METERS AND THEIR EFFECTS IN THE ROSWELL ARTESIAN BASIN IN CHAVES AND EDDY COUNTIES, NEW MEXICO

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INTRODUCTION

The Roswell Artesian basin, located adjacent to the west side of the Pecos River in Chaves and Eddy Counties, New Mexico is a rechargeable basin with two principal aquifers: the artesian limestone aquifer which produces water from depths of 250 feet to 1200 feet, and the shallow alluvial aquifer which produces water from depths of 10 to 300 feet. These aquifers, in most of the area, are separated by semi-permeable beds that range from a few feet in thickness in the northern part of the basin to about 500 feet in the southern part of the basin. Recharge to the artesian aquifer is derived primarily from infiltration of precipitation and runoff into outcrops of limestone west of the basin and recharge to the shallow aquifer is derived primarily from return flows of applied irrigation water, leakage from the underlying artesian aquifer, and local precipitation. Recharge to the artesian and shallow aquifers from precipitation has been estimated to average about 235,000 acre feet per year and about 35,000 acre feet per year, respectively. The basin was declared and closed to further appropriations of artesian water in 1931. The shallow ground water supply of the basin was closed to further appropriations in 1937. The administrative boundaries of the basin have been extended on several occasions.

BACKGROUND FOR METERING

It has been apparent for many years that pumpage in the basin has greatly exceeded recharge. Evidence of this fact has been reflected in diminishing artesian pressures, an almost continuous decline of the shallow water table, diminishing flow to the Pecos River, and saline water encroachment in the vicinity of Roswell. Pumpage for irrigation increased from less than 3 acre feet per acre in the 1930's to an average in excess of 4 acre feet per acre in the early 1960's.

As a move to help stabilize the basin by curtailing gradually increasing overpumpage, which had been estimated to exceed recharge by over 120,000 acre feet, all water rights in the basin were adjudicated by court decree with the order of the court being entered February 10, 1966. In addition to defining the extent and priorities of rights, the court also set the duty of water at 3 acre feet per acre per annum at the well, with a 5-year averaging provision, and ordered that all wells be equipped with meters as of January 1, 1967.

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METER INSTALLATION AND PROBLEMS

The installation of meters commenced in the early part of 1966 and continued into 1967. Approximately 1,575 meters were installed. Many of the meters installed during the 1966 season were installed early in that year and then used by their owner to obtain an idea of the quantities of water required for their farming operations. All meter installations were inspected and approved by the watermaster. Some wells, owned in partnership, were equipped with as many as 5 meters.

The initiation of the use of meters brought some problems, but these were soon resolved, due primarily to the excellent cooperation of the meter servicing companies. These problems included mechanical failures due to the highly corrosive action of artesian waters on aluminum parts, the freezing of water between the plastic propellers and shafts, the accumulation of the sand between the propeller and the shaft, the seepage of water into the recording head and the entrainment of air in the water which caused the meters to race. Four different brands of meters were used in the basin; three of these have a right angle gear drive between the meter head and the propeller shaft and the fourth has an encased flexible-drive shaft between the meter head and the propeller. All four brands of meters, with appropriate corrections, have been relatively trouble-free. About 5 percent of the meters were found to be inoperative during 1967 but this percentage dropped considerably during 1968.

FIRST USE UNDER METERING

In 1966 it appeared from various indications that the overall use of water was less than in 1965 due to an increase in rainfall and in preparation for the mandatory decrease the following year. It was noted, however, in December 1966, immediately prior to mandatory metering, that the majority of water users pumped large quantities of water on their lands to obtain a buildup of soil moisture before metering actually began. This pumpage was reflected markedly on water-level hydrographs, in pumpage records and in increases in some drainline flows.

During 1967 many farmers, apprehensive as to whether or not they would have enough water, left some of their acreage fallow in order that they might utilize their allowed water supply for cotton and alfalfa production. Approximately 15 percent of the irrigated acreage was believed to be fallow during the first year (1967) of compulsory metering. Most of the "bugs" in the meters, and in the use of meters, were pretty well ironed out by the end of 1967.

SECOND YEAR OF METERING

During the second year of metering (1968) pumpage was reduced 12 percent from the previous year even though less acreage was fallow than in 1967. Although much of this decrease must be attributed to the increased precipitation during the 1968 growing season, a large part undoubtedly occurred in response to increased efficiency of application. Although many farmers who had previously opposed metering now recognized its benefits to both the basin and their farm operations, many contended that the decreed duty of water should be increased to more than 3 acre feet per acre per annum.

QUANTITIES USED

Quantitative figures show that, under the Decree, and during the first year of metering, 387,361.5 acre feet of water was diverted within the basin of which 373,290.8 acre feet was diverted from wells, and 14,070.4 acre feet was diverted from the surface streams and Hagerman Canal. Water used for irrigation purposes accounted for 95.8 percent of the total; the use for municipal purposes, primarily by the Cities of Roswell and Artesia, was 3.8 percent of the total; and the use for commercial and industrial purposes was 0.4 percent of the total. The total irrigation use of 371,250.6 acre feet on 128,245 equivalent water-right acres was equal to an average diversion of approximately 2.9 acre feet per acre for the basin as a whole. Approximately 30 percent of the users exceeded 3 acre foot per acre duty. In 1968 there was a further reduction in fallow acreage but in consequence of more experience, and increased precipitation the total pumpage was reduced by 12.45 percent to 339,124.5 acre feet of which 328,985.5 acre feet was diverted from wells and 10,139 acre feet was diverted from surface water sources. The total irrigation use in 1968 of 323,917.1 acre feet on equivalent water-right acres was equal to an average diversion of 2.53 acre feet per acre for the basin as a whole. Approximately 22.6 percent of the users exceeded the decreed annual duty of 3 acre feet per acre. The quantity of water diverted during each of these two years was less than in any year since 1958 and 1944, respectively, compared to estimates of diversion for previous years.

The use of water per water-right acre by individual users during both of these years varied considerably. These differences were due to differences in crops grown, differences in soil, quality of water, types of irrigation systems, and differences in rainfall. One of the greatest differences appears to be the difference in water management.

EFFECTS OF METERED USE

Some of the effects of metered use were readily apparent. Winter irrigation, which had rapidly increased since the late 1950's,

particularly in areas of large capacity and flowing artesian wells, was drastically curtailed. No complaints of water waste to borrow pits and similar areas have been received since metering began in 1967. Crops are not generally irrigated during rains and irrigation pumps are usually shut down at those times in contrast to previous practice. The irrigator has become one of the most important persons on the farm. The resulting decrease in pumping costs have in turn reduced farm operating costs.

One of the items most notable to the farmers was that with metering and reduced withdrawals of water from the basin, pumps did not have to be lowered as had been the almost annual practice in many areas for the preceding 10 years. Service companies which specialize in this work reported a very large decrease in business.

In some ways metering has brought less rigid controls on the use of water, for with metering, emphasis is placed upon the quantity of water diverted, rather than on detailed surveys of irrigated acreage. Many farmers have elected to spread their water rights over larger areas to attain greater flexibility in farming.

OTHER RESULTS

Other less obvious results of the large reduction in pumpage enforced by the metering are indeed evident. Hydrographs on recorder wells and reports of farmers show that artesian pressures have increased considerably. Wells which had not flowed for many years flowed during the winter of 1967-1968. In the eastern part of the irrigated area near the Pecos River, drainlines were installed prior to the development of the shallow aquifer to alleviate subbing of the land due to return flow from artesian irrigation. An analyses of flow from these drainlines indicates that since 1966, in the area near Roswell where the shallow ground water supply is more directly related to artesian pressures, the flow of several drainlines has increased. In areas further south where the semi-permeable beds separating the aquifers are thicker, however, the flow of drainlines has decreased markedly, particularly during the winter months when return flow from irrigation is at a minimum. An analysis of the flow in the upper reaches of Cottonwood Creek, which reportedly did not have perennial flow prior to the development of the basin, discloses a similar trend. The measured flow in the creek has been decreasing since the early part of 1967 with the greatest decreases in flow occurring during the winter months when return flow from irrigation is at a minimum.

Effects of the decreased pumpage brought about by the enforcement of a per acre limitation through the use of meters have also been noted in the area of saline water encroachment into the artesian aquifer north and east of Roswell. In this area an increase in the salinity of the artesian water had accompanied the progressive

increase in overall pumpage prior to 1966. Since 1966 the quality of water produced by 67 sampled "high chloride wells" (1,000 to 2,000 parts per million) has progressively improved and the quality in 31 of the 53 low chloride wells (100 to 1,000 ppm chloride) has also improved. The salinity of the water produced by the remaining 22 sampled wells either has remained essentially unchanged or has increased slightly. Saline water encroachment has been further deterred by the lessening of severe summer declines of artesian head which in turn have reduced the upward movement of saline water from the basal part of the artesian aquifer.

Metering has resulted in continued emphasis on conservation measures such as land leveling and the installation of impervious conduits to transport water supplies, and has practially eliminated the uncontrolled use of water from flowing artesian wells. The practice of winter irrigation, which many agronomists believe unnecessary, has also decreased.

SUMMARY

It is recognized that it is still too early to draw definite conclusions regarding changes in conditions of the ground water basin resulting from the use of meters, and that all of the beneficial results in the basin noted within the past 2 or 3 years cannot be attributed solely to the metering of produced water. Some credit must certainly be given to improved conservation practices as well as phreatophyte eradication, stream channelization, and a somewhat improved situation in annual precipitation. The meters, however, did accelerate many of the other improvements and in my opinion, is the most important and beneficial measure that has been initiated in the Roswell ground water basin since the appropriation of water was first controlled in 1931.