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PROFILE SURVEYS IN 1915

ALONG THE

RIO GRANDE, PECOS RIVER, AND MORA RIVER NEW MEXICO

PREPARED UNDER THE DIRECTION OF
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PROFILE SURVEYS ALONG THE RIO GRANDE, PECOS RIVER, AND MORA RIVER, IN NEW MEXICO.

Prepared under the direction of W. H. HERRON, Acting Chief Geographer.

INTRODUCTION.

In order to determine the location of undeveloped water powers the United States Geological Survey has from time to time, alone and in cooperation with State organizations, made surveys and profiles of some of the rivers of the United States that are adapted to the development of power by low or medium heads of 20 to 100 feet.

The surveys are made by means of plane table and stadia. Elevations are based on heights derived from primary or precise levels of the United States Geological Survey. The maps are made in the field, and show not only the outlines of the river banks, the islands, the positions of rapids, falls, shoals, and existing dams, and the crossings of all ferries and roads, but the contours of banks to an elevation high enough to indicate the possibility of using the stream. The elevations of the various bench marks left are noted on the field sheets in their proper positions.

RIO GRANDE.[1]

The Rio Grande rises near the crest of the Continental Divide on the eastern slope of the San Juan Mountains in Colorado, at an elevation of approximately 12,500 feet above sea level, takes a general southeasterly course, and discharges into the Gulf of Mexico a few miles east of Brownsville, Tex. From its source the river follows an easterly course through a narrow canyon-like valley nearly to Del Norte, where the steep sides of the valley recede to inclose the large, level parklike region known as the San Luis Valley, which extends for 150 miles from north to south and has a maximum width of 50 miles, and through which the river flows for the most part between low banks. From Del Norte the general course of the Rio Grande is southeasterly to Garland Junction, where it becomes southerly.

[1] The description of the part of the drainage basin in New Mexico is taken largely from Lee, W. T., Water resources of the Rio Grande valley in New Mexico: U. S. Geological Survey Water-Supply Paper 188, 1907.

Four miles above the Colorado-New Mexico line, at the lower end of San Luis Valley, the river enters a canyon locally known as the Rio Grande Canyon, which continues to the head of Espanola Valley near Embudo. This canyon increases in depth from 100 feet at the State line to 700 feet near the mouth of Rio Hondo and appears from above as a gash in an otherwise level mesa. The fall of the river through the canyon is about 30 feet per mile. For a large part of its remaining course the stream passes through a succession of valleys or erosion basins which are separated by rock canyons and are limited in form and size by the character of the material in which they were excavated.

From the lower end of the Rio Grande Canyon the river flows through Espanola Valley (which is 3 to 4 miles wide and extends to a point near San Ildefonso) and enters White Rock Canyon, a narrow gorge, about 20 miles long and in places 500 feet deep, which owes its existence to sheets of hard igneous rock that protect the underlying sands and gravels. The fall in this canyon is about 10 feet per mile.

At a point almost directly west of Santa Fe the river enters Santo Domingo Valley, through which it flows to the upper end of San Felipe Canyon, 7 miles south of the Indian pueblo of Santo Domingo. This valley is 1 to 3 miles wide and contains about 13,000 acres of bottom land that has been irrigated for many years. The greater part of this land lies only a few feet above the bed of the river and is subject to frequent overflow.

Passing through San Felipe Canyon, which is a short gorge, the river enters Albuquerque Valley, through which it flows for a distance of about 35 miles until it reaches Isleta Narrows. Albuquerque Valley ranges in width from 1 to 5 miles and comprises approximately 70,000 acres of bottom land. It is bounded on both sides by steep bluffs of sand and gravel.

The narrowing at Isleta Narrows is caused by the presence of the hard igneous rock of an extinct volcanic cone west of Isleta. Below the narrows the river flows for 45 miles through Belen Valley, which extends to San Acacia and contains approximately 65,000 acres of bottom land.

From Belen Valley the river passes through San Acacia Gorge—a short, narrow gorge 250 feet deep, cut through an arm of the lava sheet which crosses the river course—and enters Socorro Valley, which extends southward to San Marcial, a distance of 40 miles, and comprises about 60,000 acres of bottom land.

Beginning a short distance below San Marcial is a narrow valley, about 40 miles long, which is cut in detritus and which differs from the others in being very narrow and having no bottom lands. This valley is the site of the Engle reservoir under construction by the

United States Reclamation Service. A few miles north of Elephant Butte the river enters a narrow rock canyon which extends to the end of the Caballos Mountains and in which, opposite Elephant Butte, is the Engle dam site.

Below Elephant Butte Canyon the Rio Grande flows through Las Palomas Valley to Rincon, a distance of 50 miles. The bottom lands in this valley include about 26,000 acres. From Las Palomas Valley the river enters Selden Canyon, which is 18 miles long but not so uniformly narrow as the other canyons, for it contains about 8,000 acres of bottom land.

Emerging from Selden Canyon at old Fort Selden, the river enters Mesilla Valley, the largest of the erosion basins of the Rio Grande, extending southward 50 miles to The Pass. The valley has a maximum width of 8 miles and contains approximately 150,000 acres of bottom land. It is cut in unconsolidated sand and gravel, its floor being 300 feet lower than the mesa level.

Below Mesilla Valley, just above El Paso, the river flows through a narrow gorge about 90 feet deep, cut in a low ledge of hard rock.

From El Paso to its mouth the river forms the boundary between the United States and Mexico. For a distance of 100 miles below El Paso it flows in a broad lowland known as El Paso Valley, 250 feet below the general upland level. This plain becomes gradually narrower, until it terminates at a point 100 miles southeast of El Paso and the river cuts through a narrow gorge, 5 miles long, formed by the southeastern extension of the Quitman Mountains.

Below the canyon is another broad valley, 16 miles long, which terminates a few miles above the mouth of Glenn Creek. For the next 60 miles the river flows through a mountainous region where the valley is narrow and in many places gorgelike. Near Ruidoso the mountains recede, leaving a broad valley with comparatively gentle side slopes. This characteristic of the topography continues for the next 60 miles (measured in a stright line) until at a point about 20 miles below Presidio the river again enters a canyon. Thence to the fall line, near Del Rio, the river flows through a succession of canyons and narrow valleys, with an occasional area in which the mountains are sufficiently far apart to include valleys of considerable area.

From Del Rio to the mouth the river flows through the Coastal Plain region, which is characterized by comparatively low topographic relief, and a few miles east of Brownsville, Tex., it discharges into the Gulf of Mexico.

The results of surveys made in 1915 along the Rio Grande in the vicinity of Buckman, N. Mex., and from Embudo, N. Mex., to the Colorado State line are presented in the plans and profiles that form Plates I to VII.

On this stretch of the Rio Grande the United States Geological Survey has maintained gaging stations near Embudo, N. Mex. (1889–1903, and continuously since 1912) and near Buckman, N. Mex.[1] (1895–1905; 1909–1914).

PECOS RIVER.

Pecos River, one of the largest tributaries of the lower Rio Grande, drains an area comprising about 32,000 square miles and extending from the Taos Mountains in northern New Mexico to the southern edge of the western panhandle region in Texas. Its source is on the eastern slope of the Santa Fe Range, in the extreme western corner of Mora County, at an elevation of 11,000 feet, and its course is southerly nearly to Punta Pajarita, thence southeasterly to the southeast corner of Guadalupe County, thence southerly again to Carlsbad, and then once more southerly to its junction with the Rio Grande at Moorhead, Valverde County, Tex. The branches of the Pecos, except some of the upper tributaries, are intermittent, though at times they carry large floods. The chief tributaries are Rio de la Vaca, Rio Tecolote, Gallinas River, Canyon Blanco, Pintada Canyon, and Alamo Gordo, Salt, Felix, Penasco, Seven Rivers, Delaware, Toyah, and Comanche creeks. Below Fort Sumner there are no important tributaries from the east, as the boundary of effective surface drainage of the Pecos parallels the river at a distance of 50 miles. The few streams in this region rise in the edge of the high plains but lose their waters in the porous soil within a few miles. Many of the streams in the western part of the basin sink before reaching the Pecos, and it is probable that the streams actually reaching the Pecos lose much water by seepage after leaving the mountains.

The upper Pecos flows through narrow valleys and deeply cut gorges nearly down to Fort Sumner, and in this part of the basin the elevations range from 4,500 feet to 11,000 feet above sea level. Below Fort Sumner the canyon-like walls of the Pecos are replaced by low rolling hills, and at Roswell the gradation from the flood plains to the rolling prairie of the lower part of the drainage basin is imperceptible. Arroyos and gulches are rare, and canyons are practically unknown. Elevations in the lower section of the basin range from 1,000 feet at the mouth to 4,500 feet near the foothills.

The distribution of precipitation throughout the Pecos basin is somewhat peculiar. Near the source of the river there is a very small area in which the mean annual precipitation is 20 inches or more, but, the rate drops to 15 inches at Anton Chico and to less than 13 inches at Santa Rosa. From this point to Carlsbad there is a narrow strip, coinciding practically with the immediate valley of the Pecos, where the precipitation is between 12 and 13 inches, and east and west of

[1] Published also as "near Rio Grande" and as "near San Ildefonso."

this narrow area it increases to 15 inches or more. Below Carlsbad the increase is fairly uniform to 19 inches at the mouth. Except on the mountains in the upper section of the basin, where much of it occurs as snow, by far the greater part of the precipitation is the rain of the summer storms.

The Carlsbad project of the United States Reclamation Service irrigates about 20,000 acres in the vicinity of Carlsbad. The irrigation plan provides for the storage of water in Lake McMillan, which is on the Pecos near Lakewood, and in a storage and distributing reservoir on the Pecos near Carlsbad, controlled by the Avalon dam, and for the diversion of water from the Avalon reservoir into a canal system watering lands on both sides in the vicinity of Carlsbad. The two reservoirs have a combined capacity of 72,000 acre-feet, thus exerting a marked effect on the flow of the Pecos below Carlsbad.

Irrigation is also extensively practiced in other sections of the Pecos Valley, especially in the vicinity of Pecos, Tex.

The results of surveys made in 1915 along Pecos River are presented in plans and profiles forming Plates VIII and IX.

The United States Geological Survey has maintained the following gaging stations on Pecos River in New Mexico. The stations are arranged in downstream order. A dash after the date indicates that station was being maintained June 30, 1916. A period after the date indicates discontinuance.

Pecos River near Cowles, N. Mex., 1910–1914.
Pecos River near Anton Chico, N. Mex., 1910–1914.
Pecos River at Santa Rosa, N. Mex., 1903–1906; 1910–1914.
Pecos River near Guadalupe, N. Mex., 1912–1914.
Pecos River near Fort Sumner, N. Mex., 1904–1910; 1912–13.
Pecos River near Roswell, N. Mex., 1903–1906.
Pecos River near Dayton, N. Mex., 1905–
Pecos River near Lakewood, N. Mex., 1906–1911.
Pecos River at Avalon, N. Mex., 1906–7.
Pecos River at Carlsbad, N. Mex., 1903–1908; 1914–

MORA RIVER.

Mora River rises in the northwestern part of Mora County, N. Mex., and flows southeastward to Watrous, and thence eastward to a point near Sanchez in San Miguel County, where it joins Canadian River. Except for Coyote and Cebolla creeks and Sapello River (which enters at Watrous), its tributaries are short and unimportant.

The results of a survey made in 1915 along Mora River are presented in the plan and profile forming Plates X and XI of this report.

The following gaging stations have been maintained by the United States Geological Survey on Mora River in New Mexico. The stations are arranged in downstream order, and the dates indicate the periods during which they were continued.

Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1911.
Mora River near Weber, N. Mex., 1903–4.
Mora River near Watrous, N. Mex., 1894–1896.
Mora River near Shoemaker, N. Mex., 1914.

PUBLICATIONS.

The following publications of the Geological Survey contain the results of investigations of stream flow at the stations indicated in the preceding lists:

Rio Grande:
Annual Reports: Eleventh, Part II; Twelfth, Part II; Thirteenth, Part III; Fourteenth, Part II; Eighteenth, Part IV; Nineteenth, Part IV; Twentieth, Part IV; Twenty-first, Part IV; Twenty-second, Part IV.
Bulletins: 131, 140.
Water-Supply Papers: 11, 16, 28, 37, 50, 66, 75, 84, 99, 132, 174, 268, 288, 308, 328, 358, 388.

Pecos River:
Water-Supply Papers: 99, 132, 174, 210, 248, 268, 288, 308, 328, 358, 388.

Mora River:
Annual Reports: Eighteenth, Part IV.
Bulletins: 131, 140.
Water-Supply Papers: 11, 99, 131, 173, 209, 247, 267, 287, 307.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., Customhouse.
Albany, N. Y., room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
St. Paul, Minn., Old Capitol Building.
Austin, Tex., Old Post Office Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Phoenix, Ariz., 417 Fleming Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

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