

WATER USE AND EFFICIENCY IN
THE PECOS VALLEY

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Because of the limited time allotted for the members of the panel, I will present a graph, prepared by Mr. Russell E. Crawford, Engineer and Manager of the Pecos Valley Artesian Conservancy District, which shows quite clearly and accurately the situation as it has developed in the Pecos Valley Basin, which differs from other basins in which ground water is used for irrigation, only in having a measured average recharge of 235,000 acre-feet per year.

The first line of the graph covering the period from 1938, just one year after the basin was closed by order of the State Engineer to further acreage expansion and development, to 1962. Here is shown a continual and generally uniform increase in pumpage from 287,000 acre-feet in 1938 to 431,000 acre-feet in 1962, with an exception in 1941 when there was 34.61 inches of precipitation in comparison with the long time average of slightly under 10 inches. This annual precipitation is shown on line four and with the exception of 1941 shows only a comparatively slight deviation from the average.

Also, in line five the recharge to the artesian basin is shown to correspond rather faithfully to the annual rainfall with the years of greater or less than average indicated quite clearly, but showing no particular cycle of either wet or dry years.

Line six shows acre-feet drawn from storage, a direction or combination of directions, influenced by the variations in annual precipitation and by the gradually increasing amount of pumpage ending with 431,000 acre-feet pumped in 1962 or 196,000 acre-feet drawn from storage in that year. Again, 1941 is conspicuous in showing addition to storage, being the only year in which the withdrawal was less than the recharge.

The bottom line shows what has happened to the water level as measured in six test wells in which continual gauges are kept. This is the average annual measurement from the land surface and is the annual average of the winter highs and the summer lows, beginning at surface level in 1938 and ending at 65.6 feet below the surface in 1962 (the compilation for 1963 is not yet available). The winter highs are at or slightly above the surface and the summer lows are from 120 to 200 feet below, depending upon the location of the well which is pumped.

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CHART 1. Pumpage, Acres Irrigated, Acre-Foot Pumped, and Change in Water Table, Pecos Valley, 1937-1962

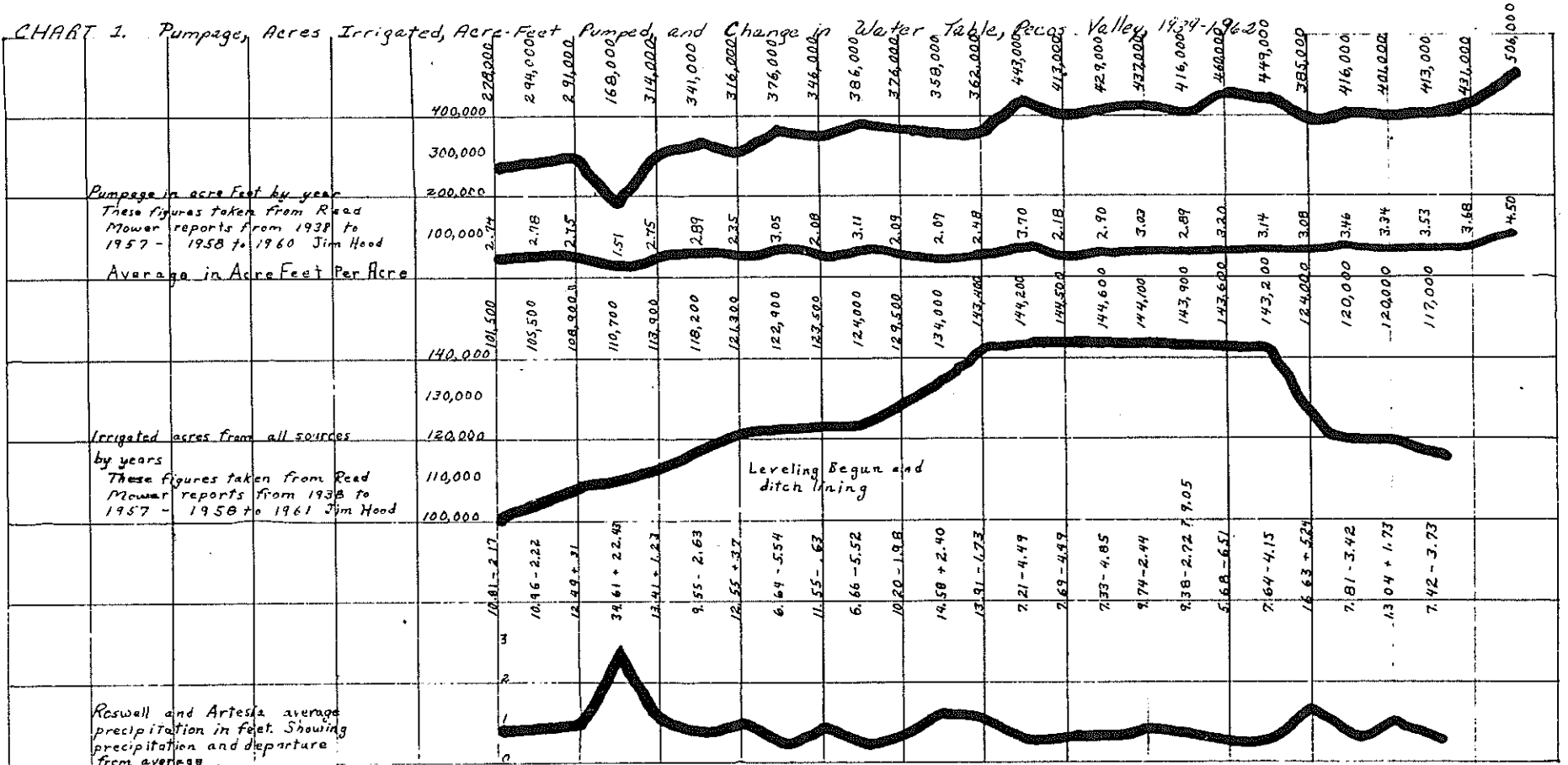
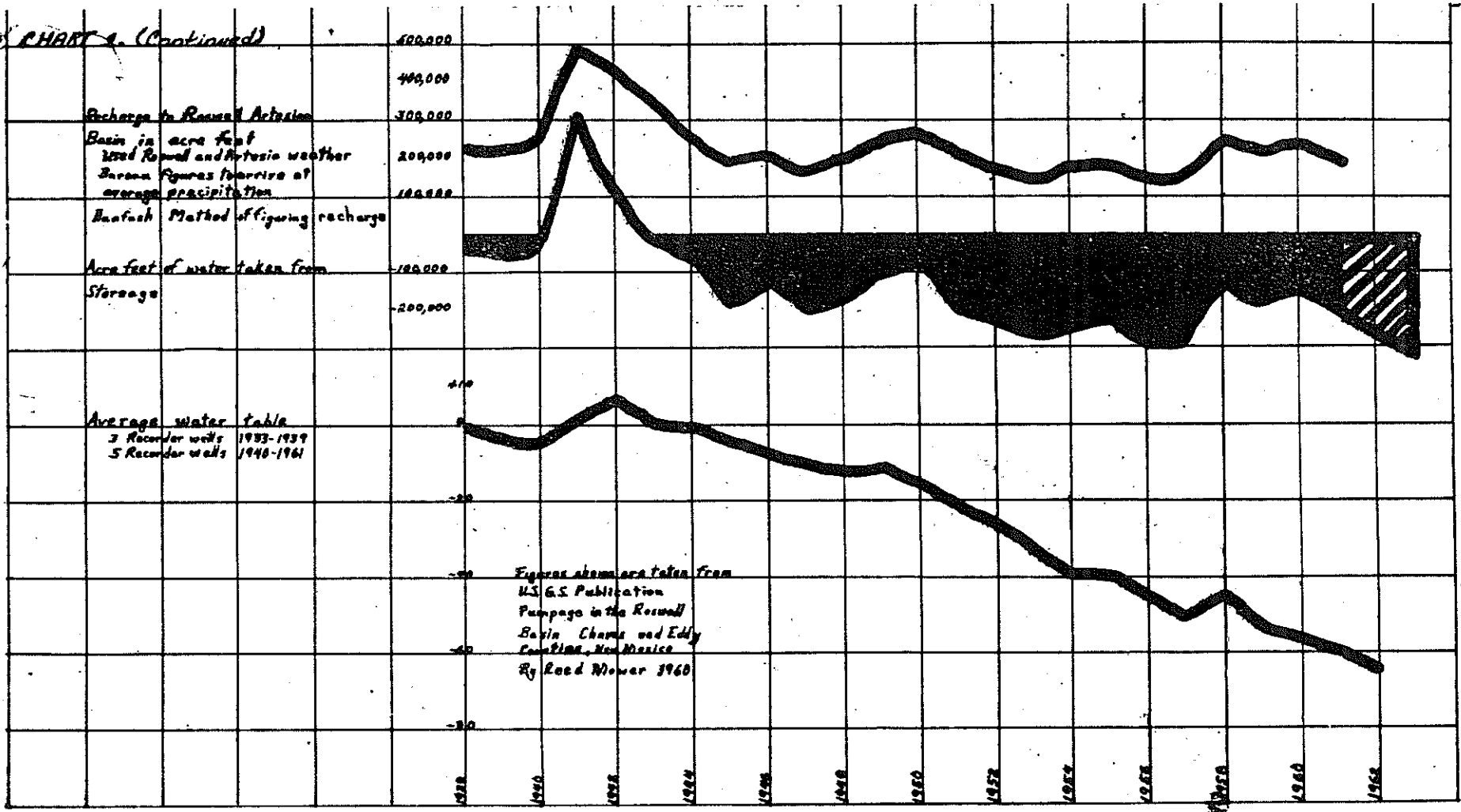


CHART 1. (Continued)



Let us look now at line three which shows the total of irrigated acres during the period and we notice a rather sharp increase from 1938 to 1950 and a sort of plateau from 1950 to 1957, reaching a peak of 144,600 acres in 1953 and looking again at the top line we find a pumpage of 460,000 acre-feet in this period (1956). Also, we find an abandonment of 1,400 acres during this plateau period, due to the failure of wells in some unfavorably located areas. There is a noticeable and very sharp drop in the acreage line beginning in 1957 and continuing less sharply into 1962. This shows the effect of the adjudication proceedings which began in 1957 and are now about completed. The decisions of this court had the effect of eliminating from legal sanction the lands which were not included in the approved water right grants and for the most part consisted of small acreages above the number of acres actually allowed in the grant. It is noticeable that there was no corresponding decline of the amount of water pumped even though the adjudication reduced the legally qualified appropriators to 117,000 acres, a reduction of 26,200 acres and the abandonment from failure of wells was 1,400 acres, a total of 27,600 acres.

To add to the occurrences which might have been expected to reduce the demand on water resources there was the adoption and fully 80 percent completion of the program of land leveling and ditch linings. There is no doubt that these practices did reduce waste and unnecessary evaporation to a considerable degree as they were intended to do and certainly they are good and necessary operations. We who were and are sincerely interested in soil and water conservation felt justified in promising that eliminating water waste by this method would tend to reduce the necessary withdrawals and so tend to balance the draft-recharge relation, but our faces were very red when we found that the amount of overdraft had increased during the entire period, not only in the total amount, but also in the amount used per acre, as shown in line two of the graph.

It is true that the increase in production per acre was even greater than the increase in water pumped per acre, it seems that the saving accomplished by the elimination of waste was transferred to greater production. This would be altogether desirable if it did not maintain and actually add to the already critical overdraft and result in abandonment of lands belonging to other farmers whose legal rights were the same as their more fortunately located neighbors.

These graphs are shown with the intention of showing what the situation is now in the Pecos Valley and probably in other basins of New Mexico for it seems reasonable to assume that efficiency in water used for irrigation should be considered under the conditions which exist, and the regulations which have been put into effect under the laws, and are intended to bring about an equitable allocation of the right to appropriate.

A quick look at these lines on the chart would seem to indicate the entire lack of control, or the complete ineffectiveness of such controls as have been attempted. Such a conclusion would be far from justified for there have been many controls and most of them have been effective.

The design of the basin itself with storage capacity of some thing more than 4,000,000 acre-feet (the estimated overdraft in the last 26 years) and the nature of the aquifers which limit the annual flow to the areas where pumpage can be economically feasible have prevented us from depleting the reserve supply as we could have done had it been from an open lake.

The laws under which we are granted the right to appropriate and the regulations under those laws which stopped further development of irrigated acres from the artesian source in 1931 and with water from the shallow ground supply in 1937 have served to prevent an over-development which certainly would have been disastrous, even though they have not worked perfectly.

The various studies by the U. S. Geological Survey have had a controlling effect in guiding the authorities and furnishing information to the users and general public as to how much we have and what is happening to it.

The Pecos Valley Artesian Conservancy District which was authorized at the request of the property owners, by special act of the State Legislature, has been helpful in control, requiring leaky wells to be repaired or plugged, granting loans for ditch lining and land leveling and otherwise supplementing the regulations of the Office of the State Engineer.

The controlling regulations have been imposed in the hope that the amount of water drawn from the underground sources would thereby be limited to the three acre-feet agreed upon by the appropriator and the State in the original grant and upon this agreement must be decided whether efficiency in the use of water in irrigation may be accomplished, and a profitable farm operation be realized.

I shall not attempt to discuss the many items of farm programming which have been indicated both by experience and laboratory research as helpful in attaining a high production with the use of a minimum amount of water but will go directly to what has been done on farms here in the Pecos Valley where the total amount drawn from the wells has been under or only slightly above three acre-feet per acre per year. This is the case in three of the six metered wells in the period of 1959, the first year in which the meters were installed by the Pecos Valley Artesian Conservancy District Board in the six wells located fairly evenly from north to south in the valley, measured to 1961. These three farms were not and are not low production farms, but are all at least average. Two of these were close to the three acre allowance in 1963 which was the dryest year on record. We may

conclude from this that probably one-third to one-half of the farms in the valley are operating somewhat closely to the agreed amount.

One farm which I know intimately has been limited, I am sure, to three acre-feet or less since its beginning as farm land, irrigated farm land, that is, in 1930. Limitation to the granted amount was not due to the desire of the operator, but because it seemed to be the maximum amount available, I am sure, however, that the available amount was never greater than in 1959 and 1961, when the meters showed a 2.89 acre-feet average for the two years.

Due to the limitation of water, everything that was considered in the program for this farm was of necessity considered with reference to its relation to water use. It took the first ten years to bring the entire 312 acres into satisfactory production with a division of cropland about 1/3 cotton, 1/3 alfalfa, and 1/3 forage crops such as grain sorghum with occasionally barley or some other small grain as suitable. Attention was given to depth of tillage especially in preparation for planting, shallow plowing followed by light subsoiling was found to be helpful in controlling depth of penetration so that it was uniform without going too far below the root zone. Analysis of the soil in each field, each year gave information as to the kind and amount of fertilizer to be added and the percentage of organic matter present. It was believed that proper fertilization is closely associated with soil structure and that the organic material present is highly important both in its plant nutrient contribution and also in the reception and retention of moisture.

From the beginning this farm was planned as a cotton and livestock farm both because that seemed to be the best way to get everything that was produced into the market, in the form of lint cotton or fat cattle, but also offered the best water economy program and the least soil depletion. There seems to be nothing that will supply organic matter as readily available as livestock manure. Nothing except cotton and cattle have been sold from this farm in the last twenty years.

It now appears that the custom of light and minimum tillage in effect on this farm is approved by soil scientists as being favorable to the availability of the soil moisture to the plant roots by preventing its being locked up by the multiplicity of soil particles which is the result of overtillage, fine mulching and in combination with increased travel of farm implements encourages compaction.

Lining of ditches with concrete was begun in 1961, following a program of land leveling which had been in effect beginning about 1950, and the installation of 1/2 mile of underground pipe to carry the water from one well to a reservoir located on high ground and used to store water from two other wells.

Whether or not this farm was always "short on water" is a question for discussion but has nothing to do with the fact that it never had more than three acre-feet and "made out" with that amount. It is significant that generally it was operated at a profit with production that was at least average for the irrigated farms of the basin. And, it is obvious that whatever success the operators realized was due to an intense effort to use everything possible in order to get the greatest benefit from the limited supply of water, which was less than three acre-feet per acre.

There is another idea suggested here which could lead to some argument and possibility of suggestions. As was stated earlier, ditch lining was not begun until 1961 and the measurements which average 2.89 per acre were obtained in 1959 and 1960, the first two years of metering. Now, if the estimate of the engineers that 30 percent of the water was lost through seepage and other ditch losses in an open system such as this where the open ditch runs average 3/4 mile then only 70 percent of the water pumped was actually applied to the land and whatever beneficial use there was realized was the use of 70 percent of 2.89 acre-feet or 2.023 acre-feet per year and it would seem possible that with the elimination of all unnecessary losses such preventable evaporation, by the use of monomolecular film, chemical weed control and all the available water saving practices we could reach the point of profitable, economical and efficient irrigation farming which could exist with the withdrawal of as little as two acre-feet per acre from the underground source and thus, be within our recharge average. Until that time, it is certainly possible to live within the decreed amount of three acre-feet with the controls now in effect provided there is added the one of required measurement at the point of withdrawal and without which the other controls will continue to be regrettably ineffective, but with a continuous flow meter on every well, we can with perfect confidence leave the institution of a suitable farm program to the ingenuity of the farm operators.

As stated before, the acreage determined by adjudication to be entitled to the use of three acre-feet of water per acre per year is 117,000 making a total adjudicated appropriation of 351,000 from an income of 235,000 an overdraft legally authorized of 116,000 acre-feet. Eventually, even this will have to be adjusted in some way. The storage will not stand an overdraft forever, then it may be necessary for efficient water use to be considered as limited to 2 acre-feet, under a strict rationing program. We think it can be done provided:

A continuous flow meter is required for each well discharge.

The controls now in effect be rigorously enforced.

Better management of farm programming is instituted.

When we farmers substitute thinking and planning for the rat race for more pumping.