

USE OF WATER IN THE PECOS RIVER BASIN, NEW MEXICO

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INTRODUCTION

As uses of water developed in the Pecos River basin in New Mexico, they were affected by availability of supply and the legal framework which controls such uses in the basin. In this paper, the history of water development will be outlined and the geographical areas in which the developments occurred will be described. Estimated quantities of water presently depleted in the basin will be given and depletions will be described by major categories of use.

GEOGRAPHICAL SETTING OF THE BASIN

The Pecos River is one of the major tributaries of the Rio Grande, joining that river near Langtry, Texas. The river rises in north-central New Mexico and travels some 300 miles before leaving the state south of Carlsbad. Surface water of the river sustains irrigation developments in both New Mexico and Texas. Total basin area in New Mexico is about 26,100 square miles; in Texas, the basin area is approximately 19,000 square miles. Three sub-basins or valleys are formed by the river before it reaches the Rio Grande. The lower valley extends from Red Bluff Reservoir to the confluence of the Pecos River and Rio Grande - all of which area is in Texas; the middle valley extends from Red Bluff Reservoir to Alamogordo Reservoir; and the upper valley lies north of that point. Both the middle and upper valleys are in New Mexico.

In 1960, population of the basin in New Mexico was about 157,500; basin population in Texas was 80,500. In Texas, total irrigated farming area in 1960 was about 294,000 acres, most of which was irrigated with ground water. New Mexico's irrigated acreage was about 191,000 acres, or about 20 percent of all irrigation in the state. Of the total, 125,000 acres were irrigated with ground water and 66,000 acres were irrigated with surface water or a combination of surface and ground water. Principal industries in New Mexico are oil and gas production, farming, potash production, ranching, and light manufacturing. Military activity is centered around Walker Air Force Base near Roswell.

Part or all of 14 counties lie within the basin area in New Mexico. Principal communities are Roswell, Carlsbad, Las Vegas, Artesia, Eunice, Jal, Santa Rosa, and Fort Sumner. Altitudes vary from over 13,000 feet in the north to about 3,000 feet above mean sea level south of Carlsbad. Average growing seasons vary in length

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from about 100 days in the northern mountain valleys to about 200 days in the south. Typical average annual precipitation is over 20 inches in mountainous areas, 14 inches at Santa Rosa, 12 inches at Carlsbad. Farm produce consists of cotton, alfalfa, corn, feed crops, vegetables, and some fruits. There is very little dryfarming in the basin and, generally, irrigation is required to mature crops. Farming enterprises range from large commercial farms to subsistence and part-time farming operations.

About one-fifth of the total area of New Mexico and about one-sixth of the state's population are in the Pecos River basin. Topography varies from level and gently rolling plains in the southern part to rolling hills and deeply dissected mountains in the western and northern portions of the basin. Perennial tributaries are found chiefly in the higher mountainous areas; flow in the main stem itself is perennial to the approximate vicinity of Anton Chico. For many years all the river surface flow, except for occasional flood waters, has been fully utilized. In 1942, the National Resources Planning Board reported water from the river had been fully appropriated for use in New Mexico and Texas.

SETTLEMENT OF THE AREA

In 1540, Coronado observed Pueblo Indians irrigating crops in the vicinity of Pecos. Spanish settlers moved into this area during the late 1700's and settled as far south as Anton Chico. Until 1838, Indians and Spanish irrigated as neighbors; in that year the remnants of the decimated Pueblo Indian population migrated out of the basin and the Spanish acquired the Indian lands and ditches. Settlement south of Anton Chico was not aggressively pushed under either the Spanish or Mexican colonial governments. Small villages to the north were reinforced and Las Vegas had been settled by 1835. Part of the hesitancy to push settlement to the south was undoubtedly due to the threat of hostile nomadic Indian tribes.

Settlement in the middle valley did not take place until the years of the American Civil War. United States troops disciplined the nomadic Indian tribes during and immediately after the war, and settlement of the middle valley became feasible. Large cattle ranches on the plains and small irrigated farms on the upper reaches and tributaries were the first agricultural enterprises, but these were soon followed by the establishment of irrigated farming in the valley proper. With acquisition as United States territory in 1848, large areas of the middle valley had become part of the public domain. After adoption of the Homestead Act of 1862, this land became available for homesteading and increasing numbers of settlers moved into the valley to establish homes.

SURFACE-WATER DEVELOPMENT

The first irrigation farmers in the middle valley maintained individual ditches and diversion structures. This method of development was not efficient for numerous reasons and the landowners realized large reservoirs and centralized ditch systems were needed to efficiently regulate and distribute the water. The necessary construction was beyond the financial capability and resources of the individuals concerned.

Recognizing this problem, which was common in all irrigated areas, both the Territory of New Mexico and the Congress took legislative action that enabled individuals to form irrigation companies which could pool resources, borrow money, and develop the land. For example, New Mexico enacted legislation in 1887 providing that any five persons could form a company for purposes of constructing reservoirs, ditches, etc., and were empowered to raise money through the sale of stock. In 1902, Congress passed the Federal Reclamation Act to assist irrigation development in the western states.

Statistics are not available to indicate extent of land irrigated by the Spanish at the time the basin was being settled by Anglo-Americans. Probably not more than 5,000 acres were irrigated, these located primarily on the main stem and tributaries north of Fort Sumner. Once the new settlers entered the basin, irrigation began to increase and was accelerated after enactment of Territorial and Federal irrigation laws. Most lands irrigated by surface water were developed between 1890 and 1930. During this period, several irrigation companies were formed and these companies account for most of the land irrigated with surface water at the present time. Projects initiated during this period included Storrie Project (near Las Vegas); Fort Sumner Project; lands irrigated by the Hagerman Irrigation Company; Hondo Project; Hope Project; and Carlsbad Project. Initially, all areas were developed by private companies; however, the Fort Sumner and Carlsbad projects were later rehabilitated with assistance obtained from the Bureau of Reclamation. Most lands of the Hondo and Hope projects were later abandoned.

As uses of surface water in irrigation increased, users became increasingly concerned about the availability of supplies. Many feared that the area was over-developing and that sufficient water was not available to sustain all developments. In 1920, the Bureau of Reclamation, representing landowners in the Carlsbad Irrigation District, brought suit in the Federal Court of New Mexico asking that all rights served by the Pecos River above Carlsbad be determined by the court. This suit, entered as United States vs. Hope Community Ditch, et al., resulted in the first major adjudication of water rights of lands in the basin. The results of the action, commonly called the "Hope Decree," were issued in 1933 and defined rights of water use in most areas above Lake McMillan. Subsequently, areas outside those covered by the Hope Decree were adjudicated until, at present, practically all lands irrigated from surface water in the basin have been covered by court decrees that define the rights of use.

GROUND-WATER DEVELOPMENT

Irrigation near Roswell started about 1880. Water for irrigation was first obtained from large springs and diversions from tributaries of the Pecos River that cross the area. Artesian ground water was first discovered in 1891 when a well drilled in the city of Roswell was found to flow. During the next few years, drilling gradually increased, but wells were first used to water lawns, gardens, and for domestic supplies. About 1900, this source of water began to be used for irrigation and thereafter large numbers of wells were drilled for irrigation purposes. Many of the early wells flowed between 500 and 1,500 gallons per minute. The Oasis well, completed in 1926, had a measured flow of 5,710 gallons per minute. By 1905, 485 wells had been drilled and there appeared to be no noticeable decline in the artesian head. The large well yields created much interest in the region and, because no noticeable decline in discharge was recognized, the supply was considered inexhaustible. As a result, much speculation in farm lands occurred and greatly exaggerated claims were made for the area.

Extensive development was made in the period 1905-1916, but by the end of the period artesian head was declining rapidly. The original area of artesian flow comprised about 663 square miles; by 1916 the area had decreased to 499 square miles and many irrigators were forced to install pumps in order to stay in business. Lands irrigated in the west and southwestern portions began to go out of production and people began to be increasingly alarmed about the future of the artesian water supply. It was now becoming apparent that the supplies were being depleted and additional wells would hasten the process.

Over-expansion in the use of artesian water for irrigation in the Roswell area finally resulted in demand for enactment of a State law to control and regulate the use of underground waters. By 1925, more than 1,400 artesian wells were in operation and about 45,000 acres were irrigated. Water levels continued to decline and more wells failed. Banks refused to invest more money in irrigated farms until some means of protecting investments was devised. The situation affected and concerned the entire community and resulted in a quantitative study of the area by Fiedler and Nye of the U. S. Geological Survey in cooperation with Chaves and Eddy Counties and the State Engineer.

The investigation confirmed the fact that the area was overdeveloped and a recommendation was made that controls be instituted immediately. The 1927 legislature enacted a ground-water law, which, in 1929, was declared invalid by the Supreme Court of New Mexico because of a technicality. In 1931, the statute was reenacted in a form acceptable to the court, and on August 21 of that year the State Engineer established an underground artesian basin. New irrigation appropriations from the then established artesian basin have not been permitted since that date.

Shallow water in the basin had not been extensively used during the period of artesian development. Once drilling into the artesian aquifer was controlled, people began to develop the shallow aquifer as a source of supply. In 1937, the State Engineer considered shallow waters within the boundaries of the artesian basin to be fully appropriated and limited further irrigation appropriations from this source.

By 1937, non-artesian water was being used for irrigation in areas outside the artesian basin. Use of this source slowly expanded until after World War II; at that time irrigation using shallow ground water began to accelerate. To control, conserve, and protect the supply, the State Engineer declared other ground-water basins. In addition to the Roswell Artesian Basin, declared ground-water basins presently consist of Carlsbad, Fort Sumner, Hondo, Jal, and Penasco basins -- encompassing collectively some 6,500 square miles. Essentially all ground-water use in the middle valley is now controlled.

In the Roswell area, uses exceed the natural rate of recharge and a condition of ground-water mining exists. This has upset the natural balance of the area and has resulted in such noticeable effects as decrease in artesian and surface flows, increased pumping lifts, and intrusion of salt water into fresh ground-water aquifers.

The rate at which uses exceed recharge to the area is indicated as follows: The annual natural recharge to ground-water aquifers is about 265,000 acre-feet, of which some 115,000 acre-feet are naturally discharged. A balance of 150,000 acre-feet remains available for consumptive use. Total pumpage from the aquifers is estimated to be between 400,000 and 430,000 acre-feet, of which about 270,000 acre-feet are consumed and the remainder is returned to the aquifers; thus, present annual consumptive use exceeds available recharge by about 120,000 acre-feet annually.

The seriousness of problems in the Roswell area led to adjudication of ground-water rights. In 1956, the State Engineer and the Pecos Valley Artesian Conservancy District jointly filed suit in the District Court of Chaves County to obtain a judicial determination of rights, both artesian and shallow, in the area. At present, adjudication proceedings are more than 99 percent complete. During the hearings it was found that about 142,000 acres of land were irrigated, of which approximately 130,000 acres had valid rights. Irrigation of the other 12,000 acres was declared illegal and such irrigation has been enjoined. Termination of the illegal use will reduce withdrawals from the basin by about 40,000 acre-feet of water per year. This should decrease the annual consumptive use by about 25,000 acre-feet, with a corresponding decrease in the amount by which the annual consumptive use exceeds the available recharge.

THE PECOS RIVER COMPACT

In 1939, Secretary of Interior Harold L. Ickes requested that the chairman of the National Resources Committee conduct a thorough

study of water problems in the Pecos River basin. The Secretary pointed out that increasingly acute problems connected with water quality and water use in the basin made a general comprehensive investigation necessary. Shortly thereafter the Pecos River Joint Investigation was made and results were published in 1942. During that same year, New Mexico and Texas began to negotiate a compact. Representatives of the states had available for use detailed basic data that had been gathered during the joint investigation. Several years were required to complete negotiations and it was not until December 1948 that the compact was signed, in Santa Fe. In 1949, the legislatures of the two states ratified the compact and Congress and the President approved the agreement. From that time forth, the compact has been binding upon the states.

The compact created a commission to administer its provisions and provide for an equitable division of water between the states. Water apportionment is based on 1947 conditions in New Mexico. In addition, salvaged water and unappropriated flood waters are apportioned.

PRESENT WATER USES IN THE PECOS RIVER BASIN IN NEW MEXICO

All of the following statistics should be understood as approximations only. Quantities are based on averages and are stated in terms of acre-feet per year. Certain items, such as reservoir evaporation, have been derived from representative periods of record; others are the results of recent inventories made in the basin. Depletion means water removed from further use in the basin, such as evapotranspiration by irrigated crops, phreatophytes, etc. Use signifies demand for water, such as that required for municipal and industrial purposes, much of which is returned to the basin supply.

Estimated depletion in the basin is about 648,000 acre-feet annually, of which 6,300 acre-feet are imported from the High Plains. Of this amount, 185,000 acre-feet are non-beneficially consumed by channel losses and by evapotranspiration of phreatophytes along the main stem of the river. Similar losses have not yet been estimated for tributary areas. In addition to the above amount non-beneficially consumed by phreatophytes and channel losses, about 40,600 acre-feet are evaporated from reservoirs and 4,900 acre-feet are evaporated from stock ponds. The remainder -- 417,500 acre-feet -- is depleted as follows: irrigation - 368,300; urban - 10,800; rural domestic and livestock - 6,500; military - 1,100; recreation, fish, and wildlife - 10,700; and miscellaneous self-supplied uses - 20,100 acre-feet. With respect to the 417,500 acre-feet, irrigation depletions comprise about 88 percent.

Urban uses are defined as those uses in communities with 2,500 or more inhabitants. These communities consist of Artesia, Carlsbad, Eunice, Jal, Las Vegas, and Roswell. Roswell is the largest user of water, diverting some 11,400 acre-feet and depleting about 8,800 acre-feet per year, all obtained from ground water. Las Vegas is the only city of this group that uses water obtained from surface sources.

The community also uses some additional water obtained from wells. Urban uses include that which is required for commercial, industrial, and manufacturing activities as well as domestic supply and lawn watering. These uses were not separately identified. Rural uses include use by communities smaller than those cited, as well as by persons who live on farms and ranches. For these purposes, about 3,500 acre-feet are diverted and 1,600 acre-feet are depleted. Ground water furnishes most of the supply, but some surface water and combined sources are used. Per capita use varies from 25 to over 200 gallons per day among rural users, and from 57 to 250 gallons per day among urban users. Average for the basin is 143 gallons per person per day -- rural, 45; urban, 200.

Livestock depletion is about 4,900 acre-feet, of which approximately 50 percent is furnished by wells. In 1963, there were in the basin approximately 340,000 cattle, 570,000 sheep, 12,000 hogs, and 162,000 chickens. A recent inventory indicates there are in the basin a total of 5,400 stock ponds capable of storing water.

Military uses deplete 1,100 acre-feet; about 2,100 acre-feet are diverted from ground-water sources to supply these uses.

Recreation, fish, and wildlife activities consume about 10,700 acre-feet annually. Of the total, about 9,000 acre-feet are depleted at Bitter Lakes National Wildlife Refuge where consumptive uses consist of evapotranspiration from grain crops, grass land, open water surfaces, and marshes. Other places of use include Carlsbad Caverns National Park and small lakes, fish hatcheries, and game refuges maintained by Federal and State agencies.

Self-supplied uses consist of commercial, industrial, mineral, and power-production activities not supplied by public utilities. Commercial and industrial activities together deplete about 900 acre-feet a year at the present time. Power production is from fuel-electric plants located near Roswell and Carlsbad that use water for cooling purposes. Both plants deplete about 900 acre-feet a year. Annual depletion by mineral industries total approximately 18,300 acre-feet, most of which is used in the production of potash. Other mineral activities include production, processing, and refining of petroleum, and some gravel washing. Of the 20,100 acre-feet depleted by self-supplied uses, about 6,000 acre-feet are supplied by surface water and 14,100 acre-feet are furnished from wells. Of the amount furnished from ground water, the potash industry obtains 6,300 acre-feet from wells located on the Southern High Plains.

A recent inventory indicates about 196,860 acres are presently being irrigated in the basin. Of this area, 39,520 acres are irrigated with surface water, 124,400 acres with ground water, and 32,940 acres from combined sources. Crop-irrigation consumptive-

use requirements range from about 0.85 to 1.80 acre-feet per acre per year. Most of the acreage in the upper valley is irrigated with surface water through community-acequia systems. Estimated area irrigated in the upper valley is about 12,500 acres. Other surface-water uses for agriculture are scattered throughout the basin, along the main stem and tributaries. Ground-water uses are found primarily in the Roswell area and to the south. Combined sources are used in some tributary areas, but most uses of this nature are located in the vicinity of Roswell and Carlsbad.

Irrigation uses throughout the basin deplete about 368,000 acre-feet annually, of which 241,000 are ground water and 127,000 are surface water. Of the total depleted by irrigation, ground water furnishes 65 percent and 35 percent is furnished by surface water.