	3,960	3,960	2,980	2,650	3,050	3,430	2,660	11,140	10,170	3,240	2,640
14	4,590	4,100	3,870	2,900	2,800	2,970	3,150	2,640	13,070	13,000	3,150	2,700
15	4,630	4,110	3,750	2,880	2,670	2,860	2,980	2,980	10,940	13,240	3,140	2,740
16	4,610	4,020	3,690	2,830	2,580	2,770	2,950	2,520	14,150	12,060	3,050	2,620
17	4,730	3,980	3,680	2,830	2,550	2,530	2,850	2,430	14,320	8,000	3,070	2,660
18	4,600	4,090	3,600	2,840	2,580	2,410	2,680	2,880	16,350	6,630	3,080	2,660
19	4,660	4,170	3,570	2,850	2,540	2,380	2,620	2,790	23,170	6,270	3,080	2,540
20	4,500	4,120	3,480	2,600	2,570	2,580	2,670	2,660	27,360	5,920	3,040	2,490
21	4,580	4,200	3,500	2,700	2,860	2,640	2,680	4,480	21,750	5,550	3,070	2,530
22	4,530	4,090	3,400	2,950	2,790	2,640	2,680	4,970	17,920	5,250	2,930	2,630
23	4,410	4,010	3,400	3,940	2,500	2,550	2,710	4,200	14,720	5,240	2,890	2,760
24	4,510	4,170	3,370	3,560	2,470	2,550	3,680	4,070	12,300	4,970	2,920	2,760
25	4,390	4,230	3,420	3,480	2,500	2,940	4,040	3,900	9,850	4,700	2,830	2,700
26	4,340	4,130	3,420	3,300	2,480	3,650	3,560	4,080	10,000	4,570	2,800	2,670
27	4,320	4,020	3,430	3,160	2,700	3,850	3,270	3,940	8,870	4,530	2,960	2,580
28	4,300	4,040	3,450	2,980	3,200	3,000	2,850	3,520	7,820	4,150	2,860	2,690
29	4,260	.....	3,560	3,080	2,920	5,730	2,960	3,580	7,020	4,070	2,800	2,740
30	4,360	.....	3,400	2,980	2,710	5,830	2,980	4,170	6,770	3,980	2,840	2,820
31	4,510	.....	3,360	.....	2,920	.....	2,830	9,400	.....	3,860	.....	2,790

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	3.65	3.30	5,070	4,150	4,570	281,160	
February.....	3.37	3.12	4,490	3,920	4,140	229,970	
March.....	3.23	2.81	4,090	3,300	3,650	224,670	
April (21).....	3.65	2.22	5,070	2,160	3,130	185,990	
May.....	3.04	2.33	3,600	2,330	2,707	166,460	
June.....	4.23	2.33	6,360	2,240	3,005	178,830	
July.....	4.07	2.35	5,960	2,420	3,632	223,340	
August.....	5.92	2.14	13,440	2,300	3,315	203,860	
September (20).....	8.89	2.84	28,880	3,460	12,320	733,080	
October.....	6.72	2.89	17,540	3,730	6,871	422,490	
November.....	2.95	2.32	3,840	2,620	3,177	189,070	
December.....	2.54	2.17	2,990	2,310	2,677	164,630	
Yearly.....	8.89	2.14	28,880	2,160	4,425	3,203,550	26.0

\*Partly Estimated

## SAN FELIPE CREEK STATION NEAR DEL RIO, TEXAS

**Description:** Automatic water-stage recorder at Silos farm road bridge  $1\frac{1}{4}$  mile 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. Zero of gage is 875.05 feet above mean sea level United States Coast and Geodetic Survey datum.

**Records:** Based upon 19 current meter measurements by wading during the year. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** September 1, 1931 to December 31, 1933.

**Remarks:** The flow of this spring fed creek is greatly modified by irrigation and municipal diversions above this station. The drainage area above this station is 62 square miles, all in the United States.

**Previous Extreme Flows:** The highest previous flow ever recorded was on Aug. 31, 1932, when a flow of 3,030 second feet was reached with a gage of 12.84 feet. The lowest flow was 26.7 second feet on July 1, 1932. Backwater from the Rio Grande reached a gage height of 15.05 feet on Sept. 1, 1932.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	112	119	66.6	67.5	68.3	65.9	61.8	71.0	54.5	54.0	61.2	48.1
2	113	118	66.9	57.3	64.2	60.7	68.6	70.9	54.6	57.3	62.3	48.5
3	112	119	67.2	65.6	63.1	60.4	63.4	70.8	54.7	58.3	62.2	50.1
4	113	119	67.5	58.0	63.5	66.3	64.9	70.7	53.7	60.2	62.1	50.4
5	113	118	67.8	63.9	60.9	64.6	65.1	70.7	53.8	58.1	62.1	49.6
6	114	119	68.0	58.6	53.6	59.4	64.1	71.9	52.8	58.3	60.9	47.6
7	112	118	68.3	61.5	59.6	56.7	65.5	70.5	54.0	58.4	60.9	50.3
8	113	118	66.0	59.3	65.7	56.4	69.4	70.4	54.1	60.8	59.7	51.9
9	113	118	63.5	62.9	62.6	56.1	70.8	71.6	54.2	59.8	59.6	52.9
10	114	118	62.2	62.3	61.8	51.0	72.2	70.3	53.2	60.0	60.7	54.0
11	114	118	62.1	63.4	58.5	49.4	71.2	68.9	52.2	60.1	59.5	51.4
12	115	119	63.2	61.6	58.8	49.1	70.3	70.1	53.1	*60.2	59.4	48.8
13	115	112	63.1	60.4	59.1	82.1	70.5	70.2	52.9	*83.6	58.3	46.2
14	115	104	63.1	63.6	61.9	82.8	70.7	69.0	51.7	*110.0	58.2	47.3
15	114	106	64.2	62.6	62.2	83.5	70.9	69.1	51.5	77.6	58.2	48.3
16	114	102	62.9	60.1	61.3	84.2	73.6	68.0	54.9	58.6	58.1	50.5
17	114	103	60.4	64.2	62.2	66.0	72.6	66.9	55.5	57.6	60.3	57.5
18	113	98	59.1	66.2	61.9	55.9	71.0	67.0	58.6	56.7	59.1	55.0
19	113	90.2	59.0	65.1	61.5	55.6	69.4	62.3	58.4	57.9	56.9	54.8
20	114	87.5	60.1	65.3	61.2	56.5	70.1	55.4	58.3	58.1	57.9	54.7
21	117	83.2	60.0	65.5	66.9	56.3	67.3	55.5	58.1	59.3	56.1	50.9
22	118	77.5	59.9	66.3	65.4	57.2	65.7	51.2	57.9	61.7	54.2	50.7
23	117	63.7	64.6	70.6	65.1	58.1	65.2	50.2	56.6	60.7	50.0	51.8
24	117	62.6	61.0	72.7	68.5	59.0	89.8	51.4	54.2	59.5	48.0	50.4
25	118	58.1	68.4	71.6	70.7	60.4	71.6	51.5	55.1	59.5	49.5	49.0
26	118	65.8	63.2	73.1	78.2	59.5	70.0	51.6	56.1	59.4	48.7	48.8
27	118	67.4	63.1	72.0	72.7	60.9	69.6	57.3	59.4	59.3	47.9	47.5
28	118	66.4	61.2	73.5	73.7	59.9	70.3	57.4	61.6	60.4	48.2	47.3
29	118	...	65.9	69.4	78.6	61.3	72.5	57.5	62.6	60.3	49.8	46.0
30	118	...	61.6	69.0	74.4	60.4	71.1	62.3	59.0	61.4	50.2	48.2
31	118	...	60.7	...	74.0	...	72.3	62.4	...	61.3	...	55.2

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.90	1.77	123	105	115	7,070	
February.....	1.99	1.33	136	54.2	98.9	5,490	
March.....	1.68	1.21	99.5	42.0	63.6	3,910	
April.....	1.78	1.22	113	43.0	65.1	3,870	
May (4).....	1.75	1.08	111	28.4	65.2	4,010	
June.....	2.77	1.28	258	46.6	61.9	3,680	
July (24).....	3.76	1.28	449	57.9	69.7	4,290	
August.....	1.44	1.21	74.2	47.9	64.0	3,940	
September.....	1.56	1.20	91.2	48.2	55.6	3,310	
October.....	2.25	1.27	191	52.9	62.2	3,820	
November.....	1.35	1.13	69.4	45.5	56.7	3,370	
December.....	1.24	1.09	59.7	41.2	50.4	3,100	
Yearly.....	3.76	1.08	449	28.4	68.9	49,860	804

\*Partly Estimated

## SYCAMORE CREEK STATION NEAR DEL RIO, TEXAS

**Description:** Automatic water-stage recorder 2 miles above the confluence with the Rio Grande, 11 miles southeast of Del Rio, Texas, and just above the highway between Del Rio and Eagle Pass, Texas.

**Records:** Based upon 15 current meter measurements during the year by wading. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** January, 1932 to December, 1933.

**Remarks:** The flow of this spring fed creek is modified by small irrigation diversions above the station. The drainage area above this station is 524 square miles all in the United States.

**Previous Extreme Flows:** The greatest flow ever recorded was on September 2, 1932, when the extreme gage height was 17.10 feet and the extreme flow was 44,800 second feet.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	15.3	16.8	15.8	14.9	9.6	9.6	4.30	1.42	.44	0	.00	2.48
2	15.3	16.2	14.4	14.2	9.1	8.6	4.36	1.45	.28	0	.00	2.45
3	15.3	16.3	14.3	14.2	8.6	8.0	4.42	1.26	.13	0	.00	2.41
4	16.0	16.9	14.9	14.3	8.1	7.3	4.47	1.30	.13	0	.10	2.38
5	16.0	16.9	16.1	14.4	8.1	6.6	4.14	1.33	.13	0	.10	2.35
6	15.2	16.4	16.8	13.2	8.1	6.6	4.10	1.36	.10	0	.20	2.31
7	15.2	18.6	15.4	12.5	7.1	6.5	3.69	1.39	.10	0	.20	2.28
8	15.9	18.6	14.0	11.2	7.1	5.8	3.31	1.42	.10	0	.20	2.25
9	15.2	17.0	13.9	10.6	6.6	5.8	3.28	1.45	0	0	.50	2.22
10	15.2	17.8	14.5	9.6	7.1	5.7	3.24	1.48	0	0	.80	2.18
11	15.1	17.9	12.5	10.1	7.0	5.6	3.20	1.73	0	0	1.10	2.15
12	15.8	16.5	11.3	9.6	6.4	5.1	2.86	1.71	0	0	1.40	2.15
13	16.4	15.2	11.3	9.6	6.3	5.5	2.82	1.69	0	0	1.70	2.15
14	17.2	15.9	12.0	10.6	6.1	5.4	2.79	1.66	0	0	2.00	2.15
15	16.4	18.0	11.4	9.6	6.0	4.9	2.75	1.64	0	0	2.30	2.15
16	16.4	15.9	10.9	9.1	5.4	4.8	2.42	1.62	0	0	2.50	2.15
17	16.5	13.9	10.2	9.1	5.3	4.9	2.39	1.60	0	0	†2.84	2.15
18	16.5	13.3	10.9	8.6	5.2	4.4	2.08	1.81	0	0	†2.84	2.15
19	17.3	12.5	12.9	9.1	5.1	5.1	2.05	1.55	0	0	†2.84	2.15
20	15.9	13.1	13.6	10.1	5.0	5.7	2.01	1.53	0	0	2.84	2.15
21	16.0	12.4	13.0	9.6	4.8	5.7	1.73	1.51	0	0	2.81	2.15
22	17.4	11.7	13.0	9.6	4.2	5.8	1.69	1.27	0	0	2.77	2.15
23	17.4	12.2	13.1	9.1	8.0	5.9	1.65	1.24	0	0	2.74	2.15
24	16.6	12.2	13.2	8.6	20.4	6.0	1.62	1.01	0	0	2.71	2.15
25	17.4	12.8	13.2	8.1	17.7	5.6	1.12	1.20	0	0	2.68	2.15
26	17.5	13.9	12.6	9.1	16.0	5.1	1.31	1.20	0	0	2.64	2.15
27	17.5	15.2	12.7	9.1	11.5	5.2	1.51	.80	0	0	2.61	2.15
28	17.5	17.2	14.0	9.6	10.4	4.7	1.54	.80	0	0	2.58	2.15
29	16.8	.....	15.3	9.6	10.1	4.2	1.57	.80	0	0	2.54	2.15
30	17.6	.....	15.3	9.6	9.3	4.3	1.60	.44	0	0	2.51	2.15
31	17.6	.....	15.4	.....	9.5	.....	1.39	.44	.....	0	.....	2.15

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.42	.37	18.4	14.5	16.4	1,010	
February.....	.44	.32	20.1	11.7	15.4	855	
March.....	.42	.31	18.0	10.2	13.5	829	
April.....	.43	.25	19.1	8.1	10.6	628	
May (23).....	.97	.20	80.9	4.1	8.4	514	
June.....	.28	.17	10.5	3.7	5.8	346	
July.....	.19	.09	4.79	1.12	2.63	161	
August.....	.12	.04	2.06	.28	1.33	81.5	
September.....	.07	.....	.80	0	.05	2.8	
October.....	.....	.....	0	0	0	0	
November.....	.10	.....	2.84	0	*1.70	*101	
December.....	.....	.....	*2.48	*2.15	2.21	*136	
Yearly.....	.97	.....	80.9	0	6.44	4,664.3	8.90

\*Partly Estimated  
†Estimated

## PINTO CREEK STATION NEAR DEL RIO, TEXAS

**Description:** Automatic water-stage recorder, cable with sit down cable car, and concrete control dam, 500 feet above Del Rio-Eagle Pass highway and 5½ miles above confluence with Rio Grande.

**Records:** Based upon 20 current meter measurements during the year by wading and from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** November, 1928 to December, 1933.

**Remarks:** The flow of this spring fed creek is modified by small irrigation diversions above the station. The drainage area above this station is 229 square miles, all in the United States.

**Previous Extreme Flows:** The greatest previous flow ever recorded was on Aug. 31, 1932, when the extreme gage height was 21.08 feet and the extreme flow 54,650 second feet. This flood flow of 239 second feet per square mile of water shed is the seventh largest ever recorded in North America for drainage areas of from 200 to 300 square miles. The creek is often dry.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	33.5	34.4	29.8	20.5	12.5	15.2	10.5	16.2	4.31	2.86	2.93	3.19
2	34.9	33.1	29.7	18.9	11.5	14.3	10.5	13.6	4.31	3.42	6.55	3.13
3	34.9	34.6	29.6	18.8	12.5	14.3	10.1	11.8	4.18	3.89	3.93	3.00
4	34.9	34.6	29.5	18.7	14.3	13.4	9.19	11.4	3.89	3.50	3.13	3.00
5	34.9	34.9	29.3	17.1	14.3	12.5	8.32	10.1	3.81	3.26	3.13	3.00
6	36.6	34.9	29.2	17.0	12.5	12.5	7.24	10.1	3.73	3.26	3.50	2.80
7	36.6	34.9	27.6	17.1	11.5	11.5	6.82	13.6	3.89	3.34	3.81	2.50
8	38.5	33.8	27.5	17.3	11.5	11.5	6.82	12.7	4.05	3.06	3.58	2.55
9	36.6	33.8	27.3	18.9	11.5	11.5	7.03	9.19	3.73	3.06	3.19	2.67
10	35.3	33.8	27.2	19.1	11.5	10.6	5.98	7.24	3.50	2.93	3.13	2.80
11	35.3	34.0	27.1	20.7	13.4	10.6	5.77	6.61	3.34	3.06	3.13	2.86
12	33.9	34.0	27.0	17.8	13.4	10.6	5.56	7.45	3.26	3.06	3.19	2.80
13	33.9	34.0	26.9	18.0	12.5	13.0	5.56	7.24	3.19	4.44	3.19	2.80
14	33.9	34.2	25.4	18.1	12.5	61.0	5.56	7.03	3.19	5.09	3.06	2.80
15	33.9	34.2	25.3	16.7	13.4	19.0	5.22	6.61	3.06	13.2	3.00	2.80
16	33.9	35.8	25.2	18.4	13.4	16.2	5.22	6.40	4.95	14.4	2.93	2.80
17	33.9	35.7	26.5	18.5	13.4	15.2	5.09	5.77	3.19	7.45	2.93	2.86
18	33.9	34.1	26.3	18.7	13.4	15.2	5.09	5.56	3.06	5.56	3.06	2.86
19	33.8	32.5	24.8	18.8	13.4	15.2	5.09	5.09	2.86	4.70	3.13	2.86
20	33.8	32.4	24.7	18.9	12.5	14.3	5.35	4.83	2.67	4.44	3.13	2.93
21	33.8	32.3	23.1	17.6	10.6	14.3	5.09	4.70	2.60	4.05	2.93	2.93
22	33.8	32.2	24.5	16.2	10.1	14.3	4.96	4.96	2.60	3.89	2.73	2.93
23	32.3	32.0	24.4	16.3	14.4	14.3	5.09	4.31	2.60	3.66	2.55	3.00
24	32.5	31.9	24.3	15.0	67.5	14.3	62.2	4.18	2.45	3.50	2.55	3.00
25	32.5	31.8	24.2	15.1	25.1	14.3	47.1	4.57	2.55	3.34	2.55	3.00
26	32.5	31.7	24.1	15.3	35.6	14.3	18.8	4.05	2.86	3.13	2.67	3.06
27	34.2	33.0	24.0	14.0	19.0	13.4	13.6	3.89	2.86	3.06	2.80	3.06
28	34.2	31.4	23.9	14.1	15.2	12.5	9.62	3.81	2.80	3.00	2.86	2.93
29	34.2	....	23.8	12.8	16.2	11.5	637	3.97	2.86	3.00	3.13	3.19
30	34.4	....	22.2	11.4	16.2	10.1	71.9	8.76	2.80	2.86	3.19	3.42
31	34.4	....	22.0	....	15.2	....	23.1	4.83	....	2.80	....	3.26

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	3.71	3.67	38.5	32.3	34.4	2,110	
February.....	3.68	3.65	35.8	29.9	33.6	1,860	
March.....	3.66	3.61	31.0	20.6	26.0	1,600	
April.....	3.62	3.52	21.9	9.9	17.2	1,020	
May.....	4.05	3.48	173	9.7	16.1	992	
June.....	4.34	3.47	392	9.2	18.9	1,130	
July (29).....	5.65	3.26	2,100	4.83	33.4	2,050	
August.....	3.58	3.17	18.8	3.81	7.44	457	
September (24).....	3.57	2.95	18.0	2.35	3.30	197	
October.....	3.67	3.02	29.5	2.73	4.33	266	
November.....	3.48	2.98	10.9	2.50	3.19	190	
December.....	3.12	2.97	3.42	2.45	2.93	180	
Yearly.....	5.65	2.95	2,100	2.35	16.6	12,052	52.6

## RIO SAN DIEGO STATION AT JIMENEZ, COAHUILA

**Description:** Automatic water-stage recorder and cable with sit down cable car. Masonry Cipoletti weir control for measuring discharges up to 617 second feet was constructed late in the year. The station is located 4.4 miles west of Jimenez, Coahuila, and five miles above the confluence with the Rio Grande.

**Records:** Based upon 90 current meter measurements from cable car and by wading. Computations by shifting channel methods. Records for 1933 considered good.

**Records Available:** 1924 to 1933.

**Remarks:** This station was constructed by the Mexican Section of the Commission and completed in November, 1932. Current meter measurements began November 3, and continuous water-stage record began November 16. From 1924 to 1932 there was a staff-gage at Paso del Salto, 3.1 miles upstream from the present station. Readings were made by agents of the Department of Agriculture, Monterrey, N. L. There is another gaging station on Rio San Diego at "Cabeceras", 31 miles upstream from the present station which is operated by the Mexican National Irrigation Commission. The flow of this spring-fed stream is modified by small storage reservoirs at San Miguel and Centenario on the National Irrigation System No. 6 at San Carlos, Coahuila, and by irrigation of Dolores Hacienda. One-fourth mile downstream from this gaging station water is diverted for the Jimenez Community. The drainage area above this station is 840 sq. 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 stream never runs dry, although its flow at times is less than 35 second feet.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	636	519	403	314	210	177	135	91.8	98.2	112	147	108
2	635	519	402	289	210	177	120	98.2	98.2	112	147	103
3	636	519	381	289	194	194	120	98.2	112	119	132	104
4	635	519	364	289	210	194	120	98.2	119	112	132	103
5	636	498	364	289	194	185	120	98.2	132	119	119	103
6	611	498	381	289	194	177	120	91.8	147	119	119	104
7	611	498	364	289	194	154	120	91.8	147	119	132	103
8	611	498	381	289	194	154	120	98.2	147	132	132	103
9	611	477	381	289	186	154	120	98.2	147	132	132	104
10	611	477	381	265	186	154	120	98.2	164	132	119	103
11	611	477	381	265	177	154	120	91.8	164	132	119	103
12	611	477	364	265	177	154	120	98.2	164	132	119	104
13	611	456	364	265	177	185	105	98.2	164	132	119	103
14	611	456	364	265	177	177	105	104	164	132	119	103
15	611	477	364	244	177	167	91.8	98.2	164	164	119	93.6
16	586	456	364	244	177	154	91.8	91.8	164	147	119	93.6
17	586	456	339	244	177	154	91.8	91.8	147	147	112	93.6
18	586	456	339	244	177	136	91.8	91.8	147	147	112	93.6
19	586	438	339	225	177	154	91.9	98.2	147	147	112	93.6
20	586	420	339	225	177	154	105	98.2	147	147	108	93.6
21	565	438	339	225	177	154	105	105	147	164	108	93.6
22	586	456	339	371	177	136	105	104	132	164	109	93.6
23	565	456	339	289	186	120	105	105	132	164	108	93.6
24	565	420	314	225	315	136	105	104	132	164	108	93.6
25	565	420	314	209	210	136	105	105	132	164	109	93.6
26	565	403	314	225	194	136	105	104	132	164	108	75.2
27	565	402	314	225	186	120	105	105	119	164	108	75.2
28	565	403	314	209	177	120	105	98.2	119	147	109	75.2
29	544	...	290	209	186	120	91.8	98.2	104	147	108	75.2
30	544	...	289	209	177	120	91.8	98.2	112	147	108	75.2
31	519	...	314	...	177	...	91.9	98.2	...	147	...	75.2

Month	Gage Height		Second Feet		Acre Feet		
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.79	2.62	636	519	592	36,430	
February.....	2.62	2.43	519	403	464	25,760	
March.....	2.43	2.26	403	290	350	21,500	
April (22).....	3.25	2.13	1,020	209	259	15,420	
May.....	3.22	2.00	989	168	190	11,710	
June.....	2.49	1.90	438	120	154	9,140	
July.....	1.94	1.84	136	91.8	108	6,630	
August.....	1.90	1.84	105	91.8	98.4	6,050	
September.....	2.07	1.87	164	98.2	138	8,220	
October.....	2.07	1.94	164	112	141	8,670	
November.....	2.03	2.10	147	108	118	7,050	
December (31)...	2.07	2.10	108	75.2	94.6	5,820	
Yearly.....	3.25	2.10	1,020	75.2	224	162,400	193

## LAS MORAS CREEK STATION NEAR EAGLE PASS, TEXAS

**Description:** Automatic water-stage recorder 0.6 mile above the confluence with the Rio Grande, 25 miles northwesterly from Eagle Pass, 0.1 mile above the main Eagle Pass-Del Rio highway, at the Las Moras Creek siphon on the Maverick County Canal. Zero of gage is 783.76 feet above mean sea level, United States Coast and Geodetic Survey datum. The Maverick County Canal siphon forms a fixed control for this station.

**Records:** Based upon 7 current meter measurements during the year by wading and dependable station rating curve. 1933 records considered good.

**Records Available:** January, 1932 to December, 1933.

**Remarks:** The flow of this spring fed creek is modified by small irrigation diversions above the station. The drainage area above this station is 166 square miles, all in the United States.

**Previous Extreme Flows:** The highest previous gage height recorded was on Aug. 31, 1932, when the extreme gage height was 7.07 feet with a discharge of 8,860 second feet. The lowest flow ever recorded was in June, 1932, when the creek was dry.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.76	1.51	1.76	2.03	1.76	2.31	0	0	0	0	0	0
2	1.76	1.51	2.03	2.03	1.76	2.31	0	0	0	0	0	0
3	2.03	1.76	1.76	2.03	2.03	2.31	0	0	0	0	0	0
4	2.03	1.76	2.03	2.03	1.76	2.31	0	0	0	0	0	0
5	2.03	1.76	2.03	2.03	1.51	2.60	0	0	0	0	0	0
6	2.03	2.03	2.03	2.03	1.51	2.90	0	0	0	0	0	0
7	2.03	1.76	2.03	2.03	1.51	2.90	0	0	0	0	0	0
8	2.03	1.76	1.76	2.03	1.51	2.90	0	0	0	0	0	0
9	2.03	1.76	1.76	2.03	1.51	2.60	0	0	0	0	0	0
10	2.03	2.03	1.76	1.76	1.76	2.31	0	0	0	0	0	0
11	2.03	1.76	2.03	1.76	1.51	2.60	0	0	0	0	0	0
12	2.03	1.76	2.03	1.76	1.28	2.31	0	0	0	0	0	0
13	2.03	1.76	2.03	2.03	1.28	10.5	0	0	0	0	0	0
14	2.03	1.51	1.76	2.03	1.05	12.2	0	0	0	0	0	0
15	2.03	2.03	2.03	2.03	1.28	10.6	0	0	0	0	0	0
16	2.03	1.76	2.03	1.76	1.05	9.21	0	0	0	0	0	0
17	2.03	1.76	2.03	1.76	.86	7.84	0	0	0	0	0	0
18	2.03	1.51	2.03	1.76	.67	6.12	0	0	0	0	0	0
19	2.03	1.76	2.03	2.03	.35	5.32	0	0	0	0	0	0
20	1.76	1.51	2.03	1.76	1.05	3.87	0	0	0	0	0	0
21	1.76	1.51	2.03	1.76	.50	3.22	0	0	0	0	0	0
22	1.76	1.51	2.03	1.19	.11	2.60	0	0	0	0	0	0
23	1.76	1.51	2.03	3.90	.11	2.03	0	0	0	0	0	0
24	1.76	1.51	2.03	2.31	.22	1.51	0	0	0	0	0	0
25	1.76	1.76	2.03	2.31	.86	1.05	0	0	0	0	0	0
26	1.76	1.76	2.03	2.03	12.7	.50	0	0	0	0	0	0
27	1.76	2.03	2.03	2.03	19.8	.22	0	0	0	0	0	0
28	1.76	1.76	2.03	2.03	9.74	0	0	0	0	0	0	0
29	2.03	....	2.03	2.03	1.51	0	0	0	0	0	0	0
30	2.03	....	2.03	2.03	1.76	0	0	1.81	0	0	0	0
31	1.76	....	2.03	....	2.03	..	0	.22	..	0	0	0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.03	1.00	2.31	1.51	1.93	118	
February.....	1.02	1.00	2.03	1.51	1.72	95.4	
March.....	1.04	1.00	2.60	1.51	1.98	122	
April (22).....	1.76	1.00	47.3	1.51	2.11	126	
May.....	1.42	.90	21.1	0	2.46	151	
June.....	1.70	.81	42.2	0	3.57	213	
July.....	....	....	0	0	0	0	
August.....	....	....	....	....	.07	4.03	
September.....	....	....	0	0	0	0	
October.....	....	....	0	0	0	0	
November.....	....	....	0	0	0	0	
December.....	....	....	0	0	0	0	
Yearly.....	1.76	....	47.3	0	1.15	829.43	5.0

## RIO SAN RODRIGO STATION NEAR EL MORAL, COAHUILA

**Description:** Automatic water-stage recorder and cable with sit down cable car located 11.2 miles west of the town of El Moral, Coahuila, 19.9 miles northward from Piedras Negras and 11.8 miles above the confluence with the Rio Grande.

**Records:** Based upon 54 current meter measurements by wading and from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** 1922 to 1933.

**Remarks:** From 1922 to 1932 there were made daily 3 staff-gage readings at this station by Agencies of the Mexican Department of Agriculture at Monterrey, N. L. This station was constructed by the Mexican Section of the Commission and completed in October, 1932. Meter measurements began August 4, 1932. The automatic water-stage record began November 8, the same year. The flow of this spring fed river is modified by irrigation diversions at El Remolino, 27.3 miles upstream. At Casa Roja, 7.5 miles downstream, some water is diverted for irrigation. The drainage area above this station is 750 square miles, entirely in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	258	226	188	135	84.4	64.6	40.6	40.6	48.4	77.0	77.0	64.6
2	269	226	188	135	84.4	70.3	40.6	36.4	48.4	126	77.0	55.1
3	269	226	179	135	91.5	64.6	36.4	32.8	44.1	91.5	70.3	47.0
4	269	226	169	144	84.4	59.0	32.8	29.7	44.1	64.6	77.0	47.0
5	258	226	169	135	84.4	59.0	36.4	32.8	48.4	59.7	77.0	47.0
6	258	226	155	126	84.4	59.0	36.4	36.4	44.1	50.9	77.0	43.8
7	258	226	155	126	84.4	59.0	32.8	32.8	59.0	55.1	84.4	47.0
8	247	216	144	126	77.0	59.0	32.8	36.4	53.7	50.9	84.4	50.9
9	247	216	135	116	77.0	53.8	32.8	32.8	48.4	50.9	77.0	50.9
10	237	216	145	126	77.0	48.4	29.7	32.8	48.4	55.1	77.0	47.0
11	237	216	145	144	77.0	44.1	29.7	36.4	48.4	55.1	77.0	50.9
12	237	216	145	144	77.0	44.1	29.6	40.6	48.4	55.1	77.0	43.8
13	237	216	145	144	70.3	48.4	32.8	40.6	48.4	55.1	64.6	47.0
14	237	216	169	135	70.3	48.4	36.4	36.4	48.4	67.1	64.6	50.9
15	237	216	179	116	77.0	44.1	32.8	36.4	48.4	198	70.3	47.0
16	236	226	179	116	77.0	44.1	32.8	32.8	59.0	91.5	70.3	47.0
17	236	216	179	107	77.0	59.0	32.8	32.8	53.7	70.3	64.6	43.8
18	236	206	179	107	70.3	64.6	36.4	32.8	48.4	64.6	70.3	43.8
19	236	198	169	116	70.3	70.3	36.4	29.7	48.4	64.6	64.6	43.8
20	237	188	169	107	64.6	59.0	40.6	29.7	53.7	64.6	70.3	47.0
21	237	188	155	98.9	64.6	53.8	36.4	29.7	53.7	64.6	64.6	47.0
22	226	188	155	98.9	64.6	48.4	36.4	32.8	59.0	59.7	59.7	47.0
23	226	188	155	98.9	64.6	44.1	36.4	32.8	53.7	59.7	59.7	47.0
24	226	188	169	107	77.0	44.1	36.4	32.8	53.7	64.6	59.7	47.0
25	226	188	155	98.9	84.4	44.1	36.4	32.8	53.7	70.3	59.7	50.9
26	237	188	155	91.5	91.5	44.1	36.4	36.4	48.4	70.3	59.7	50.9
27	226	188	155	91.5	84.4	44.1	32.8	36.4	48.4	70.3	59.7	50.9
28	237	179	155	84.4	77.0	40.6	36.4	40.6	44.1	70.3	59.7	55.1
29	237	...	155	77.0	77.0	40.6	36.4	40.6	44.1	77.0	64.6	55.1
30	237	...	155	77.0	70.3	40.6	36.4	44.1	44.1	77.0	64.6	55.1
31	237	...	144	...	70.3	...	36.4	48.4	...	77.0	...	55.1

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.36	2.23	269	226	242	14,850	
February.....	2.23	2.07	226	179	209	11,580	
March.....	2.10	1.94	188	135	161	9,900	
April.....	2.07	1.71	179	77.0	115	6,870	
May.....	1.84	1.61	107	59.0	76.9	4,730	
June.....	1.74	1.48	84.4	40.6	52.2	3,110	
July.....	1.51	1.35	44.1	26.8	35.0	2,160	
August (4).....	1.61	1.35	59.0	26.8	35.4	2,180	
September.....	1.77	1.48	91.5	40.6	49.8	2,970	
October (14).....	4.86	1.51	2,330	44.1	91.4	5,620	
November.....	1.77	1.57	91.5	55.1	69.4	4,130	
December.....	1.64	1.44	64.6	39.9	49.2	3,030	
Yearly.....	4.86	1.35	2,330	26.8	98.2	71,130	94.8

## RIO GRANDE AT EAGLE PASS STATION

**Description:** Automatic water-stage recorder and cable with stand up cable car, located ½ mile above the international highway bridge at Eagle Pass, Texas. Zero of gage is 682.91 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 28 current meter measurements during the year from cable and from R. R. bridge one mile downstream. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May, 1900 to April, 1916; November, 1923 to December, 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States and by irrigation diversions and Boquilla reservoir in Mexico. With all closed basins eliminated the drainage area above this station is 126,962 square miles; 90,043 being in the United States and 36,919 in Mexico.

**Previous Extreme Flows:** The greatest flow ever recorded was on Sept. 2, 1932, when the extreme gage height was 49.00 feet, discharge 568,630 second feet. The lowest flow ever recorded was on May 26, 1930, when the extreme gage height was 2.51 feet and the extreme flow 940 second feet. Numerous records of extremes may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,470	4,950	4,370	3,490	3,270	3,020	5,890	2,720	9,650	6,720	3,930	3,060
2	5,360	4,880	4,260	3,560	3,200	2,790	5,760	2,680	5,800	6,860	3,840	3,000
3	5,380	4,780	4,120	3,500	3,140	2,720	5,560	2,580	4,740	6,910	3,740	2,960
4	5,460	4,810	4,170	3,480	3,190	2,680	5,380	2,480	4,120	6,990	3,650	2,960
5	5,330	4,740	4,300	3,440	3,090	2,710	5,240	2,530	3,740	7,100	3,600	2,960
6	5,300	4,760	4,280	3,380	3,030	2,660	4,820	2,510	13,530	6,720	3,640	2,850
7	5,360	4,740	4,100	3,260	3,040	2,740	4,950	2,430	20,990	6,710	3,570	2,800
8	5,510	4,670	4,180	3,200	3,020	2,780	4,620	2,440	16,310	6,300	3,470	2,770
9	5,380	4,600	4,150	3,170	3,010	2,680	4,270	2,400	12,930	6,120	3,260	2,740
10	5,380	4,530	4,190	3,150	3,010	2,580	4,160	2,250	10,390	6,970	3,270	2,810
11	5,390	4,460	4,250	3,110	2,990	2,560	4,100	2,210	8,590	8,940	3,340	2,840
12	5,210	4,490	4,380	3,050	2,870	2,650	3,830	2,250	8,480	9,140	3,300	2,860
13	5,220	4,460	4,500	3,080	2,780	3,690	3,600	2,340	10,030	11,110	3,310	2,890
14	5,320	4,440	4,310	2,900	2,890	3,690	3,330	2,380	11,730	12,490	3,240	2,770
15	*5,320	4,610	4,190	2,870	3,020	3,200	3,040	2,380	11,800	15,150	3,200	2,870
16	*5,370	4,610	4,100	2,910	2,890	3,120	2,890	2,580	12,010	12,030	3,190	2,860
17	5,380	4,470	4,090	2,880	2,780	2,970	2,870	2,240	13,420	10,440	3,130	2,740
18	5,420	4,470	4,080	2,880	2,760	2,820	2,750	2,160	14,460	7,610	3,200	2,820
19	5,310	4,540	4,010	2,920	2,760	2,700	2,650	2,510	17,290	6,820	3,230	2,820
20	5,300	4,540	3,940	2,930	2,740	2,680	2,570	2,360	24,370	6,590	3,220	2,730
21	5,240	4,470	3,860	2,760	2,770	2,870	2,640	2,230	22,360	6,160	3,230	2,670
22	5,250	4,540	3,860	2,900	3,050	2,870	2,540	4,600	18,260	5,850	3,210	2,740
23	5,170	4,410	3,820	3,840	2,920	2,840	2,560	4,490	15,410	5,660	3,100	2,900
24	5,080	4,410	3,720	4,210	3,330	2,760	2,580	3,850	13,460	5,380	3,080	2,830
25	5,120	4,480	3,660	3,740	3,310	2,760	3,730	3,660	11,130	5,040	3,100	2,910
26	5,010	4,500	3,640	3,690	3,100	3,200	3,850	3,540	10,100	4,750	3,000	2,890
27	4,930	4,480	3,670	3,560	2,880	3,850	3,480	3,670	9,800	4,700	3,020	2,800
28	4,900	4,340	3,650	3,450	3,100	4,050	3,060	3,500	8,740	4,650	3,150	2,740
29	4,860	.....	3,650	3,290	3,570	5,590	2,820	3,140	7,620	4,200	3,040	2,870
30	4,820	.....	3,720	3,300	3,120	6,030	3,270	3,680	6,950	4,150	3,000	2,910
31	4,910	.....	3,530	.....	2,980	.....	2,890	4,290	.....	4,050	.....	3,020

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	5.26	4.91	5,160	4,800	5,241	322,240	
February.....	4.98	4.67	4,950	4,250	4,578	254,250	
March.....	4.74	4.32	4,500	3,490	4,024	247,440	
April.....	4.93	3.90	4,720	2,510	3,263	194,180	
May.....	4.65	3.94	4,260	2,710	3,020	185,680	
June.....	5.54	3.88	6,470	2,540	3,142	166,960	
July.....	5.47	3.82	6,270	2,370	3,732	229,490	
August (18).....	6.20	3.73	8,400	2,100	2,874	176,990	
September (20).....	10.33	4.42	25,710	3,650	11,940	710,510	
October.....	8.41	4.57	16,860	3,960	7,197	440,950	
November.....	4.63	4.01	4,100	2,850	3,309	196,880	
December.....	4.16	3.92	3,170	2,550	2,851	175,320	
Yearly.....	10.33	3.73	25,710	2,100	4,587	3,320,590	26.2

\*Partly Estimated

**RIO ESCONDIDO STATION AT VILLA FUENTE, COAHUILA**

**Description:** Automatic 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.

**Records:** Based upon 54 current meter measurements from cable car and small bridge 660 feet upstream from the cable. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** 1922 to 1933.

**Remarks:** From 1922 to 1932 there were made daily 3 staff-gage readings 2,300 feet downstream from the present station by Agencies of the Mexican Department of Agriculture at Monterrey, N. L. The zero of this old gage is 0.79 foot above the zero datum of the gage at the present station, but the water surface is practically level between the two gages. The present station was constructed by the Mexican Section of this Commission and completed in September, 1932. Meter measurements began in July and the continuous water-stage records began October 5. The flow of this spring fed stream is modified by irrigation diversions 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.

*Mean Daily Discharge in Second Feet and Annual Summary, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	297	225	133	114	44.8	40.3	11.7	9.18	28.6	5.65	39.6	21.5
2	304	225	134	124	48.4	61.8	11.7	9.18	28.6	8.48	27.5	21.5
3	296	226	133	133	44.8	47.3	13.1	8.12	26.5	27.9	27.5	21.5
4	304	219	128	138	41.7	47.3	14.1	8.12	29.7	31.4	26.5	20.8
5	287	219	124	139	38.5	40.2	14.1	10.2	29.7	21.2	25.4	20.8
6	286	225	118	134	32.5	33.5	15.5	20.1	35.0	27.9	25.4	24.7
7	297	219	123	133	30.0	22.2	13.1	27.9	59.0	18.7	27.5	27.2
8	287	207	118	129	30.0	15.9	10.2	11.7	48.0	24.4	24.4	28.6
9	286	219	113	124	28.6	14.5	11.7	17.7	29.7	23.0	19.8	30.0
10	287	219	104	90.8	32.5	13.1	11.7	17.7	27.5	16.2	18.0	31.8
11	280	219	104	73.1	32.5	13.0	14.1	14.1	26.5	15.2	18.0	23.3
12	279	207	109	69.6	32.5	13.1	10.3	5.65	27.5	17.7	18.0	25.8
13	280	194	109	73.1	32.5	15.5	14.1	4.94	30.7	10.9	19.8	21.9
14	279	171	104	65.7	32.5	27.9	14.1	4.94	25.4	420	21.5	23.3
15	280	160	113	69.6	35.3	22.6	9.17	5.65	25.4	385	21.5	25.8
16	280	171	118	73.1	32.5	17.7	17.7	4.24	24.7	138	23.7	27.2
17	273	160	109	77.3	38.5	17.6	15.5	3.53	26.5	93.6	21.5	33.2
18	265	160	109	73.1	41.7	37.4	13.1	7.06	24.7	76.3	22.6	34.6
19	251	149	109	58.6	32.5	38.8	14.1	3.18	21.9	61.8	19.8	31.8
20	250	144	113	55.4	27.5	33.9	11.7	3.18	21.9	56.5	20.8	34.6
21	244	143	113	55.4	27.5	32.5	9.17	5.65	21.9	50.9	20.8	27.2
22	237	138	109	55.4	23.3	31.4	4.94	4.23	18.0	43.8	21.5	28.6
23	236	139	104	55.4	15.9	25.8	4.94	3.53	20.8	43.8	21.5	30.0
24	225	133	104	51.9	18.4	12.7	9.17	4.23	18.0	41.7	21.5	31.8
25	212	134	104	58.6	81.2	14.1	10.3	9.18	11.7	39.6	21.5	31.8
26	212	133	104	55.4	78.0	14.1	14.1	3.53	19.8	41.7	21.5	31.8
27	207	138	104	55.4	64.6	14.1	20.1	3.53	15.5	39.6	22.6	34.6
28	200	139	104	51.9	59.3	14.1	20.1	9.18	13.1	27.5	24.4	43.4
29	212	...	104	51.9	87.2	12.7	20.1	26.5	16.2	26.5	20.8	57.2
30	212	...	104	51.9	69.9	11.3	14.1	64.3	14.1	25.4	19.8	69.9
31	219	...	104	...	64.6	...	10.2	32.1	...	27.5	...	69.9

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.62	2.26	314	200	260	15,990	
February.....	2.30	1.64	237	124	180	9,990	
March.....	1.77	1.44	144	95.3	112	6,910	
April.....	2.76	.56	349	18.4	83.0	4,940	
May.....	3.74	.39	378	12.4	41.9	2,580	
June.....	3.35	1.05	314	11.3	25.2	1,500	
July.....	1.54	.79	36	4.24	12.8	789	
August (20).....	5.31	.69	1,020	2.47	11.7	719	
September.....	2.36	.92	83.3	7.06	25.6	1,520	
October (14).....	5.87	.92	1,390	4.59	60.9	3,740	
November.....	2.03	1.02	53.3	10.2	22.8	1,360	
December.....	2.23	1.12	69.9	14.1	31.8	1,960	
Yearly.....	5.87	.39	1,390	2.47	71.8	51,998	44.4

RIO GRANDE AT LAREDO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car. Cable and car located about 2½ miles above the cities of Laredo, Texas and Nuevo Laredo, Tamaulipas. Water-stage recorder is attached to north abutment of railroad bridge at Laredo. 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 January, 1926, and zero of gage was elevation 352.65 feet. On October 25, 1930, zero of gage at recorder was changed to elevation 351.50 feet. All gage elevations are on United States Coast and Geodetic Survey sea level datum.

**Records:** Based on 160 current meter measurements from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** 1904 to 1913; from October, 1922 to 1926; 1928, 1929 and August 25, 1930 to 1933.

**Remarks:** The river flow at this station is modified by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States and by many irrigation diversions and Boquilla reservoir in Mexico. With all closed basins eliminated the drainage area above this station is 132,915 square miles, of which 91,516 are in the United States and 41,399 in Mexico.

**Previous Extreme Flows\*:** The greatest previous flow was on Sept. 3, 1932, when the peak gage reading was 52.20 feet, the flow being 402,590 second feet. In 1910 a minimum flow of 939 second feet was reached. Numerous records of extreme flows may be seen in Water Bulletin No. 1.

Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,440	4,590	4,100	3,230	2,900	2,680	5,160	2,880	4,840	6,960	3,850	2,760
2	5,230	4,620	3,990	3,160	3,000	2,630	5,160	2,540	7,700	9,180	3,780	2,760
3	5,230	4,590	3,990	3,230	2,900	2,630	5,160	2,370	7,910	8,190	3,710	2,760
4	5,220	4,520	3,890	4,060	2,830	2,510	4,840	2,370	5,160	7,060	3,600	2,760
5	5,230	4,410	3,880	3,290	2,770	2,330	4,840	2,370	15,010	6,890	3,500	2,760
6	5,050	4,410	3,890	3,160	2,830	2,260	4,730	3,810	22,600	6,960	3,600	2,760
7	5,230	4,520	3,880	3,230	2,680	2,260	4,420	2,970	15,190	6,710	3,500	2,680
8	5,050	4,410	3,780	3,110	2,680	2,190	4,590	2,290	19,070	6,500	3,500	2,630
9	5,120	4,240	3,710	3,110	2,630	2,330	4,340	2,120	15,360	6,360	3,420	2,630
10	5,050	4,240	3,710	3,040	2,630	2,260	3,990	2,120	12,180	5,930	3,280	2,560
11	4,980	4,240	3,600	3,000	2,630	2,190	3,670	2,290	9,530	6,070	3,110	2,630
12	4,980	4,170	3,710	2,900	2,630	2,120	3,670	2,190	7,910	8,190	3,110	2,630
13	4,760	4,100	3,710	2,900	2,560	2,260	3,570	2,370	7,310	8,580	3,210	2,630
14	4,770	4,100	3,890	3,000	2,510	2,900	3,390	2,190	9,360	14,940	3,110	2,630
15	4,840	4,100	3,780	2,830	2,400	3,040	3,220	2,290	10,950	32,380	3,110	2,680
16	4,840	4,160	3,670	2,680	2,510	3,280	2,970	2,370	9,890	16,670	2,970	2,630
17	4,840	4,240	3,670	2,680	2,560	2,040	2,720	2,370	10,590	12,860	2,970	2,680
18	4,830	4,170	3,640	2,680	2,400	2,900	2,650	2,540	13,100	12,040	2,970	2,680
19	4,980	4,100	3,640	2,680	2,330	3,040	2,540	2,290	13,950	7,910	2,970	2,630
20	4,840	3,990	3,530	2,770	2,330	3,040	2,370	2,120	16,600	6,710	2,970	2,760
21	4,840	4,230	3,460	2,680	2,330	2,400	2,310	2,190	24,190	6,290	2,970	2,680
22	4,840	4,240	3,390	2,680	2,260	2,400	2,310	2,190	22,250	5,930	2,970	2,680
23	4,760	4,240	3,390	2,630	2,330	2,680	2,310	2,440	18,010	5,440	2,970	2,630
24	4,770	4,240	3,350	5,440	2,560	2,630	2,310	4,520	15,360	5,230	2,890	2,680
25	4,700	4,160	3,430	3,710	2,400	2,560	2,970	4,240	13,420	5,120	2,820	2,680
26	4,700	4,170	3,350	3,780	3,040	2,330	3,810	3,810	11,120	4,840	2,820	2,760
27	4,620	4,240	3,210	3,280	3,600	2,330	3,810	3,430	9,530	4,480	2,820	2,680
28	4,590	4,240	3,280	3,230	2,900	2,860	3,430	3,370	9,360	4,340	2,680	2,680
29	4,520	.....	3,280	3,230	2,820	3,390	3,140	3,600	8,650	4,340	2,750	2,560
30	4,590	.....	3,360	3,110	3,000	3,810	2,720	3,640	7,700	4,130	2,890	2,560
31	4,590	.....	3,280	.....	3,160	.....	2,540	6,000	.....	3,960	.....	2,630

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	6.50	6.17	5,440	4,520	4,904	301,550	
February.....	6.23	5.94	4,630	3,920	4,274	237,380	
March.....	6.04	5.58	4,170	3,200	3,627	223,020	
April.....	6.92	5.35	6,990	2,630	3,171	188,720	
May.....	5.97	5.15	4,060	2,190	2,681	164,850	
June.....	6.33	5.12	5,120	2,120	2,653	157,850	
July (25).....	6.43	5.05	5,300	1,980	3,532	217,150	
August.....	7.74	5.12	9,530	2,120	2,848	175,120	
September.....	12.30	6.17	32,310	4,700	12,460	741,430	
October (15).....	13.78	5.81	39,910	3,850	8,103	498,240	
November.....	5.84	5.28	3,960	2,680	3,161	188,070	
December.....	5.38	5.18	2,900	2,470	2,673	164,350	
<b>Yearly.....</b>	<b>13.78</b>	<b>5.05</b>	<b>39,910</b>	<b>1,980</b>	<b>4,500</b>	<b>3,257,730</b>	<b>24.5</b>

\*The extreme flow of 152,350 second feet shown in Water Bulletin No. 2 for October, 1932 was in error. It should have been printed as 99,500 second feet.

## DOLORES CREEK STATION NEAR SAN IGNACIO, TEXAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 3.2 miles above the confluence with the Rio Grande, and 14 miles north of San Ignacio, Zapata County, Texas. Zero of gage is 317.66 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon previous rating curve and several estimates by hydrographer at low flows. 1933 records considered poor.

**Records Available:** January 1, 1932 to December 31, 1933.

**Remarks:** This creek is dry except during storms. The drainage area above this station is 606 square miles, all in the United States.

**Previous Extreme Flows:** On September 4, 1932, Rio Grande backwater reached a gage height of 25.4 at this station.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	0	0	0	0	0	3.2	10.0	12.0	0	0
2	0	*16.4	0	0	0	0	0	1.8	2.3	19.2	0	0
3	0	0	0	0	0	0	0	1.0	0.4	0.7	0	0
4	0	0	0	0	0	0	0	0	0	0.6	0	0
5	0	0	0	*1.2	0	0	0	723	3270	0	0	0
6	0	0	0	0	0	0	0	166	7410	0	0	0
7	0	0	0	0	0	0	0	11.8	399	0	0	0
8	0	0	0	0	0	0	87.6	2.0	4.8	0	0	0
9	0	0	0	0	0	0	14.1	1.0	0.4	0	0	0
10	0	0	0	0	0	0	0.4	0.6	0	0	0	0
11	0	0	0	0	0	0	0	16.1	0	0	0	0
12	0	0	0	0	0	0	0	109	0	0	0	0
13	0	0	0	0	0	169	0	11.5	0	0	0	0
14	0	0	0	0	0	10	0	1.2	0	0	0	0
15	0	0	0	0	0	2	0	162	0	1.7	0	0
16	0	0	0	0	0	0	0	280	51.1	1.8	0	0
17	0	0	0	0	8.4	0	0	51.0	0.6	0	0	0
18	0	0	0	0	1.4	0.1	0	8.5	0	0	0	0
19	0	0	0	0	0	5	0	1.2	0	0	0	0
20	0	0	0	0	0	0.6	0	0	0	*26.3	0	0
21	0	0	0	0	0	0	0	0	0	*175	0	0
22	0	0	0	0	0	0	0	0	0	*4.5	0	0
23	0	0	0	0	0	0	0.8	0	0	*2.1	0	0
24	0	0	0	*1	0	0	0	0	291	*2.1	0	0
25	0	0	0	*0.2	0	0	229	0	182	*2.1	0	0
26	0	0	0	0	0	0	436	0	30.7	*2.0	0	0
27	0	0	0	0	0	0	458	0	0.9	*2.0	0	0
28	0	0	0	0	0	0	564	0	0	*2.0	0	0
29	0	0	0	0	112	0	58.3	4.0	0	*1.0	0	0
30	0	0	0	0	2.0	0	15.4	227	0	*1.0	0	0
31	0	0	0	0	0.6	0	6.5	126	0	*1.0	0	0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....			0	0	0	0	
February.....	317.6		* 61.0	0	* 0.59	* 32.5	
March.....			0	0	0	0	
April.....	317.22		* 8.0	0	* 0.08	* 4.76	
May.....	319.04		887	0	4.01	247	
June.....	319.74		1,710	0	6.2	370	
July.....	319.88		2,040	0	60.3	3,710	
August.....	319.67		1,470	0	61.5	3,780	
September (6)...	327.17		21,270	0	388	23,110	
October.....	*318.76		*262	0	8.29	510	
November.....			0	0	0	0	
December.....			0	0	0	0	
Yearly.....	327.17		21,270	0	43.9	31,764.26	52.4

\*Partly Estimated

### RIO SALADO STATION AT CD. GUERRERO, TAMAULIPAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 6.2 miles above the confluence of the Rio Salado with the Rio Grande and 2 miles southeast of Ciudad Guerrero, Tamaulipas.

**Records:** Based on 153 current meter measurements during the year from cable car and from a board across a narrow place ¼ mile downstream from the cable. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** 1901 to 1912; 1923 to 1933.

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

**Previous Extreme Flows:** The greatest previous flow ever recorded at this station was on September 18, 1924, when a mean daily gage height of 17.65 feet was reached with a corresponding discharge of 35,630 second feet. The stream has not been dry since irrigation commenced in System No. 4 in 1931. Numerous extremes may be seen in Water Bulletin No. 1.

#### Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	855	855	823	313	121	115.0	94.3	141.0	378	1,200	865	491
2	717	554	519	279	121	88.3	89.0	102.0	276	1,250	819	491
3	583	441	451	223	177	77.7	89.0	81.2	314	1,550	798	484
4	512	368	519	266	150	85.1	97.5	67.1	314	4,030	777	484
5	477	343	378	360	127	85.1	89.0	69.9	1,890	5,050	756	491
6	441	339	339	918	104	81.2	69.9	1,110	6,850	4,130	756	484
7	413	328	321	530	93.6	104.0	63.6	2,270	35,070	3,390	756	456
8	400	321	378	346	93.6	121.0	97.5	2,540	33,480	2,820	735	445
9	385	293	286	286	104	88.3	159.0	689.0	24,970	2,770	734	434
10	385	314	254	248	109	77.7	159.0	413.0	8,510	2,300	717	434
11	378	314	247	206	127	81.2	208.0	685.0	4,490	1,980	735	434
12	371	261	240	185	133	127.0	248.0	636.0	3,290	1,770	717	445
13	360	261	240	169	121	192.0	201.0	1,900.0	2,680	1,620	699	445
14	346	254	261	169	121	177.0	147.0	3,350.0	2,260	1,520	685	434
15	413	261	279	163	121	312.0	124.0	1,800.0	1,940	1,470	660	424
16	2,430	247	254	200	144	844.0	102.0	1,550.0	2,330	1,410	643	413
17	4,270	240	230	286	163	625.0	107.0	1,090.0	3,230	1,520	643	434
18	4,200	247	214	206	157	403.0	97.5	812.0	3,810	1,350	629	424
19	5,340	254	199	169	127	279.0	89.0	671.0	3,070	1,250	629	406
20	4,130	254	250	169	109	200.0	97.5	569.0	2,440	1,200	611	406
21	3,990	272	279	144	109	240.0	102.0	498.0	2,260	1,180	593	406
22	3,990	3,740	247	163	98.9	254.0	97.5	477.0	2,080	1,110	593	395
23	2,030	7,280	240	314	104	163.0	155.0	441.0	1,860	1,110	554	406
24	689	7,350	240	692	104	115.0	130.0	413.0	1,660	1,080	537	396
25	2,840	7,060	240	272	388	98.9	357.0	360.0	1,550	1,040	526	388
26	6,000	6,890	199	279	533	85.1	883.0	321.0	1,520	978	526	378
27	5,860	6,530	222	313	321	77.7	660.0	286.0	1,480	953	512	378
28	5,830	3,780	192	254	240	98.9	844.0	275.0	1,410	939	491	378
29	5,650	.....	170	177	185	127.0	629.0	254.0	1,310	918	512	378
30	4,450	.....	452	144	192	109.0	339.0	254.0	1,210	918	512	371
31	3,920	.....	314	.....	144	.....	208.0	314.0	.....	890	.....	378

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	8.43	3.64	6,180	339	2,344	144,110	
February.....	8.96	3.22	7,420	231	1,774	98,520	
March.....	5.31	2.89	1,250	157	305	18,720	
April.....	6.40	2.72	2,450	127	281	16,750	
May.....	5.74	2.49	1,680	88.3	159	9,800	
June.....	5.09	2.36	1,080	74.2	184	10,970	
July (7).....	5.54	2.17	1,480	56.9	220	13,550	
August.....	7.61	2.20	4,410	60.0	788	48,480	
September (7).....	18.86	3.28	43,790	248	5,264	313,260	
October.....	8.30	4.86	5,930	890	1,764	108,490	
November.....	4.86	4.17	890	491	657	39,110	
December.....	4.20	3.77	512	371	426	26,200	
Yearly.....	18.86	2.17	43,790	56.9	1,171	847,960	38.8

RIO GRANDE AT ZAPATA STATION

**Description:** Automatic water-stage recorder and cable with stand up cable car located about 3 miles by river below the town of Zapata, Zapata County, Texas, and 1.3 mile below the confluence of the Rio Salado with the Rio Grande. Zero of the gage is at mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 27 current meter measurements during the year from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** January, 1932 to December, 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla and Don Martin reservoirs in Mexico. With all closed basins eliminated the drainage area above this station is 156,714 square miles; 92,613 being in the United States and 64,101 in Mexico.

**Previous Extreme Flows:** The greatest previous flow recorded was on Sept. 4, 1932 when the extreme gage height was 262.07 feet and the extreme flow was 261,160 second feet. The lowest flow recorded was on June 23, 1932, when the extreme gage height was 219.18 feet and the extreme flow 992 second feet.

Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	* 6.880	* 5.920	5.320	3.740	3.300	3.350	*5.000	2,740	6.030	9.640	4.940	3,490
2	* 6.610	* 5.550	4.770	3.780	3,160	2,940	*5.630	2,910	4.900	9,900	4.850	3,490
3	* 6.400	* 5.360	4.630	3.600	3,180	2,830	*5.530	2,800	8.530	11,110	4.730	3,500
4	* 6.240	* 5.270	4.580	3.880	3,150	2,860	*5.350	2,680	6.280	11,620	*4.600	3,580
5	* 6.340	* 5.180	4.390	5.520	3,060	2,780	*5.270	3,500	9.880	12,520	*4.500	3,580
6	* 6.240	* 5.190	4.250	4.500	3,040	2.680	*5.120	4,230	40,000	11,630	*4.400	3,580
7	* 6.080	* 5.150	4.340	3.980	3,050	2,650	*5.000	5,630	45,900	10,950	*4.350	3,510
8	* 6.130	* 5.110	4.340	3.680	3,000	2,670	*5.360	5,690	50,460	10,020	*4.300	3,390
9	* 6.380	* 5.020	4.250	3.510	2,940	2,660	*5.270	3,240	39,580	10,870	*4.300	3,320
10	* 6.170	* 4.930	4.150	3.390	2,830	2,670	*4.610	2,810	23,920	9,030	*4.300	3,210
11	* 6.000	* 4.940	4.150	3.310	2,940	2,670	*4.300	3,000	16,770	8.360	*4.100	3,210
12	* 5.890	* 4.900	4.150	3.190	2,900	2,730	4,080	3,330	12,620	8,830	*3.900	3,210
13	* 5.880	* 4.810	4.250	3.200	2,830	2,670	4,090	4,010	10,330	10,280	*3.850	3,210
14	* 5.670	* 4.770	4.290	3.210	2,820	2,930	3,980	5,990	10,000	10,580	*3.900	3,220
15	* 5.710	* 4.930	4.440	3.220	2,760	4.320	3.590	4,220	11,810	33,920	*3.800	3,220
16	* 7.750	* 4.790	4.250	3.140	2,690	4.330	3,470	4,200	16,750	24,480	*3.800	3,180
17	* 9.940	* 4.980	4.080	3.140	2,810	3,920	3,140	3,800	14,920	15,890	*3.700	3,150
18	* 9.940	* 4.930	4.040	3.060	2,860	3,430	2,900	3,300	17,150	13,500	*3.700	3,230
19	*11,400	* 4.820	3,900	3.050	2,800	3,380	2,790	3,290	16,870	10,800	*3.650	3,190
20	* 9,200	* 4.720	3,910	3.000	2,710	3,280	2,780	3,920	18,110	8,900	*3.650	3,160
21	* 9.550	* 4.620	3.830	2.910	2,710	3,290	2,780	2,790	23,830	8.460	*3.600	3,240
22	* 8.600	* 7.500	3.750	2.900	2,690	2,920	2,670	2,850	28,130	7,890	3.510	3,170
23	* 7.290	*12.130	3.750	3.020	2,670	2,880	2,570	2,870	23,580	7,460	3.510	3,130
24	* 5.940	*12.250	3.670	4.140	2,720	2,880	2,540	3,240	19,880	7,030	3.560	3,060
25	* 7,840	*11,990	3.720	3.460	3,220	2,870	3,040	4,860	18,610	6,960	3,530	3,100
26	*11.650	*12.050	3.670	4.200	3,500	2,870	5.540	4,560	15,480	6,500	3.500	3,110
27	*11.450	*11,290	3.580	4.330	3,670	2,760	4,400	4,070	12,700	6,250	3.500	3,230
28	*11,320	* 9,080	3.490	3.910	3,950	2,690	5,910	3,810	12,050	5,970	3.590	3,270
29	*10,810	.....	3.570	3.630	3,380	2,960	4,190	3,790	11,270	5,860	3.480	3,310
30	* 9.170	.....	3.880	3.490	3,530	3,320	3,450	3,910	10,170	5,790	3,440	3,240
31	* 9,050	.....	3,700	.....	3,460	.....	2,890	6,650	.....	5,340	.....	3,240

Month	Gage Height		Second Feet		Acre Feet		
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	222.64	221.55	*11,840	*5,580	*7,880	*484,450	
February.....	222.71	221.35	*12,320	*4,620	*6,510	*361,350	
March.....	221.65	221.10	6,090	3,490	4,100	252,080	
April.....	221.84	220.94	7,200	2,860	3,637	216,400	
May.....	221.60	220.78	5,200	2,650	3,046	187,300	
June.....	221.68	220.75	5,370	2,580	3,040	180,880	
July (23).....	222.25	220.67	7,350	2,300	4,105	252,380	
August.....	222.67	220.88	9,400	2,670	3,796	233,440	
September (8).....	233.02	221.36	58,000	4,200	18,550	1,103,840	
October.....	228.68	221.52	42,750	5,000	10,527	647,300	
November.....	221.52	221.08	5,020	3,440	*3,958	*235,520	
December.....	221.11	220.94	3,620	3,020	3,282	201,780	
Yearly.....	233.02	220.67	58,000	2,300	6.018	4,356,720	27.8

\*Partly Estimated

**EL TIGRE ARROYO STATION NEAR ZAPATA, TEXAS**

**Description:** Automatic water-stage recorder located 21 miles southeast from Zapata, Zapata County, Texas, and about 2.7 miles above the confluence with the Rio Grande. Zero of gage is 212.99 feet above mean sea level, United States Coast and Geodetic Survey datum. Meter measurements at flood stages are to be made from highway bridge 6,400 feet below the recorder. Zero of gage at highway bridge 208.13 feet above same datum.

**Records:** Based upon previous rating curve and several estimates by hydrographer at low flows. 1933 records considered poor.

**Records Available:** January 1, 1932 to December 31, 1932.

**Remarks:** This creek is dry most of the time and carries only storm flow. The drainage area above this station is 261 square miles, all in the United States.

**Previous Extreme Flows:** On September 5, 1932, Rio Grande backwater reached a gage height of 27.64 feet at this station.

*Mean Daily Discharge in Second Feet and Annual Summary, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	0	0	0	0	0	0	1.2	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	*8.1	0	0	0	0	103	0	0	0
6	0	0	0	*172	0	0	0	0	326	0	0	0
7	0	0	0	*2.5	0	0	0	0	252	0	0	0
8	0	0	0	*1.5	0	0	0	0	32	0	0	0
9	0	0	0	*1.0	0	0	48.1	0	4	44	0	0
10	0	0	0	0	0	0	15	0	0	5	0	0
11	0	0	0	0	0	0	0	0.1	0	3	0	0
12	0	0	0	0	0	0	0	1.04	0	2	0	0
13	0	0	0	0	0	142	0	1.92	0	0	0	0
14	0	0	0	0	0	55.7	0	0	0	0	0	0
15	0	0	0	0	0	24.5	0	0	0	0	0	0
16	0	0	0	0	0	7	0	0	12.2	0	0	0
17	0	0	0	0	0	1.9	0	0	4.2	0	0	0
18	0	0	0	0	0	68.0	0	0	1	0	0	0
19	0	0	0	0	0	6	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	*10.0	0	0	0
22	0	0	0	0	0	0	0	0	*4	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	*57.4	0	0	8	0	*15	0	0	0
25	0	0	0	*2.0	777	0	72.7	0	*15	0	0	0
26	0	0	0	*1.5	425	0	32.7	0	*20	0	0	0
27	0	0	0	0	1	0	33.0	0	0	0	0	0
28	0	0	0	0	0	0	40.0	0	0	0	0	0
29	0	0	0	0	0	0	11	181	0	0	0	0
30	0	0	0	0	0	0	6.5	76.4	0	0	0	0
31	0	0	0	0	0	0	2	37.4	0	0	0	0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.....	.....	0	0	0	0	0
February.....	.....	.....	0	0	0	0	0
March.....	.....	.....	0	0	0	0	0
April.....	3.57	.....	*1,180	0	*8.2	*488	
May (25).....	7.25	.....	7,500	0	38.8	2,390	
June.....	3.07	.....	810	0	10.2	605	
July.....	2.74	.....	600	0	8.68	534	
August.....	3.98	.....	1,600	0	9.6	591	
September.....	3.42	.....	725	0	26.7	1,590	
October.....	4.46	.....	720	0	1.74	107	
November.....	.....	.....	0	0	0	0	
December.....	.....	.....	0	0	0	0	
Yearly.....	7.25	.....	7,500	0	8.71	6,305	24.2

\*Partly Estimated

**RIO ALAMO STATION AT CD. MIER, TAMAULIPAS**

**Description:** Automatic water-stage recorder and cable with sit down cable car, 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." Zero of gage is 187.04 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 187 current meter measurements from cable car and by wading at a narrow place 650 feet downstream from the station. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** July 5, 1923, to 1926; 1928 and 1930 to 1933.

**Remarks:** This station was rebuilt in December 1932 by the Mexican Section of this Commission. The flood of Sept. 7, 1933 washed away the left "A" frame, but it was shortly replaced with a new one. The drainage area above this station is 1,840 square miles, all in Mexico.

**Previous Extreme Flows:** The greatest previous flow occurred on June 12, 1930, with a mean daily gage height of 11.48 feet and a corresponding flow of 11,300 second feet. The river is often dry. Numerous records of extreme flows may be seen in Water Bulletin No. 1.

*Mean Daily Discharge in Second Feet and Annual Summary, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	30.4	30.4	37.8	28.6	2.83	6.36	.71	20.5	11.3	494	441	266
2	30.4	32.1	32.1	23.3	2.47	4.94	.70	15.9	20.8	565	427	254
3	32.1	191.0	36.0	19.4	1.76	5.65	.71	11.7	15.2	742	413	254
4	36.4	44.8	33.9	43.4	1.77	7.42	.35	10.2	11.3	2,760	399	241
5	32.1	25.1	30.0	121.	1.06	6.36	.35	114.0	2,730.0	2,370	413	230
6	30.4	21.9	33.9	40.6	0.71	5.65	.35	255	6,530	1,800	441	230
7	28.3	26.8	36.0	21.2	0.70	5.65	22.2	179.0	42,020	1,410	459	230
8	23.7	26.8	36.0	13.8	0.71	4.94	646.0	112.0	11,120	1,130	441	230
9	20.1	26.9	32.2	13.8	0.35	2.83	58.6	61.8	4,310	1,020	413	230
10	28.2	36.7	33.9	13.8	0.35	2.47	19.1	38.1	2,400	1,040	427	230
11	26.8	36.7	32.1	12.7	0.36	1.06	8.83	639	1,770	848	441	218
12	21.9	40.3	36.0	11.7	0.35	.71	4.94	593	1,310	742	441	207
13	28.3	40.3	37.8	9.53	0.35	.70	2.83	283	1,050	706	399	196
14	20.3	40.3	40.6	6.71	0	.71	2.12	267	908	660	371	184
15	19.1	36.7	33.9	5.65	0	175	1.77	250	1,280	618	371	196
16	17.0	43.4	32.1	7.42	0	23.3	.71	2,180	2,370	600	371	196
17	16.2	34.3	32.2	9.53	0	8.83	.70	299	1,820	579	353	196
18	19.1	36.7	30.0	8.48	0	23.3	.35	90.8	1,470	562	353	175
19	20.1	41.7	28.6	5.65	0	78.0	.35	60.7	1,220	562	339	166
20	16.9	44.9	28.6	3.18	0	37.7	0	47.7	2,040	1,080	339	166
21	16.2	46.6	28.6	2.83	0	21.2	0	40.3	3,640	682	325	166
22	16.2	43.4	26.8	2.47	0	12.3	0	38.1	1,380	579	325	166
23	17.0	53.0	26.9	1.77	0	0	0	35.7	1,020	562	311	166
24	16.9	49.4	30.0	1.06	0	4.94	83.7	31.4	1,010	526	311	166
25	18.0	41.7	28.6	2.47	223.	3.88	2,730	24.4	1,240	512	311	155
26	16.2	40.6	26.8	200.0	1,410.	2.83	2,150	19.4	901	512	293	155
27	16.2	33.9	24.7	28.6	385.	2.82	2,160	16.6	706	512	293	148
28	21.9	36.0	23.0	1.06	173.	2.47	141.	12.4	653	494	293	141
29	16.2	...	78.8	4.94	72.4	1.76	29.7	29.0	565	477	279	141
30	19.1	...	56.9	3.18	23.3	1.06	119	120	530	441	266	141
31	26.8	...	41.7	...	10.6	...	45.2	60.0	...	441	...	141

Month	Gage Height		Second Feet		Acre Feet		
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.31	.79	42.4	13.8	22.5	1,390	
February.....	3.35	.98	671.	20.1	42.9	2,380	
March.....	2.23	.98	164.	23.0	34.4	2,120	
April.....	3.02	.30	466.	.71	22.6	1,340	
May (14-24).....	5.58	.00	2,610.	.00	74.6	4,590	
June.....	2.82	.23	311.	.35	15.3	913	
July.....	8.86	.00	6,710.	0	265.	16,320	
August.....	5.94	.66	3,110.	7.77	192.	11,810	
September (7)....	26.90	.66	76,630.	7.77	3,202.	190,520	
October.....	6.27	2.85	3,640.	427.	839.	51,620	
November.....	2.95	2.46	477.	254.	369.	21,940	
December.....	2.49	2.10	266.	141.	193.	11,860	
Yearly.....	26.90	.00	76,630	0	438	316,803	172

## RIO GRANDE AT ROMA STATION

**Description:** Automatic water-stage recorder at international bridge at Roma, Starr County, Texas. Zero of gage is 145.93 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 33 current meter measurements during the year from bridge. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** August, 1900 to March, 1914. November, 1922 to December, 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla and Don Martin reservoirs in Mexico. With all closed basins eliminated the drainage area above this station is 160,014 square miles; 93,645 being in the United States and 66,369 in Mexico. After March, 1929 the station was operated by the United States, and previously by Mexico. Datum of present gage is 1.1 ft. lower than that used prior to 1922.

**Previous Extreme Flows:**† The greatest previous flow ever recorded was on Sept. 5, 1932, when the extreme gage height was 35.4 feet and the extreme flow 203,420 second feet. The lowest flow ever recorded was on May 29, 1925, when the extreme flow was 975 second feet. Records of other extreme flows may be found in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,070	7,280	6,180	3,860	3,450	3,610	3,560	2,850	6,900	9,760	5,550	3,760
2	6,310	5,840	5,270	3,950	3,340	3,170	4,780	2,810	5,400	9,660	5,380	3,750
3	6,240	5,740	4,960	3,850	3,230	2,790	5,410	2,830	5,900	11,110	5,180	3,800
4	6,020	5,400	4,830	3,780	3,210	2,730	5,310	2,600	7,420	13,700	5,040	3,650
5	5,920	5,230	4,660	5,430	3,120	2,750	5,130	2,720	*6,450	18,350	4,890	3,650
6	5,940	5,110	4,500	5,060	3,050	2,600	5,050	4,220	*30,000	13,540	4,830	3,520
7	5,910	5,090	4,470	4,440	3,050	2,520	4,920	*4,800	*81,000	11,480	4,880	3,490
8	5,810	4,990	4,450	3,940	3,030	2,530	5,430	6,190	*59,000	10,430	4,820	3,440
9	6,100	4,830	4,440	3,750	2,930	2,550	5,250	4,600	*50,700	9,730	4,720	3,390
10	6,120	4,710	4,290	3,600	2,870	2,480	5,080	3,100	*31,500	11,220	4,710	3,350
11	5,940	4,700	4,310	3,490	2,860	2,570	4,400	4,050	17,810	8,820	4,570	3,340
12	5,710	4,680	4,210	3,420	2,850	2,490	4,080	4,430	14,350	8,580	4,360	3,330
13	5,700	4,610	4,180	3,330	2,830	2,890	3,920	3,700	12,200	10,170	4,180	3,320
14	5,580	4,620	4,210	3,230	2,810	3,860	3,860	5,300	10,840	10,560	4,120	3,360
15	5,430	4,660	4,240	3,210	2,740	3,980	3,630	5,590	11,920	20,120	4,030	3,330
16	5,620	4,790	4,290	3,230	2,660	4,240	3,360	6,050	*15,000	28,650	3,960	3,340
17	9,140	4,780	4,120	3,170	2,650	4,450	3,200	5,090	*19,500	17,710	3,930	3,280
18	9,780	5,080	4,020	3,130	2,770	3,800	2,940	3,750	*16,700	12,500	3,840	3,220
19	10,210	4,970	3,920	3,100	2,790	3,580	2,750	3,380	*20,500	11,740	3,850	3,310
20	10,120	4,730	3,840	3,050	2,630	3,430	2,650	3,170	*22,080	10,460	3,810	3,220
21	9,410	4,550	3,860	3,030	2,550	3,230	2,600	2,850	26,480	9,500	3,840	3,230
22	9,350	4,670	3,830	3,020	2,530	3,090	2,530	2,750	29,010	8,960	3,820	3,280
23	8,830	10,060	3,810	2,990	2,490	2,720	2,410	2,930	25,950	8,340	3,790	3,240
24	6,410	11,590	3,800	3,870	2,460	2,640	3,250	2,830	22,650	7,870	3,760	3,220
25	5,840	11,360	3,820	5,220	2,720	2,740	4,370	3,780	21,730	7,570	3,760	3,190
26	9,890	10,930	3,850	4,700	7,130	2,690	6,990	4,520	19,190	7,280	3,700	3,230
27	10,660	10,700	3,750	4,320	4,300	2,570	8,570	4,330	14,200	6,980	3,670	3,280
28	10,520	10,250	3,710	4,080	4,470	2,510	5,560	3,890	11,920	6,590	3,700	3,330
29	10,400	.....	3,760	3,830	4,150	2,590	5,370	3,970	11,600	6,320	3,670	3,290
30	9,690	.....	3,820	3,630	3,520	3,270	4,020	4,470	10,500	6,140	3,640	3,280
31	9,960	.....	3,990	.....	3,390	.....	3,420	4,770	.....	5,940	.....	3,240

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	6.53	4.35	11,130	5,360	7.601	467,370	
February.....	6.60	3.76	11,650	4,510	6.284	349,000	
March.....	5.68	2.97	7,370	3,670	4.238	260,610	
April.....	4.78	2.42	6,240	2,990	3.757	223,560	
May.....	6.06	2.00	8,450	2,450	3.180	195,530	
June.....	3.90	1.97	5,050	2,450	2.995	178,240	
July (24).....	7.15	2.04	10,500	2,390	4.316	265,390	
August.....	6.07	2.21	†6,800	2,550	3.946	242,620	
September (7).....	23.66	3.47	†100,000	4,400	21,280	1,266,270	
October.....	12.46	4.89	34,900	5,760	10,961	673,950	
November.....	4.89	3.55	5,750	3,620	4,267	253,890	
December.....	3.67	3.15	3,800	3,210	3,376	207,590	
Yearly.....	23.66	1.97	100,000	2,390	6,332	4,584,020	28.6

\*Partly estimated; these figures are corrected for backwater effect from Rio San Juan on these dates.

†See page 50 hereof for data concerning backwater during some previous years.

RIO SAN JUAN STATION AT SANTA ROSALIA, TAMAULIPAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 27½ river miles above the confluence with the Rio Grande and 15 miles south of Ciudad Camargo, Tamaulipas, Mexico, at a ranch called Santa Rosalia, 3 miles west of Ochoa Railway Station. Zero of gage is 205.15 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 183 current meter measurements during the year from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** May 1, 1900 to 1913; 1923 to 1933.

**Remarks:** Daily gage readings began May 1, 1900, and meter measurements Oct. 3, 1900 at La Quemada Ranch (now Ochoa settlement). The station was moved 2½ miles upstream to its present location July 14, 1902. The datum of the gage at La Quemada is not known. The gage zero at Santa Rosalia was raised on Oct. 1, 1909, an unknown amount and on May 27, 1912, the same gage was lowered 11 feet. Whether the gage zero has been moved at other times is not known.

When the river at this station rises above a gage height of 36.1 feet, water overflows the left river bank above the station and returns to the river below the station. 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 is modified at this station by irrigation diversions, 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:** On Sept. 29, 1932, there was recorded an extreme gage height of 41.01 feet with an estimated discharge of 187,170 second feet. On August 30, 1909, there occurred a flood which reached a height estimated at 49.21 feet on the present scale, according to records of the residents of the region. In Water Bulletin No. 1, the mean daily flow for this flood was given as 30,000 second feet which was copied from the records. New slope-area computations supported by measurements during recent 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. In Water Bulletin No. 1 may be seen numerous records of extreme flows.

Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	530	275	191	161	59	249	212	904	10,880	10,310	4,870	2,720
2	512	267	184	183	59	176	188	865	6,600	12,470	4,700	2,700
3	494	267	184	207	59	138	180	763	4,840	39,900	4,590	2,680
4	494	249	198	207	59	126	166	706	4,170	48,380	4,340	2,630
5	547	240	191	575	59	92	148	1,060	8,580	34,960	4,270	2,650
6	494	267	177	882	53	78	135	36,380	86,520	22,070	4,340	2,590
7	477	267	184	650	49	71	1,730	50,850	114,420	16,950	4,410	2,490
8	477	267	176	318	44	54	27,160	14,370	56,860	14,480	4,310	2,440
9	466	286	177	215	41	44	15,860	7,660	14,370	12,710	4,200	2,420
10	466	327	184	169	41	37	7,840	5,930	9,890	13,670	4,170	2,380
11	477	297	191	154	41	37	4,800	5,300	8,120	13,670	4,490	2,350
12	477	286	191	138	41	30	3,250	16,390	7,170	11,650	4,590	2,330
13	466	286	184	120	41	957	2,590	30,510	6,430	10,310	4,170	2,300
14	441	297	184	113	37	449	2,190	14,370	5,760	9,530	3,960	2,220
15	434	296	184	113	29	710	1,850	8,260	5,650	8,830	3,780	2,170
16	417	297	184	115	30	1,550	1,610	6,670	37,080	8,480	3,640	2,170
17	417	296	176	99	26	1,930	1,440	5,440	89,700	8,230	3,500	2,070
18	396	275	161	99	26	1,160	1,310	4,980	47,320	7,880	3,390	2,120
19	388	267	160	92	26	1,620	1,230	4,660	23,410	7,700	3,340	1,980
20	378	258	168	92	24	1,820	1,170	4,240	18,260	8,860	3,260	1,980
21	367	249	154	92	24	1,360	989	3,780	21,190	7,770	3,220	2,000
22	367	249	147	84	24	1,130	911	3,270	15,890	7,420	3,160	1,980
23	360	240	146	84	24	798	833	3,130	18,010	7,030	3,040	1,980
24	350	222	139	84	24	628	763	3,070	13,840	6,600	2,980	1,960
25	334	208	139	77	24	508	999	2,860	12,710	6,320	2,930	1,940
26	327	208	139	84	1,270	441	2,030	2,680	13,240	6,070	2,880	1,870
27	307	198	138	70	2,150	367	5,610	2,530	15,260	5,760	2,840	1,850
28	297	191	132	59	10,590	327	3,470	2,420	13,350	5,620	2,810	1,820
29	286	...	126	59	5,550	296	1,640	2,350	11,620	5,400	2,790	1,820
30	286	...	120	59	1,190	258	1,590	3,640	10,270	5,190	2,770	1,850
31	286	...	120	...	441	...	1,240	11,650	...	5,010	...	1,850

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	4.00	2.92	618	277	413	25,420	
February.....	3.12	2.56	334	183	262	14,540	
March.....	2.66	2.23	207	106	165	10,170	
April.....	5.28	1.97	1,250	59.0	182	10,820	
May (12).....	16.40	1.64	14,410	19.1	715	43,940	
June.....	7.84	1.74	2,510	26.5	581	34,590	
July.....	21.92	2.36	41,670	135	3,069	188,700	
August.....	30.51	4.04	92,880	689	8,442	519,050	
September (7)...	35.37	10.37	132,430	3,810	23,714	1,411,080	
October.....	23.79	12.04	57,210	4,940	12,556	772,040	
November.....	12.04	9.06	4,940	2,740	3,725	221,640	
December.....	9.06	7.18	2,740	1,820	2,204	135,490	
Yearly.....	35.37	1.64	132,430	19.1	4,679	3,387,480	260.6

† See Remarks page 37.

LOS OLMOS CREEK STATION NEAR RIO GRANDE CITY, TEXAS

**Description:** Automatic water-stage recorder attached to pile of lower side of highway bridge about 1 mile north of Rio Grande City and 3¾ miles above confluence with the Rio Grande. Zero of gage is at mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 2 current meter measurements during the year and the previous rating curve. 1933 records considered fair.

**Records Available:** January 1, 1932, to December 31, 1933.

**Remarks:** The drainage area above this station is 535 square miles, all in the United States.

**Previous Extreme Flows:** The greatest previous recorded flow was on Oct. 1, 1932, when 3,340 second feet was reached with a gage height of 166.57 feet. The creek is dry except during storms.

Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	0	0	0	1.59	0	1.59	38.9	5.76	0	0
2	0	0	0	0	0	.81	0	.90	11.1	4.22	0	0
3	0	0	0	0	0	.24	0	.52	5.96	8.15	0	0
4	0	0	0	0	0	.03	0	.24	4.05	5.76	0	0
5	0	0	0	*17.9	0	0	0	.50	140.	4.71	0	0
6	0	0	0	*39.9	0	0	1.39	14.6	*292.	3.66	1.00	0
7	0	0	0	*12.9	0	0	6.84	4.34	*238.	2.60	.50	0
8	0	0	0	0	0	0	25.6	1.89	*136.	1.55	.50	0
9	0	0	0	0	0	0	89.4	1.00	45.6	.50	0	0
10	0	0	0	0	0	0	10.4	.81	13.3	2.0	0	0
11	0	0	0	0	0	0	4.80	99.6	8.46	15.0	0	0
12	0	0	0	0	0	0	0	79.2	6.15	7.0	0	0
13	0	0	0	0	0	101	2.65	18.5	4.80	2.0	0	0
14	0	0	0	0	0	41.6	1.15	8.02	4.22	1.0	2.00	0
15	0	0	0	0	0	6.69	.52	4.80	4.0	.50	4.00	0
16	0	0	0	0	0	3.52	0	46.9	4.0	.50	2.00	0
17	0	0	0	0	0	2.04	0	12.3	3.0	.50	.50	0
18	0	0	0	0	0	5.02	0	5.76	2.0	.50	0	0
19	0	0	0	0	0	92.9	0	3.52	0	.50	0	0
20	0	0	0	0	0	17.3	0	2.18	0	.50	0	0
21	0	0	0	0	0	6.59	0	1.44	*6.30	9.00	0	0
22	0	0	0	0	0	3.35	0	.90	*1.74	5.00	0	0
23	0	0	0	0	0	1.89	0	.62	0	3.00	0	0
24	0	0	0	0	0	.81	0	.52	3.29	1.50	0	0
25	0	0	0	*1.0	1.05	.34	40.3	.34	68.0	0	0	0
26	0	0	0	*14.1	134.	.04	141.	.14	238	0	0	0
27	0	0	0	0	200.	0	39.	.04	61.9	0	0	0
28	0	0	0	0	21.5	0	8.44	.02	22.6	0	0	0
29	0	0	0	0	8.23	0	10.3	16.4	10.7	0	0	0
30	0	0	0	0	4.61	0	20.3	91.2	7.61	0	0	0
31	0	0	0	0	2.83	0	3.72	164	0	0	0	0

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.....	.....	.....	0	0	0	
February.....	.....	.....	.....	0	0	0	
March.....	.....	.....	.....	0	0	0	
April.....	155.04	.....	52.8	0	*2.86	*170	
May.....	161.42	.....	292.	0	12.0	738	
June.....	158.87	.....	172.	0	9.63	567	
July.....	159.08	.....	181.	0	13.1	805	
August.....	158.87	153.74	172.	0	18.8	1,160	
September (6)...	161.81	153.91	312.	0	46.0	2,740	
October.....	154.81	.....	20.7	0	2.76	169	
November.....	153.98	.....	*4.00	0	0.35	20.8	
December.....	.....	.....	0	0	0	0	
Yearly.....	161.81	.....	312	0	8.80	6,369.8	11.9

\*Partly Estimated

**RIO GRANDE AT RIO GRANDE CITY STATION**

**Description:** Automatic water-stage recorder and cable with stand up cable car located about 4 miles by river below Rio Grande City, Starr County, Texas, and 7.3 miles below the confluence of the Rio San Juan with the Rio Grande. Zero of gage is at mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 55 current meter measurements from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** January 1, 1932 to December 31, 1933.

**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 160,000 second feet at the Santa Rosalia station, water begins to overflow the right bank of that river at several places from El Asucar (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. The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla and Don Martin reservoirs in Mexico. With all closed basins eliminated, the drainage area above this station is 174,208 square miles; 94,323 being in the United States and 79,885 in Mexico.

**Previous Extreme Flows:** The highest gage height ever reported was in 1909, when the extreme gage height was 159.2 present gage datum, as reported by residents.

*Mean Daily Discharge in Second Feet and Annual Summary, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	* 8,660	* 9,030	7,400	4,040	3,600	4,890	3,690	4,380	15,460	20,840	10,400	6,200
2	* 7,220	* 6,550	5,380	4,010	3,480	4,320	4,130	3,870	12,310	20,220	10,010	6,260
3	* 7,030	* 6,140	5,000	4,110	3,350	3,430	5,320	3,910	11,380	43,770	9,620	6,250
4	* 6,980	* 6,040	4,870	4,000	3,340	2,900	*5,580	3,640	12,030	51,900	9,310	6,270
5	* 6,910	* 5,760	4,830	4,810	3,320	2,820	5,450	3,750	13,000	53,730	9,070	6,260
6	* 6,720	* 5,630	4,720	6,120	3,270	2,750	5,220	12,000	59,170	37,310	8,960	6,160
7	* 6,700	* 5,590	4,610	5,620	3,220	2,630	5,750	57,920	125,000	28,890	8,960	6,090
8	* 6,650	* 5,560	4,610	4,770	3,270	2,590	19,800	32,120	150,600	24,930	8,970	5,910
9	* 6,660	* 5,550	4,640	4,200	3,240	2,630	27,300	15,250	*100,200	22,690	8,760	5,840
10	* 6,780	* 5,540	4,610	3,920	3,150	2,620	15,330	11,290	*60,150	24,240	8,760	5,760
11	* 6,740	* 5,520	4,630	3,720	3,090	2,630	10,990	11,500	*32,830	23,660	8,770	5,670
12	* 6,500	* 5,460	4,620	3,610	3,050	*2,730	8,900	14,150	24,750	21,090	8,820	5,730
13	* 6,360	* 5,460	4,560	3,500	3,020	*3,380	7,470	24,210	20,460	20,830	8,460	5,790
14	* 6,400	* 5,370	4,590	3,380	2,980	*3,720	6,450	18,350	17,750	29,520	8,160	5,860
15	* 6,180	* 5,390	4,670	3,360	2,960	*4,070	5,900	14,500	16,900	26,010	7,960	5,880
16	* 6,240	* 5,410	4,720	3,380	2,880	*5,300	5,320	14,190	24,670	42,050	7,730	5,900
17	* 8,420	* 5,240	4,700	3,340	2,760	6,450	4,910	12,040	77,670	28,700	7,600	5,780
18	*10,080	* 5,320	4,490	3,300	2,820	5,860	4,530	9,620	77,000	23,390	7,370	5,460
19	*10,290	* 5,330	4,450	3,230	2,920	5,250	4,180	8,600	49,250	21,130	7,280	5,490
20	*10,840	* 5,150	4,330	3,180	2,830	5,580	3,970	7,870	36,070	19,770	7,220	5,320
21	*10,310	* 4,980	4,290	3,110	2,710	5,100	3,850	7,080	42,910	17,190	7,190	5,250
22	*10,130	* 4,950	4,230	3,070	2,680	4,710	3,750	6,450	44,580	16,050	7,170	5,300
23	*10,190	* 7,830	4,150	3,040	2,660	3,970	3,600	6,280	40,960	15,040	7,070	5,300
24	* 8,070	*10,700	4,080	3,200	2,630	3,480	3,880	6,000	34,700	14,100	6,860	5,230
25	* 6,390	*11,090	4,030	4,450	2,640	3,360	*5,080	6,040	32,170	13,520	6,700	5,180
26	* 8,500	*10,740	4,040	5,680	7,980	3,280	*9,120	7,170	30,410	13,070	6,490	5,160
27	*10,850	*10,540	3,960	4,500	8,580	3,170	*12,440	6,900	29,660	12,540	6,330	5,170
28	*11,300	*10,010	3,880	4,370	10,850	3,010	9,260	6,220	25,780	11,930	6,260	5,220
29	*11,040	.....	3,800	3,980	13,730	2,930	7,450	5,930	23,530	11,470	6,190	5,200
30	*10,830	.....	3,880	3,760	7,670	3,200	6,100	7,200	21,810	11,090	6,150	5,220
31	*10,340	.....	4,060	.....	6,030	.....	5,400	11,690	.....	10,820	.....	5,230

Month	Gage Height		Second Feet			Acre Feet	
	Extreme—Feet		Extreme		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	132.81	130.98	*11,570	*6,000	*8,270	*508,390	
February.....	132.80	130.27	*11,580	*4,920	*6,640	*368,690	
March.....	132.13	129.20	9,240	3,780	4,543	279,340	
April.....	130.82	128.48	6,430	3,010	3,959	235,560	
May.....	133.60	127.85	16,400	2,590	4,216	259,260	
June (11).....	131.01	128.00	6,950	2,550	3,759	223,660	
July.....	137.72	128.82	34,000	3,460	7,423	456,440	
August.....	144.85	128.91	69,000	3,450	11,617	714,300	
September (8).....	154.90	132.17	160,500	9,780	42,105	2,505,480	
October.....	142.80	132.85	59,780	10,690	23,596	1,450,910	
November.....	132.84	130.98	10,560	6,110	7,953	473,260	
December.....	131.07	130.28	6,300	5,110	5,656	347,790	
Yearly.....	154.90	127.85	160,500	2,550	10,806	7,823,080	44.9

\*Partly Estimated

**RIO GRANDE AT HIDALGO STATION**

**Description:** Automatic water-stage recorder at international bridge at Hidalgo, Hidalgo County, Texas. Zero of gage is 79.28 feet above mean sea level, United States Coast and Geodetic Survey datum.

**Records:** Based upon 6 current meter measurements during August and September from bridge. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** July, 1928 to Dec., 1931, also Sept. and Oct., 1932, and Sept., 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla and Don Martin reservoirs in Mexico. With all closed basins eliminated, the drainage area above this station is 175,110 square miles; 94,663 being in the United States and 80,447 in Mexico. Since 1931 this station has been operated only during flood periods. When the river rises above a stage of about 21 feet on this gage, water begins to overflow into the American floodways above this station. This gage height corresponds to a river discharge of 42,000 to 59,000 second feet. The bottom of the river at this station is subject to considerable erosion during floods, as may be seen from the cut below.

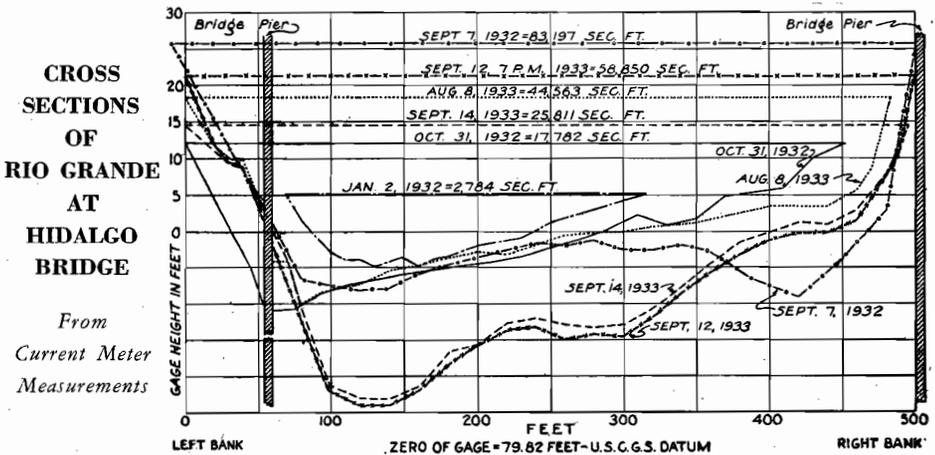
**Previous Extreme Flows:** See Water Bulletins numbers 1 and 2 and Special Flood Report-1923 by the American Section of this Commission.

*Mean Daily Discharge in Second Feet and Peaks, 1933*

Day	Sept.								
2	12,640	6	29,790	10	80,050	14	25,350	18	61,650
3	8,640	7	51,750	11	73,440	15	20,610	19	66,050
4	7,840	8	61,650	12	56,780	16	17,340	20	60,220
5	8,220	9	74,980	13	37,440	17	43,580	21	49,160

	Aug. 8, 6:00 A. M.	Sept. 10, 6:00 A. M.	Sept. 19, 1:00 P. M.	Oct. 5, 9:00 P. M.
Peak Gage Feet.....	18.60	25.30	22.70	19.85
Peak Second Feet.....	46,710	80,800	66,650	52,820



**NORTH FLOODWAY STATION SOUTH OF McALLEN, TEXAS,  
and SOUTH FLOODWAY STATION SOUTH OF McALLEN, TEXAS**

**Description:** See Water Bulletin No. 2 for description of these stations, etc.

**Remarks:** These floodways divert only excess flood water from the Rio Grande at inlets 7½ miles and 3 miles respectively, upstream from the Hidalgo gaging station. The flows reported here are the second flood flows to be carried through the floodways since their construction in 1926.

*Mean Daily Discharge in Second Feet and Peaks, September 1933*

Day	North Floodway	South Floodway	Day	North Floodway	South Floodway	Day	North Floodway	South Floodway
7	0	0	12	2,670	*1,250	17	0	172
8	0	40	13	772	* 352	18	0	860
9	5,430	7,620	14	386	252	19	1,180	*2,310
10	18,010	*19,980	15	146	211	20	1,240	*1,130
11	9,490	*8,900	16	7	193	21	558	* 199
						22	0	0

	NORTH FLOODWAY		SOUTH FLOODWAY	
	Sept. 10, 11:00 A. M.	Sept. 19, 7:00 P. M.	Sept. 10, 11:00 A. M.	Sept. 19, 4:00 P. M.
Peak Gage Feet.....	19.10	13.89	22.20	18.47
Peak Second Feet.....	19,840	2,060	21,660	2,540

\*Partly Estimated

## RIO GRANDE AT MATAMOROS STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located opposite Matamoros, Tamaulipas, Mexico, 53.3 miles upstream from the Gulf of Mexico. The water-stage recorder is attached to the central pier of the railroad bridge over the Rio Grande between Matamoros and Brownsville, 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 on 141 current meter measurements during the year from cable car. Computations by shifting channel methods. 1933 records considered good.

**Records Available:** 1901 to 1913; 1923 to 1927; 1929 to 1933.

**Remarks:** The river flow is greatly modified at this station by many irrigation diversions and Elephant Butte and Carlsbad reservoirs in the United States, also by irrigation diversions and Boquilla and Don Martin reservoirs in Mexico. Immediately above this station, particularly in Cameron and Hidalgo Counties, Texas, pumping plants divert annually large amounts of water. During floods only a small part of the water discharges past this station through the channel of the Rio Grande, as the greater part finds outlet to the Gulf of Mexico through flood channels and floodways in both countries. The gage datum was lowered five feet on October 3, 1930. With all closed basins eliminated the drainage area above this station is 175,138 square miles; 94,677 being in the United States and 80,461 in Mexico.

**Previous Extreme Flows:** The greatest previous flow recorded here was on July 20, 1906, when a mean daily flow of 38,300 second feet occurred with a gage height of 13.39 feet. The highest gage reading was on September 12, 1925, when a reading of 21.63 present gage datum was reached. In 1930 the river at this station was dry for a few days in March and April. Numerous records of extreme flow may be seen in Water Bulletin No. 1.

## Mean Daily Discharge in Second Feet and Annual Summary, 1933

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	10,600	9,320	9,500	2,190	3,570	5,540	2,080	5,930	7,130	20,200	10,240	5,720
2	10,060	8,760	9,180	2,430	2,980	4,690	2,120	5,580	13,380	19,420	9,960	5,690
3	8,720	7,770	6,750	2,540	2,350	4,200	2,380	5,010	14,480	19,420	9,850	5,790
4	7,590	6,070	5,400	2,450	2,030	4,030	2,580	4,310	11,230	21,190	9,710	5,830
5	7,060	5,620	5,190	2,450	1,880	3,850	3,180	4,130	12,430	22,180	9,430	5,690
6	6,670	5,510	4,910	2,440	1,840	3,530	3,810	4,270	13,420	22,420	9,360	5,540
7	6,390	5,440	4,590	2,490	1,840	3,290	4,480	4,940	22,560	22,420	9,320	5,440
8	6,460	5,230	4,270	3,000	2,030	3,070	5,160	21,610	25,740	22,180	9,320	5,400
9	6,460	4,940	4,030	3,880	1,690	2,930	7,520	24,900	26,380	21,540	9,220	5,370
10	6,250	4,840	3,960	4,060	1,360	2,770	20,660	22,570	26,380	20,590	9,080	5,440
11	5,930	4,840	3,670	3,640	1,210	2,630	19,600	13,770	26,380	20,550	8,900	5,400
12	5,790	4,870	3,780	3,140	1,170	2,630	12,710	10,240	26,380	20,590	8,760	5,160
13	5,720	4,840	3,810	2,680	1,170	2,420	9,010	10,590	26,340	19,780	8,620	4,840
14	5,760	4,730	3,670	2,380	1,480	2,480	7,420	20,130	25,430	19,000	8,550	4,730
15	5,830	4,590	3,500	2,270	1,770	2,740	6,530	24,720	22,600	19,070	8,230	4,630
16	5,760	4,590	3,180	2,540	1,580	3,040	6,000	21,190	20,520	19,420	7,880	4,660
17	5,580	4,660	3,110	2,680	1,310	3,460	5,580	16,250	20,240	20,830	7,450	4,910
18	5,510	4,730	3,390	2,380	1,040	3,850	5,120	14,130	21,370	20,910	7,200	5,010
19	6,180	4,770	3,600	2,070	953	4,450	4,410	11,270	22,950	20,550	7,420	4,840
20	8,190	4,730	3,640	1,880	883	5,090	4,130	9,180	23,660	19,780	7,340	4,660
21	9,710	4,630	3,350	1,760	918	5,050	3,920	8,090	23,840	18,930	7,240	4,480
22	10,640	4,410	2,820	1,680	1,260	4,910	3,710	7,200	24,020	18,120	6,810	4,200
23	9,890	4,130	2,510	1,770	1,140	4,840	3,600	6,670	24,020	16,810	6,710	4,230
24	9,080	3,960	2,310	2,140	953	4,520	3,510	5,930	24,020	15,500	6,530	4,480
25	8,580	6,180	2,330	1,840	777	4,340	3,020	5,760	22,950	14,730	6,460	4,840
26	7,450	9,360	2,610	1,580	953	3,920	2,970	5,470	21,890	13,770	6,710	4,840
27	6,250	9,890	2,860	1,760	1,920	3,320	3,780	5,580	21,890	12,850	6,710	4,560
28	6,850	9,710	2,670	2,680	4,940	2,720	7,880	6,180	21,540	12,360	6,360	4,410
29	9,110	.....	2,400	3,460	7,770	2,370	11,340	6,360	21,220	12,150	5,930	4,380
30	9,960	.....	2,240	3,600	11,480	2,330	8,480	6,500	20,660	11,550	5,760	4,420
31	9,890	.....	2,160	.....	8,970	.....	6,570	6,360	.....	10,770	.....	4,630

Month	Gage Height		Second Feet		Acre Feet	
	Extreme—Feet		Extreme		Average	Total
	High	Low	High	Low		
January.....	14.17	11.22	10,770	5,470	7,546	463,980
February.....	13.16	9.28	10,310	3,920	5,826	323,540
March.....	12.76	6.89	9,500	2,090	3,916	240,770
April.....	9.58	5.91	4,170	1,520	2,529	150,460
May (25).....	14.27	4.40	12,780	696	2,426	149,180
June.....	11.71	6.96	6,290	2,260	3,634	216,230
July.....	19.03	6.59	22,070	1,980	6,234	383,320
August.....	20.87	9.25	25,290	4,060	10,478	644,280
September (9).....	21.52	12.27	26,420	6,320	21,168	1,259,620
October.....	21.06	15.19	22,670	10,380	18,374	1,129,760
November.....	15.19	11.75	10,380	5,690	8,935	478,130
December.....	11.94	9.74	5,860	4,170	4,975	305,890
Yearly.....	21.52	4.40	26,420	696	7,936	5,745,160
						32.80

### DIVERSIONS FROM RIO GRANDE BETWEEN UPPER AND LOWER PRESIDIO STATIONS, 1933

There are 11 irrigation pumps which divert water from the Rio Grande between the Upper and Lower Presidio gaging stations. A record was kept of the operation of these pumps and their discharges were determined.

The difference between the discharge of the Rio Grande at Upper and Lower Presidio stations plus the diversions by these pumps gives the flow of the Rio Conchos which enters the Rio Grande between Upper and Lower Presidio stations.

#### *Mean Daily Diversions in Second Feet between Upper and Lower Presidio Stations, 1933*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	†0	†0	0	0	1.4	0	0	17.2	0	0	0	0
2	†0	†0	0	11.5	4.9	0	0	18.8	0	0	0	0
3	†0	†0	0	17.2	0	0	1.7	20.8	0	0	0	0
4	†0	†0	0	17.2	10.2	0	1.7	17.2	0	0	0	0
5	†0	†0	0	17.2	9.8	0	4.3	21.0	0	0	0	0
6	†0	†0	0	17.2	9.5	0	6.7	19.2	0	0	0	0
7	†0	†0	0	17.2	13.6	0	12.2	17.2	0	0	0	0
8	†0	†0	0	17.2	18.2	0	9.4	17.2	0	0	0	0
9	†0	†0	0	17.2	17.9	0	8.0	19.5	0	0	0	0
10	†0	†0	0	17.2	17.2	0	13.8	17.2	0	0	0	0
11	†0	†0	0	17.2	12.9	0	17.2	17.2	0	0	0	0
12	†0	†0	0	17.2	0	0	18.3	17.2	0	0	0	0
13	†0	†0	0	17.2	0	0	20.3	17.2	0	0	0	0
14	†0	†0	0	17.2	0	0	22.3	17.2	0	0	0	0
15	†0	†0	0	17.2	1.5	16.4	20.0	23.8	0	0	0	0
16	†0	†0	0	26.2	1.5	16.9	18.7	11.1	0	0	0	0
17	†0	†0	0	29.2	1.5	0	20.5	13.6	0	0	0	0
18	†0	†0	0	30.2	1.5	0	18.7	11.6	0	0	0	0
19	†0	†0	0	33.2	0	0	18.7	7.3	0	0	0	0
20	†0	†0	0	30.2	0	3.5	21.4	1.3	0	0	0	0
21	†0	†0	0	33.6	0	4.0	20.4	0	0	0	0	0
22	†0	†0	7.4	21.6	0	5.0	27.5	3.3	0	0	0	0
23	†0	†0	9.3	21.2	0	4.5	19.2	2.9	0	0	0	0
24	†0	†0	7.4	17.3	0	0	26.6	0	0	0	0	0
25	†0	†0	15.0	12.9	0	9.5	24.6	2.9	0	0	0	0
26	†0	†0	11.0	0	2.5	11.1	25.6	0.5	0	0	0	0
27	†0	†0	5.6	0	0	12.9	31.4	0	0	0	0	0
28	†0	†0	6.6	0	0	12.9	27.8	3.7	0	0	0	0
29	†0	†0	0.8	0	0	0	19.7	1.2	0	0	0	0
30	†0	†0	0	0	0	0	17.2	0	0	0	0	0
31	†0	†0	0	0	0	0	18.6	0	0	0	0	0

Month	Second Feet			Acre Feet Total
	Extreme		Average	
	High	Low		
January.....	.....	.....	† 0	† 0
February.....	.....	.....	† 0	† 0
March.....	.....	.....	2.04	125
April.....	15.0	.....	16.4	974
May.....	33.6	0	4.00	246
June.....	18.2	0	3.22	192
July.....	16.9	0	16.5	1,017
August.....	31.4	0	10.9	669
September*.....	23.8	0	0	0
October.....	0	0	0	0
November.....	0	0	0	0
December.....	0	0	0	0
Yearly.....	33.6	0	4.4	3,223

†Estimated

\*Diversion Pumps removed because of threatening floods.

### CHEMICAL ANALYSES OF WATER SAMPLES FROM RIO GRANDE AND TRIBUTARIES - 1933

The chemical analyses reported here were made by the United States Department of Agriculture at Riverside, California, and Tucson, Arizona, from water samples taken by the United States and the Mexican Sections of the International Boundary Commission and by the United States Bureau of Reclamation.

For the entire year at San Marcial and for the first ten months of 1933 at El Paso, Fabens and Fort Quitman, each water sample was analyzed and the figures in the tables are the totals and averages from these samples. But for November and December at each of the three last named stations, a composit sample only was analyzed. This composit sample was made up by using from each sample an amount proportional to the river flow at the time the sample was taken. This method reduced the analytical work and also improved the basis of estimating the salt burden passing each station by weighting according to stream flow.

To convert "Milligram Equivalents" to parts per million by weight, multiply each ion by its appropriate conversion factor. These factors are: HCO<sub>3</sub>, 61; Cl, 35.5; SO<sub>4</sub>, 48; Ca, 20; Mg, 12.15; Na, 23. In the tables A/B indicates alkali bases. This is substantially equivalent to the sodium (Na) but it also includes any potassium and other metals.

Conductance, reported in the tables as (K x 10<sup>5</sup> at 25° C), is a relative measure of the total salt concentration in the water samples.† It is a definite statement of an important physical property of the solution and is quite as valid and is probably more precise and more significant than is the statement of concentration in terms of total dissolved solids as parts per million.

#### Water Samples from Rio Grande at San Marcial, New Mexico, 1933

Month	No. of Samples	Tons of Salts		Mean K x 10 <sup>5</sup> @ 25° C	Total Salts p. p. m.	Mean Milligram Equivalents						Mean* Sodium Percent
		Per Acre Foot	Per Month			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	Ca	Mg	Na	
Jan.....	10	.78	35,209	86	570	3.55	2.10	4.00	3.85	1.35	4.55	47
Feb.....	4	.83	32,021	89	610	3.70	2.60	3.95	3.90	1.28	5.07	48
Mar.....	2	.76	36,070	77	560	4.00	1.60	3.94	3.15	1.53	4.86	51
Apr.....	3	.84	14,154	84	617	3.60	2.13	4.31	3.70	1.54	4.81	48
May.....	5	.60	56,682	60	442	3.12	1.60	2.92	2.91	1.18	3.55	46
June.....	11	1.11	281,374	109	818	2.56	1.95	8.00	5.36	1.98	5.10	41
July.....	13	1.43	78,993	139	1,050	2.94	2.29	10.30	6.32	2.33	6.66	44
Aug.....	5	1.38	52,274	138	1,012	3.30	3.17	8.25	5.80	2.07	6.74	46
Sept.....	5	1.56	66,041	143	1,145	3.83	3.23	8.61	6.18	1.85	7.60	49
Oct.....	4	1.34	21,306	133	985	3.46	3.02	7.83	5.70	1.77	6.51	48
Nov.....	3	1.14	26,243	121	839	3.78	2.81	6.46	4.93	1.53	6.46	50
Dec.....	4	1.00	46,200	103	736	3.70	2.34	5.35	4.41	1.73	5.04	46
Total & Mean.....	59	**1.04	746,567	107	**766	3.46	2.40	6.16	4.68	1.68	5.58	47

#### Water Samples from Rio Grande at El Paso, Texas, 1933

Month	No. of Samples	Tons of Salts		Mean K x 10 <sup>5</sup> @ 25° C	Total Salts p. p. m.	Mean Milligram Equivalents						Mean* Sodium Percent
		Per Acre Foot	Per Month			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	Ca	Mg	Na	
Jan.....	4	1.91	22,576	214	1,407	4.55	9.25	8.51	6.34	2.24	13.73	62
Feb.....	4	1.15	28,600	114	849	3.80	5.00	4.51	3.64	1.73	7.95	60
Mar.....	4	1.16	45,994	115	854	4.00	4.70	5.21	4.09	2.14	7.68	55
Apr.....	5	1.05	69,793	108	773	4.48	3.68	4.80	4.47	2.30	6.18	48
May.....	5	1.08	68,569	117	792	3.70	4.10	5.09	4.16	1.60	7.13	55
June.....	4	1.08	85,439	113	794	3.54	3.48	4.86	4.26	1.83	5.79	49
July.....	6	1.08	89,208	111	797	3.59	3.07	4.98	4.47	1.38	5.80	50
Aug.....	7	.93	88,945	103	687	3.28	2.97	4.55	4.08	1.20	5.53	51
Sept.....	4	1.15	76,682	118	846	3.60	3.49	5.45	4.53	1.88	6.18	49
Oct.....	5	1.60	53,808	158	1,178	4.52	5.75	6.69	5.48	2.11	9.26	55
Nov.....	4	1.54	31,508	173	1,133	4.75	6.36	7.25	5.84	2.45	9.66	55
Dec.....	4	1.62	40,111	175	1,194	4.70	6.65	7.18	5.94	2.08	9.64	57
Total & Mean.....	56	**1.15	701,233	135	**846	4.04	4.87	5.76	4.77	1.91	7.88	54

#### Water Samples from Rio Grande at Fabens, Texas, 1933

Month	No. of Samples	Tons of Salts		Mean K x 10 <sup>5</sup> @ 25° C	Total Salts p. p. m.	Mean Milligram Equivalents						Mean* Sodium Percent
		Per Acre Foot	Per Month			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	Ca	Mg	Na	
Jan.....	4	2.43	25,734	257	1,785	4.80	13.50	9.88	7.80	3.01	17.37	62
Feb.....	4	1.55	26,954	160	1,139	4.10	7.80	6.56	5.40	2.53	10.54	57
Mar.....	4	1.80	30,096	187	1,321	4.60	9.70	7.13	5.92	2.98	12.53	58
Apr.....	5	1.52	49,734	161	1,116	4.36	7.60	6.29	5.19	2.43	10.63	58
May.....	4	1.99	55,123	216	1,467	4.67	10.62	8.10	7.09	3.10	13.23	56
June.....	5	1.66	74,717	184	1,219	4.15	8.08	6.60	6.09	2.55	10.22	54
July.....	4	1.70	67,133	187	1,250	4.25	7.98	7.09	6.75	2.52	10.05	52
Aug.....	6	1.73	79,424	175	1,272	4.04	7.35	6.65	5.93	2.35	9.68	54
Sept.....	5	1.61	59,956	182	1,186	4.48	7.83	7.46	6.24	2.36	10.88	56
Oct.....	5	2.11	52,898	234	1,553	4.88	10.45	8.87	7.32	2.69	14.50	59
Nov.....	5	2.32	29,835	253	1,704	5.15	12.68	8.51	7.93	2.95	15.16	59
Dec.....	5	1.92	34,387	215	1,409	4.61	9.85	8.06	6.86	2.59	12.53	58
Total & Mean.....	56	**1.78	585,991	201	**1,311	4.51	9.45	7.60	6.54	2.67	12.28	57

\*\*Weighted Means. †Analyses estimated. ‡See Circular No. 232 U. S. Dept. Agr., July, 1932.

\*Per Cent of total Milligram equivalents of Ca, Mg, Na and K where given.

## Water Samples from Rio Grande at Fort Quitman, Texas, 1933

Month	No. of Samples	Tons of Salts		Mean $K \times 10^5$ @ 25° C	Total Salts p. p. m.	Mean Milligram Equivalents						Mean* Sodium Percent
		Per Acre Foot	Per Month			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	Ca	Mg	Na	
Jan.....	4	3.10	39,711	358	2,278	4.50	22.00	10.91	10.16	2.59	24.82	66
Feb.....	4	2.56	39,987	269	1,870	4.20	17.00	9.13	7.54	4.19	18.57	61
Mar.....	5	3.07	37,454	323	2,254	4.24	22.08	10.09	9.36	4.56	22.50	62
Apr.....	3	3.37	42,563	359	2,481	4.93	25.33	10.31	9.20	3.97	27.40	67
May.....	4	3.63	39,059	387	2,670	4.30	27.80	11.30	10.27	5.12	28.00	64
June.....	5	2.86	32,969	323	2,100	3.74	19.89	9.43	9.03	3.96	20.07	61
July.....	4	2.25	57,484	306	2,060	3.64	17.96	9.40	8.87	3.27	18.86	61
Aug.....	4	2.25	42,952	247	1,658	3.45	13.81	7.38	7.39	2.75	14.46	59
Sept.....	5	2.34	67,649	251	1,721	3.81	13.67	8.23	7.73	2.95	14.99	59
Oct.....	4	2.41	52,900	261	1,774	3.76	14.56	8.47	7.63	2.68	16.08	61
Nov.....	4	2.81	36,614	316	2,069	4.20	18.09	10.49	8.65	3.71	19.76	62
Dec.....	5	2.48	42,780	284	1,825	4.90	15.17	9.28	9.17	3.22	16.57	58
Total & Mean.....	51	**2.72	582,122	307	**2,001	4.14	18.95	9.53	8.75	3.58	20.17	62

## Water Samples from Rio Grande at Roma, Texas, 1933

Date of Sample	K x 10 <sup>5</sup> at 25°C	% Na & K	Milligram Equivalents							Total Salts p. p. m.	SiO <sub>2</sub> p. p. m.
			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na		
Jan. 6.....	184	51	3.20	8.80	6.73	.....	6.50	2.68	9.55	1,116	..
Feb. 2.....	160	49	3.20	8.00	6.11	.....	5.55	3.20	8.56	1,052	..
Mar. 2.....	144	47	3.20	6.80	5.15	.....	5.70	2.30	7.15	920	..
Apr. 10.....	141	47	3.60	5.60	5.87	.....	5.10	2.94	7.03	924	..
May 9.....	130	53	2.80	6.80	5.46	.....	4.50	2.56	8.00	888	..
July 3.....	116	48	2.50	4.91	4.10	0.07	3.55	2.50	5.64	771	13
Aug. 1.....	117	48	2.70	4.57	4.34	0.01	3.80	2.30	5.68	754	10
Sept. 2.....	94	48	2.75	3.17	3.66	0.06	3.58	1.47	4.28	636	15
Oct. 6.....	81	47	3.25	2.76	2.69	0.07	3.75	.90	3.88	748	14
Nov. 4.....	85	39	3.25	2.90	2.96	0.14	3.82	1.78	3.96	560	10
Dec. 2.....	105	42	3.25	3.92	4.16	0.05	3.95	2.66	4.81	695	16

## Water Samples from Rio Grande at Rio Grande City, Texas, 1933

Date of Sample	K x 10 <sup>5</sup> at 25°C	% Na & K	Milligram Equivalents							Total Salts p. p. m.	SiO <sub>2</sub> p. p. m.
			HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na		
Feb. 3.....	163	40	3.20	7.14	5.18	.....	6.25	3.05	6.22	971	24
Mar. 2.....	130	42	2.90	5.33	4.70	0.05	4.73	2.93	5.44	838	11
Apr. 6.....	158	52	3.10	7.41	6.07	0.11	4.95	3.07	8.56	1,038	14
May 10.....	144	51	2.55	6.40	5.26	0.03	4.13	2.84	7.01	926	8
June 12.....	131	50	2.65	5.87	4.53	0.03	3.98	2.59	5.71	836	18
July 4.....	116	47	2.80	4.62	4.05	0.11	3.60	2.71	5.41	762	19
Aug. 8.....	62	35	2.60	1.54	2.49	0.03	3.32	1.04	2.13	424	7
Sept. 13.....	62	23	3.05	1.38	2.18	0.14	3.62	1.56	1.59	420	19
Oct. 3.....	43	25	2.80	0.86	0.73	0.05	2.68	0.66	1.25	396	15
Nov. 16.....	101	38	3.10	3.24	4.11	0.18	4.70	1.85	4.22	688	8
Dec. 20.....	110	45	3.20	3.73	4.90	0.07	4.55	1.94	5.43	741	12

## WATER SAMPLES FROM SPRINGS ON AMERICAN SIDE OF RIO GRANDE, 1933

## Goodenough Spring Southwest of Comstock, Val Verde County, Texas

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Nov. 2.....	46.9	0.06	13	4.55	0.33	0.34	0.18	3.45	1.76	0.58	0.20

## Spring Branch Creek, Hudspeth Ranch, 25 miles north of Comstock, Val Verde County, Texas

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Aug. 20.....	47.2	0.08	8	4.70	0.43	0.19	Trace	3.70	1.22	0.40	.....

## Headwater Spring, Hudspeth Ranch, 30 miles north of Comstock, Val Verde County, Texas, on Devils River

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Aug. 20.....	48.2	0.09	11	4.70	0.43	0.27	Trace	3.75	1.08	0.38	.....

\*Per Cent of total milligram equivalent of Ca, Mg, Na.

\*\*Weighted Means.

**WATER SAMPLES FROM SPRINGS ON AMERICAN SIDE OF RIO GRANDE, 1933  
(Continued)**
*East Spring of San Felipe Group, at Del Rio, Val Verde County, Texas*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Apr. 27.....	45.3	0.08	11	4.40	0.38	0.16	0.18	4.35	0.92	0.27	0.36

*West Spring of San Felipe Group, at Del Rio, Val Verde County, Texas*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Apr. 27.....	47.6	0.10	10	4.75	0.38	0.20	0.14	4.57	0.95	0.29	0.33

*Spring in Dead Man Canyon, 1/2 mile above junction with Pecos River in  
Val Verde County, Texas*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Mar. 15.....	43.5	....	7	3.70	0.58	0.47	0.18	3.80	1.15	0.36	....

*Spring on Pecos River, 1/2 mile N. of R. R. bridge, 6 miles west of Comstock,  
Val Verde County, Texas*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Mar. 15.....	44.3	....	8	4.00	0.53	0.42	0.11	3.85	1.20	0.41	....

**WATER SAMPLES FROM SPRINGS ON MEXICAN SIDE OF RIO GRANDE  
1933 and 1934**
*Ojo de Agua Spring 5 miles West of Remolino, about 30 miles West of Piedras Negras,  
Coahuila, Mexico*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Sept. 15,'33.....	37.4	....	3	4.00	0.14	0.13	Trace	3.63	0.50	0.24	....
Sept. 15,'33.....	37.4	....	8	4.00	0.10	0.09	Trace	3.52	0.32	0.51	....
Jan. 10,'34.....	39.6	....	8.0	4.25	0.24	0.17	0.14	3.68	1.13	0.43	....

*Spring pond 6 miles Southwest of Albercas, and about 18 miles West of Zaragoza, Coahuila,  
Mexico, at head of Las Moritas Creek Tributary to Rio San Antonio*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Jan. 10,'34.....	41.1	....	5.0	4.25	0.24	0.17	0.11	3.52	0.84	0.22	....

*Los Tanques Spring, located 600 feet from pond mentioned above and Tributary  
to Rio San Antonio*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Jan. 10,'34.....	39.6	.03	5.0	4.50	0.19	0.28	0.07	3.58	0.91	0.23	....

*Spring, 4 miles West of Zaragoza, Coahuila, Mexico*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Jan. 10,'34.....	42.6	.04	5.0	4.60	0.24	0.28	0.11	3.64	0.98	0.24	....

*Rio Escondido, about 2,000 feet below headwater spring, just above junction with Arroyo Seco  
about 8 miles S. W. of Zaragoza, Coahuila, Mexico*

Date of Sample	K x 10 <sup>5</sup> at 25°C	Boron p. p. m.	% * Na & K	Milligram Equivalents per Liter							
				HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	Ca	Mg	Na	K
Jan. 10,'34.....	48.9	....	8.0	5.30	0.19	0.28	0.14	4.35	1.19	0.45	....

\*Per cent of total milligram equivalents of Ca, Mg, Na, and K where given.

### CHEMICAL AND BACTERIOLOGICAL ANALYSES 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.

Month 1933	Chemical Analysis—Parts per Million					Bacteriological Analysis	
	Turbidity	Total Alkalinity	Phenolphthalein Alkalinity	Hardness	Magnesia	Total Bacteria Per Sq. Cm. in Agar-Agar at 37.5° C.	Bacillus Coli Per 100 c.c.
<b>AVERAGE</b>							
January.....	32	148	4	420	36.0	240	58
February.....	29	150	4	421	37.1	144	47
March.....	25	141	4	403	28.0	114	44
April.....	185	137	4	322	24.9	2,881	325
May.....	83	128	4	284	24.1	1,125	295
June.....	127	130	4	287	26.9	942	513
July.....	615	134	5	254	18.9	1,820	567
August.....	500	124	5	249	18.9	2,491	531
September.....	4,370	108	6	165	12.5	10,009	2,057
October.....	1,593	119	6	192	12.2	5,997	1,108
November.....	137	142	8	274	16.2	446	258
December.....	35	141	7	294	25.1	105	198
<b>Total.....</b>	<b>7,731</b>	<b>1,602</b>	<b>61</b>	<b>3,565</b>	<b>280.8</b>	<b>26,314</b>	<b>5,992</b>
Average.....	644	133	5	297	23.4	2,193	499
Minimum.....	25	108	4	165	12.2	105	44
Maximum.....	4,370	150	8	421	37.1	10,009	2,057
<b>MINIMUM</b>							
January.....	19	128	2	361	27.1	73	10
February.....	20	143	3	393	28.1	38	4
March.....	25	137	2	355	20.4	60	7
April.....	25	95	3	229	8.74	166	10
May.....	35	115	3	244	12.6	212	50
June.....	61	118	3	258	19.4	435	10
July.....	99	98	4	190	7.7	330	50
August.....	83	112	3	208	9.7	285	10
September.....	1,350	77	4	103	2.9	2,450	100
October.....	348	75	4	107	1.4	735	50
November.....	47	130	5	207	5.8	118	50
December.....	25	132	6	262	10.6	17	10
<b>MAXIMUM</b>							
January.....	229	157	6	469	47.6	920	100
February.....	86	161	6	450	43.7	617	100
March.....	25	147	6	432	45.6	224	100
April.....	2,338	155	6	373	35.9	34,650	1,000
May.....	509	140	6	324	32.0	12,980	1,000
June.....	449	153	6	317	36.9	2,875	1,000
July.....	2,139	154	6	299	27.2	8,890	1,000
August.....	3,090	140	6	344	25.2	39,950	1,000
September.....	15,675	129	7	264	28.2	33,750	10,000
October.....	5,212	147	9	257	26.2	53,900	10,000
November.....	384	155	10	373	34.0	1,290	1,000
December.....	51	150	9	344	47.6	725	1,000

NOTE—Turbidity reached 20,000 parts per million on September 9th.

## SILT SAMPLING OF RIO GRANDE WATER

The gravimetric percentages of dry silt reported here were determined by the United States Dept. of Agriculture of Riverside, California, 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.

It is impossible to foretell the density with which this silt would settle into the bottom of a reservoir; but merely 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.

*Gravimetric Percentages of Dried Silt in the Rio Grande at San Marcial, New Mexico,  
as Determined from Water Samples During 1933*

Date	% Silt	Date	% Silt	Date	% Silt	Date	% Silt	Date	% Silt
Feb. 10	1.024	June 3	1.22	July 1	.58	Aug. 4	7.79	Oct. 7	2.01
Feb. 13	.645	June 5	.84	July 5	.16	Aug. 10	2.98	Oct. 13	1.38
Feb. 21	.670	June 15	3.15	July 8	3.97	Aug. 13	2.30	Oct. 20	0.84
Feb. 28	.555	June 17	1.33	July 10	6.75	Aug. 17	1.00	Oct. 28	0.34
March 24	.478	June 18	5.78	July 11	3.37	Aug. 25	.28		
March 30	.274	June 19	9.16	July 13	1.55			Nov. 3	0.35
April 7	.145	June 20	7.80	July 15	.61	Sept. 3	.94	Nov. 1	0.88
April 13	.095	June 23	4.26	July 17	5.10	Sept. 9	.22	Nov. 17	0.71
April 29	.084	June 25	3.57	July 18	8.70	Sept. 15	10.86		
May 5	.579	June 26	2.65	July 19	5.73	Sept. 23	.91	Dec. 1	0.69
May 9	.237	June 28	.91	July 21	.89	Sept. 29	5.40	Dec. 9	0.83
May 17	.570			July 26	6.33			Dec. 19	0.96
May 23	2.05			July 27	6.24			Dec. 27	0.74
May 30	1.11								

*Tons of Suspended Silt Passing San Marcial in the Rio Grande During 1933*

Months	Tons of Water	SUSPENDED SILT		
		Tons	Average Per Cent By Weight	Acre Feet At 1,452 Tons Per Acre Feet
January.....	61,435,540	† 368,613	† .60	† 253.9
February.....	52,507,380	380,153	.724	261.8
March.....	64,593,060	281,626	.436	194.
April.....	22,932,850	34,399	.150	23.7
May.....	128,573,670	1,595,410	1.241	1098.8
June.....	344,999,890	13,535,941	3.924	9322.3
July.....	75,181,640	2,917,704	3.881	2009.4
August.....	51,554,680	2,471,761	4.794	1702.3
September.....	57,611,130	2,988,692	5.188	2058.3
October.....	21,639,900	430,634	1.99	296.6
November.....	31,330,220	206,779	.66	142.4
December.....	62,878,200	503,026	.80	346.4
Yearly.....	975,238,160	25,714,738	2.6368	17,709.9

†Estimated

*Gravimetric Percentages of Dried Silt in the Rio Grande at Roma, Texas  
as Determined from Water Samples During 1933*

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 daily by the American 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 0.908 of the mean suspended silt in the stream within reasonable limits of accuracy.

The daily figures were computed in accordance with the foregoing.

It is impossible to foretell the density with which this silt would settle into the bottom of a reservoir; but merely 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.

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.0198	.0165	.0110	.0014	.0107	.0312	.0201	.0344	.2049	.1570	.0248	.0140
2	.0157	.0069	.0135	.0011	.0080	.0300	.0352	.0242	.2079	.2197	.0407	.0135
3	.0151	.0052	.0091	.0135	.0151	.0272	.0352	.0223	.2291	.1716	.0426	.0014
4	.0074	.0066	.0157	.0143	.0151	.0234	.0264	.0201	.2005	.1933	.0344	.0033
5	.0182	.0099	.0212	.1634	.0074	.0209	.0258	.0256	.9174	.1744	.0418	.0091
6	.0143	.0223	.0088	.0223	.0099	.0143	.0228	.0302	.9842	.1034	.0374	.0132
7	.0187	.0228	.0041	.0297	.0132	.0077	.0998	.1224	1.0274	.0976	.0339	.0030
8	.0286	.0278	.0069	.0434	.0102	.0096	.1526	.0836	.4815	.0726	.0305	.0110
9	.0272	.0118	.0055	.0154	.0102	.0088	.0946	.2170	.7208	.0734	.0360	.0168
10	.0275	.0143	.0055	.0154	.0118	.0030	.1188	.0591	.7895	.3154	.0140	.0077
11	.0201	.0036	.0176	.0129	.0030	.0091	.0979	.1510	.7694	.0935	.0121	.0077
12	.0297	.0077	.0118	.0173	.0085	.0099	.1037	.0619	.7238	.0591	.0096	.0030
13	.0110	.0047	.0077	.0102	.0102	.0168	.0616	.0792	.4389	.0624	.0044	.0132
14	.0102	.0278	.0066	.0135	.0110	.0531	.0531	.0729	.2893	.0641	.0094	.0113
15	.0080	.0198	.0066	.0091	.0113	.0877	.0495	.2321	.3410	.6149	.0080	.0030
16	.0085	.0216	.0033	.0044	.0082	.1433	.0558	.1103	.2706	.3952	.0124	.0099
17	.0297	.0234	.0099	.0066	.0077	.0484	.0473	.1218	.3707	.2844	.0190	.0022
18	.0311	.0173	.0231	.0052	.0085	.0330	.0399	.0272	.3740	.3872	.0140	.0030
19	.0322	.0099	.0228	.0085	.0066	.0374	.0459	.0575	.4210	.3641	.0146	.0014
20	.0226	.0055	.0132	.0185	.0102	.0363	.0330	.0206	.3798	.2398	.0206	.0003
21	.0187	.0036	.0091	.0146	.0066	.0272	.0173	.0165	.5420	.1694	.0121	.0030
22	.0220	.0072	.0118	.0044	.0030	.0168	.0212	.0157	.6366	.1903	.0030	.0014
23	.0176	.0319	.0099	.0091	.0033	.0322	.0173	.0113	.8044	.2370	.0000	.0063
24	.0165	.0429	.0091	.0935	.0129	.0143	.1614	.0124	.7568	.1430	.0000	.0030
25	.0198	.0338	.0077	.0374	.0173	.0154	1.0519	.0303	.4760	.1898	.0022	.0058
26	.0184	.0278	.0055	.0616	.4859	.0157	.4001	.0327	.3468	.2365	.0000	.0030
27	.0305	.0187	.0022	.0847	.0781	.0113	.4309	.0226	.2651	.0759	.0000	.0063
28	.0102	.0176	.0044	.0473	.0734	.0118	.1254	.0363	.2054	.0492	.0000	.0091
29	.0132	....	.0058	.0165	.0179	.0176	.2387	.0580	.1823	.0374	.0107	.0014
30	.0140	....	.0168	.0121	.0113	.0220	.1133	.0836	.1598	.0539	.0123	.0058
31	.0143	....	.0088	....	.0324	....	.0520	.1455	....	.0443	....	.0044

*Tons of Suspended Silt Passing Roma in the Rio Grande During 1933*

Months 1933	Tons of Water	Suspended Silt		
		Tons	Average Percent by Weight	Acre Feet at 1,452 Tons Per Acre Feet
January.....	636,090,570	124,300	.0195	85.6
February.....	474,989,000	91,300	.0192	62.9
March.....	354,690,210	36,300	.0102	25.0
April.....	304,265,160	91,000	.0299	62.7
May.....	266,116,330	136,300	.0512	93.9
June.....	242,584,640	76,500	.0315	52.7
July.....	361,195,790	533,300	.1476	367.3
August.....	330,205,820	249,300	.0755	171.7
September.....	1,723,393,470	10,338,200	.5999	7,120.0
October.....	917,245,950	1,942,300	.2118	1,338.0
November.....	345,544,290	63,000	.0182	43.4
December.....	282,529,990	18,200	.0065	12.6
Yearly.....	6,238,851,220	13,700,000	.2196	9,435.8

## STORED WATER IN LARGE RESERVOIRS OF THE RIO GRANDE BASIN

From the records of the United States Reclamation Bureau, the following data are taken for Elephant Butte reservoir on the Rio Grande, and for the McMillan and Avalon reservoirs on the Pecos river, all in New Mexico. The data for Boquilla reservoir on the Rio Conchos in Chihuahua is taken from the records of the "Compania Agricola y de Fuerza Electrica del Rio Conchos, S. A." and that for Don Martin reservoir on the Rio Salado is from the records of the National Irrigation Commission of Mexico.

The monthly figures represent the number of acre feet of water in storage on the last day of each month, and the normals represent the averages for the years 1924 to 1933 inclusive, except Don Martin, where storage began with 1930. For previous years records see Water Bulletin No. 2.\*

Month	Elephant Butte		McMillan and Avalon		Boquilla		Don Martin	
	Thousands of Acre Feet		Acre Feet		Thousands of Acre Feet		Acre Feet	
	1933	Normal	1933	Normal	1933	Normal	1933	Normal
Jan.....	1,432	1,268	45,000	42,715	1,595	1,246	1,056,330	861,510
Feb.....	1,432	1,277	44,000	41,435	1,652	1,227	1,006,550	861,683
Mar.....	1,397	1,251	37,900	35,740	1,582	1,170	1,014,330	866,443
Apr.....	1,275	1,253	22,900	23,780	1,522	1,106	994,330	845,032
May.....	1,211	1,383	16,000	29,480	1,449	1,033	941,730	632,682
June.....	1,395	1,383	15,000	24,155	1,449	981	886,060	665,390
July.....	1,299	1,298	12,400	21,470	1,535	1,021	826,930	672,458
Aug.....	1,185	1,218	10,000	22,965	1,720	1,189	853,560	679,540
Sept.....	1,121	1,189	32,300	30,965	2,132	1,324	922,800	824,750
Oct.....	1,111	1,197	22,800	38,615	2,089	1,328	975,310	857,928
Nov.....	1,111	1,200	26,600	38,625	2,035	1,276	985,530	892,508
Dec.....	1,125	1,217	25,300	40,270	1,973	1,259	976,780	894,170
Change.....	-270	.....	-19,700	.....	-400	.....	-125,820	.....

\*The Mexican Section of the Commission revises and supplements the water storage figures in Water Bulletin No. 2 for 1930 for Don Martin Reservoir as follows:

Jan. 31, 4,660 ac. ft., Feb. 28, 3,930 ac. ft., Mar. 31, 730 ac. ft., Apr. 31, 21,730 ac. ft.

## EVAPORATION FROM FREE WATER SURFACES IN THE RIO GRANDE BASIN

Two types of land pans are generally used for determining evaporation from free water surfaces in the Rio Grande basin.

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.

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.

The data tabulated below for the evaporation stations at Santa Fe, Elephant Butte Dam, and Mesilla Park, New Mexico and Dilley, Texas are from records of the United States Weather Bureau. The data from Monterrey and Don Martin, Nuevo Leon, Mexico, are from records of the Mexican Department of Agriculture and Development. The equipment at all of the stations mentioned above is of the type described first above.

The following data for stations at Balmorhea, Winterhaven, and Weslaco, Texas are from records of the Texas A. and M. College, and the equipment at these stations is of the second type described above.

The evaporation stations at Dilley and Winterhaven, Texas are not in the Rio Grande Basin, but their records are reproduced here because of their proximity to the east side of the basin and because of the lack of records within the basin in the same region.

*Santa Fe, New Mexico*

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....	0.92	1.54	0.83	1.72	1.45	1.26	1.40	1.23	1.83	*1.35	12.18	1.35
Feb.....	2.24	2.28	3.01	2.10	1.93	1.95	2.71	2.46	2.56	*2.36	21.24	2.36
Mar.....	2.96	5.08	3.94	4.03	4.31	3.73	3.60	3.73	3.44	4.36	39.18	3.92
Apr.....	5.64	8.22	4.76	6.70	6.02	7.05	7.28	5.50	7.06	*6.47	58.23	6.47
May.....	8.35	9.01	5.92	12.24	6.84	9.67	8.59	8.63	8.81	7.66	85.72	8.57
June.....	11.99	10.29	8.78	9.31	11.21	11.85	10.74	10.73	10.00	8.36	103.26	10.33
July.....	8.81	9.53	9.18	9.31	10.01	8.41	8.19	8.99	9.15	8.89	90.47	9.05
Aug.....	9.28	7.47	9.44	8.09	7.55	6.86	7.22	7.43	5.59	7.65	76.58	7.66
Sept.....	7.76	6.75	6.71	5.46	7.51	6.62	6.86	5.53	4.69	6.39	64.28	6.43
Oct.....	6.15	4.47	4.83	5.29	4.58	4.51	4.28	4.51	2.44	3.91	44.97	4.50
Nov.....	3.30	2.03	2.93	2.87	1.59	1.89	1.93	2.17	*2.08	*2.08	18.71	2.34
Dec.....	1.20	0.77	1.02	1.08	1.66	1.41	1.20	1.82	*1.13	*1.13	10.16	1.27
Total.....	68.60	67.44	61.35	68.20	64.66	65.21	64.00	62.73	55.57	47.22	624.98	64.25

\*Estimated

## At Elephant Butte Dam, New Mexico

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....	2.55	2.44	1.73	3.09	2.80	3.45	2.52	1.72	2.24	2.34	24.88	2.49
Feb.....	3.85	4.66	4.90	4.76	2.80	4.19	4.37	2.25	4.68	3.18	39.64	3.96
Mar.....	7.64	8.24	5.30	7.85	7.71	7.31	6.23	6.75	6.20	7.22	70.45	7.05
Apr.....	8.76	11.08	6.99	10.22	9.10	11.13	9.75	6.71	9.61	8.29	91.64	9.16
May.....	11.57	11.74	9.83	14.83	9.81	12.01	11.71	10.34	11.20	11.77	114.81	11.48
June.....	14.97	15.38	13.16	13.42	14.48	14.20	12.01	11.56	11.86	9.93	130.97	13.10
July.....	10.74	11.96	12.02	12.38	12.10	9.93	9.58	10.42	9.72	13.10	111.95	11.20
Aug.....	11.40	10.80	11.01	8.98	9.62	7.98	9.10	8.33	8.99	11.17	97.38	9.74
Sept.....	10.57	9.29	7.27	7.61	8.32	7.45	8.09	6.54	7.87	9.89	82.90	8.29
Oct.....	8.65	6.81	5.93	6.61	5.87	4.54	6.37	5.90	4.72	6.65	62.05	6.20
Nov.....	5.04	4.15	4.15	4.74	2.75	2.51	3.05	3.48	3.64	4.51	38.02	3.80
Dec.....	2.78	2.51	1.96	2.42	2.18	2.31	1.78	1.98	2.23	3.84	23.99	2.40
Total.....	98.52	99.06	84.25	96.91	87.54	87.01	84.56	75.98	82.96	91.89	888.68	88.87

## At Mesilla Park, near Las Cruces, New Mexico

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....	2.94	2.73	1.91	3.22	3.03	3.21	2.75	2.59	2.99	2.75	28.12	2.81
Feb.....	4.39	5.34	4.65	4.42	4.15	4.31	4.74	2.99	4.00	4.16	43.15	4.31
Mar.....	7.09	8.08	5.15	7.25	8.16	7.11	6.43	7.15	7.63	9.41	73.46	7.35
Apr.....	8.15	9.39	7.29	9.28	9.08	8.88	8.54	7.73	11.20	10.28	89.82	8.98
May.....	10.10	8.69	9.04	11.64	9.52	10.41	10.86	10.84	13.36	14.15	108.61	10.86
June.....	12.09	10.24	10.56	10.28	11.78	11.60	11.89	11.92	14.22	12.28	116.86	11.69
July.....	9.06	9.14	10.13	10.29	10.82	9.12	9.90	10.25	13.40	13.54	105.65	10.56
Aug.....	9.72	8.35	9.30	7.89	7.80	7.75	9.05	8.49	12.26	11.08	91.69	9.17
Sept.....	8.92	6.81	7.24	6.84	6.92	7.05	7.76	7.48	9.42	9.79	78.23	7.82
Oct.....	7.08	4.99	4.59	5.80	5.22	5.01	5.93	6.88	5.66	6.20	57.36	5.74
Nov.....	4.18	3.50	3.63	4.38	2.67	2.59	3.74	3.56	4.18	4.14	36.57	3.66
Dec.....	2.44	2.39	2.09	2.17	2.78	2.55	2.17	2.84	2.50	3.54	25.47	2.55
Total.....	86.16	79.65	75.58	83.46	81.93	79.59	83.76	82.72	100.82	101.32	854.99	85.50

## At Balmorhea, Texas

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....			3.52	2.68	3.12	2.97	2.07	1.64	2.59	2.56	21.15	2.64
Feb.....			5.37	4.17	3.70	3.64	4.17	2.67	3.06	3.13	29.91	3.74
Mar.....			4.42	5.63	7.09	5.10	5.42	5.30	5.30	5.77	44.03	5.51
Apr.....			5.87	7.81	7.48	6.10	6.01	5.69	6.82	6.80	52.58	6.57
May.....			8.94	9.56	7.63	6.97	7.93	6.90	5.89	8.46	62.28	7.79
June.....			9.64	7.87	9.81	8.01	6.83	7.73	7.81	7.83	65.53	8.19
July.....			8.81	8.37	6.98	7.86	7.95	7.36	6.82	9.42	63.57	7.95
Aug.....			6.76	9.29	5.03	7.69	7.40	7.13	6.12	7.41	56.83	7.10
Sept.....			5.60	5.38	5.21	5.37	6.65	7.38	3.78	6.00	45.37	5.67
Oct.....			3.89	5.06	4.35	4.13	3.28	5.91	3.54	4.48	34.64	4.33
Nov.....			3.93	4.10	2.44	2.87	2.50	2.98	3.09	3.21	25.12	3.14
Dec.....			1.97	2.11	2.05	2.73	1.87	1.74	1.61	3.46	17.54	2.19
Total.....			68.72	72.03	64.89	63.44	62.08	62.43	56.43	68.53	518.55	64.82

## At Winterhaven, Texas. Latitude 29° 40', Longitude 99° 50'

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....								1.55	2.10	1.74	5.39	1.80
Feb.....								2.16	2.34	2.12	6.62	2.21
Mar.....								4.77	5.22	4.28	14.27	4.76
Apr.....								3.64	5.98	5.98	15.60	5.20
May.....								4.85	6.21	7.77	18.83	6.28
June.....								6.27	8.86	8.97	24.10	8.03
July.....								6.94	8.95	8.91	24.80	8.26
Aug.....								7.09	8.14	7.78	23.01	7.67
Sept.....								7.29	4.42	6.68	18.39	6.13
Oct.....								5.89	4.19	4.57	14.65	4.88
Nov.....								3.77	3.09	3.19	10.05	3.35
Dec.....								1.65	1.62	2.75	6.02	2.01
Total.....								55.87	61.12	64.74	181.73	60.58

## At Dilley, Texas

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....					†3.45	3.46	1.88	2.58	2.89	2.46	16.72	2.79
Feb.....					†3.04	3.84	4.66	2.74	3.34	2.40	20.02	3.34
Mar.....					†5.82	7.09	5.49	6.16	5.83	5.61	36.00	6.00
Apr.....					†7.20	8.17	7.50	5.49	6.88	8.09	43.28	7.21
May.....					†7.15	†9.71	5.93	6.67	8.44	9.51	47.46	7.91
June.....					†11.83	10.38	7.57	8.32	9.84	10.37	58.31	9.72
July.....					†13.30	†10.65	10.54	8.64	10.24	11.38	64.75	10.79
Aug.....					†11.72	†11.90	†11.00	8.39	9.89	8.77	61.67	10.28
Sept.....					†7.65	9.42	†8.00	8.25	5.45	6.62	45.39	7.56
Oct.....					7.16	†7.18	4.82	6.68	4.57	5.87	36.28	6.05
Nov.....					3.64	3.09	2.49	4.20	3.52	3.80	20.74	3.46
Dec.....					2.40	2.96	2.56	2.22	2.03	3.80	15.97	2.66
Total.....					†84.36	87.85	†72.44	70.34	72.92	78.68	466.59	77.77

†Estimated

*At Don Martin, Nuevo Leon, Mexico*

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....				.....	3.63	4.09	3.41	2.61	3.78	3.66	21.18	3.53
Feb.....				.....	4.36	4.56	5.71	3.06	5.05	4.16	26.90	4.48
Mar.....				.....	9.62	9.33	7.52	5.82	8.61	7.89	48.79	8.13
Apr.....				.....	11.57	10.82	10.85	5.92	10.18	9.78	59.12	9.85
May.....				.....	12.48	13.56	9.83	8.44	11.57	12.83	68.71	11.45
June.....				12.22	15.75	15.37	10.92	11.70	14.05	13.41	93.42	13.35
July.....				12.07	15.58	14.81	14.26	10.77	15.25	12.39	95.13	13.59
Aug.....				14.25	14.79	14.31	14.98	10.73	13.12	11.70	93.88	13.41
Sept.....				11.56	7.84	10.53	10.82	10.70	6.87	8.28	66.60	9.51
Oct.....				7.41	7.68	7.54	5.81	8.94	5.38	5.94	48.70	6.96
Nov.....				5.89	3.73	4.56	3.06	5.71	4.37	4.16	31.48	4.50
Dec.....				.....	2.91	3.61	3.07	3.38	2.80	4.33	20.10	3.35
Total.....				63.40	109.94	113.09	100.24	87.78	101.03	98.53	674.01	102.11

*At Monterrey, Nuevo Leon, Mexico*

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....	2.39	3.63	3.48	4.99	.....	4.04	3.20	3.88	4.17	2.51	32.29	3.59
Feb.....	3.29	7.13	.....	3.63	.....	.....	5.28	3.74	4.27	3.14	30.48	4.35
Mar.....	5.85	7.68	.....	3.71	8.10	.....	4.87	4.42	4.70	5.67	45.00	5.62
Apr.....	6.77	8.11	4.76	3.62	9.71	.....	5.89	3.01	6.50	6.19	62.07	6.21
May.....	7.37	10.30	.....	.....	.....	7.18	5.23	3.35	6.28	9.33	49.04	7.01
June.....	9.88	9.95	.....	.....	10.71	8.85	5.55	3.64	7.69	8.48	64.75	8.09
July.....	10.94	11.80	.....	.....	12.23	8.13	7.90	4.35	8.17	7.56	71.08	8.88
Aug.....	13.61	3.62	.....	3.79	10.62	7.36	9.00	6.09	8.22	.....	62.31	7.79
Sept.....	6.09	1.43	.....	4.01	.....	5.94	7.33	4.32	3.72	3.77	36.61	4.58
Oct.....	4.89	3.69	.....	3.76	.....	4.81	.....	3.56	3.24	3.77	27.72	3.96
Nov.....	4.04	3.20	.....	3.60	3.44	3.90	3.18	3.76	3.74	3.01	31.87	3.54
Dec.....	2.43	2.98	.....	.....	2.98	3.14	2.98	3.97	2.51	3.96	24.95	3.12
Total.....	77.55	73.52	.....	.....	.....	.....	.....	48.09	63.21	.....	538.17	66.74

*At Saltillo, Coahuila, Mexico*

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....							5.04	2.71	6.59	5.03	19.37	4.84
Feb.....							6.42	2.19	4.39	5.04	18.04	4.51
Mar.....							8.34	6.56	7.85	7.43	30.18	7.54
Apr.....							8.94	8.30	10.86	10.39	38.49	9.62
May.....							9.09	9.04	11.86	*10.04	40.03	10.01
June.....						13.26	*9.41	8.78	11.54	9.69	52.68	10.54
July.....						10.91	9.73	7.31	9.53	10.17	47.65	9.53
Aug.....						10.28	10.60	8.73	10.52	8.43	48.56	9.71
Sept.....						8.82	8.91	8.28	5.61	*7.90	39.52	7.90
Oct.....						7.88	4.49	7.09	7.07	*6.63	33.16	6.63
Nov.....						4.21	4.63	6.31	5.76	6.76	27.67	5.53
Dec.....						4.37	3.80	7.80	6.34	9.59	31.90	6.38
Total.....							89.40	83.10	97.92	97.10	427.25	92.74

*At Weslaco, Texas. Latitude 26° 9', Longitude 97° 57'*

Month	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Total	Normal
Jan.....									2.96	2.72	5.68	2.84
Feb.....									3.35	3.18	6.53	3.26
Mar.....									5.52	4.66	10.18	5.09
Apr.....									5.59	5.28	10.87	5.44
May.....									5.27	7.32	12.59	6.30
June.....									6.95	7.08	14.03	7.02
July.....									6.48	6.30	12.78	6.39
Aug.....									7.88	5.97	13.85	6.92
Sept.....									4.24	4.09	8.33	4.16
Oct.....									5.51	4.16	9.67	4.84
Nov.....									3.98	3.08	7.06	3.53
Dec.....									2.53	3.10	5.63	2.81
Total.....									60.26	56.94	117.20	58.60

**BACK WATER AT ROMA STATION**

Studies of synchronized discharge hydrographs confirmed by levels have shown that backwater from the Rio San Juan reached the Roma gaging station at certain times during the 1932 and 1933 floods. Similar studies show that backwater did not affect the Roma station during the years 1929, 1930 and 1931.

The proper corrections have been made in the 1933 records of Roma station shown on page 34 hereof.

The following corrections on account of backwater are made in the 1932 records as published in Water Bulletin No. 2.

	Mean Daily Second Feet		Total Acre Feet	Average Second Feet	Acre Feet Per Square Mile
Sept. 27.....	34,730	Sept.....	3,047,630	51,216	
Sept. 28.....	24,500	Oct.....	2,371,870	38,574	
Sept. 29.....	30,000	Year.....	8,098,030	11,155	50.6
Sept. 30.....	44,900				
Oct. 1.....	50,700				
Oct. 2.....	84,000				

**FLOW OF THE RIO GRANDE AND TRIBUTARY CONTRIBUTIONS**

*From San Marcial, New Mexico to the Gulf of Mexico  
For the Years 1929 and 1930*

The following records have not been published heretofore. They are of gaging stations on the Rio Grande and on tributaries maintained by the Mexican Department of Agriculture and Development. The records of similar stations maintained by United States Agencies have been published by the United States Geological Survey in their Water Supply Papers numbers 686, 703 and 718.

All of the aforementioned records have been studied as simultaneous hydrographs and adjusted where necessary, in the light of original records, so that the published records referred to here, form a consistent whole.

## RIO GRANDE AT UPPER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located 1 mile from Haciendita, Texas, 8 miles above the confluence of the Rio Conchos and about 10 miles northwest of the towns of Ojinaga, Chihuahua, and Presidio, Texas. Zero of gage is 2,579.40 feet above mean sea level, International Boundary Commission datum.

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered good at low flow and fair at high flow.

**Remarks:** River flow is greatly modified at this station by Elephant Butte reservoir and diversions for irrigation in both the United States and Mexico. This station was operated by the Chihuahua Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated, the drainage area above this station is 37,488 square miles, of which 35,229 are in the United States and 2,259 in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1929

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	185	155	130	135	0	700	0	350	450	240	600	250
2	185	160	160	125	0	360	0	300	250	210	580	250
3	180	155	155	130	0	400	0	500	210	180	560	235
4	180	170	155	100	5	220	0	780	195	150	550	235
5	185	165	135	55	10	175	0	850	165	155	490	235
6	185	165	140	50	60	175	30	810	165	145	445	225
7	190	160	175	80	80	155	40	1,050	170	135	420	220
8	185	165	140	145	55	130	25	650	175	130	390	225
9	185	160	125	650	40	110	20	520	225	125	375	215
10	185	165	130	230	45	105	0	450	3,200	120	440	215
11	180	165	135	125	55	55	0	950	370	120	410	220
12	180	170	125	90	55	45	0	900	255	125	450	230
13	185	170	130	35	85	40	0	1,350	210	165	465	220
14	185	165	230	20	60	35	0	1,380	270	1,200	580	205
15	185	165	260	15	35	30	0	2,300	240	770	460	205
16	185	160	260	15	30	25	0	1,520	210	450	355	205
17	170	160	210	11	60	20	0	1,500	235	1,250	355	200
18	170	160	110	10	20	20	0	1,480	250	1,700	355	200
19	150	160	95	10	75	15	55	1,400	255	2,050	350	195
20	140	160	100	10	70	10	200	1,550	230	1,050	350	195
21	135	165	110	5	40	5	220	1,500	190	600	340	190
22	130	165	100	5	35	0	150	1,600	195	730	355	190
23	125	145	110	0	85	0	145	1,900	190	700	295	190
24	140	145	100	0	230	0	70	1,300	170	575	310	185
25	185	140	110	0	340	0	30	950	160	420	305	185
26	180	140	100	0	750	0	25	850	140	1,700	300	175
27	180	140	100	0	280	0	770	680	165	1,450	295	180
28	170	150	110	0	860	0	1,150	490	155	1,050	300	205
29	170	...	125	0	600	0	700	580	210	850	295	220
30	155	...	165	0	2,400	0	660	560	300	730	290	235
31	140	...	135	...	1,100	...	550	550	...	620	290	235

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	6.77	6.51	190	125	170	10,480	
February.....	6.72	6.49	170	140	159	8,820	
March.....	6.94	6.34	260	95	141	8,660	
April.....	7.48	....	650	0	68	4,070	
May.....	8.05	....	2,400	0	244	14,990	
June.....	7.31	....	700	0	94	5,610	
July.....	8.56	....	1,150	0	156	9,600	
August.....	9.38	6.72	2,300	300	1,020	62,580	
September.....	8.08	5.63	3,200	140	320	19,050	
October.....	9.42	5.32	2,050	120	642	39,460	
November.....	6.99	6.02	600	290	402	23,930	
December.....	6.05	5.63	295	175	214	13,170	
Yearly.....	9.42	....	3,200	0	304	220,420	5.88

## RIO GRANDE AT UPPER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located 1 mile from Haciendita, Texas, 8 miles above the confluence of the Rio Conchos and about 10 miles northwest of the towns of Ojinaga, Chihuahua, and Presidio, Texas. Zero of gage is 2,579.40 feet above mean sea level, International Boundary Commission datum.

**Records:** Based on 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered good at low flow and fair at high flow.

**Remarks:** River flow is greatly modified at this station by Elephant Butte reservoir and diversions for irrigation in both the United States and Mexico. This station was operated by the Chihuahua Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated, the drainage area above this station is 37,488 square miles, of which 35,229 are in the United States and 2,259 in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	290	180	115	140	105	210	355	810	110	20	255	155
2	265	175	110	140	95	265	285	640	100	200	260	225
3	240	175	110	130	90	510	240	410	110	680	250	220
4	220	180	105	150	95	335	185	570	220	720	235	215
5	205	185	100	150	120	300	120	235	155	820	205	210
6	205	180	95	145	110	245	85	200	200	2,100	235	210
7	195	180	95	145	100	680	75	320	215	3,100	295	195
8	195	175	95	135	90	410	70	310	185	820	295	200
9	195	170	105	105	90	275	95	480	150	590	260	205
10	200	170	125	90	85	575	140	2,100	130	520	255	205
11	195	165	140	85	80	770	230	2,450	100	490	235	215
12	200	170	145	80	80	440	145	1,450	90	470	220	215
13	210	175	140	80	85	265	140	1,150	105	490	225	245
14	205	205	130	80	100	370	120	1,700	95	590	400	330
15	180	220	125	85	85	525	100	1,400	150	2,500	280	335
16	190	215	115	80	85	*800	95	1,120	140	1,400	255	300
17	185	225	120	80	85	*850	85	860	120	830	235	270
18	190	240	120	80	85	800	70	710	105	660	225	250
19	180	225	110	80	110	775	65	680	100	570	205	235
20	190	210	100	80	105	760	60	630	100	530	200	220
21	190	200	90	75	90	680	65	560	105	500	180	195
22	180	180	85	70	80	560	70	360	105	490	170	185
23	180	165	80	65	80	540	145	290	95	470	175	175
24	185	155	80	60	85	510	195	240	80	400	180	200
25	180	145	80	65	120	340	155	225	70	350	180	200
26	185	135	90	75	135	230	165	220	60	325	180	195
27	190	130	100	75	125	215	280	195	50	320	155	180
28	190	125	105	80	90	300	610	155	40	325	155	170
29	180	...	115	320	80	*450	540	130	40	325	155	195
30	175	...	120	150	75	440	540	125	30	270	155	245
31	175	...	130	...	70	...	670	115	...	260	...	270

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	6.06	5.53	290	175	198	12,190	
February.....	5.87	5.21	240	125	181	10,030	
March.....	5.38	4.84	145	80	109	6,690	
April.....	6.18	4.70	320	60	106	6,300	
May.....	5.34	4.78	135	70	94	5,770	
June.....	...	5.85	850	210	481	28,610	
July.....	6.84	4.47	670	60	200	12,290	
August.....	9.72	5.08	2,450	115	672	41,340	
September.....	5.66	4.58	220	30	112	6,650	
October.....	10.24	4.56	3,100	20	714	43,900	
November.....	6.31	5.55	400	155	224	13,310	
December.....	6.27	5.56	335	155	221	13,620	
Yearly.....	10.24	4.47	3,100	20	277	200,700	5.35

\*Partly Estimated

## RIO GRANDE AT LOWER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 6 miles below the towns of Presidio, Texas, and Ojinaga, Chihuahua, and 7½ miles below the confluence of the Rio Conchos with the Rio Grande.

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered poor.

**Remarks:** The river flow is greatly modified by irrigation diversions and Elephant Butte reservoir in the United States and by Boquilla reservoir, on the Rio Conchos, as well as by irrigation diversions in Mexico. The river section at this station is very changeable due to combined effects of sediment and variation in flow of the Rio Grande and the Rio Conchos, and is subject to backwater from storm flows in the Alamito Creek which enters the river about ½ mile below this station. This station was operated by the Chihuahua Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated, the drainage area above this station is 60,434 square miles, of which 35,575 are in the United States and 24,859 in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1929

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,850	1,550	1,580	1,280	1,250	3,350	1,120	4,050	2,420	1,650	2,150	1,320
2	1,900	1,620	1,500	1,220	1,120	2,150	1,350	3,200	2,250	1,680	1,980	1,350
3	1,880	1,580	1,500	1,250	1,180	1,800	1,250	3,120	2,080	1,380	1,920	1,350
4	1,920	1,600	1,520	1,280	1,120	1,700	1,250	2,550	1,550	1,250	1,980	1,380
5	1,980	1,520	1,520	1,300	1,180	1,580	1,180	2,400	1,380	1,280	1,920	1,350
6	2,000	1,550	1,600	1,300	1,150	1,450	1,220	2,350	1,300	1,200	1,720	1,250
7	1,900	1,450	1,450	1,250	1,280	1,450	1,300	2,550	1,320	1,150	1,580	1,250
8	1,680	1,580	1,420	1,750	1,370	1,420	1,250	2,820	1,320	1,120	1,500	1,300
9	1,670	1,620	1,480	2,250	1,280	1,400	1,220	2,350	1,320	1,120	1,420	1,280
10	1,680	1,650	1,500	1,450	1,170	1,380	1,230	2,500	*6,000	1,100	1,450	1,350
11	1,750	1,650	1,520	1,320	1,280	1,350	1,220	2,950	2,800	1,050	1,420	1,380
12	1,420	1,650	1,520	1,320	1,220	1,320	1,200	2,680	2,780	1,180	1,550	1,370
13	1,300	1,720	1,450	1,300	1,250	1,250	1,200	3,330	2,670	1,270	1,520	1,250
14	1,280	1,680	1,400	1,380	1,300	1,220	1,280	2,300	3,650	3,150	1,520	1,250
15	1,250	1,620	1,350	1,350	1,300	1,250	1,250	3,700	3,420	2,500	1,450	1,250
16	1,170	1,650	1,350	1,350	1,380	1,380	1,250	2,350	2,980	2,500	1,520	1,280
17	1,100	1,680	1,400	1,320	2,080	1,300	1,280	2,720	2,780	3,700	2,100	1,300
18	1,100	1,720	1,420	1,380	1,450	1,250	1,300	2,650	2,600	3,800	2,050	1,350
19	1,250	1,750	1,480	1,450	1,400	1,220	1,150	2,600	2,480	4,150	1,680	1,350
20	1,400	1,820	1,450	1,380	1,420	1,180	1,320	3,750	3,050	2,350	1,780	1,170
21	1,520	1,680	1,450	1,400	1,420	1,120	1,380	3,830	3,100	1,920	1,830	1,120
22	1,480	1,580	1,430	1,380	1,680	1,150	1,350	2,920	3,200	2,100	1,780	1,170
23	1,550	1,550	1,450	1,400	1,420	1,180	1,320	3,200	3,180	1,980	1,320	1,320
24	1,480	1,580	1,480	1,580	2,650	1,200	1,380	2,350	2,850	1,850	1,380	1,400
25	1,500	1,600	1,450	1,250	1,820	1,170	1,350	2,120	2,650	1,750	1,350	1,500
26	1,420	1,620	1,450	1,280	1,780	1,150	1,500	1,920	2,400	1,920	1,400	1,350
27	1,450	1,580	1,450	1,220	1,920	1,080	2,130	2,000	2,400	3,200	1,380	1,350
28	1,420	1,580	1,450	1,170	1,880	1,100	1,700	2,280	2,220	4,350	1,350	1,280
29	1,650	.....	1,400	1,120	2,080	1,070	2,650	2,400	2,320	2,900	1,300	1,350
30	1,700	.....	1,380	1,220	3,550	1,100	4,450	2,680	2,150	2,420	1,250	1,300
31	1,650	.....	1,320	.....	2,600	.....	4,350	2,380	.....	2,250	.....	1,480

Month	Gage Height		Second Feet		Acre Feet		
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	15.19	14.13	2,000	1,100	1,560	95,800	
February.....	15.03	14.38	1,820	1,450	1,620	90,110	
March.....	14.79	14.48	1,600	1,320	1,460	89,500	
April.....	15.45	14.20	2,250	1,120	1,360	81,130	
May.....	16.05	14.05	3,550	1,120	1,580	97,150	
June.....	16.33	14.10	3,350	1,070	1,390	82,750	
July.....	17.10	14.15	4,450	1,120	1,560	95,960	
August.....	16.86	15.16	4,050	1,920	2,740	168,600	
September.....	*18.50	14.42	*6,000	1,300	2,550	151,980	
October.....	17.39	14.65	4,350	1,050	2,100	129,360	
November.....	15.88	14.91	2,150	1,250	1,620	96,300	
December.....	15.16	14.69	1,500	1,120	1,310	80,830	
Yearly.....	*18.50	14.05	*6,000	1,050	1,740	1,259,470	20.8

\*Partly Estimated

## RIO GRANDE AT LOWER PRESIDIO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 6 miles below the towns of Presidio, Texas and Ojinaga, Chihuahua, and 7½ miles below the confluence of the Rio Conchos with the Rio Grande.

**Records:** Based on 101 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered poor.

**Remarks:** The river flow is greatly modified by irrigation diversions and Elephant Butte reservoir in the United States and by Boquilla reservoir, on the Rio Conchos, as well as by irrigation diversions in Mexico. The river section at this station is very changeable due to combined effects of sediment and variation in flow of the Rio Grande and the Rio Conchos, and is subject to backwater from storm flows in the Alamito Creek which enters the river about ½ mile below this station. This station was operated by the Chihuahua Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated, the drainage area above this station is 60,434 square miles, of which 35,575 are in the United States and 24,859 in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,950	900	930	415	430	420	*480	1,680	570	110	680	710
2	1,680	860	900	415	320	1,620	*450	2,100	530	1,380	660	640
3	1,320	830	800	410	300	600	*440	2,000	480	960	630	590
4	1,420	1,000	610	370	305	560	430	1,500	365	1,650	610	610
5	1,320	950	580	360	320	630	390	1,220	310	5,400	760	610
6	1,250	960	530	350	380	1,080	380	925	290	4,400	950	560
7	1,280	975	510	340	370	1,380	375	1,480	340	3,450	1,000	530
8	1,350	920	520	360	360	650	375	1,200	310	1,900	860	525
9	1,300	940	535	330	375	590	430	2,220	290	1,150	840	525
10	1,250	950	550	320	380	920	525	10,600	270	940	820	500
11	1,250	940	560	315	390	1,900	1,400	*7,000	235	830	730	505
12	1,350	920	580	310	400	1,000	1,250	6,800	215	830	680	560
13	1,400	860	560	320	400	540	700	8,200	215	810	640	555
14	1,500	925	525	320	355	520	1,080	7,000	210	1,050	1,050	620
15	1,480	890	490	300	350	950	760	*7,700	215	3,350	930	710
16	1,550	850	470	320	350	1,150	675	*6,500	310	2,800	880	605
17	1,380	840	455	360	345	1,200	670	5,200	530	1,900	800	1,150
18	1,300	860	455	340	340	1,900	520	*5,500	430	1,500	760	590
19	1,220	920	490	340	345	1,500	510	4,500	355	1,400	720	760
20	1,150	925	*450	340	350	990	525	3,400	365	1,400	670	950
21	1,080	910	*430	330	345	925	590	2,900	240	1,350	640	830
22	1,100	925	*400	300	340	725	530	2,500	245	1,070	615	710
23	1,120	925	370	300	335	630	525	1,770	240	1,070	595	740
24	1,050	920	370	280	335	610	2,000	1,250	210	900	585	510
25	1,030	910	355	440	360	550	2,100	770	180	930	590	670
26	1,000	890	340	460	450	560	2,050	660	155	860	585	1,020
27	1,300	900	350	460	460	530	2,300	600	120	770	560	770
28	1,250	910	355	490	400	525	2,700	560	115	770	540	580
29	1,000	...	365	430	400	610	2,300	580	115	750	535	810
30	925	...	390	550	420	*520	2,020	550	115	730	585	1,050
31	925	...	355	...	380	...	1,700	590	...	700	...	830

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	15.29	14.45	1,950	925	1,270	78,310	
February.....	14.53	14.31	1,000	830	911	50,590	
March.....	14.43	13.47	930	340	503	30,900	
April.....	13.76	13.11	550	280	366	21,770	
May.....	13.47	12.94	460	335	367	22,590	
June.....	16.12	13.53	1,900	420	876	52,140	
July.....	17.06	13.26	2,700	375	1,010	61,850	
August.....	19.75	14.20	10,600	550	3,210	197,270	
September.....	14.23	13.07	570	115	286	17,000	
October.....	18.47	13.05	5,400	110	1,520	93,450	
November.....	14.69	13.74	1,050	535	717	42,640	
December.....	14.63	13.68	1,150	500	688	42,300	
<b>Yearly.....</b>	<b>19.75</b>	<b>12.94</b>	<b>10,600</b>	<b>280</b>	<b>982</b>	<b>710,810</b>	<b>11.8</b>

\*Partly Estimated

**RIO GRANDE AT LAREDO STATION**

**Description:** Automatic water-stage recorder and cable with sit down cable car. Cable and car located about 2½ miles above the cities of Laredo, Texas, and Nuevo Laredo, Tamaulipas. Water-stage recorder is attached to north abutment of railroad bridge at Laredo. 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 January, 1926, and zero of gage was elevation 352.65 feet. On October 25, 1930, zero of gage at recorder was changed to elevation 351.50 feet. All gage elevations are on United States Coast and Geodetic Survey sea level datum.

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered good.

**Remarks:** The river flow at this station is modified by many irrigation diversions and Elephant Butte reservoir in the United States and by many irrigation diversions and Boquilla dam in Mexico. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated the drainage area above this station is 132,915 square miles, of which 91,516 are in the United States and 41,399 in Mexico.

*Mean Daily Discharge in Second Feet and Annual Summary, 1929*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,100	2,700	2,050	1,950	1,600	4,100	5,000	5,100	2,950	2,750	3,380	2,350
2	3,000	2,700	2,100	1,950	1,450	3,400	7,300	3,850	2,800	2,750	4,180	2,280
3	3,000	2,400	2,100	1,950	1,350	3,200	5,300	3,800	2,950	2,720	4,450	2,380
4	3,100	2,550	2,250	1,950	1,450	3,700	7,500	3,800	2,400	2,720	3,880	3,000
5	3,100	2,550	2,350	1,900	1,550	3,700	5,300	3,500	2,400	2,700	3,650	2,600
6	3,150	2,650	2,400	1,800	1,600	4,200	4,000	3,150	2,450	2,480	3,200	2,650
7	3,150	2,700	2,500	1,900	1,550	3,700	3,000	3,100	2,400	2,280	3,100	2,220
8	3,250	2,700	2,550	2,100	1,400	2,900	2,250	3,000	2,200	2,080	2,950	2,050
9	3,250	2,700	2,650	4,200	1,400	2,250	2,250	2,900	2,250	2,000	2,880	2,220
10	3,250	2,700	2,650	3,350	1,500	2,100	2,300	3,500	2,200	1,970	2,800	2,400
11	3,250	2,700	2,700	2,500	1,500	2,000	2,300	3,500	2,050	1,900	2,750	2,350
12	3,100	2,650	2,500	2,100	1,550	2,000	1,900	3,300	2,400	1,850	2,780	2,600
13	3,000	2,650	2,150	1,900	4,550	1,900	1,900	3,100	2,000	1,800	2,750	2,700
14	2,900	2,550	2,000	1,900	3,350	1,900	1,850	2,950	2,200	3,400	2,620	6,800
15	3,250	2,300	1,900	1,900	2,100	1,900	1,800	3,100	5,500	10,400	2,480	9,000
16	3,150	2,400	2,000	2,100	1,800	1,800	1,800	3,100	23,000	6,900	2,400	9,200
17	3,250	2,550	2,150	1,900	1,650	1,650	1,800	2,950	27,000	5,150	2,350	3,080
18	3,150	2,550	2,250	1,900	1,550	1,450	1,750	2,900	23,000	4,550	2,350	3,050
19	3,450	2,550	2,350	1,800	2,900	1,550	1,650	3,100	6,500	4,400	2,300	2,550
20	3,450	2,400	2,500	1,650	2,600	1,600	1,650	3,300	4,500	4,280	2,270	2,200
21	3,250	2,550	5,600	1,900	2,500	1,650	1,650	4,100	3,900	3,870	2,250	2,220
22	3,150	2,550	4,800	1,900	3,150	1,650	1,650	3,800	4,000	3,550	2,220	2,220
23	3,100	2,550	2,500	1,650	2,750	1,750	1,550	3,500	3,500	3,520	2,280	2,280
24	2,750	2,550	2,500	1,650	17,500	1,800	1,450	3,500	3,500	3,800	2,200	2,200
25	2,250	2,550	2,250	1,800	8,600	1,800	1,450	6,800	2,900	4,100	2,170	2,100
26	2,400	2,100	2,500	1,650	6,200	1,850	1,450	6,000	2,500	3,950	2,220	2,080
27	2,400	2,550	2,250	1,650	2,100	1,900	1,900	4,000	2,500	3,700	2,220	2,200
28	2,400	2,550	2,000	1,650	2,300	1,750	2,350	3,500	2,500	3,680	2,220	2,170
29	2,550	.....	1,800	1,800	3,350	1,600	2,900	3,600	2,450	3,650	2,300	2,200
30	2,500	.....	1,800	1,600	3,000	1,450	5,300	3,600	2,450	3,050	2,320	2,180
31	2,650	.....	1,800	.....	3,500	.....	2,550	3,100	.....	2,700	.....	2,220

Month	Gage Height		Second Feet		Acre Feet		
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	4.80	4.10	3,450	2,250	2,990	183,870	
February.....	4.50	4.10	2,700	2,100	2,560	142,020	
March.....	6.30	3.90	5,600	1,800	2,450	150,550	
April.....	5.60	3.75	4,200	1,600	2,000	118,910	
May.....	10.30	3.50	17,500	1,350	3,010	185,160	
June.....	5.60	3.60	4,200	1,450	2,270	135,270	
July.....	7.12	3.60	7,500	1,450	2,800	172,170	
August.....	6.25	4.40	6,800	2,900	3,630	223,140	
September.....	10.80	3.95	27,000	2,000	5,110	304,170	
October.....	8.12	3.47	10,400	1,800	3,500	215,510	
November.....	5.39	3.87	4,450	2,170	2,730	162,490	
December.....	7.50	3.80	9,200	2,100	2,960	181,990	
Yearly.....	10.80	3.47	27,000	1,350	3,005	2,175,250	16.4

\*Partly Estimated

## RIO GRANDE AT LAREDO STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car. Cable and car located about 2½ miles above the cities of Laredo, Texas, and Nuevo Laredo, Tamaulipas. Water-stage recorder is attached to north abutment of railroad bridge at Laredo. 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 January, 1926, and zero of gage was elevation 352.65 feet. On October 25, 1930, zero of gage at recorder was changed to elevation 351.50 feet. All gage elevations are on United States Coast and Geodetic Survey sea level datum.

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered good.

**Remarks:** The river flow at this station is modified by many irrigation diversions and Elephant Butte reservoir in the United States and by many irrigation diversions and Boquilla dam in Mexico. This station was operated by the Monterey Office of the Mexican Department of Agriculture and Development. With all closed basins eliminated the drainage area above this station is 132,915 square miles, of which 91,516 are in the United States and 41,399 in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,140	2,050	1,510	1,520	4,420	2,420	2,330	2,550	2,050	1,120	4,900	3,460
2	2,080	2,050	1,510	1,520	2,610	1,960	2,280	2,720	1,920	1,060	4,750	3,420
3	2,120	2,080	1,530	1,540	2,830	1,680	2,190	2,830	1,880	1,030	4,550	3,410
4	2,170	2,080	1,550	1,550	2,350	1,670	2,140	2,960	1,840	1,040	4,300	3,420
5	2,170	2,050	1,560	1,560	3,680	1,640	1,960	2,930	1,670	1,060	4,050	3,380
6	2,140	2,000	1,540	1,480	2,540	1,750	1,830	2,800	1,510	7,600	3,850	3,330
7	2,170	1,900	1,520	1,370	1,750	1,780	1,790	2,830	1,460	22,600	3,750	3,280
8	2,140	1,880	1,520	1,110	1,640	2,030	2,030	3,820	1,440	44,750	3,980	3,280
9	2,110	1,870	1,500	1,050	1,470	2,030	3,180	3,520	3,280	35,200	4,200	3,260
10	2,120	1,860	1,480	1,050	1,440	2,540	2,770	2,640	1,460	13,600	5,230	3,230
11	2,110	1,870	1,480	1,080	2,580	5,000	2,830	2,370	1,360	9,500	5,550	2,960
12	2,050	1,830	1,480	850	1,720	8,500	2,830	3,100	1,360	8,480	5,560	3,080
13	2,080	1,810	1,510	930	1,380	11,450	2,680	3,730	1,290	8,520	5,560	3,080
14	2,080	1,800	1,520	1,380	1,390	12,400	2,610	4,750	1,250	5,950	5,300	2,960
15	2,170	2,380	1,520	1,370	1,410	9,820	2,230	6,800	1,230	5,300	5,100	3,080
16	2,240	4,150	1,660	1,220	1,220	8,200	2,090	5,030	3,080	26,250	5,100	3,050
17	2,240	2,720	3,100	1,110	2,480	8,950	1,780	5,950	1,570	25,600	4,620	3,020
18	2,240	2,160	1,730	1,000	2,370	10,100	1,700	6,820	1,150	13,250	4,450	3,050
19	2,200	1,830	1,570	1,050	1,470	8,000	1,690	7,250	1,100	8,550	4,340	2,860
20	2,170	1,760	1,520	1,160	1,420	5,560	1,730	7,500	1,050	6,300	4,340	2,980
21	2,140	1,720	1,500	1,360	1,220	4,430	1,980	6,300	1,030	7,050	4,100	2,880
22	2,170	1,670	1,500	1,360	1,110	4,550	1,820	5,450	1,020	6,230	4,100	3,250
23	2,200	1,680	1,460	1,260	1,780	4,030	1,820	4,930	1,000	6,800	4,050	3,580
24	2,140	1,660	1,450	1,220	2,160	3,720	1,790	3,450	1,060	6,800	4,050	2,830
25	2,310	1,640	1,450	1,220	875	3,460	1,760	5,200	680	5,500	3,850	2,880
26	2,560	1,590	1,390	5,100	750	3,090	1,720	4,920	855	5,130	3,700	3,330
27	2,500	1,550	1,380	2,160	750	2,770	1,690	4,650	1,520	4,900	3,620	3,120
28	2,330	1,520	1,380	4,850	750	2,720	1,680	2,960	1,600	6,800	3,550	2,830
29	2,300	.....	1,420	10,160	1,830	2,610	1,780	2,600	1,180	9,250	3,480	2,600
30	2,300	.....	1,480	6,260	1,660	2,460	1,980	2,390	1,100	6,350	3,450	2,900
31	2,170	.....	1,520	.....	2,770	.....	2,230	2,220	.....	5,130	.....	2,640

Month	Gage Height		Second Feet		Acre Feet		
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	3.98	3.83	2,580	2,020	2,195	135,000	
February.....	5.60	3.40	5,100	1,520	1,970	109,410	
March.....	5.08	3.20	3,990	1,380	1,556	95,680	
April.....	8.70	3.00	15,650	745	1,995	118,710	
May.....	6.68	2.98	8,000	710	1,865	114,700	
June.....	8.62	3.46	15,280	1,560	4,711	280,310	
July.....	4.95	3.40	3,720	1,520	2,094	128,770	
August.....	6.77	4.12	8,250	2,330	4,128	253,830	
September.....	6.14	3.50	5,100	500	1,466	87,260	
October.....	18.35	4.11	53,300	1,030	10,216	628,170	
November.....	6.55	5.50	6,600	3,450	4,381	260,690	
December.....	5.60	4.06	3,620	965	3,111	191,270	
Yearly.....	18.35	2.98	53,300	500	3,320	2,403,800	18.1

## RIO SALADO STATION AT CD. GUERRERO, TAMAULIPAS

**Description:** Staff gage and cable with sit down cable car, located about 6.2 miles above the confluence of the Rio Salado with the Rio Grande and 2 miles southeast of Ciudad Guerrero, Tamaulipas.

**Records:** Based on station rating curve made up from 154 current meter measurements during previous years from cable car. Computations by shifting channel methods. 1929 records are considered fair.

**Remarks:** The flow of the Rio Salado is modified by irrigation. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 21,830 square miles, entirely in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1929

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	67	34	25	11	9	1,480	4	2	5	742	226	32
2	65	32	25	11	7	953	4	2	5	636	215	28
3	65	30	25	11	5	636	4	2	4	554	170	21
4	65	30	23	12	4	424	95	2	4	999	138	18
5	62	28	23	12	4	318	62	2	4	999	113	18
6	62	28	23	12	4	155	53	2	4	989	88	14
7	60	28	21	12	4	109	124	2	4	989	85	14
8	60	28	21	12	4	120	106	2	4	978	81	11
9	58	26	19	14	4	145	62	2	2	978	78	11
10	57	26	19	14	4	141	53	2	2	855	78	11
11	57	26	18	14	3	113	53	2	12	636	78	11
12	57	25	16	16	3	81	327	2	97	547	78	7
13	57	25	14	16	3	62	64	2	353	512	81	7
14	57	25	14	16	3	53	41	2	168	385	78	7
15	57	25	14	16	3	41	34	0	71	583	78	28
16	56	25	14	16	3	34	26	0	3,180	1,620	78	18
17	56	25	14	16	2	26	21	0	2,540	837	78	18
18	56	25	12	177	2	21	18	0	777	318	74	14
19	56	25	12	141	2	18	12	0	583	283	67	11
20	53	26	12	113	2	14	9	0	424	215	60	11
21	53	26	12	95	2	12	7	0	441	198	42	11
22	53	28	12	71	2	9	5	0	1,020	226	39	7
23	51	28	11	42	2	9	4	95	795	226	35	4
24	48	28	11	28	2	7	4	41	759	215	32	4
25	46	26	11	25	2	7	4	21	830	215	39	4
26	44	26	11	25	2	5	4	53	777	212	35	4
27	42	26	9	21	2	4	4	64	777	208	35	7
28	39	26	9	16	335	4	4	26	848	226	32	7
29	35	..	9	12	777	4	4	14	777	226	32	7
30	34	..	11	9	636	4	4	9	777	226	32	7
31	34	..	11	..	742	..	2	7	..	226	..	7

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.26	1.74	67	34	53.6	3,300	
February.....	1.74	1.57	34	25	27.0	1,500	
March.....	1.57	1.15	25	9	15.5	954	
April.....	3.94	1.15	424	9	113.0	6,730	
May.....	4.66	.16	777	2	83.2	5,120	
June.....	5.61	.72	1,480	4	167.0	9,940	
July.....	3.48	.49	327	2	39.3	2,420	
August.....	2.56	0	95	0	11.5	710	
September.....	9.77	.43	3,180	2	535	31,820	
October.....	5.77	3.15	1,620	198	550	33,840	
November.....	3.28	1.67	226	32	79.2	4,710	
December.....	1.64	.92	32	4	12.2	752	
Yearly.....	9.77	0	3,180	0	141.0	101,800	4.66

## RIO SALADO STATION AT CD. GUERRERO, TAMAULIPAS

**Description:** Staff gage and cable with sit down cable car, located about 6.2 miles above the confluence of the Rio Salado with the Rio Grande and 2 miles southeast of Ciudad Guerrero, Tamaulipas.

**Records:** Based on station rating curve made up from 154 current meter measurements during previous years from cable car. Computations by shifting channel methods. 1930 records are considered fair.

**Remarks:** The flow of the Rio Salado is greatly modified by the Don Martin reservoir, which forms a part of National Irrigation System No. 4, Coahuila-Nuevo Leon. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 21,830 square miles, entirely in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	17.3	.81	1.90		837	6,150	77.7	9.18	0	.71	1,750	227
2	15.9	.81	1.90	0	311	1,580	64.6	7.77	0	.35	1,070	221
3	13.4	.81	1.70	0	1,090	921	61.4	5.30	0	26.80	577	214
4	12.7	.81	1.70	0	2,390	456	52.6	3.53	0	105.00	496	201
5	10.9	.81	1.52	0	1,350	356	43.8	2.83	964	88.30	456	195
6	10.9	.71	1.31	0	779	285	32.1	1.77	311	64.6	374	177
7	10.2	.71	1.13	0	3,240	247	30.0	1.41	105	46.6	270	171
8	9.18	.71	.95	0	1,290	356	28.6	1.41	58.6	28.6	597	201
9	8.48	.64	.95	0	637	177	26.8	1.06	45.8	22.2	1,010	195
10	7.77	.64	.95	0	365	985	136.0	.71	34.3	14.8	637	188
11	6.71	.64	.88	0	208	8,010	64.6	.71	25.4	13.4	483	182
12	6.00	.64	.88	0	2,650	14,920	136.0	.71	22.2	10.9	419	177
13	6.00	.56	.88	0	878	14,760	171.0	.71	19.1	9.18	1,090	166
14	5.30	.57	.81	0	347	6,070	118.0	.71	17.3	7.77	1,550	155
15	4.24	303.0	.81	0	214	1,660	84.8	.64	14.1	545.0	1,160	145
16	3.53	311.0	.81	0	131	1,140	131.0	.57	13.4	818.0	1,050	136
17	3.53	195.0	.71	0	84.8	899	96.8	.46	15.9	496.0	779	126
18	2.08	136.0	.71	114	64.6	2,520	779.0	.39	7.77	1,330.0	677	118
19	1.70	114.0	.71	921	8,550	1,370	1,310	.32	5.30	838	637	101
20	1.52	49.8	.64	294	3,470	697	818	.25	2.83	718	561	92.5
21	1.30	26.8	.64	247	1,050	459	182	.25	1.77	738	496	81.2
22	1.30	19.1	.64	255	430	899	67.4	.18	1.41	430	483	114.0
23	1.13	12.7	.54	166	.285	311	84.8	0	1.06	374	470	109.0
24	1.13	10.9	.57	88.3	1,180	255	64.6	0	1.06	1,420	443	101.0
25	1.02	9.18	.39	77.7	838	214	46.6	0	.71	2,190	419	96.8
26	1.02	6.71	.32	5,900	347	195	28.6	0	.71	1,310	408	96.8
27	1.02	4.24	.32	10,020	240	171	23.7	0	.71	718	347	101.0
28	.95	2.83	.32	2,320	12,200	145	20.5	0	.71	397	312	96.8
29	.95	...	.25	1,490	18,030	118	17.3	0	.71	2,580	262	96.8
30	.88	...	.25	2,710	15,000	92.5	14.1	0	.71	2,450	247	92.5
31	.88	...	.18	...	5,830	...	11.7	0	...	2,910	...	88.3

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	1.38	.56	17.3	.88	5.45	335.0	
February.....	3.54	.43	311.0	.56	43.3	2,400.0	
March.....	.79	.26	1.90	.18	.85	52.1	
April.....	9.61	0	10,020.0	0	823.0	49,000.0	
May.....	12.99	2.07	18,030.0	64.6	2,720.0	167,240.0	
June.....	11.68	2.33	14,920.0	92.5	2,210.0	131,740.0	
July.....	5.41	1.21	1,310.0	11.7	156.0	9,570.0	
August.....	1.12	.07	9.18	0	1.32	81.1	
September.....	4.89	0	964	0	55.7	3,310.0	
October.....	6.59	.46	2,910.0	.35	668.0	41,060.0	
November.....	5.97	3.28	1,750.0	247.0	651.0	38,740.0	
December.....	3.18	2.23	227	81.2	144.0	8,850.0	
Yearly.....	12.99	0	18,030.0	0	625.0	452,380.0	20.7

**RIO ALAMO STATION AT CD. MIER, TAMAULIPAS**

**Description:** Automatic water-stage recorder and cable with sit down cable car, 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."

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered good.

**Remarks:** This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 1,840 square miles, all in Mexico.

*Mean Daily Discharge in Second Feet and Annual Summary, 1929*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	1.0	1.1	1.4	.7	0	0	0	2.5	2.1	.7	0
2	3.1	1.0	1.1	1.1	.5	0	0	0	1.2	2.1	.7	0
3	3.1	1.0	1.0	.7	.2	0	0	0	1.0	2.1	.7	0
4	3.1	1.0	1.0	.7	.1	0	77.0	0	.7	1.1	.7	0
5	2.5	1.0	1.0	.5	0	0	10.6	0	0	.7	.7	0
6	1.9	1.0	.7	.2	0	0	7.1	0	0	.7	0	0
7	1.7	1.0	.5	.1	0	0	4.1	0	0	.7	0	0
8	1.7	1.0	.5	38.6	0	0	2.8	0	0	0	0	0
9	1.4	1.0	.2	142.0	0	0	1.4	0	0	0	0	0
10	1.5	1.0	.3	34.9	0	0	0	0	0	0	0	0
11	1.3	1.1	.7	10.0	0	0	58.6	0	131.0	0	0	0
12	1.3	1.1	.7	5.0	0	0	125.0	0	111.0	50.7	0	0
13	1.1	1.1	.7	3.5	22.7	0	107.0	0	20.0	142.0	0	0
14	1.0	1.3	.7	2.1	53.6	0	114.0	0	5.6	114.0	0	0
15	1.0	1.3	.7	1.6	12.7	0	51.6	0	132.0	96.9	0	0
16	.7	1.4	1.0	1.4	5.6	0	10.6	0	122.0	15.0	0	40.3
17	.5	1.4	1.0	1.1	3.5	0	4.9	0	29.7	29.8	0	12.1
18	.5	1.3	1.3	1.0	2.2	0	3.5	0	177.0	25.7	0	4.6
19	.2	1.3	1.7	.5	1.3	0	2.1	0	170.0	16.9	0	1.4
20	.2	1.3	1.9	.5	1.0	0	2.1	0	124.0	13.1	0	.9
21	.2	1.3	2.5	.2	.7	0	1.1	0	133.0	9.9	0	.7
22	.2	1.3	5.0	28.4	.2	0	0	0	228.0	7.1	0	.7
23	.2	1.6	6.2	10.0	1.0	0	0	0	79.5	5.5	0	.5
24	.2	1.7	5.0	5.6	1.0	0	0	0	218.0	31.1	3.8	.4
25	.2	1.6	4.4	3.5	0	0	2.8	136	9.9	3.1	0	.4
26	.5	1.4	4.4	2.1	0	0	4.1	2,140	3.4	2.3	0	.3
27	.7	1.3	4.4	1.6	0	0	2.1	186	4.3	2.3	0	.3
28	1.0	1.1	3.5	1.4	0	0	.7	33.3	2.8	2.0	0	0
29	1.0	...	1.9	1.3	0	0	0	8.8	1.8	1.9	0	0
30	1.0	...	2.5	1.0	0	0	0	1.7	1.2	1.9	0	0
31	1.0	...	2.2	...	0	...	0	1.9	...	1.0	...	0

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	.43	.07	3.1	.2	1.2	73.6	
February.....	.30	.16	1.7	1.0	1.2	67.2	
March.....	.62	.07	6.2	.2	1.0	119.0	
April.....	2.66	.03	142.0	.1	10.1	599.0	
May.....	1.35	0.0	53.6	0.0	3.4	209.0	
June.....	0	0	0	0	0	0	
July.....	2.92	0	125.0	0	19.1	1,180.0	
August.....	7.96	0	2,140	0	87.9	5,400	
September.....	2.92	0	228	0	50.8	3,020	
October.....	1.97	0	142	0	17.9	1,100	
November.....	.10	0	0.7	0	0.1	6.9	
December.....	1.21	0	40.3	0	2.0	124.0	
Yearly.....	7.96	0	2,140.0	0	16.4	11,900.0	6.5

## RIO ALAMO STATION AT CD. MIER, TAMAULIPAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, 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."

**Records:** Based on about 100 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered good.

**Remarks:** This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 1,840 square miles, all in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	0	0	1	0	26	883	37	5	2	1	69	34
2	0	0	0	0	9	230	31	4	1	1	41	34
3	0	0	0	0	5	65	28	3	1	1	25	29
4	0	0	0	0	152	32	25	2	4	0	17	29
5	0	0	0	0	65	22	23	1	22	0	13	19
6	0	0	0	0	12	16	20	1	65	0	10	19
7	0	0	0	0	335	12	19	1	16	0	8	22
8	0	0	0	0	46	230	69	0	7	0	138	19
9	0	0	0	0	11	53	145	0	5	0	953	20
10	0	0	0	0	6	10,420	101	0	5	0	201	26
11	0	0	0	0	477	2,630	34	0	4	0	79	20
12	0	0	0	0	39	11,300	37	0	2	0	41	20
13	0	0	0	0	9	6,530	17	0	2	424	57	14
14	0	0	0	0	5	1,270	23	0	1	583	450	11
15	0	0	0	0	4	768	25	0	1	88	194	8
16	0	0	0	0	3	1,940	23	0	0	23	118	10
17	0	7	0	4	2	1,940	152	0	69	254	106	10
18	0	9	0	706	1	1,450	44	0	12	2,650	85	8
19	0	7	0	35	1	588	27	0	5	185	74	8
20	0	5	2	12	0	353	14	0	4	95	60	14
21	0	4	12	7	28	254	14	0	3	46	46	13
22	0	4	5	4	8	307	13	0	2	25	37	8
23	0	2	4	4	4	184	20	0	1	16	37	9
24	0	2	2	3	3	138	46	0	1	12	31	13
25	0	1	2	2	5	99	17	0	1	62	34	12
26	0	1	1	177	37	85	10	0	0	20	29	9
27	0	1	1	127	1,230	69	6	17	6	12	29	9
28	0	1	1	21	3,530	56	6	14	3	8	29	10
29	0	..	0	583	6,360	46	8	4	2	2,300	34	11
30	0	..	0	57	1,060	41	8	6	2	118	37	11
31	0	..	1	..	848	..	6	4	..	53	..	9

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	0	0	0	0	0	0	
February.....	.72	0	9	0	1.57	87	
March.....	.69	0	12	0	1.03	63	
April.....	3.41	0	706	0	58.10	3,460	
May.....	8.89	.10	6,360	0	462.00	28,410	
June.....	11.48	.82	11,300	12	1,400.00	83,230	
July.....	2.03	.59	152	6	33.80	2,080	
August.....	.95	0	17	0	2.00	123	
September.....	1.57	.01	69	0	8.30	494	
October.....	6.00	0	2,650	0	225.00	13,840	
November.....	3.80	.69	953	8	103.00	6,110	
December.....	1.25	.69	34	8	15.70	968	
Yearly.....	11.48	0	11,300	0	192	138,865	75.5

## RIO SAN JUAN STATION AT SANTA ROSALIA, TAMAULIPAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 27½ river miles above the mouth of the San Juan River and 15 miles south of Ciudad Camargo, Tamaulipas, Mexico, at a ranch called Santa Rosalia, 3 miles west of Ochoa Railway station.

**Records:** Based on about 200 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered good.

**Remarks:** The river flow is modified by irrigation diversions along San Juan River basin. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 13,000 square miles, entirely in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1929

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	304	155	113	145	57	46	1,200	187	201	802	378	265
2	293	162	113	141	57	42	583	198	180	717	353	258
3	283	162	102	138	49	35	293	159	279	653	339	258
4	283	152	95	127	46	35	3,910	134	180	600	332	272
5	283	152	88	120	42	53	749	106	166	523	318	272
6	279	155	81	117	39	60	742	95	155	466	318	265
7	272	166	78	102	35	57	399	81	145	406	307	258
8	265	166	74	95	32	53	265	71	124	360	318	251
9	265	155	74	95	28	53	198	74	102	311	307	244
10	258	141	74	92	28	49	159	60	95	283	286	237
11	258	141	71	85	25	46	138	57	92	258	272	233
12	251	138	71	81	21	42	120	78	*3,000	237	258	222
13	251	138	71	74	18	42	141	166	2,820	699	251	222
14	244	152	67	300	127	42	187	138	996	600	244	226
15	244	155	67	180	6,200	35	307	109	424	371	229	1,130
16	240	155	67	127	1,910	32	134	95	328	960	219	3,430
17	233	155	67	106	671	28	166	81	494	3,000	219	639
18	226	155	88	95	335	25	138	74	540	1,470	212	392
19	219	145	95	71	191	25	127	67	7,420	830	212	283
20	208	141	99	67	138	25	127	996	8,830	607	201	244
21	201	134	112	64	106	25	109	304	5,650	1,100	191	233
22	191	134	124	706	92	18	92	208	3,090	883	184	226
23	187	134	212	251	74	92	81	297	8,480	593	173	215
24	177	131	297	99	67	127	*4,100	480	7,060	494	184	215
25	180	131	229	272	57	109	2,440	996	4,410	445	205	215
26	166	131	191	177	53	99	883	399	2,050	427	220	219
27	155	131	177	127	46	75	477	4,240	1,590	427	237	222
28	148	124	166	102	46	74	279	2,500	1,260	445	229	223
29	145	...	159	85	42	699	198	625	1,130	438	244	219
30	141	...	155	67	42	459	159	353	982	427	251	219
31	148	...	155	...	42	...	191	247	...	406	...	219

Month	Gage Height		Second Feet		Acre Feet		
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	3.05	2.13	304	141	226	13,880	
February.....	2.30	2.00	166	124	146	8,110	
March.....	3.02	1.48	297	67	117	7,200	
April.....	4.53	1.44	706	64	144	8,540	
May.....	11.91	.95	6,200	18	346	21,260	
June.....	4.46	.95	699	18	86.7	5,160	
July.....	...	1.64	*4,100	81	616	37,870	
August.....	9.18	1.38	4,240	57	441	27,120	
September.....	14.83	1.74	8,830	92	2,080	123,520	
October.....	9.02	2.95	3,000	237	653	40,140	
November.....	3.58	2.62	378	173	256	15,260	
December.....	9.48	2.76	3,430	215	388	23,830	
Yearly.....	14.83	.95	8,830	18	458	331,890	25.5

\*Partly Estimated

## RIO SAN JUAN STATION AT SANTA ROSALIA, TAMAULIPAS

**Description:** Automatic water-stage recorder and cable with sit down cable car, located about 27½ river miles above the mouth of the San Juan River and 15 miles south of Ciudad Camargo, Tamaulipas, Mexico, at a ranch called Santa Rosalia, 3 miles west of Ochoa Railway Station.

**Records:** Based on 249 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered good.

**Remarks:** The river flow is modified by irrigation diversions along San Juan River basin. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The drainage area above this station is 13,000 square miles, entirely in Mexico.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	191	106	42	14	46	18,720	1,270	258	134	131	4,590	1,760
2	191	106	35	14	67	7,590	1,130	237	109	388	4,060	1,700
3	184	99	32	14	64	4,130	1,060	222	92	1,870	3,880	1,730
4	184	106	32	14	237	2,650	953	208	95	1,020	3,460	1,660
5	191	99	32	25	152	2,190	883	194	109	636	3,210	1,520
6	184	95	32	18	106	2,050	812	184	92	494	2,970	1,410
7	184	92	25	14	102	1,910	742	169	81	406	2,790	1,340
8	184	85	25	14	71	3,280	706	159	67	441	2,720	1,310
9	184	85	25	14	60	4,060	*2,600	152	64	371	3,070	1,340
10	177	85	25	11	49	4,240	1,940	148	85	353	3,280	1,340
11	169	74	25	25	92	30,720	1,840	141	148	272	3,000	1,320
12	155	74	32	42	371	28,250	1,200	138	812	237	3,390	1,310
13	155	71	35	42	230	16,240	953	131	353	208	3,460	1,240
14	148	64	35	42	152	16,240	883	123	173	18,360	3,600	1,180
15	148	64	32	32	113	9,180	777	120	120	14,130	4,240	1,160
16	148	60	32	32	78	16,600	1,090	113	530	7,420	3,960	1,130
17	148	56	32	32	60	9,360	918	106	1,090	4,770	3,110	1,080
18	145	53	32	25	42	7,950	742	106	318	5,300	2,750	1,090
19	127	49	42	*2,600	148	4,590	742	95	155	*32,310	2,580	1,080
20	127	49	35	1,240	396	4,130	636	88	99	19,770	2,440	1,040
21	124	53	32	424	237	5,470	530	81	78	11,650	2,300	1,010
22	124	56	32	226	127	4,240	477	78	67	13,770	2,190	989
23	124	53	32	155	184	3,530	441	74	64	9,890	2,120	989
24	127	46	32	120	265	2,830	547	71	60	7,950	2,050	971
25	124	46	32	92	1,450	2,440	530	67	49	*21,190	2,010	971
26	117	46	25	78	2,230	2,150	388	74	60	10,950	1,940	971
27	117	42	25	71	4,590	1,910	353	124	5,830	7,770	1,910	971
28	127	42	21	64	13,770	1,840	300	138	318	6,710	1,840	953
29	124	...	18	56	12,010	1,620	293	742	141	13,420	1,800	953
30	113	...	14	49	7,240	1,450	279	353	95	11,480	1,800	936
31	109	...	14	...	24,010	...	265	212	...	6,890	...	918

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.69	2.23	191	109	150.0	9,230	
February.....	2.20	1.61	106	42	69.9	3,880	
March.....	1.61	1.41	42	14	29.5	1,610	
April.....	*8.86	1.34	*2,600	11	185.0	11,110	
May.....	20.96	1.64	24,010	42	2,220.0	136,360	
June.....	22.63	6.20	30,720	1,450	7,390.0	439,460	
July.....	*8.86	3.05	*2,600	265	648	52,130	
August.....	4.59	1.97	742	67	165	10,130	
September.....	12.37	1.84	5,830	49	383	22,790	
October.....	*21.98	2.53	*32,310	131	7,440	457,310	
November.....	11.55	6.59	4,590	1,800	2,880	171,610	
December.....	6.56	5.02	1,760	918	1,210	74,130	
Yearly.....	22.63	1.84	*32,310	11	1,920	1,389,950	107

\*Partly Estimated

RIO GRANDE AT MATAMOROS STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located opposite Matamoros, Tamaulipas, Mexico. The water-stage recorder is attached to the central pier of the railroad bridge over the Rio Grande between Matamoros and Brownsville, Texas. The cable and car are located 0.3 mile upstream from the bridge. Zero of present gage is 15.30 feet above mean sea level.

**Records:** Based on 181 current meter measurements during the year from cable car. Computations by shifting channel methods. 1929 records considered good.

**Remarks:** Immediately above this station, particularly in Cameron and Hidalgo Counties, Texas, pumping plants divert annually large amounts of water. During floods only a small part of the water discharges past this station through the channel of the Rio Grande, as the greater part finds outlet to the Gulf of Mexico through flood channels and floodways in both countries. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development.

Mean Daily Discharge in Second Feet and Annual Summary, 1929

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,750	1,500	550	2,500	850	5,100	2,200	1,300	3,400	4,800	3,700	2,900
2	3,600	1,550	525	2,200	500	5,100	1,950	1,500	3,300	4,500	3,850	2,850
3	3,450	1,800	525	1,900	400	5,900	2,950	3,000	3,150	4,000	3,900	2,600
4	3,350	2,150	525	1,700	350	6,000	3,150	3,450	2,900	3,720	3,820	2,220
5	3,600	2,050	775	1,600	275	5,400	5,700	5,000	2,400	3,600	3,550	2,350
6	3,020	1,800	825	1,550	500	4,500	11,500	5,100	2,000	3,700	3,350	2,520
7	3,380	1,700	525	1,700	500	3,800	13,400	4,400	1,750	3,700	3,480	2,350
8	3,500	1,450	425	1,700	200	3,500	6,800	3,300	1,700	3,450	3,700	2,350
9	3,220	1,400	250	1,500	90	3,900	4,000	3,050	1,700	3,200	3,750	2,500
10	3,080	1,620	500	2,500	40	4,200	3,250	2,950	1,600	2,980	3,750	2,280
11	3,020	2,050	750	5,000	20	4,500	2,850	2,900	1,500	2,850	3,750	1,980
12	3,050	2,130	800	4,800	20	3,900	2,550	2,950	1,400	2,780	3,500	1,920
13	3,250	1,700	850	4,550	140	3,500	2,500	2,100	1,750	3,200	3,650	1,920
14	3,380	1,400	850	4,750	200	2,850	2,650	1,700	2,200	3,500	2,920	2,100
15	3,200	1,100	700	4,350	220	2,550	3,750	1,500	4,400	3,450	2,630	2,280
16	3,020	1,000	550	3,550	1,300	2,400	4,500	1,300	4,150	3,850	2,520	2,500
17	2,850	1,000	750	3,100	4,750	2,300	4,000	1,200	4,000	4,200	3,200	3,450
18	2,750	1,120	1,250	2,850	4,700	2,030	3,550	1,500	13,500	9,050	2,950	10,200
19	2,850	950	1,000	2,480	4,000	1,720	2,600	1,900	16,000	10,500	2,650	8,800
20	3,000	625	1,250	2,200	3,500	1,800	2,250	1,950	17,000	6,550	2,300	5,700
21	3,050	625	1,320	2,400	2,600	2,300	2,000	1,900	16,800	6,200	2,980	4,400
22	2,950	625	1,600	2,480	1,850	2,150	1,900	1,800	14,000	6,900	2,220	4,150
23	2,800	700	1,880	1,950	1,500	2,000	1,800	1,800	11,500	4,350	2,450	4,000
24	2,550	800	3,250	2,820	1,650	1,650	1,350	2,200	10,000	3,600	2,650	3,650
25	2,380	950	4,650	3,880	2,050	1,250	1,150	2,500	12,000	3,550	2,900	3,350
26	2,320	825	4,400	3,650	3,300	1,100	1,800	3,100	11,000	3,900	2,950	3,080
27	2,530	700	3,780	2,900	12,000	1,050	5,000	5,200	8,200	4,470	2,720	2,750
28	2,520	650	3,150	2,200	18,000	1,250	4,800	14,500	6,600	4,950	3,000	2,480
29	2,250	...	2,650	1,820	17,500	1,300	3,250	8,000	5,900	6,250	2,980	2,420
30	1,750	...	2,450	1,400	7,700	1,400	2,500	5,000	5,500	4,650	2,950	2,520
31	1,600	...	2,550	...	6,000	...	2,300	3,500	...	4,180	...	2,450

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	3.50	-.68	3,750	1,600	2,960	181,730	
February.....	1.55	-.97	2,150	625	1,280	71,350	
March.....	4.60	-2.05	4,650	250	1,480	90,950	
April.....	4.85	-.32	5,000	1,400	2,730	162,610	
May.....	12.50	-3.32	18,000	20	3,120	191,810	
June.....	6.21	.42	6,000	1,050	3,010	179,310	
July.....	9.39	.52	13,400	1,150	3,680	226,020	
August.....	8.66	.21	14,500	1,200	3,280	201,420	
September.....	12.83	.68	17,000	1,400	6,380	379,440	
October.....	7.55	2.83	10,500	2,780	4,530	278,840	
November.....	3.80	1.39	3,900	1,980	3,120	185,890	
December.....	7.49	1.42	10,200	1,920	3,260	200,370	
Yearly.....	12.83	-3.32	18,000	20	3,246	2,349,740	13.4

## RIO GRANDE AT MATAMOROS STATION

**Description:** Automatic water-stage recorder and cable with sit down cable car, located opposite Matamoros, Tamaulipas, Mexico. The water-stage recorder is attached to the central pier of the railroad bridge over the Rio Grande between Matamoros and Brownsville, Texas. The cable and car are located 0.3 mile upstream from the bridge. Zero of present gage is 15.30 feet above mean sea level.

**Records:** Based on 151 current meter measurements during the year from cable car. Computations by shifting channel methods. 1930 records considered good.

**Remarks:** Immediately above this station, particularly in Cameron and Hidalgo Counties, Texas, pumping plants divert annually large amounts of water. During floods only a small part of the water discharges past this station through the channel of the Rio Grande, as the greater part finds outlet to the Gulf of Mexico through flood channels and floodways in both countries. This station was operated by the Monterrey Office of the Mexican Department of Agriculture and Development. The gage datum was lowered five feet on October 3, 1930.

## Mean Daily Discharge in Second Feet and Annual Summary, 1930

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,300	1,750	170	710	14,700	29,800	7,200	2,050	4,100	3,900	21,000	5,650
2	2,100	1,780	190	350	14,000	30,000	6,450	2,000	3,300	1,930	17,300	4,500
3	2,000	1,880	660	350	8,000	29,900	5,850	2,000	2,400	1,250	13,000	5,300
4	2,120	1,800	640	190	5,600	23,500	5,200	1,700	1,800	1,200	10,200	5,100
5	2,420	1,760	500	125	4,400	12,200	5,100	2,250	1,900	1,000	9,300	4,950
6	2,650	1,720	220	175	3,800	9,400	4,500	2,500	2,200	1,100	8,800	4,800
7	2,380	1,550	190	500	4,700	8,000	4,250	2,420	2,300	2,300	8,200	4,750
8	1,980	1,520	235	165	4,250	7,100	3,650	2,400	4,300	1,900	8,000	4,700
9	1,750	1,500	180	50	3,600	6,800	3,550	2,650	4,050	2,850	8,300	4,450
10	1,700	1,460	130	30	4,200	7,200	3,400	3,100	2,800	12,700	9,800	4,250
11	1,850	1,240	125	15	4,500	10,700	3,650	3,630	1,550	23,000	11,600	4,200
12	2,320	1,110	90	10	3,550	21,000	4,500	3,050	1,420	23,500	10,800	4,080
13	2,620	900	0	0	3,100	29,200	5,100	2,800	2,300	18,000	10,600	3,980
14	2,550	790	0	0	3,100	32,000	5,600	2,950	2,650	12,500	10,800	4,000
15	2,200	850	0	0	3,500	31,000	5,100	2,800	775	13,000	11,100	4,150
16	1,900	810	0	0	3,450	30,500	4,600	2,530	800	21,500	11,700	3,850
17	1,780	1,100	100	0	3,100	30,200	4,100	2,850	925	20,500	11,000	3,600
18	1,780	3,520	195	0	2,000	30,000	3,650	3,800	825	20,000	9,800	3,400
19	1,980	4,350	150	0	1,550	29,500	3,500	5,050	700	23,000	8,900	3,370
20	2,120	4,120	350	0	1,250	28,200	4,100	5,950	1,200	23,500	8,300	3,370
21	2,000	3,350	820	1,700	3,400	26,500	4,350	6,400	2,950	24,000	7,700	3,480
22	1,880	2,520	1,200	3,000	8,700	22,800	3,750	6,800	3,050	24,200	7,600	3,600
23	1,920	1,980	1,350	2,750	5,200	20,200	3,250	8,000	1,800	21,300	7,200	3,550
24	2,120	1,680	1,400	1,700	3,400	18,000	2,750	8,200	1,100	19,800	6,900	3,400
25	2,100	1,630	1,150	1,100	2,400	16,500	2,420	7,400	950	21,500	6,500	3,250
26	2,080	810	680	710	3,700	14,000	2,480	6,100	750	22,000	6,200	3,370
27	2,400	650	540	930	6,000	12,000	2,600	5,200	300	21,900	6,100	3,300
28	2,170	250	310	4,300	5,900	10,700	3,050	5,100	200	21,500	6,000	3,400
29	1,880	.....	600	13,300	13,000	9,700	2,600	4,800	3,950	15,200	5,900	3,500
30	1,700	.....	870	13,600	25,000	8,500	2,350	4,500	5,200	17,500	7,500	3,150
31	1,670	.....	1,000	.....	29,000	.....	2,150	4,200	.....	22,000	.....	2,900

Month	Gage Height		Second Feet			Acre Feet	
	Mean Daily—Feet		Mean Daily		Average	Total	Per Sq. Mile
	High	Low	High	Low			
January.....	2.19	.98	2,650	1,670	2,080	127,780	
February.....	3.97	-1.75	4,350	250	1,730	95,960	
March.....	.66	-3.43	1,400	0	453	27,860	
April.....	8.88	-3.66	13,600	0	1,580	90,760	
May.....	15.22	.74	29,000	1,250	6,520	400,770	
June.....	16.70	6.28	32,000	6,800	19,840	1,180,380	
July.....	6.10	1.04	7,200	2,150	4,030	247,540	
August.....	6.60	.43	8,200	1,700	4,040	248,290	
September.....	4.84	-1.80	5,200	200	2,080	124,060	
October.....	**20.55	**5.01	24,200	1,000	14,820	911,480	
November.....	19.61	11.47	21,000	5,700	9,480	563,910	
December.....	11.40	8.32	5,650	2,900	3,980	244,660	
Yearly.....	16.70	-3.66	32,000	0	5,889	4,263,450	24.3

\*\*5-Foot change in gage scales, gage lowered.