APPLICATION OF ENVIRONMENTAL TRITIUM IN THE MEASUREMENT OF RECHARGE AND AQUIFER PARAMETERS IN A SEMI-ARID LIMESTONE TERRAIN

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ABSTRACT

This project is part of a continuing inquiry into regional patterns of recharge and groundwater flow in a large and complex artesian basin plagued by problems of overdraft, declining water quality, and saltwater intrusion.

Starting from the Hydrologic Model established in a previous investigation, the present phase of the work has concentrated on determinations of environmental tritium in the basin's Recharge Belt. Sampling density, frequency, and areal coverage in the Discharge Belt were also increased. Special attention was given to the southern part of the study area (Artesia) where tritium peaks predicted by the Model apparently had failed to materialize.

For the sampled wells, all available information on depth and geologic character of water-bearing horizons, as well as construction and history of each well have been collected and summarized. The areal precipitation over the basin has been recomputed for the years 1955-1974, and statistics on surface runoff have been assembled. All of the relevant data are included as appendices to the present report.

Tritium concentrations in groundwater from the Recharge Belt are, on the whole, lower than might be expected from the Model. Also, in considerable parts of the Recharge Belt the groundwater is confined. It is tentatively concluded that a slow recharge component is more important than had been assumed by the Model.

Rapid recharge seems to occur along present drainage systems, especially that of Rio Hondo. This requires a re-examination of the sources of recharge, the loci where recharge is preferentially fed into the groundwater system, and the details of the recharge process. In addition to tritium determinations, other methods of physical measurements and of mathematical analysis will have to be used, such as: Oxygen-18/Oxygen-16 isotope ratio measurements; analysis of observation well water level records, and their correlation with precipitation and runoff; recharge computations. Some of these studies are presently in progress.

The distribution of environmental tritium within the basin itself, both in time and space, suggests that interaquifer leakage is an important factor in these patterns, not considered in the previous study.

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ABOUT THE AUTHORS

G. W. Gross was the principal investigator on this project.

R. N. Hoy did much of the tritium measurement work and the computer analysis of all measurement results. She collected and interpreted the drillers' logs, produced the listing of tritium and well data and wrote the pertinent report material.

C. J. Duffy recomputed the basinwide precipitation, and the tritium input function. He investigated the relationship between surface runoff and recharge and made major contributions to the pertinent sections.

The responsibility for any omissions or errors rests with the principal investigator.

INTRODUCTION

The Roswell Groundwater Basin

General

The Roswell basin is located in western Chaves and Eddy counties, New Mexico (Fig. 1). It is drained by the Pecos River. The eastern edge of the basin is east of the Pecos River and its western boundary is formed by the Sacramento Mountains. The northern and southern limits of the basin are arbitrarily drawn at Arroyo Macho (north of Roswell) and Major Johnson Springs (south of Artesia) respectively. The basin is divided into three longitudinal zones: the Sacramento (elev. 9,000 feet) and Guadalupe mountains form the west flank; a bedrock (structural) slope dips eastward from these mountains, and a flat alluvial plain, up to 24 mi. wide, forms the eastern flank along the Pecos River (elev. 3,400 feet). The Roswell basin has a semi-arid continental climate, with abundant sunshine, low relative humidity, and large temperature contrasts. Winters are short and mild, and summers are long and hot. Annual mean temperature is 59°F. Nearly 70% of total precipitation falls from May through September, mostly by intense, but brief and localized, thundershowers. However, winter snows accumulate in the Sacramento Mountains and enter the basin as spring runoff. The Roswell basin is one of the most important areas of artesian water production in the United States (Bean, 1949). Irrigated lands (140,000 acres in 1968) produce mainly

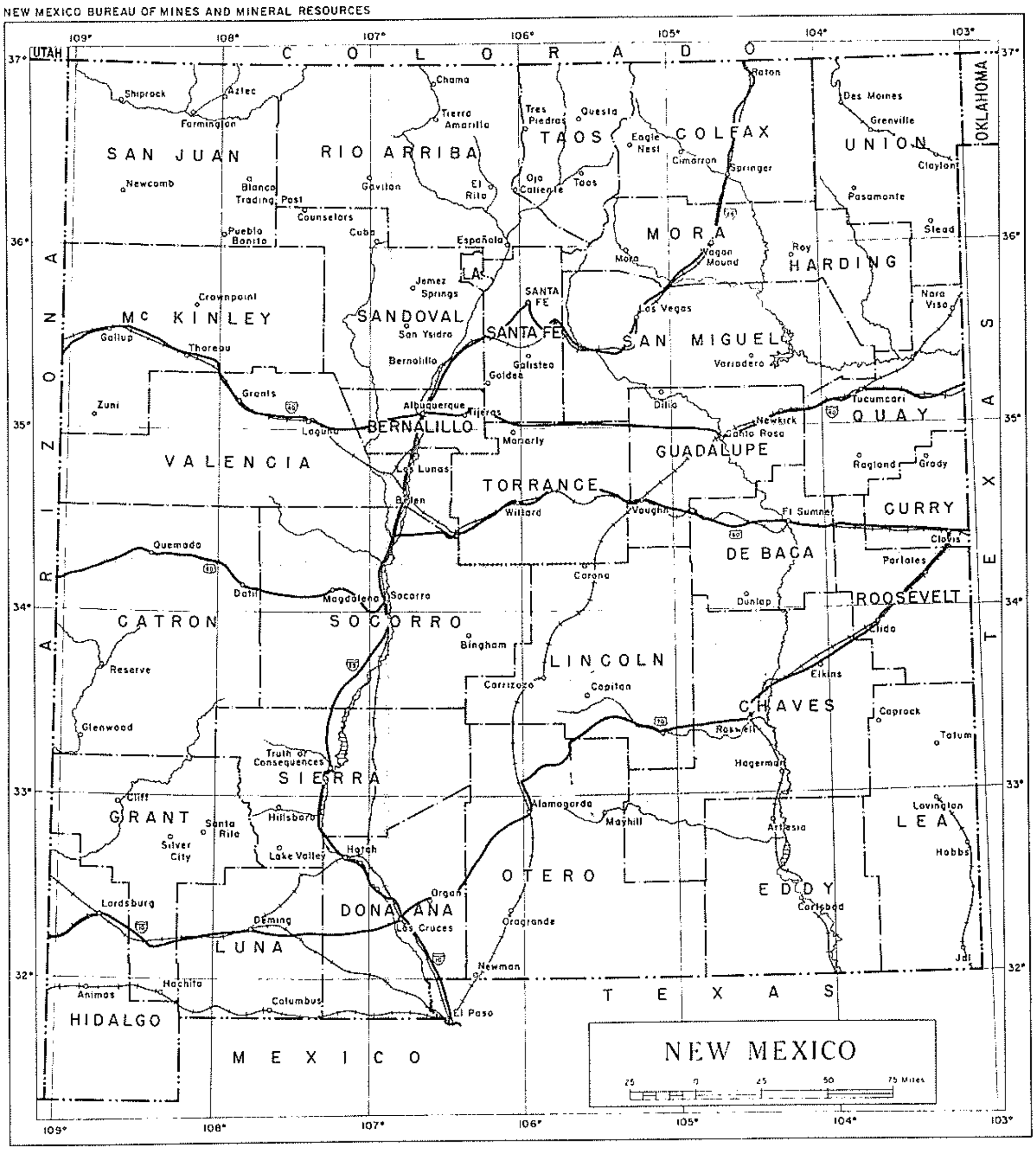

Figure 1

Orientation map of the study area.

alfalfa, cotton, and sorghum. Oil is produced from the Permian San Andres formation in the vicinity of Roswell and other locations in the basin.

The irrigated lands are mainly located in the alluvial plain. Most of the irrigation waters are pumped from the Permian San Andres formation and from the Alluvium. Heavy pumpage has produced a continuous decline in water levels since about 1942. Furthermore, salt water intrusion northeast of Roswell threatens the basin economy. These problems have prompted quantitative studies of the socio-economic and hydrologic facets of the basin management.

Surface Drainage

Only four major streams cross the study area. They are, from north to south, Arroyo del Macho, Rio Hondo, Rio Felix, and Rio Penasco. These streams are perennial in their upper reaches, intermittent in the central region, and they rarely flow at their outlet, the Pecos river. The most important of these by far is Rio Hondo with its tributaries Ruidoso and Bonito.

Geohydrology

A geologic sketch of the study area is given in Fig. 2. A simplified representation of the groundwater flow system consists of three members, called the Alluvium aquifer, Semiconfining Layer, and Principal aquifer, respectively (Fig. A4). A succinct description follows. Further details are found in Appendix A.

A shallow water table aquifer is present in the quaternary

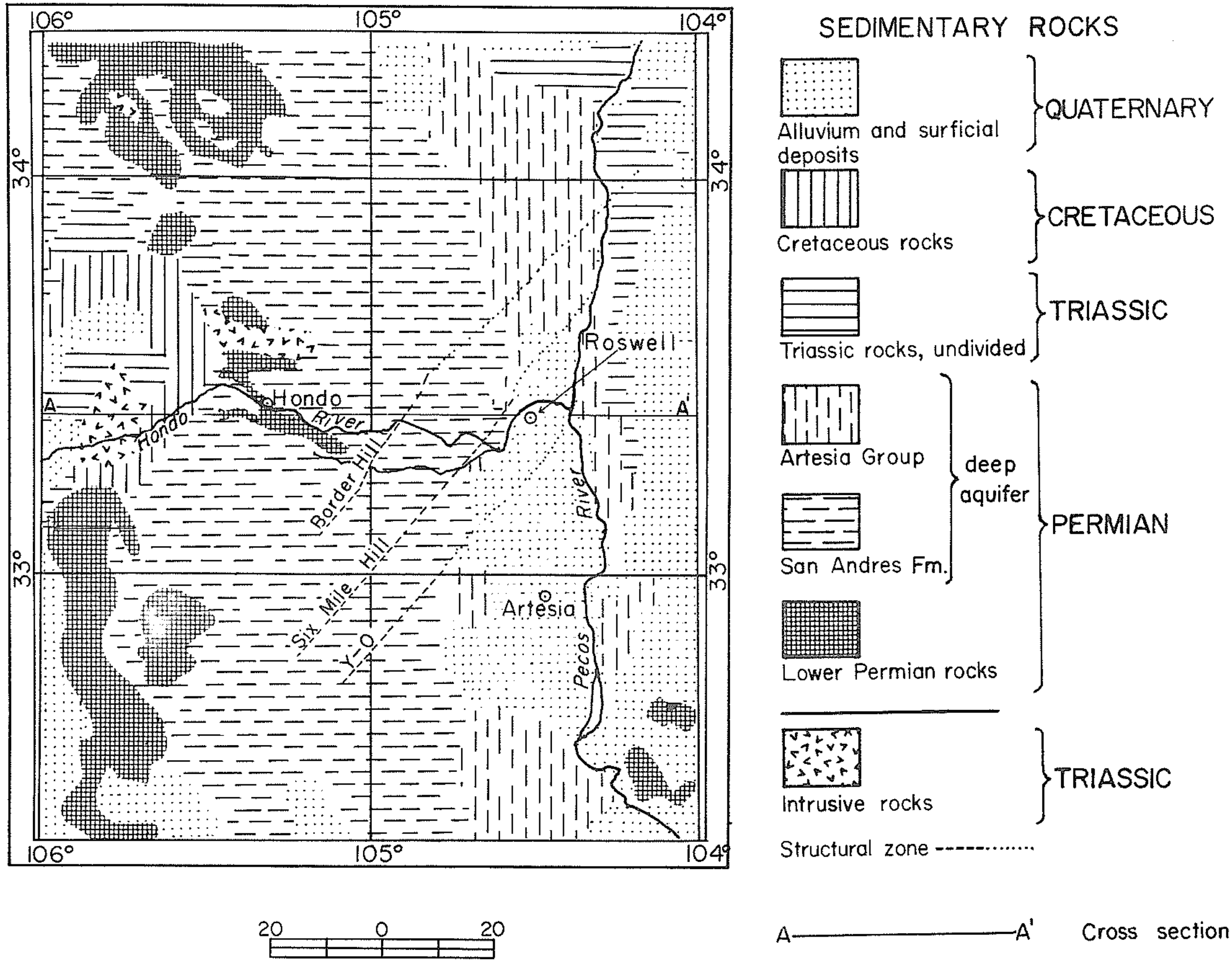

Figure 2. Geologic sketch (from Rabinowitz et al., 1976b).

alluvium which forms a strip up to 24 miles wide and up to 500 feet thick along the banks of the Pecos river (Kelley, 1971). It is the Alluvium aquifer of the present report.

Below the Alluvium there is in some areas (especially west and north of Roswell) a clastic, poorly consolidated formation of red beds included by earlier authors into the Permian Artesia group (see below) but mapped by Kelley (1971, p. 30) as the Plio-cene/Pleistocene Gatuna formation (up to 200 ft thick). Hydrologically it possibly forms one unit with the Alluvium. It is also possible that Kelley's Gatuna formation is identical with the red shales forming a thin aquitard over the lower San Andres formation in the Roswell area, as described by Havenor (1968, p. 11). In the present report, we make the arbitrary assumption (for lack of adequate information) that Alluvium and Gatuna form one hydrologic unit. This assumption may have to be revised in the future.

In much of the study area, especially in its southern part, the Alluvium aquifer rests upon a semiconfining layer of heterogeneous clastic and evaporite rocks which produce water in certain parts of the basin (especially around Dexter and Hagerman - see Havenor, 1968, p. 11). These strata belong to the Permian Artesia group which, as mentioned above, is partly (or completely) missing west of Roswell due to erosion; it is thickest around Dexter and Hagerman. This variation in thickness may, at least in part, be responsible for the large contrast in interaquifer leakage (between the Alluvium and Principal aquifers) between the northern and southern parts of the study area (Hantush, 1957). The Artesia group is up to 2000 feet thick (Kelley, 1971).

Especially in the Artesia area, it is possible that shallow groundwater, classified as Alluvium aquifer, actually comes from the upper part of the Artesia group.

Below the Artesia group is the Permian San Andres formation. It is predominantly composed of dolomite and limestone but west and north of Roswell contains much gypsum giving rise to sinkholes and other spectacular solution features. It is up to 1400 feet thick. Near its base it contains about 100 feet of sandstone (thinning southward) which is correlated with the Glorieta sandstone of northeastern New Mexico.

The San Andres formation is the predominant hydrologic unit in the basin. Together with the Artesia group, where it yields significant quantities of groundwater, the San Andres formation forms the Principal aquifer.

The San Andres is about 650 feet below the surface near the Pecos river at Roswell. It dips to the east-southeast. In the region under study, three complex zones of flexure, fracture, and faulting cut the basin diagonally from NE to SW. These "structural zones" are the loci of large-scale solution features, and conceivably serve to channel both recharge and groundwater flow.

Moreover, they divide the study area into three tectonic blocks which have been differentially displaced with respect to each other.

The sequence of structure zones and blocks in the northern part of the study area is from north to south:

Border Hill Structural Zone

Six-Mile Block

Six-Mile Hill Structural Zone

Roswell Block

Y-O Structural Zone

Orchard Park Block

The displacements between the blocks also introduce changes of an as yet ill-defined character into the groundwater flow patterns.

Kelley (1971) subdivides the San Andres formation into three members; the upper member (Fourmile Draw), the middle member (Bonney Canyon which contains the Slaughter porosity zone of the petroleum geologists), and the lower member (Rio Bonito). He recognized a change in facies in the Fourmile Draw member of the San Andres formation along a north-south traverse (loc. cit., pp. 12-14 and Fig. 4). To the south of T.16S. the evaporite facies of the Fourmile Draw changes to a carbonate facies without gypsum. This explains a large decrease of the transmissivity going from Roswell to Artesia.

In parts of the study area (notably west of Roswell) the upper part of the San Andres has been removed by erosion. Beneath the erosional surface, solution removal of calcium carbonate, gypsum, and anhydrite has created a zone of secondary porosity and high permeability of 200-300 feet thickness.

Going from west to east parallel with the Rio Hondo, the Principal aquifer rises (stratigraphically) from the Glorieta sandstone into this high-permeability zone. The transition occurs approximately at R21E. It is marked by a dramatic flattening of the hydraulic gradient (see water table contour map in Mourant, 1963). Between Roswell and the Pecos river, the Principal aquifer, developed mainly in the secondary porosity zone, is above the Slaughter porosity zone.

In the central part of the study area (between Dexter and Hagerman, Havenor's Orchard Park block) the Principal aquifer is developed in the upper member of the San Andres (Fourmile Draw) and in the overlying Grayburg formation of the Artesia group (Havenor, 1968, p. 9).

It is to be expected that the hydrologic properties of the Principal aquifer vary with the lithology of the host rocks. Indeed, studies by several authors (Theis, 1951; Hantush, 1957; Motts and Cushman, 1964) have shown that in different regions the Principal aquifer has widely different transmissivities (e.g., 200,000 ft^2/day near Roswell; 10,000 ft^2/day near Dexter). Particularly, a region of low permeability is indicated between

Artesia and the Village of Hope. This region is east and southeast of the location where Kelley (1971) observed the absence of gypsum in the Fourmile Draw member of the San Andres formation. By contrast, the high gypsum and anhydrite content of the San Andres west of Roswell has given rise to large solution and collapse features, especially where the formation is intersected by the structure zones. The old Hondo reservoir is located in a depression of this origin (on the Six-Mile Structure zone). The Rio Hondo loses most of its water between Picacho and Roswell where it flows through two of these zones, the Border Hill and Six-Mile Hill (Bean, 1949).

Recharge Belt

The Recharge Belt is considered to lie on the structural slope (see above) that connects the Sacramento-Guadalupe uplift to the Pecos valley. Its landscape is dominated by the San Andres formation which also is the Principal aquifer in this Belt. In some parts, it appears that the Glorieta sandstone is the principal water-conducting horizon.

Fig. 3 is an outline, taken from Bean (1949), showing the relation of the Recharge Belt to the basin. Two points are worthy of note: (1) the large size of the Recharge Belt compared to the Discharge Belt which is a narrow strip along the Pecos river; (2) the uncertainty of the Recharge Belt's eastern boundary over a substantial part of its course, especially at Roswell.

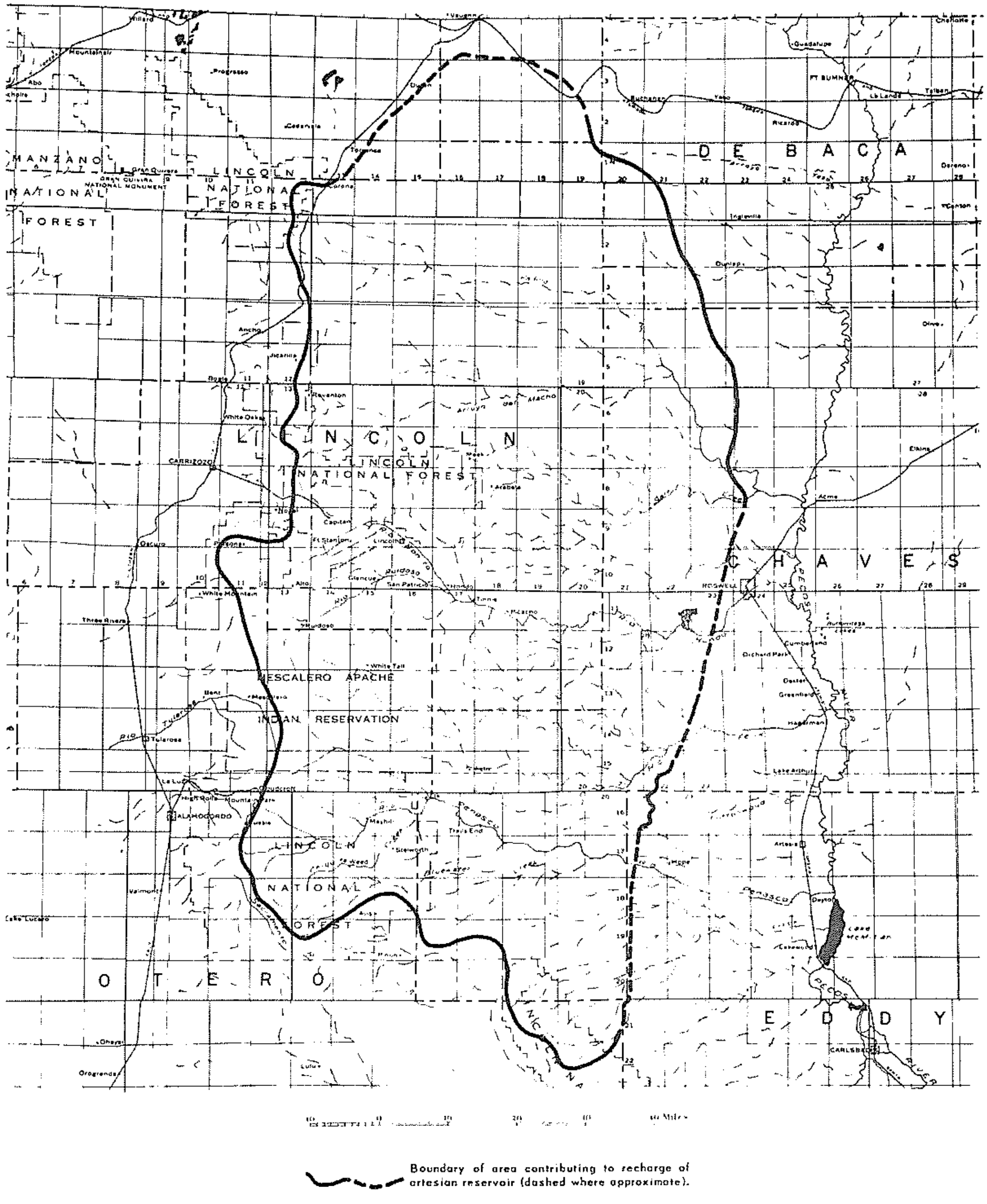

Figure 3

Recharge Belt (from Bean, 1949).

The most important groundwater boundary for the purpose of this study is the zone where the Principal aquifer changes from an unconfined aquifer in the west to a confined aquifer in the east. Rather than a sharp boundary, it is probably a zone of transition. The width of this Transition zone is rather ill defined. West of Roswell, we estimate that it may be as much as 5 miles wide. For the lack of precise information we assume that this boundary roughly coincides with the western edge of the Alluvium. This assumption is made specifically for the northern part of the study area (west of Roswell). A better understanding of the nature of the aquitard in this area, and of the hydrologic character of the Gatuna formation may require a revision of this view in the future. The boundary here defined is the eastern boundary of the Recharge Belt (or recharge boundary). South of Rio Hondo this boundary, though irregular in detail, roughly parallels the north-south trend of the basin. North of Rio Hondo, however, it is seen to angle in a northeasterly direction thus reducing the confined area of the Principal aquifer (Fig. 2).

The total area contributing to recharge is about 7000 to 8000 square miles. It extends from about 10 miles west of Roswell to the crest of the Sacramento Mountains and from Vaughn south to the Guadalupe Mountains (Bean, 1949, p. 20) in a zone that is about 60 miles wide at the latitude of Roswell (Fig. 3). Fiedler and Nye (1933) consider that the <u>principal intake area</u> is a north-south strip, only about 12 miles wide, along the Alluvium/San Andres boundary. Structure zones, sinkholes, and solution channels are believed to create an ideal situation for water percolation. Bean (1949) comments further on the fact that within the "principal intake area" itself, recharge conditions are more favorable along the Rio Hondo drainage system and north of it due to the evaporitic composition of the upper San Andres.

In the Recharge Belt, soil cover is scanty and mainly found in draws and depressions. The water table is deep (typically 300 feet to 500 feet below the ground surface). The land is used primarily for cattle and sheep raising. Water from the Hondo and the Felix are used for growing cattle feed, notably on the J. P. White Ranch (formerly Diamond A Ranch) and the Flying H Ranch, respectively.

Toward the western edge of the Recharge Belt, where the paleozoic sediments abut against or lie upon the igneous and metamorphic complex of the Sacramento Mountains, higher elevations, higher precipitation, and evergreen forests change the character of the Recharge Belt.

Basin Discharge: Interaquifer Leakage

Interaquifer leakage between the Principal aquifer and the Alluvium aquifer plays an important role in the basin's hydrologic cycle. In addition, there may be leakage of unknown extent between the Principal aquifer and deeper aquifers.

Prior to the intense development of the basin during the last 25 or 50 years, groundwater discharge took place as leakage from the Principal into the Alluvium aquifer, as springs along the Pecos river, and as base flow in the latter. Irrigation now drains a water volume in excess of natural discharge; most of the springs have ceased to flow, and base flow to the Pecos river is greatly reduced.

Direction and amount of leakage between two aquifers depend on the sign and the amplitude of the head difference between the two and their hydraulic connection. In the Roswell basin the leakage is therefore a function of both precipitation and pumpage.

In the early stages of basin development, the piezometric head of the Principal aquifer was always higher than the water table of the Alluvium aquifer. Consequently, leakage was, in general, from the Principal into the Alluvium aquifer (Hantush, 1957, pp. 50-51; pp. 67-70; Saleem and Jacob, 1971, p. 56, Table 19). As the basin was developed and pumpage from the Principal aquifer increased, seasonal reversals began to be observed, although net annual leakage still remained, in general, from the Principal into the Alluvium aquifer (see, e.g., Hantush, 1957, p. 70, Table 15). It is, however, possible that in a sequence of dry years and consequently increased pumpage the net annual leakage may also become reversed. This point may be of considerable importance for the understanding of tritium measurements, to be discussed later.

Similar reasoning may be applied to the relation between the Principal and deeper aquifers, although quantitative estimates are impossible for this case because of lack of data.

In principle, leakage from the Alluvium to the Principal aquifer will increase tritium concentration of water pumped from the Principal aquifer, while leakage from deeper aquifers would dilute it.

Summary of Previous Results

The model proposed in a previous report (Rabinowitz and Gross, 1972; Rabinowitz, Gross, and Holmes, 1976a, b, c) was based on the correlation of tritium pulses in wells of the central and eastern parts of the basin with atmospheric tritium concentration.

The main features of this model are summarized as follows:

Recharge is added to the Principal aquifer mainly through the outcrop of the San Andres formation. This outcrop occurs in a north-south oriented strip of about 20 miles width on the western flank of the basin. Most of the recharge occurs along a narrow, 12 miles wide strip in the "principal intake area" (see Recharge Belt above) through fractures and solution features. Surface run-off in this area is negligible. The "principal recharge area" west of Roswell is characterized by a very low hydraulic gradient indicating a high flow velocity.

The major recharge loci are the "structure zones" where they are close to (within 6 miles of) the eastern edge of the Recharge Belt. It is there where fractures and solution features are most highly developed.

The recharging water, which enters the aquifer near the recharge boundary, flows under confined conditions a short time (a few months) later. Therefore, the flow in the unconfined part can be neglected and the confined part is treated as a uniform velocity field.

In the calculations, recharge is treated as a line source.

In the confined aquifer, uniform mixing of recharge water with aquifer water is assumed over a vertical interval of 200 feet with one percent average porosity.

Leakage from the shallow aquifer is, on the whole, negligible. Hence, tritium concentration peaks observed in deep wells along the Pecos river can be correlated with peaks earlier observed in precipitation. The picture, then, is one of an orderly parade of peaks progressing across the basin from the Recharge Belt in the west to the Pecos in the east, each with its distinctive "flag" for easy identification.

With this model, regional values of groundwater velocity, groundwater residence time, and dispersivity were computed.

In following discussions, this model will be referred to as the Hydrologic Model or, simply, the Model.

OBJECTIVES OF THE PRESENT WORK

The previous investigation (Rabinowitz and Gross, 1972) was a first attempt to fashion tritium data spanning about 15 years into a regional Hydrologic Model of the Roswell basin. The Model was mainly based on a comparison of tritium concentration in samples from irrigation wells in the basin with tritium concentration in precipitation. The tritium here referred to is "environmental tritium", that is tritium spontaneously occurring in natural waters, as opposed to tritium artificially introduced into the hydrologic cycle as a tracer. For further discussion, see Rabinowitz et al., 1976a. During this work it became apparent that groundwater data from the Recharge Belt were needed for an interpretation. Because they were not available the Model failed to take into proper consideration a boundary condition of critical importance. It circumvented the problem by assuming practically instantaneous recharge.

Recharge is defined here as the process by which new water is incorporated into an aquifer by precipitation and percolation through the unsaturated (vadose) zone to the water table. It is one of the factors controlling the amount of water that may be extracted from an aquifer without depleting it (safe yield). Because of the complex interaction of evapotranspiration and unsaturated flow it is the least well understood phase of the hydrologic cycle.

In subsequent phases of the work, covered in part by the present report, emphasis was therefore placed on measurements in the Recharge Belt.

Moreover, a number of new sampling points within the basin itself were established, especially in its southern part (between Hagerman and Artesia). The objectives were (1) to obtain a more complete areal coverage and, at the same time, a better characterization, in terms of tritium vs. time profiles, of both the shallow and the deep aquifer complexes. (2) To check the Model prediction of delayed appearance of tritium peaks in the southern part of the study area.

To our surprise, we found that tritium concentrations of groundwater in the Recharge Belt appeared to be, on the whole, lower than seemed consistent with the Model. This suggested one of two possible causes: (1) recharge takes place much more slowly than previously assumed; (2) mixing with older (deeper) water is more important than previously assumed. However, tritium determinations alone are not sufficient to clarify this point because tritium concentration depends not only on time elapsed during percolation through the unsaturated zone but also on hydrodynamic mixing of recharge entering the groundwater system, with the water it already contains.

We started therefore to look for other approaches that might be helpful in this matter. One major source of potential information were the water level records of six observation wells in the Recharge Belt, kept by the Pecos Valley Artesian Conservancy District for more than 15 years. These could be expected to show seasonal effects of recharge.

A third approach consisted in looking for alternative sources or mechanisms of recharge and the data required to either support or reject them.

The present study reports the progress made in this investigation. It broadly formulates alternative recharge mechanisms as working hypotheses and presents the data that have been acquired in the course of their examination. It points out future directions to follow.

PROCEDURES

Sampling Points for Tritium Measurements

As a result of the previous report (Rabinowitz and Gross, 1972) the need was recognized to increase the number of sampling points (which had been largely restricted to only seven wells and precipitation during the eight preceding years, 1965 to 1973) in order to obtain typical tritium concentration values for water from different parts of the basin, specifically:

- Precipitation
- Streams
- Springs
- Groundwater
  - Recharge Belt
    - Observation wells
    - Windmills and House wells
    - Irrigation wells
  - Discharge Belt
    - Windmills
    - Irrigation wells
      - Alluvium aquifer
      - Principal aquifer

Sampling points include six long-record wells discussed in detail in a previous report (Rabinowitz and Gross, 1972):

Woods

Patterson

Allison

Elk

Clardy

Pollard

Systematic sampling was extended to the southern part of the basin (between Hagerman and Artesia).

All sampling points for this report are described in the listing of Appendix A and are shown on the map of Fig. A2. Information on well depth, lithology, casing, perforated intervals, ownership, and other pertinent facts were mainly extracted from the files of the New Mexico State Engineer's Office in Roswell. They are given for each well in Appendix A.

The stratigraphic position of the aquifer horizons is generally not known. An interpretation for a majority of the wells was attempted on the basis of the available data. Because these data are generally poor, the interpretation is highly speculative and subject to revision as better information becomes available.

Sampling procedures for some of the sampling points are discussed in the following.

<u>Precipitation</u>

Continuous sampling of precipitation (rain and snow) takes place at Socorro (4,600 ft a.s.l.). Additional samples are collected primarily in summer at Langmuir Laboratory (10,783 ft a.s.

l.), Roswell (FAA weather station - 4,300 ft a.s.l.) and Elk. Composite monthly samples have generally been measured.

Precipitation measurements are required for the interpretation of tritium in groundwater.

Streams

Stream samples have been taken periodically from various points along the upper and middle course of the rivers Bonito, Ruidoso, and Hondo in the north of the study area; from Salado Creek, a Bonito tributary; from the Rio Felix in the center; from the Rio Penasco in the south; and from the Pecos river at Roswell and Artesia, in the east (Fig. A2).

The tritium content of surface streams averages out the large fluctuations of atmospheric samples. Seasonal fluctuations in streams are the result of different runoff sources (winter snows, summer thunderstorms) and of dilution of precipitation runoff by base flow (bank storage, groundwater).

Springs

Three springs in the Recharge Belt have been sampled repeatedly. They are: Trout Farm spring, about 1 mile west of Hondo; Cleve's spring; Paul's spring, close to the western edge of the Recharge Belt, west of Artesia.

Recharge Belt

Following a suggestion by M. S. Hantush (1957) ten observation wells were drilled in the Recharge Belt by a cooperative effort of the New Mexico State Engineer Office, the Pecos Valley Artesian Conservancy District (PVACD), and the U. S. Geological Survey (USGS). They are located along a north-south line a few miles east of the 105° meridian in R.19 to R.21. These observation wells were equipped with water level recorders. Six of these recorders have been maintained continuously for the last 15-18 years. These wells, shown on the sample location map of Fig. A2 as 01, 02, 03, 04, 07, 08, have been sampled periodically for the present work since the spring of 1974. They are described in detail in Appendix B. The description is based on Crawford and Burton (1958).

Windmills in the Recharge Belt, used for stock tanks and domestic use, are a useful complement to the observation wells. They are typically from 300-500 feet deep, and their pumping rate (order of $\leq$10 gpm) is not expected significantly to distort the natural groundwater flow, (even in those few cases where they are equipped with electric pumps).

A number of windmills was therefore added to the sampling points. They are mainly located to the northwest, west, and southwest of Roswell.

Flowing irrigation wells exist on both banks of the Rio Felix (center of the study area - Flying-H Ranch). One of these wells flows always, others only in winter when no pumping takes place.

Another regularly sampled well in the southern part of the

Recharge Belt, though not flowing, is the municipal water well of Hope.

Southern Part of the Principal Aquifer

According to earlier findings (Hantush, 1957) the Principal aquifer south of Hagerman has a lower transmissivity than in the north. The leakage between the Alluvium aquifer and the Principal aquifer is also much lower in the south. As a result of our earlier tritium studies (Rabinowitz et al., 1976b) it was therefore concluded that the residence time in the south was at least twice that in the north (7-15 years vs. 5 years). The passage of these peaks should therefore be apparent in samples taken after 1967.

A number of deep and shallow sampling points in and around Artesia were therefore added for the present work.

Tritium Measurement Techniques

The laboratory procedures have been described in detail in a previous report (Rabinowitz and Gross, 1972). During the present report period, the electronic counting circuitry was completely replaced under the direction of Prof. C. R. Holmes of this institution. This resulted in substantial improvement of resolution and accuracy in the measurements.

Observation Well Records

During the course of this study it was recognized that the water level records from the recharge observation wells could yield important clues to the recharge characteristics of the basin.

Several of the wells, notably No. 2, show a high barometric efficiency. Large fluctuations, typically with periods of a few days, show a strong correlation with atmospheric pressure changes recorded at Roswell. They mask longer term (e.g. seasonal) trends related to recharge.

A statistical analysis, still in progress, will include correlation of water level data with several other possible inputs such as atmospheric pressure, precipitation, mean temperature, basin pumpage, and stream discharge. It is hoped that the relationships between water levels and the previously mentioned variables will lead to a physical connection between system input and output.

RESULTS

Precipitation Inventory

Fifteen rain gauges operated by National Oceanic and Atmospheric Administration (NOAA: Local Climatological Data, 1976) in the study area were used to compute partial and total precipitation volumes by the Thiessen polygon method (Linsley, Kohler, and Paulhus, 1975) for the period 1955-1974. The results are tabulated in Appendix C. The average total yearly precipitation volume over the basin for this period was 6×10^6 acre-feet. Some records are incomplete and were complemented by correlation with neighboring gauges. These precipitation data are the basis for computing the tritium input function (Rabinowitz et al., 1976a).

Of particular interest is the year 1974. Precipitation over most of the basin was extremely low from January through July, and extremely high in August, September, and October, practically amounting to a step function. This feature is used to examine the Hydrologic Model's concept of "instantaneous recharge." If recharge is "instantaneous," then the aquifer response to a sudden, large input should also be quite abrupt.

Surface Water Inventory

Stream gauges, maintained by the U. S. Geological Survey (Water Resources Data for New Mexico) are located on the main basin tributaries (Fig. D1). The three major lines of drainage, the Rio Hondo, Rio Felix, and Rio Penasco originate in the western mountains and flow in an easterly direction to their outlet, the Pecos river. Discharge data for these streams are presented in Appendix D.

The most important tributary is the Rio Hondo formed by the confluence of Rio Bonito and Rio Ruidoso. Several gauges are maintained on this stream system. Spring runoff in the headwaters of this channel system can be considered a snowmelt index (Rio Ruidoso, Hollywood gauge, see Table D2). For the most part, irrigation, infiltration, and evapotranspiration completely absorb the flow in the Rio Hondo between the village of Hondo and Twin Rivers Reservoir. The latter is generally dry and its only purpose is flood protection for the City of Roswell (population 45,000).

The two other main streams in the study area, Felix and Penasco, also have gauges which are located near their outlets at the Pecos river.

Arroyo Macho, toward the northern end of the study area, has no gauge. It flows only after large rainfall events.

Channel leakage in the Rio Hondo and Rio Penasco constitute a rapid recharge component to the groundwater basin. Mourant (1963,

p. 10) has estimated the loss in streamflow to be 1.0 to 1.5 cubic feet per second per mile in the Hondo. Water level data from Observation Well #8, near the Hondo at Diamond A Ranch indicate that the average water level is about 300 feet below the streambed, thus allowing for substantial storage in the aquifer below. Large fluctuations in the water table below the Hondo correspond with changes in stream depth. It is suspected that a similar mechanism occurs in the Penasco Drainage. However, Observation Well #7 is not located near a stream gauge to confirm this. No data exist concerning the Rio Felix.

The contribution of these tributaries to groundwater recharge in terms of volume is not known at present. However, a model has been proposed and is currently being tested to give a more adequate description of rapid recharge.

Tritium Measurements

All tritium measurement results are listed in Appendix A. The units used for reporting these results are defined in Appendix A.

Where referred to in the text of the report, sampling points are designated by a letter symbol followed by a number, keyed to the listing of Appendix A. The letter symbol represents the sample category (such as Spring, Principal Aquifer Well, etc.) and the number refers to the sampling point location. The categories and symbols are tabulated in Appendix A.

Precipitation

Tritium in precipitation has been steadily declining since 1963 (Test Ban Treaty) when it peaked around 10,000 TU.

Simple yearly average concentrations of tritium in precipitation for the study area are shown in Table I.

Streams

The tritium concentration in streams appears to have decreased substantially from January/July 1973, when it exceeded 100 TU at sampling points on Rio Hondo and Pecos, to 1974, when it was 80 TU or less. Moreover, the Hondo and its tributaries seem to show a summer tritium high (possibly related to snowmelt and storm runoff) and a winter low. Because of the large fluctuations in tritium content of the atmospheric water samples it is not possible at present to compare average tritium levels in surface and

Table I. - Yearly Precipitation, Tritium Concentration, and Tritium Input Function.

Computed with precipitation estimates of Appendix C and tritium concentration measured at Socorro and Ottawa (IAEA, 1974).

Year	Total Precip. (Areal) (Inches)	TU	Pre*TU	$f=0.1\frac{P_i}{\bar{P}}$	f*TU*Precip.
1955	13.77			.102	
1956	7.56			.056	
1957	13.88	117.	1624.	.103	167.3
1958	19.35	257.	4973.	.143	711.1
1959	12.16	801.	9740.	.090	876.6
1960	14.13	191.	2699.	.104	280.7
1961	12.40	173.	2145.	.092	197.3
1962	14.79	551.	8149.	.109	888.2
1963	9.08	1897.	17225.	.067	1154.1
1964	8.88	827.	7344.	.066	484.7
1965	13.82	447.	6178.	.102	630.2
1966	12.92	226.	2920.	.095	277.4
1967	11.43	259.	2960.	.084	248.6
1968	15.47	156.	2413.	.114	275.1
1969	15.64			.116	
1970	9.65	173.	1670.	.071	119.
1971	14.16	141.	1997.	.105	209.6
1972	20.33	88.1	1791.	.150	268.7
1973	11.10	147.	1631.	.082	133.7
1974	20.07	72.	1445.	.148	213.9
Mean:	13.53				

P_i = Precip. in i^{th} Year

$\bar{P}$ = 1955-1974 Mean Precip.

precipitation water. The tritium content in streams would generally be decreased due to dilution by base flow fed by older groundwater.

Springs in the Recharge Belt

Paul spring, Cleve's spring, and Trout Farm spring all showed high concentrations (20-100 TU) in early 1973. They are at present below 10 TU. Thus, they are apparently fed by systems in which rapid recharge can take place.

Observation Wells in the Recharge Belt

Observation Well #8, located within the drainage of Rio Hondo, shows inequivocal evidence of rapid recharge. Tritium levels are consistently high (40-50 TU), and water level fluctuations are closely synchronized with discharge through the river. Thus, this well exhibits the characteristics of rapid recharge as formulated in the Hydrologic Model.

Observation Well #7, located near the north bank of Rio Penasco, shows these characteristics also. Unfortunately, it could be sampled only twice because of a cave-in in the well bore which has also prevented the continuation of water level records.

By contrast, the remaining observation wells show generally much lower tritium contents.

Observation Wells #2, #8, and #9 showed one high (>10 TU) tritium concentration each in April 1974 (Fig. 4a). In the case of wells #2 and #9, measurement error may have been involved. But,

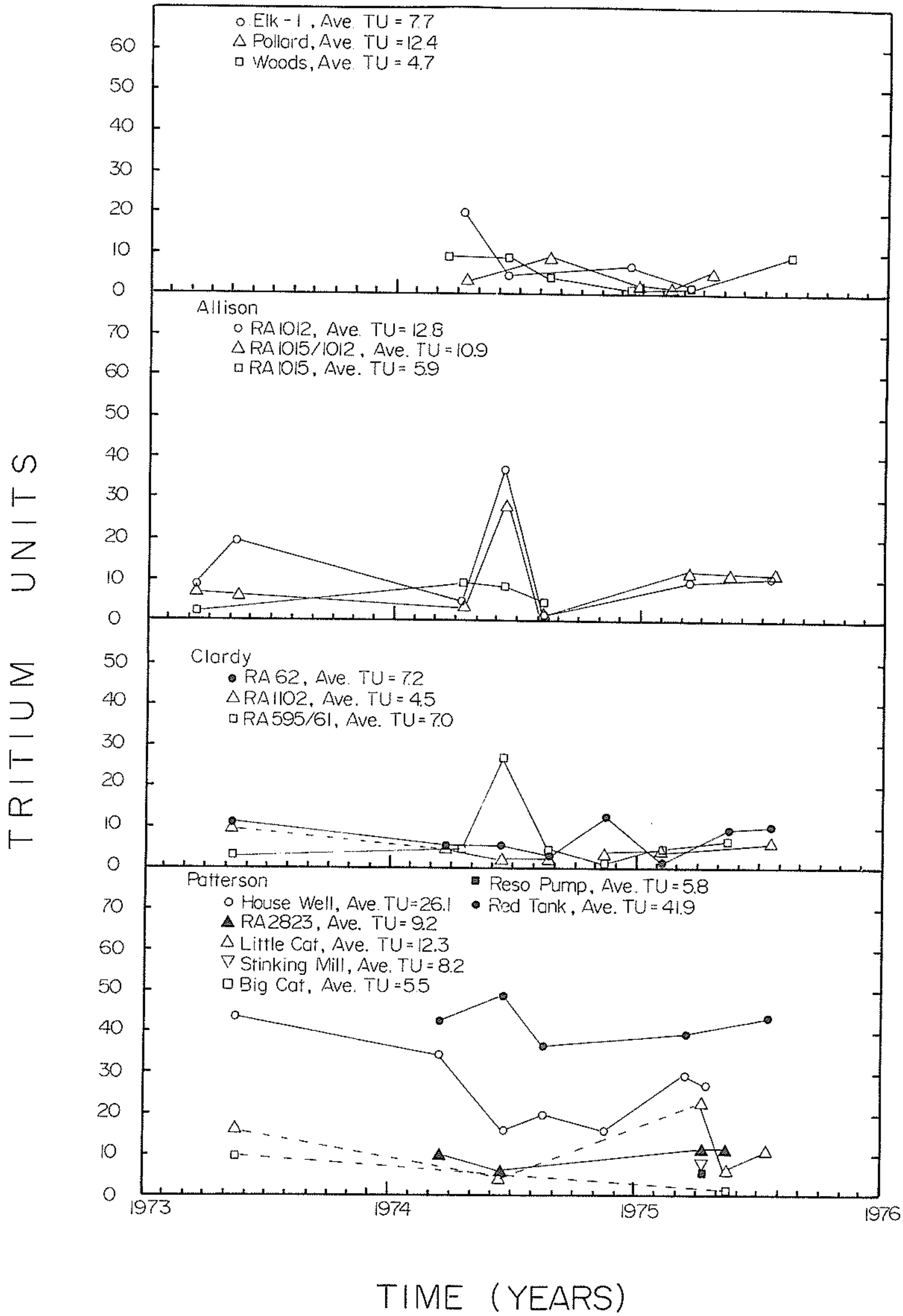

Figure 4a. Tritium concentration vs. time. Observation wells 1974/75.

if real, these high values suggest a rapid recharge component from a 1972/73 atmospheric high.

Several observation wells (notably #2 and #9) show strong water level oscillations with periods of days, in response to barometric pressure changes. Thus, even in the Recharge Belt, partly confining conditions are encountered. Confining or partly confining conditions are also observed in the southern portion of the Recharge Belt (flowing wells on the Flying-H Ranch). This suggests that percolation of precipitation water perhaps does not, everywhere, occur as freely or as rapidly as required by the Hydrologic Model. Alternatively, dilution by mixing with older (deeper) water is greater than assumed heretofore.

The barometric-pressure fluctuations in water levels mask seasonal water level changes in response to recharge. However, taken together with the tritium data, these seasonal fluctuations appear to be pulses of head changes in response to recharge elsewhere rather than recharge occurring in the immediate surroundings of the observation wells themselves. This problem, of considerable importance for an understanding of recharge in the basin, is discussed below.

Observation Wells #2 and #3 are located on the northwest and southeast flank, respectively, of the Border Hill structural belt, characterized by intense fracturing, faulting, and folding. These structural belts have been considered prime loci for infiltration

(Bean, 1949). No evidence for this is apparent from the data (water levels and tritium) of these two wells.

Observation Well #4 is located in a major dry valley. A nearby windmill (distant 100-200 ft) was also sampled and no significant tritium difference observed. Tritium does not indicate rapid recharge, but seasonal well level fluctuations are pronounced.

Mourant (1963, p. 21) gives the hydrograph of a well (12.23.5.311) located to the southeast of the now abandoned Hondo reservoir in the Hondo drainage. This location corresponds exactly with our Patterson wells [WR5]. A water level rise of 17 feet was recorded in response to the extraordinary (>30") rainfall of 1941. The rise seems to have been general in wells around Roswell. Runoff through Rio Hondo in 1941 was about 178,000 acre-feet (Table D1), the highest ever recorded.

Bean (1949, pp. 25-26) and Mourant (1963, pp. 20-23) show conclusively that wells in the eastern zone of the Recharge Belt (the "principal intake area"), specifically between Woods well in Range 22 to the west, and Patterson in R. 23 to the east, experience seasonal drawdown effects due to pumping in the irrigated basin around Roswell.

Whether this effect extends to the observation wells here discussed, especially Nos. 2 (in R. 20) and 3 (R. 21), has not yet been established.

Other Wells in the Recharge Belt

Hope Municipal Well [WR14]. This well showed a concentration of 15 TU in July 1973, perhaps related to the 1973 atmospheric high, and a high of 20 TU in January 1975, perhaps related to the heavy rains of fall 1974. Thus, a rapid recharge component may exist for this well.

The Flying-H Flowing Wells [WR16, 17] are in the San Andres formation. Systematically sampled since 1974 and showing, as a rule, very low tritium values. But 45 TU were recorded in August 1973, in one of these wells in apparent correspondence with an atmospheric high. Thus, in spite of confining conditions, a rapid recharge component is present.

Windmills in the Recharge Belt. Used as stock and house wells, a number of them have been regularly sampled to supplement information from the observation wells. They are, in general, characterized by low tritium contents. But one of them, located where U. S. 380 crosses the Border Hill [M1], has given high tritium values indicating rapid recharge at that location. This windmill is also located 2 miles north of the Rio Hondo. The association between high tritium values and rapid recharge is evident here.

Discharge Belt

Elk #1 [WP1] is a flowing observation well in the confined section of the Principal aquifer. It is equipped with a pressure recorder maintained by the United States Geological Survey. It is located on the east bank of the Pecos River east of Roswell. This well showed a concentration of 20 TU in April 1974, in correspondence with modest tritium highs observed in the Allison and Clardy wells (see above).

Irrigation Wells: Principal Aquifer. Roswell. Irrigation wells in the Principal aquifer show, in general, tritium levels of less than 10 TU like the Recharge Belt observation wells and windmills. Significant differences have been observed as follows (Fig. 4b):

Allison [WP5] showed 20 TU in May 1973 (one well) and close to 40 TU during the early summer of 1974 (2 wells). An early summer 1974 peak was also observed in one of the Clardy wells [WP4].

These summer peaks coincide with a period of below-average precipitation (January-July 1974) and therefore increased pumpage in the basin.

Irrigation Wells: Principal Aquifer. Artesia. A number of wells have been sampled systematically since the summer of 1973. Except for two instances in July 1973, tritium levels have been below 10 TU. The hydrologic model predicts that high values should have been observed between 1967 and 1972 (corresponding to an estimated residence time between 7 and 15 years of the 1958/60 atmospheric tritium high).

Alluvium Aquifer and Transition Zone (between Recharge and

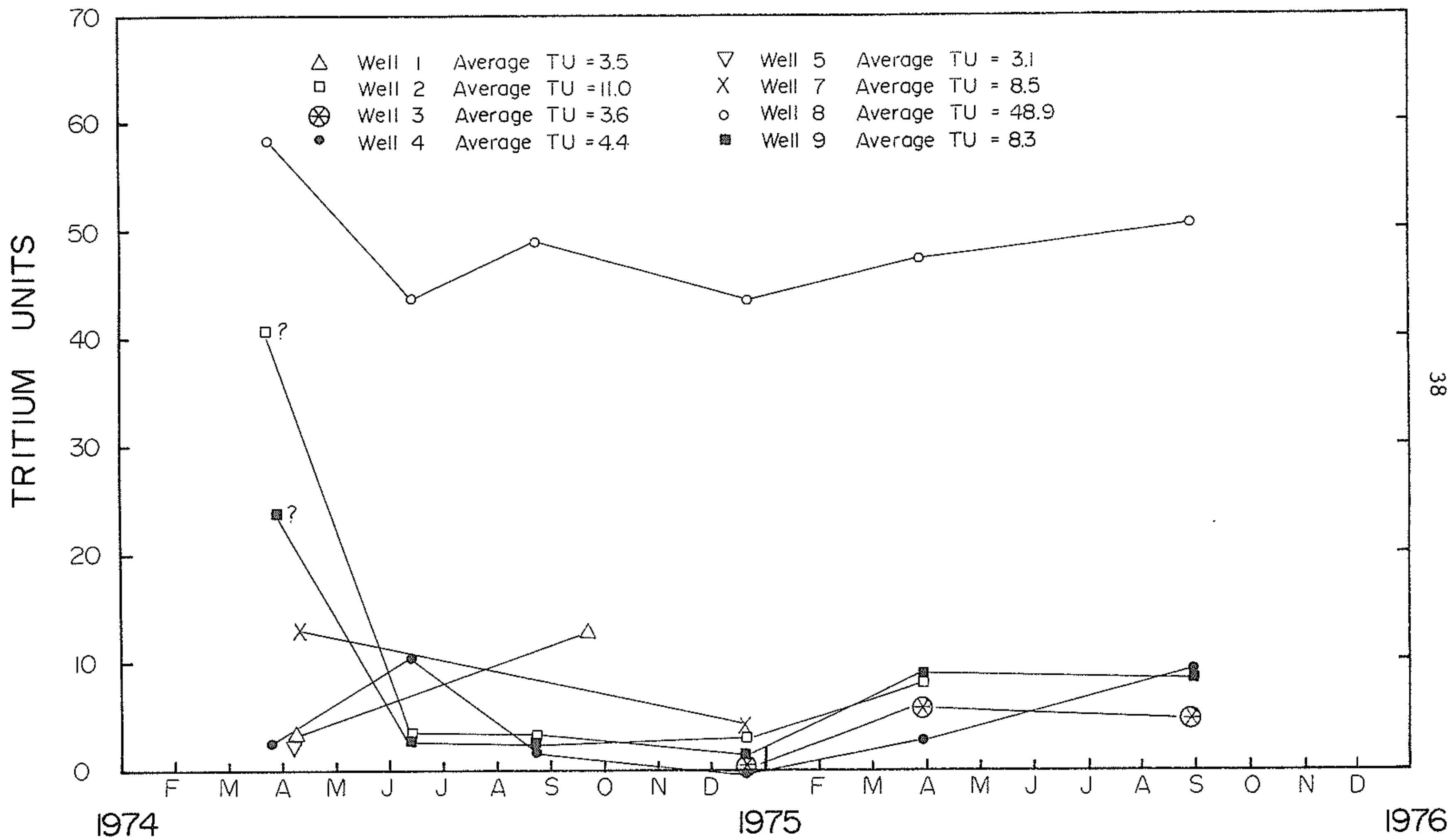

Figure 4b.

Tritium concentration vs. time. Long-Record wells since 1973.

Discharge belts). This category includes shallow irrigation wells, windmills and one hand-dug well equipped with a windmill [M12]. The wells in this category generally show tritium levels higher than the Principal aquifer. The highest concentrations were observed in the hand-dug well on the Pecos flood plain east of Artesia (80-90 TU). In general, it appears that water from the upper 100 feet of the Alluvium has higher tritium concentrations than water from deeper portions of the unconfined aquifer. This may possibly reflect a hydrologic difference between Alluvium and Gatuna. The higher tritium content of the shallower groundwater may also be related to recirculation of irrigation water, selective retention of tritium in the soil, or evaporation effects.

The shallow Patterson wells [WR5], with concentrations of up to 40 TU, may belong into this category. We have, however, classed them in the Recharge Belt because they produce mainly from the San Andres formation.

DISCUSSION

Tentative Interpretation of Tritium Measurements Since 1973

This section refers to data summarized under Results and listed in Appendix A.

A tritium peak in recharge is indicated by measurements on samples taken between January and July 1973, from streams, springs, and certain wells in the Recharge Belt. However, this peak is not evident in measurements of rain and snow during the same time period or the year before (*see* Table I).

The presence of this peak supports the concept of a rapid recharge component (appearing in springs and wells only months after the atmospheric event and disappearing equally rapidly). As a rule, however, tritium levels in the Recharge Belt are low (<10 TU), similar to levels measured in deep wells along the Pecos River, and the apparent failure of sampling points in the Recharge Belt to respond to the large precipitation input of July/October 1974 is puzzling. Since the Recharge Belt is so wide, it is possible that any new contribution is so highly diluted in the large reservoir that, in general, a modest tritium increase, or one limited to the input of one single year or less, will be hardly noticeable, except under special localized circumstances, or at times when tritium concentration in recharge is unusually high (e.g. 1962-1964). Therefore if, as at present, tritium concentrations in recharge are relatively low, groundwater (piezometric or water table) levels could show rapid changes in response to recharge while tritium concentrations stayed low on the whole. This mechanism would require the existence of a slow recharge component, or one of "old" (deep?) water, in which to dilute the new recharge. "Slow" means older than the half-life of tritium (12 yrs).

Our results suggest that rapid recharge occurs especially along present drainage systems.

A tritium peak also seems to show up in certain irrigation wells pumping from the confined part of the Principal aquifer, in the dry months of intensified pumping that precede the high rainfalls of July/October 1974. This suggests leakage from the Alluvium to the Principal aquifer (Fig. 4).

Tritium levels in precipitation water of $\leq$10 TU represent the background tritium concentration generated by cosmic rays. This was the typical level before 1954 (date of the first atmospheric nuclear tests). From a high around 10,000 TU in 1963, tritium levels in precipitation have been declining continuously, until now the average level in the study area is around 100 TU or less (see Table I). Minor peaks (of a few hundred TU) may be superimposed on this essentially uniform decline. They are attributed to small atmospheric tests conducted by parties who were not signatories to the Nuclear Test Ban Treaty of 1963.

On the basis of the Hydrologic Model one would therefore expect a continuous decline of tritium levels in groundwater of both the Recharge and Discharge belts. But with a residence time of 3 to 4 years (computed by the Model), the levels in the Discharge Belt could actually be higher than in the Recharge Belt unless, of course, dispersion in the migrating groundwater compensates for the higher tritium content of the older recharge. Also, migration in the unconfined part of the Principal aquifer has been supposed to be much slower than in the confined region (Saleem and Jacob, 1971; Rabinowitz and Gross, 1972). Overall, therefore, tritium levels would tend to equalize in both zones. If the typical residence time in the recharge area is no more than a few years (Rabinowitz et al., 1976) then the average tritium concentration in groundwater from the Recharge Belt should be a weighted average over the last 5 to 10 years (corrected for radioactive decay) and, therefore, should be appreciably higher than presently observed.

The Hydrologic Model

The Model outlined earlier was a first attempt to use the tritium data of the basin to examine concepts derived from conventional hydrologic and geologic studies, and to predict future hydrologic developments. It may be the only study of this type of as large a hydrologic basin as this one.

The Model results seem to confirm accepted concepts regarding transmissivities, porosities, and flow patterns in different parts of the basin. Groundwater residence times were computed that seem to harmonize with the general hydrologic picture. However, part of this agreement was achieved by adjusting parameters (groundwater flow velocity, dispersivity, size, and location of the Recharge Belt) in the dispersion model.

Major objections to the Model as formulated concern the assumption of a uniform and rather high flow velocity for the northern part of the basin (70 ft/day); the practically simultaneous appearance of the most prominent tritium pulses in seven long-record wells (monitored for 10 years or longer); the apparent lack of broadening of these pulses as they travel from west to east through the basin; the discounting of leakage between the Shallow and the Principal aquifer as a significant factor in the observed tritium distribution; the apparent failure of major tritium pulses to materialize after 7 to 15 years in the southern part of the study area (Artesia), as predicted by the Model; and the arbitrary treatment of recharge due to the lack of observations in the Recharge Belt.

Another point of concern is the similarity in tritium concentrations between well waters in the Recharge Belt and near the basin outlet.

These problems will now be discussed.

Uniform flow velocity

The water table contour map published by Mourant (1963) shows a large flattening of the hydraulic gradient eastward between R.21E and R.22E (about 2 miles west of Observation Well #3). This is believed to be the zone where the water table passes from the Glorieta in the west into the carbonate facies of the San Andres.

The Model assumes that significant recharge only occurs east of this zone and thus excludes from consideration the major part of the Recharge Belt.

Correlation of well pulses in long-record wells

Only one well in the Recharge Belt was systematically monitored during the last 15 years. It is Woods Well [WR3], located about 6 miles west of the Recharge Boundary, within Mourant's zone of high groundwater flow velocity.

The Patterson wells [WR5] are located about 5 miles east of the Recharge Boundary, near the Hondo drainage. Allison is roughly on the center line of the basin, and the remaining three (Clardy, Wiggins, Pollard) are aligned approximately north-south along the Pecos River. Yet the largest tritium pulse in all of these wells occurs at about the same time (within about 6 months), thus apparently contradicting the concept of a sequential progression of these pulses from the Recharge Belt eastward across the basin. In order to meet this difficulty, the hydrologic model assumed that (a) recharge to the basin wells came mainly from the high-velocity zone east of Woods Well; (b) recharge to Woods well came from the low-velocity zone to the west. According to this view, the synchronicity of tritium peaks between Woods well and the remaining wells is fortuitous. The synchronicity of pulses in wells along the western flank of the basin (Patterson), or along its center line (Allison [WP5]) with those along the Pecos river (Elk [WP1], Clardy [WP4], Wiggins [WP8], Pollard [WP12]) was explained by supply from different portions of the intake area and, consequently, different flow directions and distances.

The approach followed in the Hydrologic Model was to establish a detailed correlation between individual tritium peaks in recharge with those in well samples, as a function of time.

In the present report we suggest an alternative approach that may possibly prove of some usefulness in light of the objections raised against the hydrologic model. Considering the long-record wells (Fig. 5), the over-all similarity of all seven curves is obvious. This is particularly striking if, instead of looking at individual peaks, one considers the general trend. What appears

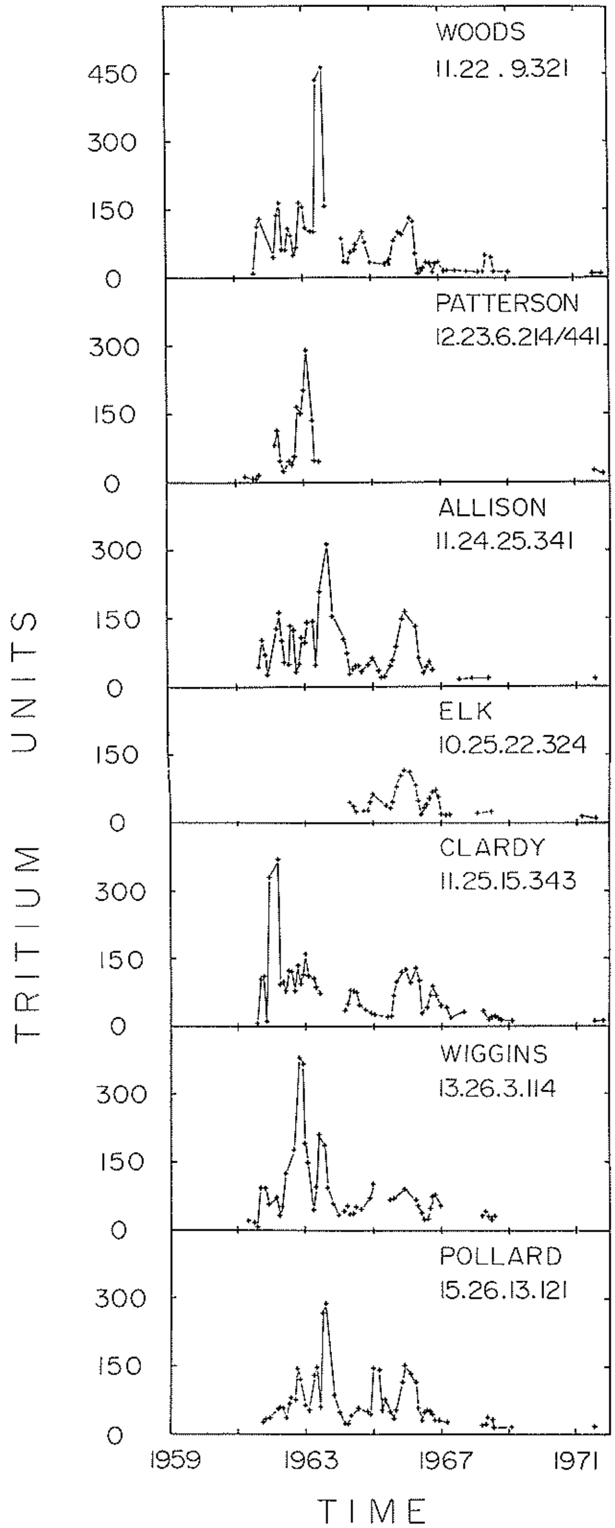

Fig. 5.

Tritium concentration vs. time profiles for Long-Record wells 1959 to 1971. (from Rabinowitz et al., 1976b).

then is a roughly monotonic build-up to a maximum in 1962/63, and a subsequent steep decline (with a minor hump in 1965) to the present. This general trend roughly parallels the over-all build-up of tritium in the atmosphere (Fig. 6a) apparently without time lag.

Interaquifer leakage

An orderly synchronous progression of groundwater recharge pulses down-gradient across the basin was deduced from about 60 wells distributed over the northern part of the basin and sampled repeatedly over a period of 3 years (1959-1961). Their tritium concentrations were contoured into a sequence of highs and lows oriented in a general north-south direction and seen to migrate with time eastward across the basin. From this it was argued that inter-aquifer leakage between Alluvium and Principal aquifer in the northern (Roswell) part of the basin is negligible, since a much more random pattern of tritium highs and lows should be expected in this case. The number of sampling points in relation to the basin area was, however, insufficient to establish a conclusive contour pattern.

Tritium pulses in the southern part of the basin.

From earlier geological and hydrological studies (e.g. Hantush, 1957) it was known that the transmissivity between Artesia and Hagerman is much lower than further north, around Roswell. Thus, when no large tritium pulses were observed in the south, in

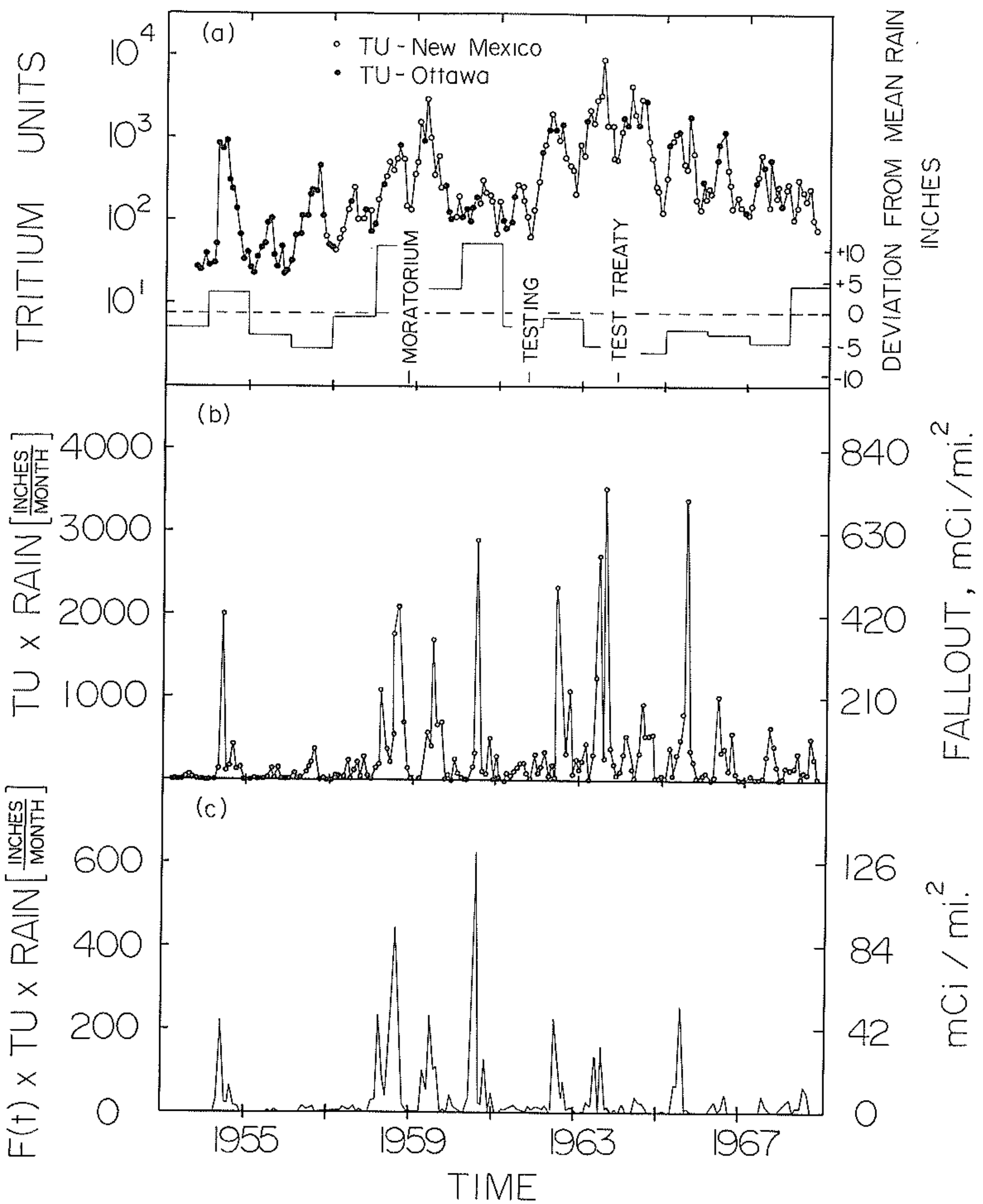

Fig. 6. Results of previous work (Rabinowitz et al., 1976a).
(a) Tritium concentration in the atmosphere.
(b) Tritium fallout in the Roswell basin.
(c) Tritium input function, Roswell basin.

remarkable contrast with the north, this was seen as evidence for a much larger travel time ($\geq$8 ys. vs. 4 ys.). High tritium values have never been observed in the Principal aquifer around Artesia. The model prediction has not been substantiated.

The reason may lie in an insufficient sampling density and frequency in the Artesia area during the critical time period. It may, however, be related to the smaller leakance of the Artesia Group in this area compared to the northern portion (Hantush, 1957).

Recharge mechanism

As mentioned above, only very few tritium measurements of groundwater from the Recharge Belt were made between 1956 and 1974. Since that time, sampling emphasis has been shifted to the Recharge Belt.

A rough calculation of expected tritium levels according to the Hydrologic Model can be made as follows: The annual mean precipitation over the basin in 1974 was 20" (see Appendix C). A representative tritium content for precipitation at that time is conservatively estimated at 100 TU. According to the model we assign (Rabinowitz et al., 1976a, c).

Effective recharge: 4.5"

Effective porosity: 1%

Effective aquifer thickness: 200 feet

Therefore, assuming "instantaneous" mixing of recharge, typical concentrations in water from the Recharge Belt in 1975 should be:

$$\frac{4.5'' \times 100\ \text{TU}}{200\ \text{ft} \times 0.01 \times 12''/\text{ft}} \cong 20\ \text{TU}$$

Actual concentrations would be higher if mixing was not instantaneous over the whole aquifer thickness, and smaller if the "effective thickness" (= aquifer thickness x porosity) was substantially higher.

As a rule, the concentration was found to be substantially lower than 20 TU. Exceptions are, as indicated earlier:

Observation Well #8 [08], located within the drainage of Rio Hondo;
Observation Well #7 [07], located within the drainage of Rio Penasco
Border Hill Windmill [M1], located on the Border Hill structure zone.

Thus, "instantaneous" recharge can and does occur as conceived by the model, but it does not seem to be uniform over the Recharge Belt.

High flow velocities, whether uniform or not, and rapid recharge appear to be supported by the quick recovery of drawdowns in the basin following copious summer rains. Hantush (1957, p. 81) calculated a typical recovery time of about 20 days for a drawdown of 63 feet. He carefully pointed out, however, that the major portion of such a recovery is due to well shutdown, not recharge effects. Moreover, the recovery here considered is that of head, or impulse, it does not represent actual mass flow in the aquifer. Saleem and Jacob (1971, pp. 117-121) have calculated the applicable impulse travel times for a distance of 6 miles as follows:

Alluvium aquifer: 2-4 years

Principal aquifer: 3 days

Recharge Belt (Roswell): 2-4 years

We suggest that recharge has both a rapid and a slow component and that mixing (dilution) of new recharge with "older" water is, on the average, significantly greater than assumed by the Model.

The slow component may owe its existence to a low rate of percolation of precipitation from the surface to the water table over a major portion of the Recharge Belt; or it may be the result of mixing of rapidly percolating surface water with older water. The older water may come from one or both of two sources: (1) slow migration of water in the Principal aquifer itself from parts of the Recharge Belt outside the "principal intake area"; (2) migration from deeper aquifers (either by upward leakage or by lateral migration from the west where these aquifers outcrop).

Bean (1949, pp. 20-25) distinguishes, within the Recharge Belt, areas of high and low intake capacity related to both lithology and structure (see above, section on Geohydrology).

Alternative Mechanisms for Recharge and Tritium Pulses

The difficulties with the Hydrologic Model, as they have been discussed above, became progressively apparent as this work was being completed and led to a search for alternative mechanisms of recharge and propagation of tritium peaks that may either supplement or replace the Model by providing a better fit to the data. Moreover, these mechanisms may act singly or in combination.

These alternatives will now be presented, together with the evidence to substantiate or reject them.

The Tritium Input Function

The Hydrologic Model was based on a tritium input function computed from the formula (Rabinowitz et al., 1976a)

$$C_n \times k \frac{P_i}{\bar{P}} P_n$$

where

C_n = tritium concentration in precipitation in the n^{th} time period during the i^{th} year

k = 0.1, a calibration constant

P_i = precipitation in the i^{th} year

P_n = precipitation during the n^{th} time period in the i^{th} year

$\bar{P}$ = mean annual precipitation

Tritium concentration was averaged for seasonal pulses, and precipitation from two rain gauges (Farnsworth Ranch and Dunlap) was used.

The resultant tritium input function is shown in Fig. 6c. Also shown is tritium concentration in precipitation (Fig. 6a). The latter builds up in successive years to three major peaks (1954, 1959, 1963). The minima between peaks are successively higher indicating a tritium build-up in the atmosphere. Thus, the peaks are superposed on a monotonic increase of atmospheric tritium to a maximum of near 10,000 TU in 1963 and a basically monotonic decrease from then to the present.

The tritium vs. time plots of the long-record wells studied for the hydrologic model (Rabinowitz et al., 1976b and Fig. 5 of the present report), also show one dominant peak in 1962/63. In the Hydrologic Model, this peak was correlated with the 1958-1960 tritium input function (Rabinowitz et al., 1976b).

For the present report, a new approximate tritium input function was computed from above formula but using (a) the basinwide annual precipitation as computed in Appendix C; (b) the average tritium concentration for each year, as measured at Socorro. The results are shown in Table I and Fig. 7. In contrast to the original tritium input function, this one shows a monotonic increase and decrease similar to the tritium concentration vs. time curves for precipitation and for long-record wells.

The above considerations have a bearing on the following discussion of alternative interpretations of recharge and tritium peaks.

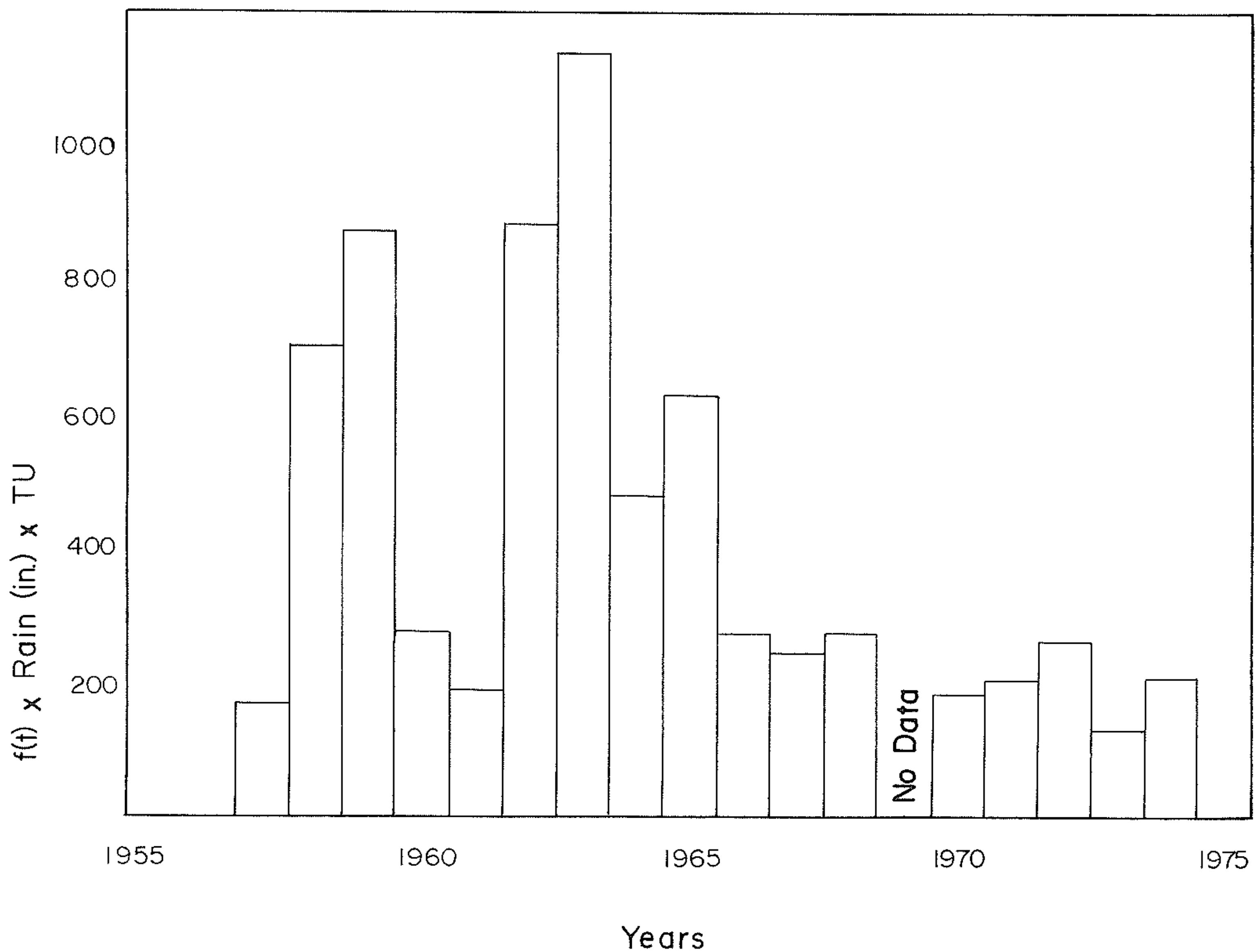

Fig. 7. The tritium input function recomputed for the present work (Numerical data are given in Table I, p. 31).

Alternative 1: Recharge is transported mainly through the drainage system.

If a major part of the recharge were introduced through the major stream channels, both as surface and subsurface flow, it could be injected into the deep aquifer further to the east. Recharge could be rapid, as postulated, but the groundwater flow velocity could be substantially lower. The correlation of tritium well peaks with peaks in precipitation and the progression of these peaks eastward through the basin would stand as developed in the Hydrologic Model. This is an important consideration for the following reason: If it is assumed that tritium peaks in wells along the Pecos river are the result of down-gradient migration within the Principal aquifer, then the correlation is unique and the time lag of 3½ to 4 years is confirmed by the best available evidence (Rabinowitz et al., 1976b). This is so because tritium observations in Principal aquifer wells began as early as 4 to 5 years after the first atmospheric nuclear explosion series so that the correlation has a rather precisely defined starting point.

The three major rivers in the groundwater basin, Hondo, Felix, and Penasco, have stream gauges and the runoff has been measured for over 30 years. The results are presented in Appendix D. Because on the Felix and Penasco the gauges are located near the outlet, it is difficult to evaluate the contribution of these streams to recharge. On the Hondo, however, there are several gauges (Fig. D1);

along with groundwater level data they indicate that the Hondo is a losing stream. It is possible that even those drainage channels which are usually dry could play an important role in concentrating and transmitting subsurface runoff (at velocities substantially greater than deduced from the average water table gradient) and therefore make a significant contribution to groundwater recharge. No quantitative estimate of this contribution can be made at this time.

Bean (1949, pp. 20-25) has estimated the recharge along the prominent drainage systems in the basin. The largest recharge occurs along the Hondo drainage below Picacho. He estimates that in a typical year the Hondo contributes about 19,000 acre-feet to basin recharge and the Penasco about 9,000 acre-feet. This compares to an average basinwide yearly recharge (period 1952-1972) variously estimated at 130,000 acre-feet (Rabinowitz and Gross, 1972, pp. 150 and 164) or at 240,000 acre-feet (Saleem and Jacob, 1971, p. 30). During the same period, the yearly basinwide pumpage was about 434,000 acre-feet (Saleem and Jacob, 1971, p. 45, and Water Master reports from N. M. State Engineer Office, Roswell).

Subsurface runoff is greatest west and north of Roswell because of the lithologic character of the San Andres in that area (gypsum and anhydrite) which is enhanced by intersection with structure zones. Figs. D2 and D3 indicate appreciable channel losses.

On the negative side, tritium measurements from the deep Patterson wells [WR5], located close to the Hondo drainage near the western edge of the Alluvium, show no evidence of very recent recharge from the Hondo. Tritium measurements from these wells are therefore in striking contrast with Observation Well 8 in the Recharge Belt, the location of which with respect to the drainage is quite similar. The difference is, of course, that Rio Hondo has ceased to flow 10-15 miles west of Patterson while it is perennial at Observation Well #8. Thus, subsurface flow along the Hondo drainage at this point (Patterson) appears to be minor. The 17-foot water level rise in 1941/42, mentioned earlier (see Results - Observation wells) may not be indicative of local injection of new recharge water.

Alternative 2: Recharge takes place over a much broader zone than postulated in the Model, including a substantial contribution from snowmelt in the Sacramento mountains and, on the average takes much longer than previously assumed.

A slow recharge component has not been considered in the Model. Infiltration of snowmelt and summer rain from the Sacramento mountains could be a recharge source that has not been considered, except for the surface runoff provided to the major drainage channels discussed under Alternative 1.

Consequences of this mechanism for the Hydrologic Model would be far reaching:

(1) A substantial part of recharge would come from winter and not summer precipitation.

(2) This portion of the recharge would occur much more slowly than the recharge component postulated in the Model. This would account for the "dilution" of recent recharge as suggested by the tritium results.

If winter precipitation provides a substantial part of the recharge, a plausible mechanism is as follows: Snowmelt enters the system at the westernmost edge of the Recharge Belt (or 30-50 miles west of the string of observation wells), perhaps through an aquifer deeper than the San Andres.

Data on snowpack and snowmelt are not available for the Sacramento mountains.

Runoff through the Rio Ruidoso in its upper reach (Hollywood gauge, see Table D2) was taken as a measure of annual snowmelt. A correlation of these data with observation well levels gave an essentially negative result. However, it could still be possible that a large runoff component, produced by seasonal snowmelt, is absorbed into the groundwater system in the headwaters reaches. A comparison of runoff through the Ruidoso between gauges at Hollywood and Hondo, during the years when both gauges operated simultaneously (Table D3) or through the Hondo between Picacho and Diamond-A Ranch (Table D4) indicates that some runoff from snowmelt disappears in the upper channel reach. Thus, Bean's estimate of recharge through the Hondo below Picacho probably takes into account a major part, but not all, of recharge taking place in the channel system formed by the Ruidoso, Bonito, and Hondo.

A further approach, to be tried in the next phase of this work, consists in determining the source of water in the Recharge Belt by O^{18}/O^{16} isotope ratios. These should differ depending on the origin of the water (summer thunderstorms vs. snowmelt).

Either Alternative 1 or 2 could lead to the conjecture that the aquifer tapped by the observation wells and windmills in the Recharge Belt is not directly connected to the Principal aquifer but is perhaps a separate sub-system hemmed in between the structure zones. These structure zones are supposed strongly to localize recharge. Since they trend southwest-northeast, this sub-aquifer may therefore actually discharge in the same direction and, if so, can not be the main supply to the Principal aquifer to the east.

Alternative 3: The Principal Intake Area or Recharge Belt is as postulated (a strip 6-12 miles wide along the western edge of the Alluvium) but two recharge components, one rapid, one slow, occur and complicate the picture.

Rapid recharge occurs in zones or areas of tectonic fracturing, areas of intense solution features, and along the prominent drainage lines (Macho, Hondo, Felix, Penasco).

Slow recharge occurs in the intervening portions of the

Recharge Belt.

The likely consequences of this mechanism would be as follows:

The over-all recharge to the basin consists of a mixture of the two components. As a result, large tritium fluctuations in recharge tend to be damped out. For the years of very high tritium content in the atmosphere this would mean that the effective tritium content in recharge was much lower than computed by assuming that the Tritium Input Function is uniform throughout the Recharge Belt. This, in turn, would lead to lower values of the dispersivity (Rabinowitz et al., 1976c).

Alternative 4: Prominent tritium peaks in wells tapping the Principal aquifer are, in part or mainly, due to leakage from the Alluvium aquifer or from direct infiltration.

According to this view, the 1962/1963 tritium peak of the long-record wells (Fig. 5) does not correspond to any specific tritium concentration peak in precipitation; rather, the well peak reflects the progressive build-up of tritium in recharge (especially of the Alluvium aquifer) in the preceding years, combined with the progressive lowering of heads in the Principal aquifer due to intensified withdrawal during a series of years of below-average precipitation. In fact, withdrawal by pumping reached a peak in 1964 and then declined, especially after water pumpage began to be metered in 1967 (Fig. 8).

Alternative 4 would explain the absence of peaks in the

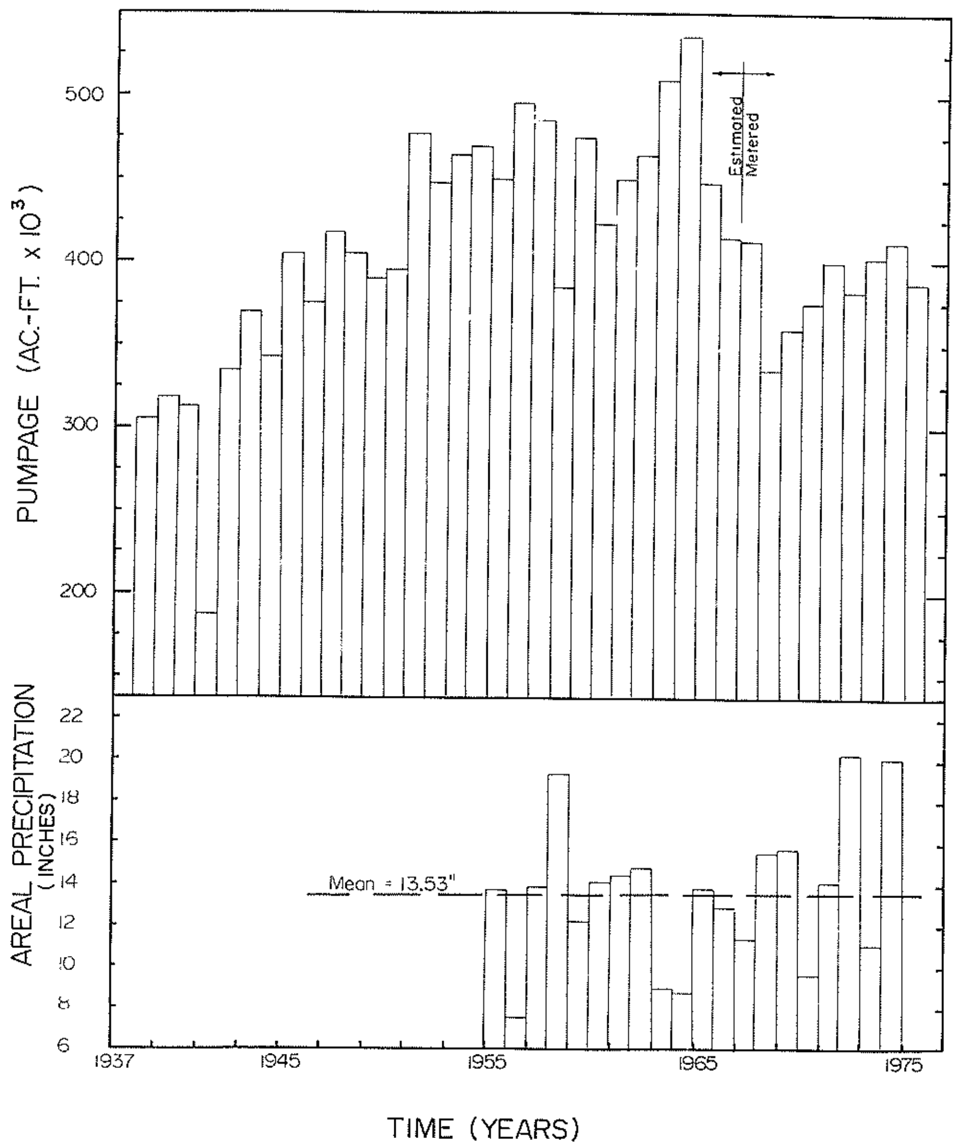

Fig. 8.

Annual pumpage and areal precipitation.
Pumpage was taken from Saleem and Jacob (1971) and Water Master records. Precipitation from Appendix C.
The highest peak in pumpage (1963-1965) corresponds to an extended low in precipitation. This is also the approximate time of the highest tritium peak in Long-Record wells (cf. Fig. 5).

southern portion of the study area (where leakage between the Alluvium and the Principal aquifer is much smaller than in the north.

In spite of the high values of computed dispersivity and velocity, the peaks do not appear to get appreciably flatter and broader in their (assumed) progression from the recharge area and across the basin. This was interpreted as the result of "slug flow" (Rabinowitz et al., 1976c). If, however, these peaks are the result of vertical rather than horizontal migration, this would be expected without special assumptions about flow characteristics.

A similar argument is made for the parallelism in the tritium vs. time curves of the seven long-record wells among themselves and with atmospheric concentration trends.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Tritium measurements on precipitation, surface, and groundwater from the Recharge Belt suggest that recharge consists of both a slow and a fast component and that the slow component may be more important than previously assumed.

In the Hydrologic Model which was the starting point for this investigation, the Recharge Belt was arbitrarily limited to areas of high transmissivity due to tectonic fracturing and development of solution features. This was in line with the concept of predominantly rapid recharge. This concept requires further examination by methods other than tritium determinations. Approaches presently contemplated include Oxygen-18 to Oxygen-16 isotope ratio determinations, modelling of recharge, and correlation between precipitation and observation well records. Specifically, the roles of winter snows and of (surface and subsurface) drainage channels requires, and is being subjected to, close scrutiny.

The synchronicity of tritium peaks throughout the basin, their failure to broaden appreciably downgradient, and their apparent absence in the Artesia area all point to interaquifer leakage as an important factor in explaining the distribution of environmental tritium in both space and time.

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Appendix A

LISTING OF TRITIUM MEASUREMENTS

Notes to Appendix A

This listing continues and supplements that given by Rabinowitz and Gross (1972).

Units of tritium measurements.

Tritium measurements are reported in Tritium Units (TU).

$$1 \text{ TU} = 1 \text{ tritium atom per } 10^{18} \text{ hydrogen atoms}$$
$$= 7.2 \times 10^{-3} \text{ dpm/ml}$$
$$= 3.24 \times 10^{-15} \text{ Ci/ml}$$

Coordinate system.

The coordinate system used for reporting the location of sampling points is the standard Land Survey coordinate system illustrated in Fig. A1.

Most irrigation wells have this coordinate location affixed to the water meter, in addition to the well permit number. This number (preceded by the letters RA) is also given in the listing if it was available.

Listing categories and symbols.

Sampling points are shown in the map of Fig. A2. Each sampling point is labeled with a letter symbol designating its category, and with a number. The categories and symbols used in this report are as follows:

Listing category	Symbol
Precipitation	None
Socorro (incl. Condensed Water)	
Langmuir Lab	
Elk (Charles Mulcock)	

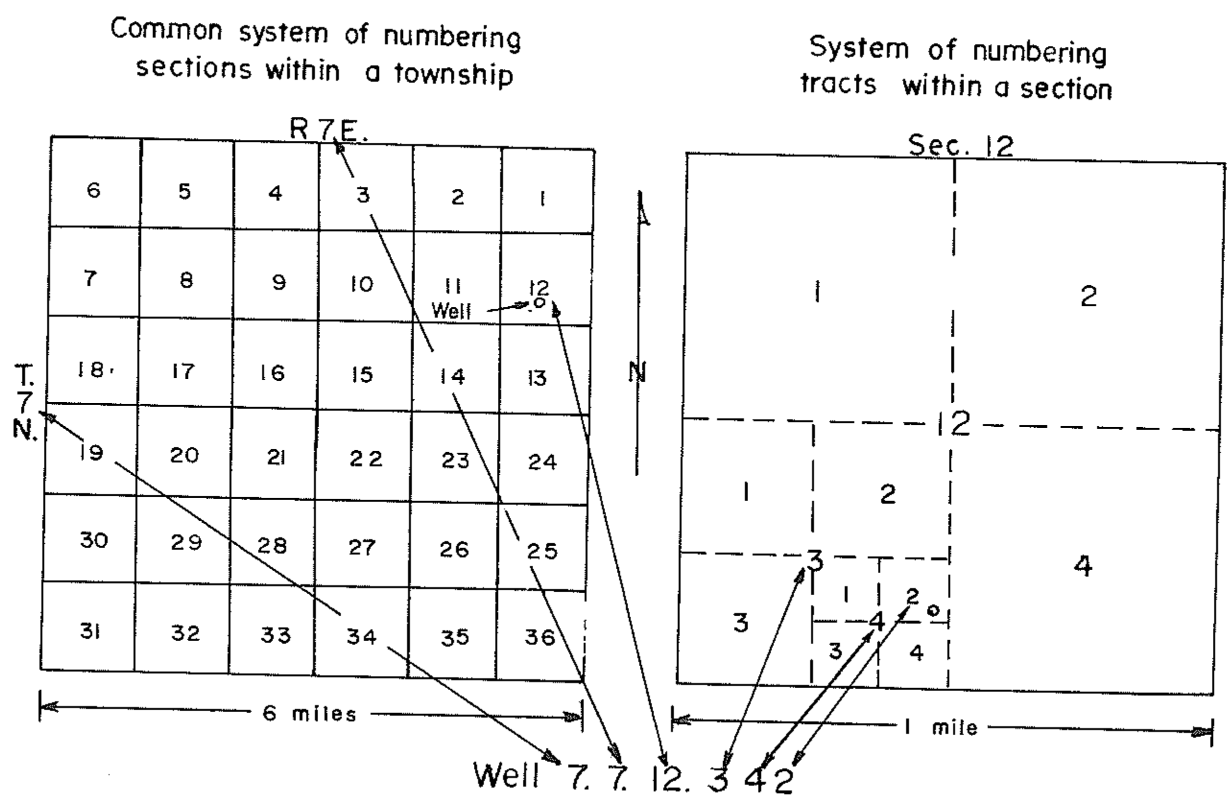

Fig. A1.

Coordinate system for locating wells.

Listing category	Symbol
Precipitation con't. Roswell airport Fort Stanton	None
Surface Water	S
Springs	F
Observation Wells	O
Windmills (located mostly in the Recharge Belt but includes a few in the Discharge Belt)	M
Wells in the Recharge Area (includes irrigation wells, house wells, Hope municipal supply)	WR
Wells Producing from the Alluvium Aquifer	WA
Wells Producing from the Principal Aquifer	WP
Wells Producing from the Alluvium and Principal Aquifers	WAP

Geological well correlation.

With the continued study of the hydrology of the Roswell Basin, the need for a better understanding of the structure, stratigraphy, and geological history of the area has become more pressing. The lithologies of the domestic, stock, and irrigation wells sampled for tritium are of particular interest. Without some knowledge of the construction of the wells (depth, casing, perforation) and the lithologies encountered in the well bore, the interpretation of the tritium measurements in relation to the Alluvium and Principal aquifers is difficult, and the validity of the suggested alternatives to the Hydrologic Model cannot be ascertained.

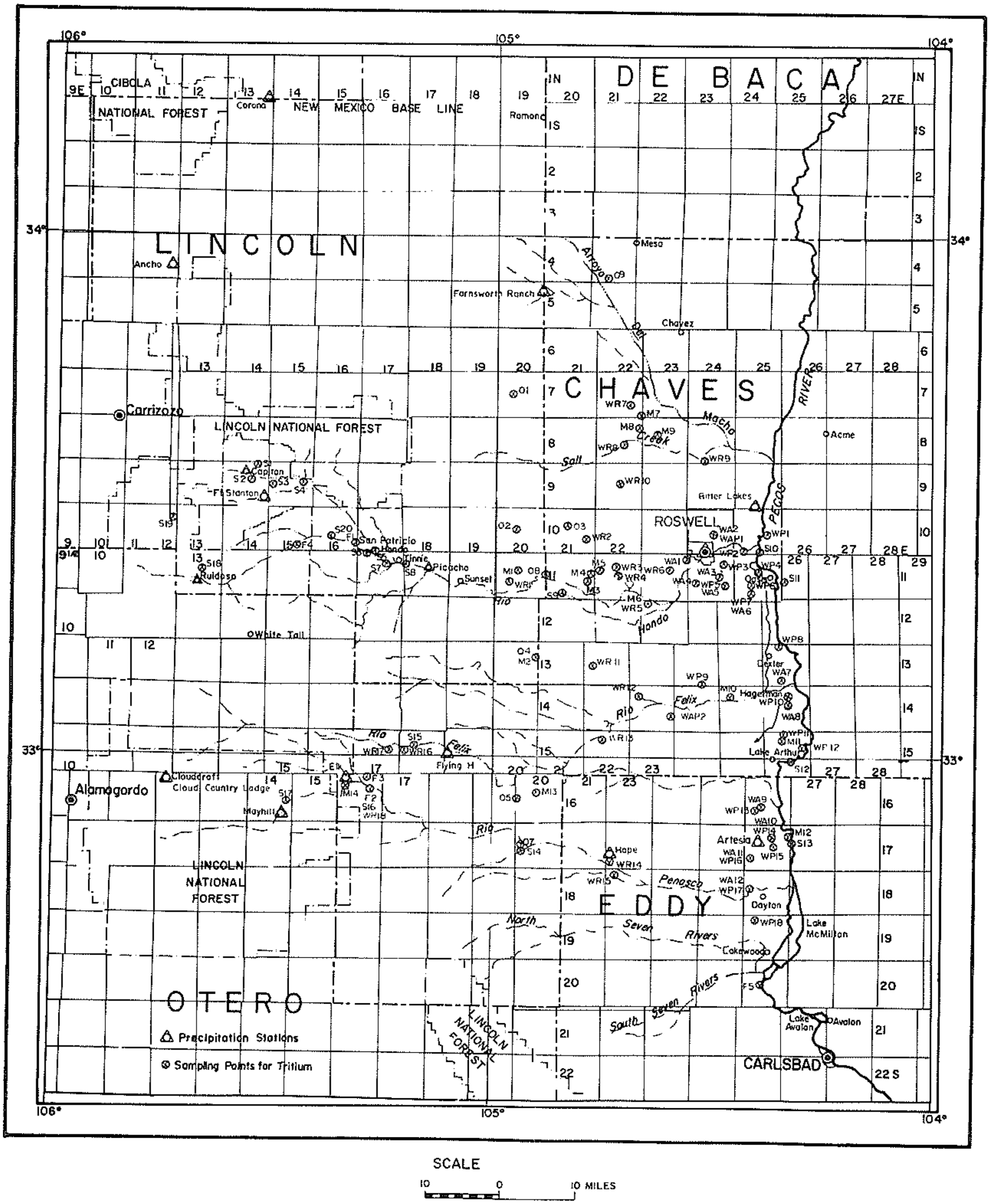

Fig. A2.

Sampling points and precipitation measuring stations.

For this report, an effort to collect the necessary data for the wells sampled was started. When possible, the well constructions were taken directly from the drilling reports required by the State Engineer's Office, and the lithologies were interpreted from the drillers' logs which must accompany these reports. If these reports were not available, data for some of the wells were acquired by communication with the person in charge of the well. The above procedures do not apply to the Observation Wells, for which data were obtained from a paper by Crawford and Burton (1958).

A simplified stratigraphic column and cross-section for the area of the study are given in Figs. A3 and A4. From the logs the best actual examples of the full section seem to be found in Artesia. In the determination of the well lithologies, no divisions were made beyond the formations and groups (underlined in Fig. A3) due to lack of information obtainable from the simplified drillers' logs. While these logs are descriptive, they are often ambiguous in regard to geologic meaning, e.g. "hard rock," an entry sometimes referring to the carbonate facies of the San Andres formation and sometimes referring to some rock which wore the drill bit rapidly. An example of the difficulties encountered in interpretation is the Lovington sandstone. This unit in the upper part of the San Andres formation is a well defined marker bed in the area of Artesia (Kinney et al., 1968). It is lithologically well described, but it could not be picked out with any certainty from

AGE	GROUPS, FORMATIONS, MEMBERS	DESCRIPTION
Holocene and Pleistocene	Alluvium	0-300 ft. thick Caliche, gravels, sands some clays.
Pleistocene and Pliocene	Gatuna formation	0-250 ft. thick Sands, clays, gravels, red color, thin layers of carbonates.
Permian	Artesia group Tansill formation Yates formation Seven Rivers formation Queen formation Grayburg formation	0-400 ft. thick Upper portion: Clays, sands, evaporites. Lower Portion: Clays, sands, carbonates. The Queen formation is usually considered to form the aquitard.
	San Andres formation Fourmile Draw member Bonney Canyon member Rio Bonito member	200-? ft. thick Upper portion: Evaporites, sands (Lovington sandstone), carbonates. Lower portion: Carbonates, sands (Glorieta sandstone), shales.
	Yeso formation	

Precambrian

Fig. A3

Simplified Stratigraphic Column for the Roswell Basin the logs used. The most difficult boundaries to define were those between Alluvium, Gatuna formation, and Artesia group, probably due to lithologic similarities between these formations. The boundary between the Artesia group and the San Andres formation was relatively easy to distinguish, except where the Four Mile Draw member of the San Andres formation is present in a well, since it is a predominantly evaporitic facies which resembles the Artesia group. If no boundary distinctions were possible, the formations thought to be present were simply listed without indicating specific intervals (see Map #WP8 in the listing). In a few cases, no characteristics of any formations could be established, in which case the lithologic descriptions were given as recorded in the driller's log (see Map #WP11 in the listing). The thickness and hydrologic behavior of the various formations is dependent upon the geologic structure and history of the particular location and in some cases also on marked facies changes within a formation. These points will be discussed below.

The Alluvium was essentially considered as the poorly defined lithologic mixture encountered within the first one or two hundred feet of the well bore. Based on the drillers' logs, caliche, gravel, sand, and some clay are the major components. No widespread sequence of the different layers of components or their relative thicknesses, e.g. thin gravel always overlain by thick sand, was observed in the Alluvium. In fact, no attempt was made

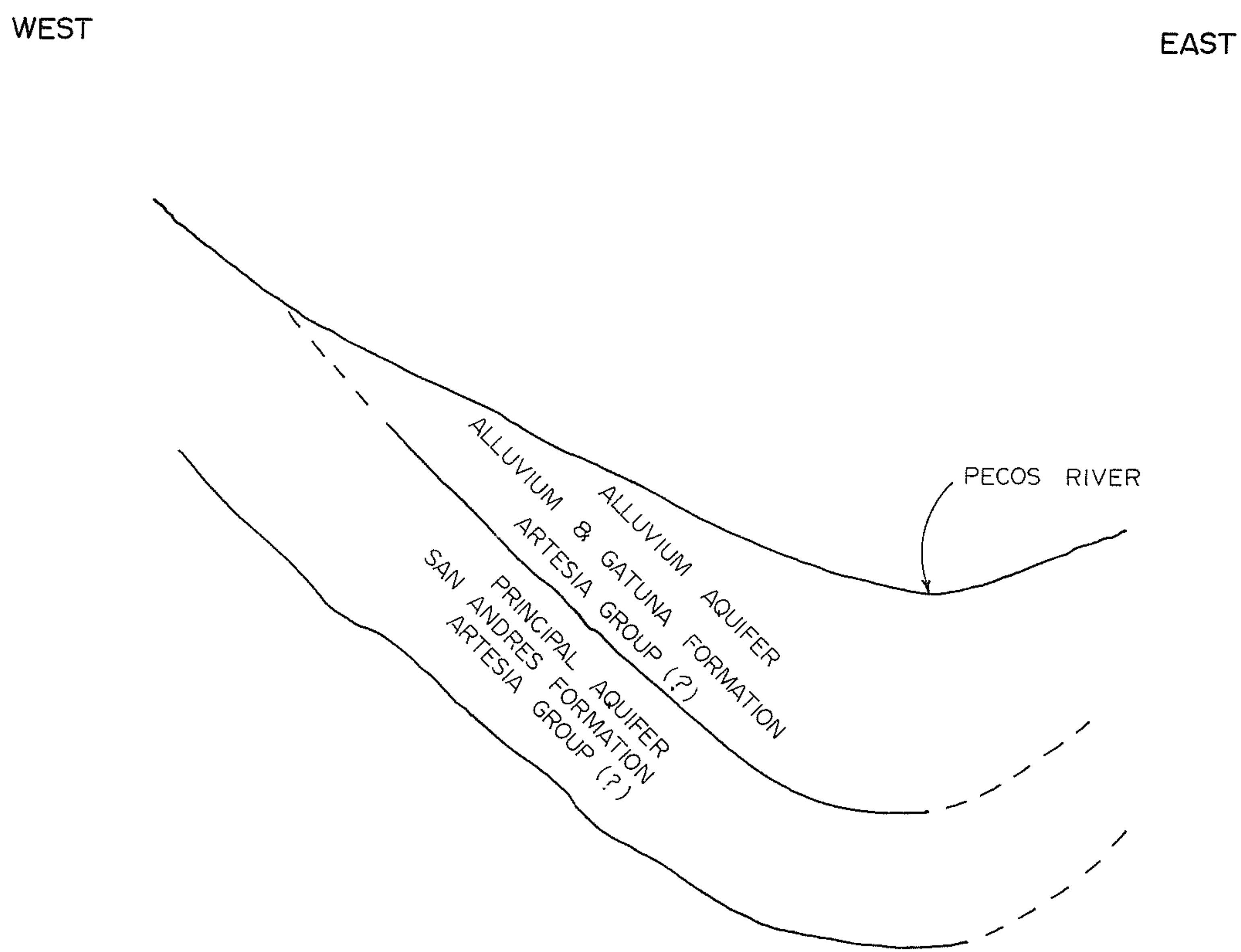

Fig. A4.

Simplified hydrologic cross section of the Roswell basin.

to give a quantitative measure to the relative thicknesses of the various components within any formation or group due to lack of data and because of facies changes. The upper boundary of the Gatuna formation was considered to be the depth at which the same components as in the Alluvium were encountered, but in a somewhat more orderly sequence of finer-grained material which was often red in color. In addition to the sands, clays, and gravels of the Gatuna formation, there were occasional evaporites and a thin ($\leq$20 ft) layer of "rock," interpreted as carbonate material, or "lime-rock" frequently occurring in the lower part of the formation. Just to the south-southeast of Roswell, the lower boundary of the Gatuna formation was considered to be a second thin layer of "rock." In certain other areas, the first occurrence of gypsum or anhydrite ("gyp rock") or gumbo (a term, usually referring to a clayey substance, often used in the section of the log interpreted as Artesia group) was considered as the lower boundary of the Gatuna formation. The Artesia group was considered to include predominantly clays, sands, and evaporites in the upper two-thirds of a complete section, and sands, clays, and carbonates in the lower one-third of a section. The boundary between the Artesia group and the San Andres formation was drawn at the top of a carbonate layer underlain by one or two relatively thin layers of shales, sands, and possibly carbonates or evaporites, and then major thicknesses of carbonates. If the shale and sand layers appeared to be missing, the boundary was drawn at the top of the first major thickness of carbonate material.

The most predominant differences in facies and thicknesses, due to the geologic history and structure of a particular area, which also seem to have an effect upon the hydrologic character of the basin are listed below. Fig. A5 shows the general location of these areas.

1) To the west and northwest of Roswell, the Alluvium and Gatuna formation are not as thick as might be expected from the thicknesses near Artesia and the relative locations of the wells. In some areas, the rocks overlying the San Andres formation do not seem to fit either the Alluvium or the Gatuna formations but are rather nondescript. The Artesia group, at least the lower section, seems to be missing, as well as the upper part of the San Andres formation. This is evidenced by the lack of terms, such as gumbo, in the driller's logs which have been interpreted as referring to the lithology of the Artesia group, the lack of any thin shales or sands in the upper part of the San Andres formation, and the occurrence, within the first two hundred feet, of massive carbonates and "black lime," a term often used by drillers to describe the dark-colored carbonates occurring in the lower sections of the San Andres formation (Havenor, 1968). This contrasts with the generalized cross-section which shows the Artesia group as present on the western edges of the basin and would support the idea that the San

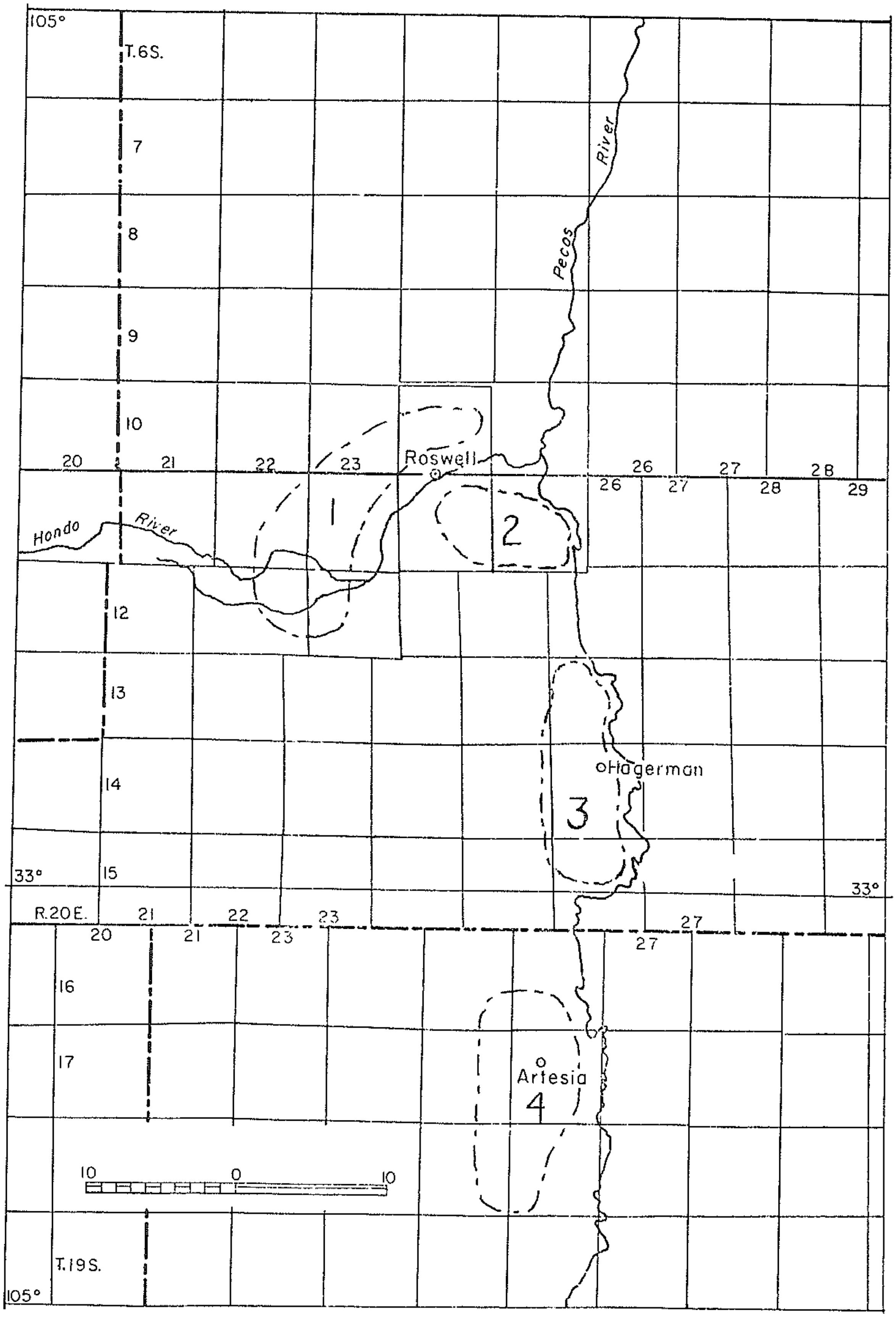

Fig. A5. Geologic sub-regions.

Andres formation and the Artesia group have been eroded from the Roswell structural block.

Judging from the tritium measurements and the interpreted well lithologies, the Hydrologic Model is affected in this area by the following conditions: (a) The boundary between the Recharge Area and the Discharge Belt is difficult to define. At present, a transition zone seems more plausible than a line boundary. The logs of the Patterson Wells (see Map #WR5 in the listing) provide excellent examples of the difficulties in interpreting well lithologies in this area. (b) The Principal aquifer to the west and northwest of Roswell behaves as a confined aquifer in some areas and as a semiconfined or even unconfined aquifer in other areas. This varying behavior is supported in that in some of the wells within the Basin, although they were drilled into the Principal aquifer, the tritium measurements correspond more closely to the Alluvium aquifer, indicating semi-confined conditions (see Map #WAP1 in the listing). Another possible explanation for this behavior is leakage around the casing. In other wells, the water levels rose far above the producing horizons implying confined conditions (see Map #WA3 in the listing). (c) The erosional features of the San Andres formation influence the flow of recharging water into this area.

2) Just to the south-southeast of Roswell, the four major geologic units are present, however, the lower portions of the

Artesia group and the upper portions of the San Andres formation do not seem to be as well developed as in the full section. Compared to the average thicknesses of the four geologic units over the basin, the thicknesses in this area seem thin. The upper boundary of the San Andres formation is encountered within the first three to four hundred feet of the well. As one moves south, the depth of this boundary increases to approximately six hundred feet. The major effect of the geology of this area on the Hydrologic Model is to support the theory of leakage between the aquifers. Many of the wells in this area have flowed at one time, indicating confined conditions; however, if the geologic section is less developed than in the full section as the well lithologies seem to indicate, the confining layer is more of a semi-confining boundary.

3) In the area of Hagerman and Dexter, the depth to the upper boundary of the San Andres formation is dramatically deeper than anywhere else in the basin, approaching eight hundred to one thousand feet. The full geologic section appears to be present, with the exception of the well at Map #WP11. In all of the wells in this area, there is an increased quantity of gypsum and anhydrite in the Gatuna formation and Artesia group compared to the average. It is not known whether this represents facies changes within the geologic units or some other localized cause such as solution and precipitation. The effect upon the Hydrologic Model

appears mainly to be that of much more confined conditions than found farther north.

4) In the area of Artesia, the full geologic section is again present. It also seems that the stratigraphy over the area is much more orderly than in either Roswell, where the thicknesses were variable or parts of the section were missing, or at Hagerman and Dexter, where suspected facies changes altered the characteristics of the neighboring well lithologies. The depths to the various units is closer to an expected value compared to the shallow depths in Roswell and the dramatic deepening around Hagerman and Dexter. The geology and hydrology of the Artesia area is probably the closest to the idealized picture of the basin.

From the four above considerations and from other notes made during the interpretation and correlation of these well logs, several suggestions have been made. It is apparent that a more detailed geologic record during the drilling of new water wells would be very helpful and possibly lead to more quantitative results. An analysis of well records from oil and gas exploration wells in the area would probably be most helpful in increasing our understanding of the aquifers. More interpretations of the data available, subjective though these interpretations are, could possibly help arrive at solutions to the problems such as defining the boundary between the Recharge Area and the Discharge Belt, delineating facies changes, and so forth. It was noted during interpretations that a relatively thin layer of blue clay exists in almost every well throughout the basin, particularly around Roswell. Unfortunately this layer could not be correlated directly with either the Gatuna formation or the Artesia group although it usually occurred within this interval. It is not known whether this clay is even an extensive feature or just patchy areas, but it did seem to stand out in the drillers' logs and might be a useful marker bed.

The interpretation of the well lithologies might also be helpful in verifying some of the theories related to the structural zones and blocks of this basin. The structural studies by Havenor (1968) and Kinney et. al. (1968) as well as the study of stratigraphy by Kelley (1971), in which the Gatuna formation is given greater emphasis than previously, are substantiated by the interpretations made for this report.

In all cases, it is apparent that the more detailed study of the subsurface geology of the domestic, stock, and irrigation wells is absolutely necessary for the interpretation of the Hydrologic Model for this part of New Mexico and that a potential source of information exists in these drillers' logs.

Listing of Tritium Measurements

PRECIPITATION

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PRECIPITATION: WORKMAN CENTER ROOF
NEW MEXICO TECH CAMPUS
SOCORRO, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
11/15/71	215.5	1429	RAIN COLLECTED FROM 1300 TO 2400 HRS.
05/30/72	187.0	1454C	RAIN(GENERAL FRONT) COLLECTED ALL DAY
05/30/72	66.3	1428	RAIN COLLECTED ONLY FROM 1030 TO 1130
07/72	135.2	1455C	RAIN COMPOSITE FOR JULY 1972
07/20/72	96.2	1433	RAIN COLLECTED APPROXIMATELY 2200 HRS.
08/72	102.7	1456C	RAIN COMPOSITE FOR AUGUST 1972
08/06/72	99.7	1435	THUNDERSHOWER COLLECTED 1800-1830
08/08-09/72	114.3	1437	RAIN
08/26-27/72	89.2	1440	RAIN LESS THAN 2 INCHES
09/06-13/72	81.2	1457C	RAIN COMPOSITE
09/06-13/72	80.7	1441	RAIN COMPOSITE
10/72	137.6	1458C	RAIN COMPOSITE FOR OCTOBER 1972
05/31/73	87.6	1493	RAIN
06/14/73	123.6	1494	RAIN
07/10/73	97.5	1495	RAIN
07/10/73 & 07/17/73	161.1	1497C	RAIN COMPOSITE TOTAL: 1.61 INCHES
09/10-11/73 & 09/18/73	127.1	1525	RAIN COMPOSITE TOTAL: 0.71 INCHES
01/09/74	39.4	1852	RAIN TRACE
01/17/74	79.4	1853	RAIN TRACE
02/06-07/74	157.7	1854	SNOW TRACE
04/30/74	155.3	1855	RAIN 1.15 INCHES
05/06/74	139.7	1856	RAIN 0.05 INCHES
05/20/74	195.9	1857	RAIN TRACE
07/6-7,12-14,19,27-29/74	50.0	1730	RAIN COMPOSITE TOTAL: 1.00 INCHES
07/09-10/74	58.3	1850	RAIN TRACE
07/14-15/74	17.3	1851	RAIN TRACE
08/03-26/74	81.1	1731	RAIN COMPOSITE TOTAL: 2.97 INCHES
09/13-14/74	85.9	1732	RAIN 0.66 INCHES
09/15-26/74	59.4	1733	RAIN COMPOSITE TOTAL: 2.28 INCHES
10/06-29/74	39.4	1734	RAIN COMPOSITE TOTAL: 3.22 INCHES

PRECIPITATION

PRECIPITATION (CONTINUED): WORKMAN CENTER ROOF
NEW MEXICO TECH CAMPUS
SOCORRO, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
12/08/74	85.2	1740	RAIN & SNOW 0.09 INCHES
12/25/74	43.9	1739	SNOW 0.45 INCHES
01/01/75	49.7	1741	SNOW TRACE
03/12/75	167.5	1860	RAIN 0.05 INCHES
05/22-29/75	188.7	1859	RAIN COMPOSITE TOTAL: 0.19 INCHES
06/07-09/75	93.3	1861	RAIN TRACE
07/05-23/75	93.0	1862	RAIN COMPOSITE TOTAL: 1.61 INCHES
07/16-18/75	87.4	1940	RAIN COMPOSITE TOTAL: 1.18 INCHES
08/09/75	204.2	1863	RAIN TRACE
08/12-24/75	42.7	1939	RAIN COMPOSITE TOTAL: 1.39 INCHES
08/25/75	122.2	1858	RAIN TRACE
08/28/75	32.1	1943	RAIN 0.81 INCHES
09/03-[illegible]/75	42.1	1941	RAIN COMPOSITE TOTAL: 3.24 INCHES
09/07-09/75	45.1	1944	RAIN 0.82 INCHES
09/10/75	47.4	1945	RAIN 0.215 INCHES
09/10-11/75	45.1	1946	RAIN & HAIL 0.35 INCHES
09/11-12/75	42.8	1947	RAIN 0.585 INCHES

PRECIPITATION

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CONDENSED H2O: 'M' MOUNTAIN STATION
SOCORRO, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/27/63	1615.7	1438	
07/04/63	1346.8	1481	TRACE PRECIPITATION
07/06/63	1118.8	1482	RELATIVE HUMIDITY 34%
07/07/63	2243.9	1483	RELATIVE HUMIDITY 34%
07/10/63	1334.2	1480	RELATIVE HUMIDITY 38-58%

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PRECIPITATION

PRECIPITATION: LANGMUIR LABORATORY
17 MILES WEST OF SOCORRO, N.M.
ELEVATION: 10,783 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/20-21/72	66.4	1445	SNOW MELT
07/06-31/74	68.0	1735	RAIN COMPOSITE TOTAL: 5.09 INCHES
08/01-27/74	43.5	1736	RAIN COMPOSITE TOTAL: 2.24 INCHES
12/08/74	63.1	1737	SNOW
07/05-29/75	70.7	1864	RAIN COMPOSITE TOTAL: 3.01 INCHES
07/12/75	103.1	1865	RAIN TRACE
07/13-27/75	99.4	1866	RAIN COMPOSITE TOTAL: 3.65 INCHES
08/08-28/75	65.1	1942	RAIN COMPOSITE TOTAL: 3.13 INCHES

PRECIPITATION

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PRECIPITATION: MULCOCK WEATHER STATION
EAST OF ELK, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS		
07/74	49.6	1727	RAIN	COMPOSITE	
08/74	49.2	1726	RAIN	COMPOSITE	
08/24-30/74	39.4	1729	RAIN	COMPOSITE	TOTAL: 4 TO 4.5 INS.
09/74	33.7	1728	RAIN	COMPOSITE	TOTAL: 10.03 INCHES
03/12/75 & 03/30/75	97.2	1932	RAIN	COMPOSITE	TOTAL: 0.54 INCHES
05/11-30/75	68.3	1933	RAIN	COMPOSITE	TOTAL: 0.39 INCHES
07/03-10/75	55.8	1934	RAIN	COMPOSITE	TOTAL: 1.11 INCHES
07/11/75	68.4	1935	RAIN	1.65 INCHES	
7/12-27/75 & 7/29-30/75	56.3	1936	RAIN	COMPOSITE	TOTAL: 1.90 INCHES

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PRECIPITATION

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PRECIPITATION: ROSWELL WEATHER BUREAU
ROSWELL, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/66	588.8	1447	RAIN
07/18-20/72	87.7	1431	RAIN COMPOSITE TOTAL: 4.97 INCHES
07/18-20/72	92.3	1451C	RAIN COMPOSITE FOR JULY 1972
07/20/72	74.1	1432	RAIN PARTIAL OF 4.27 INCHES
08/72	67.1	1452C	RAIN COMPOSITE FOR AUGUST 1972
08/06-07/72	71.8	1434	RAIN 0.62 INCHES
08/08/72	43.6	1436	RAIN COLLECTED FROM 1000 TO 1150 HRS.
08/08-09/72	48.6	1442	RAIN PARTIAL OF 0.88 INCHES
08/26/72	54.4	1443	RAIN PARTIAL OF 0.97 INCHES
09/72	36.3	1453C	RAIN COMPOSITE FOR SEPTEMBER 1972
09/06/72	56.1	1444	RAIN PARTIAL OF 0.97 INCHES
04/24-30/74	109.4	1725	RAIN COMPOSITE TOTAL: 0.50 INCHES
08/26/74 - 10/11/74	36.1	1724	RAIN COMPOSITE TOTAL: 4.11 INCHES
FALL TO WINTER 1974	22.6	1867	RAIN & SNOW COMPOSITE TRACES
04/10/75 - 06/23/75	63.1	1931	RAIN COMPOSITE TOTAL: 0.99 INCHES
07/04-27/75	57.3	1930	RAIN COMPOSITE TOTAL: 2.69 INCHES
08/02-26/75	29.5	1938	RAIN COMPOSITE TOTAL: 1.24 INCHES

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PRECIPITATION

PRECIPITATION: FT. STANTON, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	224.1	1496	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S1
DESCRIPTION LOCATION # 9.14.10.000 SALADO CREEK
BRIDGE ON US 380 AT EAST END OF CAPITAN, N.M.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/74	53.7	1620	
03/26/75	43.1	1816	
06/10/75	56.4	1867	
08/20/75	44.6	1912	

MAP # S2
DESCRIPTION LOCATION # 9.14.11.240 SALADO CREEK
ON US 380 AT INTERSECTION OF ROAD TO CAPITAN PASS, APPROXIMATELY 2 MILES EAST OF CAPITAN, N.M.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	39.4	1584	AIR T=21.4 C PH=8.3
03/26/75	56.5	1817	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S3
DESCRIPTION LOCATION # 9.15.18.400* RIO BONITO
AT BRIDGE ON NM 214 TO FORT STANTON, N.M. *GRID ACTUALLY NOT PRESENT SINCE ON
U.S. MARINE HOSPITAL RESERVE.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	68.0	1592	T=14.2 C PH=7.85
03/26/75	77.1	1818	
06/10/75	13.4	1888	
08/26/75	63.0	1913	
10/04/75	57.3	1981	

MAP # S4
DESCRIPTION LOCATION # 9.15.14.240 RIO BONITO
BACA CAMPGROUND TURNOFF ON FOREST ROAD 57 OFF NM 380, APPROXIMATELY 8 MILES EAST
OF CAPITAN, N.M.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/01/73	119.0	1479	
07/10/73	95.7	1585	
06/12/74	17.3	1643	
12/16/74	33.0	1748	
03/26/75	63.0	1819	
06/10/75	75.8	1886	
08/26/75	28.9	1914	
10/04/75	33.2	1982	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S5
DESCRIPTION LOCATION # 11.17.04.120 RIO BONITO
AT BRIDGE ON US 70 ABOVE CONFLUENCE WITH RIO RUIDOSO IN HONDO, N.M. THE RIVER AT THIS POINT IS OFTEN DRY EVEN THOUGH IT IS FLOWING FARTHER UPSTREAM. LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
08/26/74	31.8	1720	FLOW=20 GPM (ESTIMATE) T=20.3 C
12/16/74	27.4	1751	
03/26/75	49.2	1778	HIGH FLOW
06/10/75	46.3	1890	
08/26/75	7.9	1916	

MAP # S6
DESCRIPTION LOCATION # 11.17.05.000 RIO RUIDOSO
AT BRIDGE ON SMALL SIDE ROAD SOUTH OFF US 70, JUST WEST OF BRIDGE OVER RIO BONITO ON US 70. ABOVE CONFLUENCE WITH RIO BONITO IN HONDO, N.M. LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/27/73	43.1	1599	PH=8.00
03/24/74	50.9	1619	RIO BONITO DRY AT CONFLUENCE T=13.5 C
06/12/74	31.6	1644	RIO BONITO DRY AT CONFLUENCE
12/16/74	37.7	1750	
03/26/75	60.0	1821	HIGH FLOW
06/10/75	52.2	1891	
08/26/75	46.5	1915	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S7
DESCRIPTION LOCATION # 11.17.11.300 RIO HONDO
CROSSING ON NM 395, APPROXIMATELY 2 MILES EAST OF HONDO, N.M., SOUTH OF US 380.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/01/73	71.2	1464	

MAP # S8
DESCRIPTION LOCATION # 11.18.07.000 RIO HONDO
FIRST STOP WEST OF ROSWELL, N.M. ON US 380 ON MAY 1973 FIELD TRIP. THIS STOP
WAS THE KIMBRELL WELL (NOT USED FOR TRITIUM MEASUREMENTS) 2 MILES EAST OF
TINNIE, N.M., 300 FT. FROM THE RIVER.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/73	83.3	1597	PH=8.3

SURFACE WATER

MAP SYMBOL IS S#

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MAP # S9
DESCRIPTION LOCATION # 11.21.29.400 RIO HONDO
AT THE INTERSECTION OF US 380 AND THE ROAD TO P.V.A.C.L. OBSERVATION WELL #4,
APPROXIMATELY 24 MILES WEST OF ROSWELL, N.M. THE RIVER SELDOM FLOWS AT
THIS CROSSING.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
12/17/74	21.4	1756	

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MAP # S10
DESCRIPTION LOCATION # 10.25.34.334 PECOS RIVER
BRIDGE ON US 380, EAST OF ROSWELL, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	140.7	1600	PH=8.4
03/26/75	32.1	1786	
08/27/75	23.5	1925	

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SURFACE WATER

MAP SYMBOL IS S#

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MAP # S11
DESCRIPTION LOCATION # 11.26.27.000 BOTTOMLESS LAKES
APPROXIMATELY 6 MILES EAST OF ROSWELL, N.M. NORTH SIDE OF THE MAIN LAKE.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/06/71	110.8	1371	
07/06/71	126.2	1372	

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MAP # S12
DESCRIPTION LOCATION # 15.26.27.000 PECOS RIVER
EAST OF LAKE ARTHUR, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	130.1	1604	SHALLOW FLOW CLEAR WATER T=24.8 C PH=8.20

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MAP # S13
DESCRIPTION LOCATION # 17.27.08.200 PECOS RIVER
EAST OF ARTESIA, N.M. ON US 82.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	66.3	1632	T=13.1 C
12/18/74	32.5	1769	
03/28/75	32.0	1828	
08/27/75	39.9	1956	

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SURFACE WATER

MAP SYMBOL IS S#

MAP # S14
DESCRIPTION LOCATION # 17.20.18.434 RIO PENASCO
SOUTH OF P.V.A.C.D. OBSERVATION WELL #7. TURNOFF TO THE WELL IS APPROXIMATELY 11 MILES WEST OF HOPE, N.M., SOUTH OFF US 82.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
12/19/74	5.8	1772	
03/28/75	15.2	1827	
08/28/75	14.4	1964	FLASHFLOOD

MAP # S15
DESCRIPTION LOCATION # 15.18.16.000 RIO FELIX
SAMPLED AT DIFFERENT LOCATIONS ON THE RIO FELIX AS IT FLOWS THROUGH THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	2.7	1595	T=18.2 C PH=7.50
12/19/74	4.1	1773	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S16
DESCRIPTION LOCATION # 16.16.11.240 RIO PENASCO
APPROXIMATELY 3 MILES EAST OF ELK, N.M. CLOSE TO HWY MARKER 51 ON US 82, NEAR MULCOCK'S TRAILER.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS	
07/11/73	27.8	1594	T=18.6 C	PH=7.87
04/08/74	8.7	1622	T=14.2 C	
12/19/74	9.8	1787		
02/21/75	9.4	1804		
08/28/75	15.3	1970	FLASHFLOOD	

MAP # S17
DESCRIPTION LOCATION # 16.14.24.000 RIO PENASCO
APPROXIMATELY 2 MILES EAST OF MAYHILL,N.M. ON US 82.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS	
07/11/73	29.2	1593	T=14.1 C	PH=8.10

SURFACE WATER

MAP SYMBOL IS S#

MAP # S18

DESCRIPTION

LOCATION # 11.13.15.000 RIO RUIDOSO
0.3 MILES ON NM 37 FROM STOPLIGHT AT JUNCTION OF NM 37 AND ROAD PAST AIRSTRIP IN RUIDOSO, N.M. STOP #8 ON ROSWELL GEOLOGICAL SOCIETY FIELD TRIP ON OCTOBER 27, 1971.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/27/71	112.9	1403	

MAP # S19

DESCRIPTION

LOCATION # 10.12.00.000 RIO BONITO
ABOVE BONITO LAKE, APPROXIMATELY 8 MILES NORTH OF RUIDOSO, N.M. ON NM 48.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/10/75	76.9	1892	
12/18/75	45.3	1989	

SURFACE WATER

MAP SYMBOL IS S#

MAP # S19
DESCRIPTION LOCATION # 10.12.00.000 BONITO LAKE
AT BONITO DAM, APPROXIMATELY 8 MILES NORTH OF RUIDOSO, N.M. ON NM 48.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	115.7	1582	T=WARM

MAP # S19
DESCRIPTION LOCATION # 10.12.00.000 RIO BONITO
BELOW BONITO DAM, APPROXIMATELY 8 MILES NORTH OF RUIDOSO, N.M. ON NM 48.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	109.2	1583	T=13.0 C PH=7.3
06/10/75	82.3	1893	
12/18/75	64.1	1990	

SURFACE WATER

MAP SYMBOL LS S#

MAP # S2C
DESCRIPTION LOCATION # 10.16.21.000 RIO RUIDOSO
ABOUT 6 MILES ON US 70 ABOVE INTERSECTION OF RIO RUIDOSO AND RIO BONITO
IN HONDO, N.M.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	80.7	1587	T=WARM PH=8.00

SPRINGS

MAP SYMBOL IS F#

MAP # F1
DESCRIPTION LOCATION # 10.17.29.000 SPRING RANCH TROUT FARM
1.5 MILES NORTH OF JUNCTION OF US 70 AND US 380 ON US 380.
ADDRESS: P.O. BOX 44 HONDO, N.M. 2/76 TROUT FARM NOW OUT OF BUSINESS.
LOCATED IN THE 'RECHARGE AREA'

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/29/71	10.7	1406	
05/27/73	101.5	1603	PH=7.45
03/24/74	7.2	1577	
08/26/74	6.6	1721	T=17.9 C
12/16/74	5.7	1749	
02/22/75	0.0	1792	
03/26/75	11.8	1820	
06/10/75	78.9	1889	
08/26/75	28.9	1917	
10/04/75	9.1	1983	

SPRINGS

MAP SYMBOL IS F#

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MAP # F2

DESCRIPTION LOCATION # 16.16.11.400 PAUL SPRING
ON RIO PENASCO, SOUTH BANK OPPOSITE MULCOCK'S TRAILER. APPROXIMATELY 3 MILES
EAST OF ELK, N.M., CLOSE TO HWY MARKER 51 ON US 82. ISSUES FROM SAN ANDRES
LIMESTONE. USUALLY SAMPLED AT GARDEN HOSE AT TRAILER.
LOCATED IN THE 'RECHARGE AREA'

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	20.0	1498	FLOW=35 TO 45 GPM (ESTIMATE) T=15.6 C PH=7.7
04/08/74	10.1	1623	T=13.1 C
06/15/74	10.4	1683	
08/23/74	13.8	1688	T=15.2 C
12/19/74	1.7	1790	
02/21/75	1.5	1801	T=9.0 C
08/28/75	13.0	1971	

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SPRINGS

MAP SYMBOL IS F#

MAP # F3
DESCRIPTION LOCATION # 16.16.03.000 CLEVE'S SPRING
APPROXIMATELY 2 MILES EAST OF ELK, N.M., BETWEEN HWY MARKERS 49 AND 50 ON US 82.
ISSUES FROM SHALY HORIZON IN SAN ANDRES LIMESTONE, IN A GROVE OF TREES ON
HILLSIDE A FEW HUNDRED FEET NORTH OF ROADSIDE.
LOCATED IN THE 'RECHARGE AREA'

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	7.2	1579	T=15.5 C
06/15/74	6.1	1684	
08/23/74	1.3	1687	T=16.7 C
12/19/74	7.7	1788	
02/21/75	6.6	1796	
08/28/75	18.8	1972	
12/19/75	9.2	1992	

MAP # F4
DESCRIPTION LOCATION # 10.15.00.000 NOSKER SPRING
ON RIO RUIDOSO, APPROXIMATELY 11 MILES WEST OF HONDO, N.M. ON US 70.
LOCATED IN THE 'RECHARGE AREA'

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/10/73	8.2	1588	COLDER THAN RIVER PH=7.2

OBSERVATION WELLS

MAP SYMBOL IS O*

MAP # 01
DESCRIPTION

LOCATION # 7.20.16.333 P.V.A.C.D. OBSERVATION WELL # 1
APPROXIMATELY 17 MILES NORTH OF ROSWELL, N.M. ON US 285 AND 24 MILES WEST OF US 285 ON CORN RANCH ROAD.
DRILLER'S LOG: K.G. MILLER, AUGUST THROUGH OCTOBER 1955 T.D.: 750 FT.
CASING: 5 1/2 IN. TO 464 FT. AND FROM 475 TO 657 FT., PERFORATED FROM 530 FT. TO BOTTOM WATER: 450 TO 463 FT., 471 TO 473 FT., 480 TO 510 FT.
WATER DEPTH UPON COMPLETION: 450 FT. OPEN INTERVAL: 464 TO 475 FT. AND 530 FT. TO BOTTOM LITHOLOGY: 0 TO 515 FT., SAN ANDRES FORMATION (390 TO 515 FT., GLORIETA SANDSTONE); 515 FT. TO BOTTOM, YESO FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/10/74	3.5	1575	WATER LEVEL=459.59 FT. T=18.5 C
09/20/75	12.3	1974	WATER LEVEL=461.08 FT. SAMPLE BETWEEN 470 & 530 FT.

OBSERVATION WELLS

MAP SYMBOL IS O#

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MAP # 02
DESCRIPTION

LOCATION # 10.20.16.444 P.V.A.C.D. OBSERVATION WELL # 2
APPROXIMATELY 24 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 5 MILES
NORTH OF US 380 ON DIRT ROAD.
DRILLER'S LOG: K.G. MILLER, DECEMBER 1955 AND JANUARY 1956 T.D.: 503 FT.
CASING: 7 IN. TO 503 FT., PERFORATED FROM 435 TO 500 FT. WATER: 437 TO 462
FT., 464 TO 470 FT., 480 TO 500 FT. OPEN INTERVAL: 435 FT 500 FT.
LITHOLOGY: 0 TO 440 FT., SAN ANDRES FORMATION (325 TO 440 FT., GLORIETA
SANDSTONE); 440 FT. TO BOTTOM, YESO FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/22/74	40.8	1606	WATER LEVEL=424 FT.
06/12/74	3.4	1646	WATER LEVEL= 424.2 FT.
08/26/74	3.0	1719	WATER LEVEL=426.0 FT. T=18.6 C
12/17/74	1.3	1755	WATER LEVEL= 423.5 FT.
03/27/75	8.8	1823	
06/26/75	8.7	1919	WATER LEVEL=422.3 FT.

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OBSERVATION WELLS

MAP SYMBOL IS O#

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MAP # 03
DESCRIPTION LOCATION # 10.21.16.222 P.V.A.C.D. OBSERVATION WELL # 3
APPROXIMATELY 18 MILES WEST OF OF US 285 IN ROSWELL, N.M. ON US 380 AND 6 MILES NORTH OF US 380 ON DIRT ROAD.
DRILLER'S LOG: K.G. MILLER, JANUARY THROUGH MARCH 1956 T.D.: 672 FT.
CASING: 10 IN. TO 40 FT., 7 IN. TO 670 FT. (INSIDE 10 IN. CASING), PERFORATED FROM 585 TO 668 FT. WATER: 600 TO 610 FT., 640 TO 650 FT. OPEN INTERVAL: 585 TO 668 FT. LITHOLOGY: 0 TO 90 FT., LIMESTONE RUBBLE; 90 TO 630 FT., SAN ANDRES FORMATION (500 TO 630 FT., GLORIETA SANDSTONE); 630 FT. TO BOTTOM, YESO FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
12/16/74	0.6	1752	WATER LEVEL=581.75 FT. T=18.2 C
03/27/75	5.4	1625	
06/26/75	4.8	1920	WATER LEVEL=591.86 FT. SAMPLE TAKEN AT 650 FT.

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OBSERVATION WELLS

MAP SYMBOL IS O#

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MAP # 04
DESCRIPTION LOCATION # 13.20.13.222 P.V.A.C.D. OBSERVATION WELL # 4
APPROXIMATELY 18 MILES WEST OF OF US 285 IN ROSWELL, N.M. ON US 380 AND 18 MILES SOUTH OF US 380 ON DIRT ROAD.
DRILLER'S LOG: K.G. MILLER, NOVEMBER AND DECEMBER 1955 T.D.: 386.5 FT.
CASING: 7 IN. TO 386.5 FT., PERFORATED FROM 238 TO 386.5 FT. WATER: 263 TO 268 FT., 272 TO 290 FT., 350 TO 355 FT. OPEN INTERVAL: 238 TO 386.5 FT.
LITHOLOGY: 0 TO 20 FT., LIMESTONE RUBBLE; 20 TO 380 FT., SAN ANDRES FORMATION (243 TO 380 FT., GLORIETA SANDSTONE); 380 FT. TO BOTTOM, YESO FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/22/74	2.7	1581	WATER LEVEL=260.75 FT.
06/13/74	13.5	1655	WATER LEVEL=260.92 FT.
08/25/74	1.7	1713	WATER LEVEL=261.6 FT. T=19.2 C
12/17/74	0.0	1757	WATER LEVEL=258.82 FT. T=18.7 C
03/28/75	2.5	1826	WATER LEVEL=260 FT.
08/27/75	9.2	1928	

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OBSERVATION WELLS

MAP SYMBOL IS O#

MAP # 05
DESCRIPTION

LOCATION # 16.20.18.333 P.V.A.C.D. OBSERVATION WELL # 5 APPROXIMATELY 8 MILES WEST OF HOPE, N.M. ON NM 83, 4 MILES NORTH OF NM 83 ON NM 13, AND 3 MILES WEST OF NM 13 ON DIRT ROAD.
DRILLER'S LOG: K.G. MILLER, APRIL THROUGH JULY 1956 T.D.: 767 FT.
CASING: 6 5/8 IN. TO 610.5 FT., PERFORATED FROM 555.5 FT. TO 610.5 FT.
WATER: 600 TO 615 FT., 630 TO 634 FT., 694 TO 711 FT. OPEN INTERVAL: 555.5 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, SAN ANDRES FORMATION (675 FT. TO BOTTOM, GLORIETA SANDSTONE)
AFTER APRIL 1974, WELL BORE CAVED IN. WELL NOW EQUIPPED WITH WINDMILL AND USED FOR STOCK.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	3.1	1624	T=16.7 C

MAP # 07
DESCRIPTION

LOCATION # 17.20.18.434 P.V.A.C.D. OBSERVATION WELL # 7 APPROXIMATELY 8 MILES WEST OF HOPE, N.M. ON NM 83, AND 2 MILES SOUTH OF NM 83 ON DIRT ROAD.
DRILLER'S LOG: A.H. LEWIS, JANUARY AND FEBRUARY, 1957 T.D.: 801 FT.
CASING: 7 IN. TO 801 FT., PERFORATED FROM 680 TO 800 FT. WATER: 160 TO 164 FT., 680 TO 801 FT. OPEN INTERVAL: 680 TO 800 FT. LITHOLOGY: 0 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	12.9	1626	WATER LEVEL=460.19 FT. T=16.3 C
12/19/74	4.0	1771	WATER LEVEL < 460.9 FT. T=16.0 C

OBSERVATION WELLS

MAP SYMBOL IS O#

MAP # 08
DESCRIPTION LOCATION # 11.21.18.333 P.V.A.C.D. OBSERVATION WELL # 8 APPROXIMATELY 18 MILES WEST OF ROSWELL, N.M. ON US 380 AND 2 MILES SOUTHWEST OF US 380 ON DIRT ROAD. DRILLER'S LOG: A.H. LEWIS, FEBRUARY AND MARCH 1957 T.D.: 524 FT. CASING: 7 IN. TO 524 FT., PERFORATED FROM 410 TO 489 FT. WATER: 410 TO 470 FT. OPEN INTERVAL: 410 TO 489 FT. LITHOLOGY: 0 FT. TO BOTTOM, SAN ANDRES FORMATION (380 FT. TO BOTTOM, GLORIETA SANDSTONE)

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/22/74	58.7	1607	WATER LEVEL=399.4 FT.
06/13/74	43.7	1657	WATER LEVEL=399.7 FT.
08/26/74	49.2	1718	WATER LEVEL=400.69 FT. T=17.8 C
12/17/74	43.6	1754	T=16.2 C
03/27/75	47.1	1824	
08/26/75	50.8	1918	WATER LEVEL=389.02 FT.

OBSERVATION WELLS

MAP SYMBOL IS O#

MAP # 79.
DESCRIPTION LOCATION # 4.21.33.111 P.V.A.C.D. OBSERVATION WELL # 9
APPROXIMATELY 36 MILES NORTH OF ROSWELL, N.M. ON US 285 AND 8 MILES WEST OF US 285 ON DIRT ROAD.
DRILLER'S LOG: A.H. LEWIS, APRIL THROUGH JUNE 1957 T.D.: 760 FT.
CASING: 7 IN. TO 760 FT., PERFORATED FROM 620 TO 720 FT. WATER: 620 TO 720 FT. OPEN INTERVAL: 520 TO 720 FT. LITHOLOGY: 0 TO 20 FT., ALLUVIUM; 20 TO 190 FT., ARTESIA GROUP; 190 TO 720 FT., SAN ANDRES FORMATION (540 TO 720 FT., GLORIETA SANDSTONE); 720 FT. TO BOTTOM, YESO FORMATION.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/74	24.4	1608	WATER LEVEL=590.6 FT. QUESTIONABLE DATA
06/13/74	3.6	1653	WATER LEVEL=590.72 FT.
09/25/74	2.2	1714	WATER LEVEL=590.6 FT. T=19.8 C
12/18/74	2.8	1760	WATER LEVEL=590.76 FT. T=17.3 C
03/27/75	8.3	1822	
10/04/75	5.7	1988	WATER LEVEL=590.64 FT. SAMPLE TAKEN AT 670 FT.

WINDMILLS

MAP SYMBOL IS M#

MAP # M1

DESCRIPTION: LOCATION # 11.20.16.222 BORDER HILL WINDMILL ON THE J.P. WHITE RANCH (FORMERLY THE DIAMOND A RANCH). SOUTH SIDE OF US 380, ACROSS FROM TURNOFF TO P.V.A.C.D. OBSERVATION WELL #2. TURNOFF TO THE WELL IS APPROXIMATELY 22 MILES WEST OF ROSWELL, N.M. ON US 380. STOP #2 ON ROSWELL GEOLOGICAL SOCIETY FIELD TRIP ON OCTOBER 27, 1971. LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	40.4	1545	T=18.3 C PH=7.24
05/20/75	25.2	1841	
07/21/75	13.2	1911	

MAP # M2

DESCRIPTION: LOCATION # 13.20.12.443 JOHNSON WINDMILL APPROXIMATELY 24 MILES SOUTHWEST OF ROSWELL, N.M., 100 FT. FROM P.V.A.C.D. OBSERVATION WELL #4. LOCATED IN THE 'RECHARGE AREA'. IN DECEMBER 1974, REPORTED AS SURROUNDED BY SAN ANDRES CLIFFS AND LOCATED IN ALLUVIAL-FILLED SMALL VALLEY WHICH SHOULD CONCENTRATE RECHARGE. DEPTH REPORTED AS 275 FT. IN MARCH 1975.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/22/74	7.6	1580	
06/13/74	1.8	1654	
12/17/74	2.8	1758	
08/27/75	9.6	1929	

WINDMILLS

MAP SYMBOL IS M#

MAP # NOT GIVEN ONE DUE TO INSUFFICIENT LOCATION.
DESCRIPTION LOCATION # 10.21 OR 22.00.000 MARLEY WHITNEY WINDMILL
ON MARLEY WHITNEY RANCH, APPROXIMATELY 14 MILES WEST OF ROSWELL, N.M. , NORTH OF
US 380.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	19.6	1547	

MAP # M3
DESCRIPTION LOCATION # 11.21.24.411 SILVER MAPLE WINDMILL
ALSO KNOWN AS 'ARCHIE'S WELL'. ON WOODS RANCH, OPERATED BY SONNY WRIGHT,
APPROXIMATELY 14 MILES WEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.
DEPTH REPORTED AS 600 FT. IN SAN ANDRES FORMATION IN MARCH 1975.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/26/75	10.1	1782	
08/26/75	15.5	1924	

WINDMILLS

MAP SYMBOL IS M#

MAP # M4
DESCRIPTION LOCATION # 11.21.13.422 MIDDLE WINDMILL
ON WOODS RANCH, OPERATED BY SUNNY WRIGHT, APPROXIMATELY 14 MILES WEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.
DEPTH REPORTED AS 500 TO 600 FT. IN SAN ANDRES FORMATION IN MARCH 1975.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/26/75	4.0	1781	
08/26/75	8.5	1923	

MAP # M5
DESCRIPTION LOCATION # 11.22.18.211 APACHE WINDMILL RA 3562
ON WOODS RANCH, OPERATED BY SONNNY WRIGHT, ABOUT 14 MILES WEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.
DRILLER'S LOG: H.R. DAVIS, MAY 1956 T.D.: 780 FT. CASING 8 IN. TO 15 FT.
WATER: 525 TO 560 FT. OPEN INTERVAL: 15 FT. TO BOTTOM LITHOLOGY: 0 TO 20 FT., CALICHE AND GRAVEL; 20 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/26/71	10.2	1411	
03/26/75	2.4	1780	
05/20/75	7.0	1842	
08/26/75	10.9	1922	

WINDMILLS

MAP SYMBOL IS M#

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MAP # M6
DESCRIPTICN LOCATION # 12.23.06.222 RED HOUSE WINDMILL
ON PATTERSCN RANCH, APPROXIMATELY 7 MILES SOUTHWEST CF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON.
LOCATED IN THE 'RECHARGE AREA'.
IN NOVEMBER 1974, DEEPENED APPROXIMATELY 50 FT. TO 462 FT. TOTAL DEPTH.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/74	26.5	1614	
11/02/74	2.2	1744	T=17.5 C

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MAP # NOT GIVEN CNE DUE TO INSUFFICIENT LOCATION.
DESCRIPTICN LOCATION # NOT KNOWN 'THE FLAT' WINDMILL
ON PATTERSCN RANCH, APPROXIMATELY 7 MILES SOUTHWEST CF ROSWELL, N.M. LATE 1975, SOLD TO HENDERSCN. APPROXIMATELY 1 MILE FROM THE RED HOUSE WINDMILL.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/14/74	0.8	1777	

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WINDMILLS

MAP SYMBOL IS M#

MAP # M7
DESCRIPTION LOCATION # 7.22.36.422 CORN WINDMILL
ON TCM CORN RANCH, APPROXIMATELY 20 MILES NORTHWEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/74	4.0	1611	
05/20/75	2.3	1845	
07/21/75	15.6	1900	

MAP # M8
DESCRIPTION LOCATION # 8.22.13.223 CORN WINDMILL
ON DICK CORN RANCH, APPROXIMATELY 20 MILES NORTHWEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.
DEPTH REPORTED AS 450 FT. IN MARCH 1973 AND AS 500 FT. IN DECEMBER 1974.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	14.0	1492	PUMPING 2 GPM (ESTIMATE) PH=7.50
05/26/73	11.3	1543	T=20.5 C PH=7.55
03/23/74	7.7	1610	
08/25/74	3.2	1716	PUMPING 0.25 GPM (ESTIMATE) T=19.8 C RUSTY WATER
11/02/74	27.7	1746	T=17.0 C
12/18/74	3.2	1762	
05/20/75	6.3	1846	
07/21/75	8.8	1899	
09/21/75	11.6	1978	

WINDMILLS

MAP SYMBOL IS M#

MAP # M9
DESCRIPTION LOCATION # 8.23.16.111 CORN WINDMILL RA 4660
ON DICK CORN RANCH, APPROXIMATELY 20 MILES NORTHWEST OF ROSWELL, N.M.
LOCATED IN THE 'RECHARGE AREA'.
DRILLER'S LOG: CLEAN-OUT, CONRAD G. KEYES, AUGUST 1962 T.D.: 585 FT.
CASING: 8 5/8 IN. TO 14 FT. OPEN INTERVAL: 14 FT. TO BOTTOM LITHOLOGY:
OLD OIL TEST HOLE, HOWEVER, NO FORMATION RECORDS AVAILABLE.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	9.3	1491	PUMPING 3-5 GPM (ESTIMATE) PH=6.94
05/26/73	1.2	1572	T=24.0 C PH=7.00
03/23/74	8.1	1609	
08/25/74	2.7	1715	PUMPING 1 GPM (ESTIMATE) T=20.0 C
11/02/74	0.5	1745	T=21.5 C

MAP # M10
DESCRIPTION LOCATION # 14.25.08.411 WINDMILL
APPROXIMATELY 6 MILES WEST OF HAGERMAN, N.M. ON ROAD TO CHAVES COUNTY CATTLE CO.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/21/75	6.7	1909	

WINDMILLS

MAP SYMBOL IS M#

MAP # M11
DESCRIPTION LOCATION # 15.26.09.133 WINDMILL
APPROXIMATELY 5 MILES SOUTH OF HAGERMAN, N.M. ON NM 2 AND 1/4 MILE EAST OF NM 2.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/21/75	17.7	1905	

MAP # M12
DESCRIPTION LOCATION # 17.26.12.142 HAND DUG WINDMILL
APPROXIMATELY 4 MILES EAST OF ARTESIA, N.M. ON US 82 AND 1 MILE NORTH OF US 82
ON DIRT ROAD, ON THE FLOOD PLAIN OF THE PECOS RIVER.
PROBABLY VERY SHALLOW SINCE ORIGINALLY DUG BY HAND.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	83.5	1633	T=17.5 C
03/28/75	91.6	1829	
08/27/75	98.9	1957	

WINDMILLS

MAP SYMBOL IS M#

MAP # M13

DESCRIPTION LOCATION # 16.20.16.241 R.H. MCASHAN WINDMILL
APPROXIMATELY 12 MILES WEST OF HOPE, N.M. ON US 82 AND 5 MILES NORTH OF US 82
ON NM 13, CLOSE TO THE ROAD.
LOCATED IN THE 'RECHARGE AREA'.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	13.6	1625	
02/21/75	8.9	1798	

MAP # M14

DESCRIPTION LOCATION # 16.16.08.121 BATES WINDMILL
BETWEEN HWY MARKERS 46 AND 47 ON US 82, APPROXIMATELY 1 MILE SOUTH OF ELK, N.M.
ADDRESS: MRS. CARIE S. BATES STAR ROUTE EAST MAYHILL, N.M. 88339
LOCATED IN THE 'RECHARGE AREA'.
TOTAL DEPTH: 140 FT. IN SAN ANDRES FORMATION. IN APRIL 1974, WINDMILL
DISCONNECTED AND ELECTRIC PUMP INSTALLED.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	13.9	1621	T=13.2 C
06/15/74	15.5	1685	
08/23/74	3.5	1686	T=13.5 C
12/19/74	12.3	1789	
02/21/75	8.7	1803	T=14.0 C
08/28/75	18.6	1973	
12/19/75	17.7	1991	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR1
DESCRIPTION
LOCATION # 11.20.20.440 R.C. NUNEZ WELL RA 150-H
APPROXIMATELY 23 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 2 MILES SOUTH OF US 380 ON UNMARKED ROAD.
DRILLER'S LOG: CLEAN-OUT AND DEEPEN ELZY PERRY, JR., APRIL 1955
T.D.: 561 FT. CASING: 6 IN. TO 17 FT. WATER: 530 TO 561 FT.
WATER DEPTH UPON COMPLETION: 520 FT. OPEN INTERVAL: 17 FT. TO BOTTOM
LITHOLOGY: 0 TO 530 FT., NO RECORD; 530 TO 545 FT., LIMESTONE; 545 TO 561 FT., SANDSTONE BOTH UNITS IN SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	49.6	1536	PUMPING 3-4 GPM (ESTIMATE)

MAP # WR2
DESCRIPTION
LOCATION# 10.21.25.111 MARLEY WHITNEY WELL RA NOT KNOWN
APPROXIMATELY 13 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 3 MILES NORTH OF US 380 ON DIRT ROAD.
DEPTH REPORTED IN JANUARY 1972 AS 703 FT. WITH CASING FROM 0 TO 60 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/12/72	20.3	A-3	
03/23/73	22.9	1546	PUMPING

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR3
DESCRIPTION

LOCATION # 11.22.09.321   H.L. WOODS WELL   RA NOT KNOWN
APPROXIMATELY 11 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380, AND 3 MILES SOUTH OF US 380 ON DIRT ROAD.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
INFORMATION FROM DAN RABINOWITZ'S DISSERTATION, 1972:   LOCATED 100 FT. EAST OF ABANDONED WOODS WELL. WATER LEVEL AT COMPLETION WAS 420 FT. BELOW SURFACE, WHICH MAY EXPLAIN THE DRILLING OF THE NEW WELL SINCE THE TOTAL DEPTH OF THE OLD WOODS WELL WAS 435 FT.   OWNER: MR. WRIGHT   ELEVATION: 3954 FT.   DEPTH: 578 FT.   PRODUCTION INTERVAL: 511 TO 578 FT. (PERFORATED CASING), PUMPS AT 555 FT. BELOW SURFACE   FORMATION: SAN ANDRES LIMESTONE   DATE DRILLED: 10/64

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/09/68	0.0	1808	SUPPLEMENTAL TO LAST REPORT.
07/16/72	22.4	1427	DISCHARGE=2500 GPD
03/24/74	9.8	1617	
06/13/74	8.1	1656	
08/25/74	4.3	1712	FROM TAP T=20.5 C
12/16/74	0.0	1753	
03/26/75	1.2	1779	
08/26/75	9.5	1921	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR4
DESCRIPTION LOCATION # 11.22.22.111 WRIGHT WELL RA NOT KNOWN
APPROXIMATELY 10 MILES WEST-SOUTHWEST OF ROSWELL, N.M.
WATER LEVEL REPORTED AS 414 FT. IN JANUARY 1972.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/14/71	5.9	1401	DISCHARGE=1 GPM T=18.3 C SP COND=1220 CL=60 PPM
01/12/72	21.6	A-5	

MAP # WR5
DESCRIPTION LOCATION # 12.23.06.214 'LITTLE CAT' WELL RA 2888
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975,
RANCH SOLD TO HENDERSON.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
DRILLER'S LOG: O.B. LEWIS, JANUARY 1955 T.D.: 655 FT. CASING: NOT
MENTIONED, 10 IN. DIAMETER HOLE WATER: 623 TO 638 FT. OPEN INTERVAL:
0 FT. TO BOTTOM LITHOLOGY: 0 TO 575 FT., NOT GIVEN; 575 FT. TO BOTTOM,
SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/73	16.6	1571	T=20.1 C PH=7.35
06/14/74	5.7	1660	PUMPING 880 GPM (METER)
04/25/75	23.6	1883	
07/21/75	10.1	1903	
08/27/75	8.3	1949	
09/12/75	7.8	1976	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR5
DESCRIPTION LOCATION # 12.23.06.441 'BIG CAT' WELL RA 2887/2888-COMB B
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON. (FORMERLY REPORTED AS RA 1777-A) ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
DRILLER'S LOG: CONRAD G.KEYES, JULY THROUGH OCTOBER, 1961 T.D.: 640 FT.
CASING: 13 3/8 IN. TO 315 FT. WATER: 573 TO 612 FT. WATER DEPTH UPON COMPLETION: 270 FT. OPEN INTERVAL: 315 FT. TO BOTTOM LITHOLOGY: 0 TO 88 FT, ALLUVIUM; 88 FT. TO BOTTOM, SAN ANDRES FORMATION WATER FROM GREY SAND UNIT IN SAN ANDRES FORMATION.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/73	9.4	1570	PUMPING 1300 GPM T=20.4 C PH=7.40
05/20/75	1.7	1869	
09/12/75	5.7	1975	

MAP # WR5
DESCRIPTION LOCATION # 12.23.05.311 'RED TANK' RA NOT KNOWN
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON.
DEPTH REPORTED IN MARCH 1974 AS 370 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/74	41.7	1615	
06/14/74	48.6	1659	
08/24/74	36.6	1711	PUMPING 1.0 GPM T=18.5 C
03/26/75	39.2	1783	
07/21/75	43.4	1904	
08/27/75	41.3	1950	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

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MAP # WR5
DESCRIPTION LOCATION # 12.23.05.313 'HOUSE WELL' RA NOT KNOWN
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975
RANCH SOLD TO HENDERSON.
DEPTH REPORTED IN MAY 1973 AS 390 FT., PUMP AT 360 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/74	34.0	1613	
06/14/74	15.7	1662	
08/24/74	19.8	1710	T=17.9 C HIGH IN H2SO4
11/02/74	15.6	1743	T=16.7 C
03/26/75	27.8	1784	
04/25/75	26.6	1884	
08/27/75	24.3	1951	

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WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR5
DESCRIPTION LOCATION # 12.23.05.341 'TRYGG' WELL RA 2823
ON PROPERTY ADJACENT TO EAST SIDE OF PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, PATTERSON RANCH SOLD TO HENDERSON.
DRILLER'S LOG: RANDY JOHNSTON, FEBRUARY THROUGH JULY, 1949 T.D.: 458 FT.
CASING: 14 5/8 IN. TO 143 FT. WATER: 90 TO 100 FT., 190 TO 195 FT., 210 TO 215 FT., 310 TO 320 FT., 445 TO 458 FT. OPEN INTERVAL: 143 FT. TO BOTTOM
LITHOLOGY: 0 TO 90 FT.,ALLUVIUM; 90 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/16/72	21.5	1424	PUMPING 1500 GPM (ESTIMATE)
03/24/74	9.1	1576	PUMPING 1400 GPM
06/14/74	6.0	1661	PUMPING 1200 GPM
04/25/75	10.7	1879	
05/20/75	10.8	1868	

MAP # NOT GIVEN ONE DUE TO INSUFFICIENT LOCATION
DESCRIPTION LOCATION # NOT KNOWN 'STINKING MILL' WELL RA NOT KNOWN
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON.
REPORTED IN MARCH 1975 AS 409 FT. DEEP AFTER BEING DEEPENED IN DECEMBER 1974, 70 FT. OF WATER ABOVE BOTTOM.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/25/75	8.2	1881	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # NOT GIVEN ONE DUE TO INSUFFICIENT LOCATION.
DESCRIPTION LOCATION # NOT KNOWN 'NORTH' WELL RA NOT KNOWN
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/16/72	19.8	1425	

MAP # NOT GIVEN ONE DUE TO INSUFFICIENT LOCATION
DESCRIPTION LOCATION # NOT KNOWN 'RESO (RESERVOIR) PUMP' RA NOT KNOWN
ON PATTERSON RANCH, APPROXIMATELY 7 MILES SOUTHWEST OF ROSWELL, N.M. LATE 1975, RANCH SOLD TO HENDERSON.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/25/75	5.8	1880	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR6
DESCRIPTION LOCATION # 11.23.15.222 CHARLES SMITH WELL RA 2555
ON CHARLES SMITH RANCH, OPERATED BY K.K. JENNINGS. APPROXIMATELY 4 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 2 MILES SOUTH OF US 380 ON UNMARKED ROAD.
DRILLER'S LOG: W.D. DOLLIN, COMPLETED AUGUST 1949 T.D.: 649 FT.
CASING: 15 1/2 IN. TO 179 FT., 12 IN. FROM 179 TO 487 FT., 10 IN. FROM 487 FT TO 649 FT., NO PERFORATIONS REPORTED. WATER: 167 TO 176 FT. WATER DEPTH UPON COMPLETION: 107 FT. LITHOLOGY: 0 TO 57 FT., ALLUVIUM; 57 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	21.9	1541	T=20.5 C PH=7.21 H2S

MAP # WR7
DESCRIPTION LOCATION # 7.22.26.131 TOM CORN WELL RA NOT KNOWN
ON TOM CORN RANCH, APPROXIMATELY 20 MILES NORTHWEST OF ROSWELL, N.M.
REPORTED IN MAY 1973 AS DRILLED IN 1950.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/73	8.6	1596	T =22.0 C PH= 7.55
09/21/75	5.6	1980	FROM SPIGOT AT HOUSE, RUN 10 MINUTES BEFORE SAMPLING

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

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MAP # WR8
DESCRIPTION LOCATION # 08.22.22.223 DICK CORN WELL RA NOT KNOWN
ON DICK CORN RANCH, APPROXIMATELY 20 MILES NORTHWEST OF ROSWELL, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
08/25/74	2.0	1717	T=20.5 C
12/18/74	6.9	1761	
07/21/75	11.0	1901	
09/21/75	11.4	1979	RUN 10 MINUTES BEFORE SAMPLING

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MAP # WR9
DESCRIPTION LOCATION # 08.24.33.311 WELL RA 2601-A
APPROXIMATELY 11.5 MILES NORTH OF ROSWELL, N.M. ON NM 285, EAST SIDE OF ROAD.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	12.6	1544	PUMPING 700 GPM (ESTIMATE)

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MAP # WR10
DESCRIPTION LOCATION # 9.23.15.334 MORLEY WELL RA NOT KNOWN
APPROXIMATELY 10 MILES NORTHWEST OF ROSWELL, N.M.
REPORTED IN JANUARY 1972 AS STOCK WELL, 386 FT. DEEP.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/12/72	16.0	A-2	

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WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR11
DESCRIPTION LOCATION # 13.22.20.113 MCGEE WELL RA NOT KNOWN
APPROXIMATELY 20 MILES SOUTHWEST OF ROSWELL, N.M.
REPORTED IN JANUARY 1972 AS STOCK WELL, 620 FT. DEEP.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/12/72	66.2	A-4	

MAP # WR12
DESCRIPTION LOCATION # 14.23.08.144 MADE TANK RA NOT KNOWN
APPROXIMATELY 18 MILES WEST OF HAGERMAN, N.M.
DEPTH REPORTED AS 460 FT. IN JANUARY 1972.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/13/72	13.5	A-6	

MAP # WR13
DESCRIPTION LOCATION # 15.22.09.122 F.RUNYON WELL RA NOT KNOWN
APPROXIMATELY 14 MILES SOUTHWEST OF HAGERMAN, N.M.
DEPTH REPORTED AS 520 FT. IN JANUARY 1972.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/12/72	18.1	A-7	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR14
DESCRIPTION LOCATION # 17.23.30.120 HOPE CITY WELL RA 3081
HOPE, N.M. APPROXIMATELY 20 MILES WEST OF ARTESIA, N.M. ON US 82. USUALLY SAMPLED AT GAS STATION.
DRILLER'S LOG: LEONARD GEORGE, JANUARY AND FEBRUARY, 1954.
T.D.: 600 FT. CASING: 14 IN. TO 558 FT., PERFORATED FROM 498 TO 558 FT.
WATER: 535 FT. TO BOTTOM OPEN INTERVAL: 498 FT. TO BOTTOM LITHOLOGY:
0 TO 80 FT., ALLUVIUM; 80 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	13.9	1529	T=13.1 C
06/14/74	5.8	1667	WATER LEVEL=552.16 FT.
07/22/74	1.6	1692	
08/23/74	9.6	1693	
09/25/74	2.8	1766	
10/28/74	0.5	1767	
11/28/74	4.2	1768	
12/26/74	1.5	1795	
02/12/75	19.4	1839	
02/21/75	2.2	1799	
03/17/75	7.6	1840	

MAP # WR15
DESCRIPTION LOCATION # 18.23.05.333 WELL RA NOT KNOWN
APPROXIMATELY 5 MILES SOUTH OF HOPE, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/19/71	16.9	1402	T=18.9 C SP COND=800 CL=20 PPM

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR16
DESCRIPTION LOCATION # 15.18.17.143 HENDRIX WELL RA 4761-S
ON THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M. ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.
REPORTED IN JULY 1973 AS 306 FT. DEEP WITH 300 FT. OF CASING.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/08/74	6.2	1574	DISCHARGE=250 GPM T=16.2 C
06/15/74	4.1	1677	PUMPING 1200 GPM
08/23/74	9.5	1689	FLOWING 10 GPM (ESTIMATE) T=16.0 C
12/19/74	0.5	1774	LEAKING THROUGH CASING
02/21/75	2.5	1802	T=16.5 C
08/28/75	9.7	1969	FLOWING 400 GPM

MAP # WR16
DESCRIPTION LOCATION # 15.18.18.141 FLYING H WELL RA 4761
ON THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M. ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/15/74	1.8	1678	PUMPING 370 GPM
08/23/74	6.6	1690	T=15.8 C
12/19/74	0.2	1775	FLOWING
02/21/75	1.0	1797	T=16.0 C
08/28/75	13.8	1965	

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR16
DESCRIPTION LOCATION # 15.18.18.311 W.R. JOY WELL RA NOT KNOWN
ON THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M. ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/15/74	7.4	1681	FLOWING 250 GPM
08/23/74	6.7	1691	FLOWING (PARTIALLY OPENED) T=15.8 C
12/19/74	0.0	1776	FLOWING
08/28/75	13.3	1966	FLOWING 20 GPM (ESTIMATE)

MAP # WR17
DESCRIPTION LOCATION # 15.17.13.141 LELAND HENDRIX WELL RA 4761-S2
ON THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M. ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/15/74	3.5	1679	PUMPING 1400 GPM
08/28/75	13.3	1968	PUMPING 600 GPM

WELLS LOCATED IN THE 'RECHARGE AREA'

MAP SYMBOL IS WR#

MAP # WR17

DESCRIPTION LOCATION # 15.17.14.312 FUNK WELL RA 4326
ON THE FORMER FLYING H RANCH. TURNOFF TO RANCH IS APPROXIMATELY 20 MILES EAST OF MAYHILL, N.M. ON US 82, BETWEEN HWY MARKERS 60 AND 61. RANCH IS APPROXIMATELY 10 MILES NORTH OF US 82 ON DIRT ROAD.
REPORTED IN JULY 1973 AS 400 FT. DEEP WITH 65 FT. OF SCREEN.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	44.5	1527	PUMPING 800 GPM (ESTIMATE) T=18.4 C PH=7.08
06/15/74	5.8	1680	PUMPING 228 GPM (METER)

MAP # WR18

DESCRIPTION LOCATION # 16.16.11.421 MULCOCK WELL RA NOT KNOWN
APPROXIMATELY 3 MILES EAST OF ELK, N.M. CLOSE TO HWY MARKER 51 ON US 82. WELL IS APPROXIMATELY 1000 FT. UPSTREAM FROM MULCOCK'S TRAILER.
DEPTH REPORTED AS 180 FT. IN JULY 1973.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/15/74	7.0	1682	

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

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MAP # WA1
DESCRIPTION LOCATION # 11.23.01.413 MRS. L.L. LANE WELL RA 1879
APPROXIMATELY 2 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 3/4 MILE SOUTH OF US 380 ON UNMARKED ROAD.
DRILLER'S LOG: GEORGE STERRETT, STARTED MARCH 1945 AND COMPLETED IN 1945
T.D.: 160 FT. CASING: 18 IN. TO 160 FT., PERFORATED FROM 90 TO 120 FT. AND FROM 150 TO 160 FT. WATER: 75 TO 96 FT., 154 TO 160 FT. OPEN INTERVAL: 90 TO 120 FT. AND 150 TO 160 FT. LITHOLOGY: 0 TO 75 FT., ALLUVIUM; 75 FT. TO BOTTOM, GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	13.1	1538	T=19.1 C PH=7.20
05/26/73	17.3	1565	PUMPING 1500 GPM (ESTIMATE) T=19.5 C PH=7.35

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MAP # WA1
DESCRIPTION LOCATION # 11.23.01.433 LARRY HENDRICKS WELL RA 1428/1879
APPROXIMATELY 2 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380 AND 3/4 MILE SOUTH ON NM 447.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	17.0	1540	PUMPING 1300 GPM (METER) T=18.9 C PH=7.26

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WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA1
DESCRIPTION LOCATION # 11.23.12.221 LARRY HENDRICKS WELL RA 458
APPROXIMATELY 4 MILES SOUTHWEST OF ROSWELL, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	10.6	1539	PUMPING 600 GPM (ESTIMATE) T=18.9 C PH=7.20

MAP # WA1
DESCRIPTION LOCATION # 11.23.12.332 CHARLES SMITH WELL RA 1521-M
ON CHARLES SMITH RANCH, OPERATED BY K.K. JENNINGS. APPROXIMATELY 3 MILES WEST OF US 285 IN ROSWELL, N.M. ON US 380, AND 2 MILES SOUTH OF US 380 ON UNMARKED ROAD.
DEPTH REPORTED AS 165 FT. IN MARCH 1973.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	11.3	1484	PUMPING 900 GPM (METER) PH=7.43
05/25/73	5.4	1554	PUMPING 900 GPM T=20.4 C PH=7.20

MAP # WA1
DESCRIPTION LOCATION # 11.24.07.214 LONGWILL WELL RA 55-A3
APPROXIMATELY 2 MILES SOUTHWEST OF ROSWELL, N.M.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/23/73	18.6	1537	PUMP 600 GPM, SAMPLE AFTER 10 MIN. T=18.8 C PH=7.22

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA2
DESCRIPTION
LOCATION # 10.24.15.330 H.A. COGDILL WELL RA 5010
APPROXIMATELY 3 MILES NORTH OF ROSWELL, N.M. ON US 285 AND 1 MILE EAST OF US 285 ON NM 431.
DRILLER'S LOG: G.J. CLARK, AUGUST 1964 T.D.: 120 FT. CASING: 6 5/8 IN. TO 120 FT., PERFORATED FROM 55 TO 120 FT. WATER: 55 TO 60 FT.
WATER DEPTH UPON COMPLETION: 40 FT. OPEN INTERVAL: 55 FT. TO BOTTOM
LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/05/73	150.4	1459	
03/24/73	26.6	1489	PH=6.98

MAP # WA2
DESCRIPTION
LOCATION # 10.24.22.212 ALBERT SANDOVAL WELL RA 4005
APPROXIMATELY 3 MILES NORTH OF ROSWELL, N.M. ON US 285 AND 1.5 MILES EAST OF US 285 ON NM 431.
DRILLER'S LOG: CECIL LEDBETTER, MARCH AND APRIL 1959 T.D.: 61 FT.
CASING: 7 IN. TO 60 FT., PERFORATED 38 TO 58 FT. WATER: 20 TO 28 FT., 32 TO 38 FT., 54 TO 61 FT. WATER DEPTH UPON COMPLETION: 15 FT. OPEN INTERVAL: 38 TO 58 FT. AND BOTTOM FOOT OF HOLE. LITHOLOGY: 0 TO 60 FT., ALLUVIUM

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/05/73	29.0	1463	

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA3

DESCRIPTION LOCATION # 11.24.14.314 J.C. EBERHART WELL RA 1920-S
APPROXIMATELY 4 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2.
DRILLER'S LOG: C.G. YOUNG AND J.F. MONTGOMERY, JULY 1965 T.D.: 205 FT.
WATER: 154 TO 188 FT. WATER DEPTH UPON COMPLETION: 93 FT. OPEN INTERVAL:
0 TO 205 FT. LITHOLOGY: 0 TO 118 FT., ALLUVIUM; 118 FT. TO BOTTOM, GATUNA
FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	11.8	1485	PUMPING 800 GPM (ESTIMATE)

MAP # WA4

DESCRIPTION LOCATION # 11.24.20.333 WELL RA NOT KNOWN
APPROXIMATELY 4 MILES SOUTH OF ROSWELL, N.M. ON US 285.
REPORTED AS SHALLOW IN JANUARY, 1972.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/12/72	31.1	R-1	

NOTE: No tritium measurements available at this time for the well at Map # WA5.

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

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MAP # WA6

DESCRIPTION LOCATION # 11.25.28.333 GLENN C. WHEELER WELL RA 1572-S2
APPROXIMATELY 2 MILES TO SOUTHEAST OF ROSWELL, N.M. ON NM 2, 2 MILES EAST AND NORTH OF NM 2 ON NM 255, AND 1 MILE EAST ON UNMARKED ROAD. REPORTED IN MARCH 1973 AS THREE WELLS, OR OUTLETS FROM THE SAME WELL, IN A LINE ABOUT 200 FT. APART. DRILLER'S LOG SHOULD BE FOR AT LEAST ONE OF THESE WELLS OR THE WELL IF THERE ARE THREE OUTLETS. (T.U.'S INDICATE 3 DIFFERENT WELLS.)
DRILLER'S LOG: GEORGE STERRETT, COMPLETED IN MAY 1949 T.D.: 89 FT.
CASING: 16 IN. TO 89 FT., PERFORATED FROM 24 TO 89 FT. OPEN INTERVAL: 24 TO 89 FT. LITHOLOGY: 0 TO 89 FT., ALLUVIUM

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	14.9	1486	PUMPING 500 GPM (ESTIMATE) PH=6.92
03/24/73	27.8	1487	PUMPING 500 GPM (ESTIMATE) PH=6.97
03/24/73	22.2	1488	PUMPING 500 GPM (ESTIMATE) PH=7.00

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MAP # WA7

DESCRIPTION LOCATION # 13.26.28.411 J.R. MCNEIL WELL RA 2930
APPROXIMATELY 2 MILES SOUTHEAST OF DEXTER, N.M. ON NM 2, CLOSE TO INTERSECTION OF NM 2 AND NM 339.
DRILLER'S LOG: LEONARD GEORGE, AUGUST 1952 T.D.: 200 FT. CASING: 7 IN. TO 185 FT. (TO SHUT OFF BAD WATER), 5 3/16 IN. FROM 180 TO 200 FT., PERFORATED FROM 185 TO 200 FT. WATER: 185 TO 200 FT. OPEN INTERVAL: 185 TO 200 FT.
LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	10.1	1871	

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WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA7
DESCRIPTION

LOCATION # 13.26.33.421 RICHARD HARSHEY WELL RA 1317
APPROXIMATELY 4 MILES SOUTHEAST OF DEXTER, N.M. ON NM 2 AND JUST TO WEST OF NM 2 ON UNMARKED ROAD.
DRILLER'S LOG: G.M. STERRETT, JUNE AND JULY, 1961 T.D.: 213 FT.
CASING: 16 IN. TO 213 FT., PERFORATED FROM 100 TO 213 FT. WATER: 54 TO 66 FT., 83 TO 172 FT. OPEN INTERVAL: 100 TO 213 FT. LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	8.3	1637	PUMPING 1011 GPM (METER) T=17.0 C

MAP # WA8
DESCRIPTION

LOCATION # 14.26.15.113 C.J. FORD WELL RA 1333-F
APPROXIMATELY 1 MILE SOUTH OF TURNOFF TO HAGERMAN, N.M. ON NM 2, ON EAST SIDE OF ROAD.
DRILLER'S LOG: LEONARD GEORGE, MAY 1955. T.D.: 150 FT. CASING: 16 IN. TO 150 FT., PERFORATED FROM 45 FT. TO BOTTOM WATER: 45 FT. TO BOTTOM
OPEN INTERVAL: 45 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	138.9	1636	PUMPING 2993 GPM (METER) T=17.5 C
06/14/74	17.4	1663	
08/24/74	30.1	1703	

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA9

DESCRIPTION

LOCATION # 16.26.21.300 J.H. EVEREST WELL RA 1459
APPROXIMATELY 1.5 MILES NORTH ON NM 2 OF JUNCTION OF US 285 AND NM 2, NORTH OF ARTESIA, N.M.
DRILLER'S LOG: D.N. GRAY, 1937 T.D.: 131 FT. CASING: 12 1/2 IN. TO 131 FT. LITHOLOGY: 0 TO 131 FT., ALLUVIUM AND GATUNA FORMATION
CLEAN-OUT A.F.SMITH, JUNE 1956 T.D.: 132 FT. CASING: PERFORATED 43 FT. TO 128 FT. OPEN INTERVAL: 43 TO 132 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	16.0	1872	

MAP # WA10

DESCRIPTION

LOCATION # 17.26.10.333 V.L. GATES WELL RA 1331
APPROXIMATELY 1 MILE EAST OF US 285 IN ARTESIA, N.M. ON US 82, ON NORTHWEST CORNER OF INTERSECTION AT THIS POINT.
DRILLER'S LOG: D.N. GRAY, DECEMBER 1938 AND JANUARY 1939 T.D.: 278 FT.
CASING: 0 TO 278 FT., NO DIAMETER OR PERFORATIONS MENTIONED. LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	26.5	1531	T=16.7 C
04/09/74	18.1	1627	T=18.7 C
06/14/74	14.8	1669	
08/24/74	7.8	1699	T=19.0 C
08/28/75	8.4	1959	

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

MAP # WA10

DESCRIPTION

LOCATION 17.26.15.111 CHARLES L. ALLISON WELL RA 1227
APPROXIMATELY 1 MILE EAST OF US 285 IN ARTESIA, N.M. ON US 82.
DRILLER'S LOG: E.C. & D.N. GRAY, DECEMBER 1935 AND JANUARY 1936 T.D.:
240 FT. CASING: 10 IN. TO 194 FT., 8 IN. FROM 188 FT. TO BOTTOM, PERFORATED
OVER ENTIRE LENGTH. WATER: 10 TO 15 FT., 175 FT. TO BOTTOM
OPEN INTERVAL: 194 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND
GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	17.5	1532	PUMPING 800 GPM T=24.0 C PH=7.10
04/09/74	8.0	1628	
06/14/74	8.3	1670	
08/24/74	8.3	1696	

MAP # WA10

DESCRIPTION

LOCATION # 17.26.15.120 J.M. VOGEL WELL RA 1183
APPROXIMATELY 1.25 MILES EAST OF US 285 IN ARTESIA, N.M. ON US 82, SOUTH SIDE
OF ROAD.
DRILLER'S LOG: GRAY BROS., JULY AND AUGUST 1934 T.D.: 225 FT. CASING:
10 IN. TO 220 FT. WATER: 20 TO 25 FT., 155 TO 225 FT. OPEN INTERVAL:
220 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	15.1	1533	PUMPING 970 GPM T=18.8 C PH=7.35
03/28/75	8.3	1834	

WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

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MAP # WA10

DESCRIPTION LOCATION # 17.26.15.133 MASON WELL RA 1503-F
APPROXIMATELY 1 MILE EAST OF US 285 IN ARTESIA, N.M ON US 82, AND 0.5 MILES SOUTH OF US 82 ON UNMARKED ROAD.
DRILLER'S LOG: W.P. BLACK, OCTOBER 1944 T.D.: 240 FT. CASING: 14 IN. TO 130 FT., PERFORATED OVER ENTIRE LENGTH, 10 IN. FROM 162 TO 240 FT., PERFORATED OVER ENTIRE LENGTH. WATER: 10 TO 15 FT., 73 TO 83 FT.
OPEN INTERVAL: 0 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	8.8	1629	PUMPING 900 GPM
06/14/74	0.0	1672	PUMPING 800 GPM
03/28/75	12.0	1832	

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MAP # WA11

DESCRIPTION LOCATION # 17.26.30.211 DON MENEFEE WELL RA 1826-AS*
APPROXIMATELY 1 MILE WEST OF US 285 IN ARTESIA, N.M. ON US 82, 2 MILES SOUTH OF US 82 ON 13TH STREET, AND 1/4 MILE WEST OF THIS ROAD ON DIRT ROAD.
*DRILLER'S LOG: RA REPORTED AS 1826-A IN MARCH 1975, HOWEVER, THIS SEEMS TO BE THE SAME WELL.
C.C. YOUNG AND J.F. MONTGOMERY, MARCH AND APRIL, 1964 T.D.: 200 FT.
CASING: 16 IN. TO 200 FT., PERFORATED FROM 140 TO 200 FT. WATER: 152 TO 161 FT., 161 TO 167 FT. WATER DEPTH UPON COMPLETION: 40 FT. OPEN INTERVAL: 140 FT. TO BOTTOM LITHOLOGY: 0 FT. TO BOTTOM, ALLUVIUM AND GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/28/75	2.5	1831	PUMPING 250 GPM, SAMPLED AFTER 10 MIN.

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WELLS PRODUCING FROM THE ALLUVIUM AQUIFER

MAP SYMBOL IS WA#

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MAP # WA12

DESCRIPTION

LOCATION # 18.26.18.221 VANDIVER WELL RA 3181-S5*
APPROXIMATELY 6 MILES SOUTH OF ARTESIA, N.M. ON US 285, AND 1.5 MILES WEST OF US 285 ON NM 229.
*DRILLER'S LOG: RA REPORTED AS 3181 IN MAY 1975, HOWEVER, THIS SEEMS TO BE THE SAME WELL.
A.F. SMITH, MARCH 1959 T.D.: 258 FT. CASING: 16 IN. TO 257 FT.,
PERFORATED FROM 60 TO 257 FT. WATER: 50 TO 60 FT., 240 TO 250 FT.
WATER DEPTH UPON COMPLETION: 115 FT. OPEN INTERVAL: 60 FT. TO BOTTOM
LITHOLOGY: 0 TO 170 FT., ALLUVIUM; 170 FT. TO BOTTOM, GATUNA FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	14.8	1877	

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP1
DESCRIPTION LOCATION # 10.25.22.324 ELK#1 RA NOT KNOWN
APPROXIMATELY 10 MILES EAST-NORTHEAST OF ROSWELL, N.M.
EQUIPPED WITH USGS PRESSURE RECORDER.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
INFORMATION REPORTED IN DAN RABINOWITZ'S DISSERTATION, 1972:
OWNER: STATE ENGINEER'S OFFICE ELEVATION: 3650 FT. DEPTH: 650 FT.
PRODUCTION INTERVAL: 621 TO 650 FT. (OPEN HOLE) FORMATION: SAN ANDRES
LIMESTONE DATE DRILLED: 1962

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
10/19/67	26.0	1813	SUPPLEMENTAL TO LAST REPORT
10/09/68	9.5	1812	SUPPLEMENTAL TO LAST REPORT
04/10/74	19.5	1642	FLOWING WITH 22 LBS. PRESSURE T=19.5 C
06/12/74	4.5	1645	FLOWING WITH 13.5 LBS. PRESSURE
12/17/74	6.3	1759	
03/26/75	0.0	1785	LET WELL FLOW FOR 1/2 HOUR BEFORE SAMPLING

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP2

DESCRIPTION

LOCATION # 10.25.32.333 CONSERVANCY WELL RA 4568-S
APPROXIMATELY 5 MILES EAST OF US 285 IN ROSWELL, N.M. ON US 380, NORTH SIDE OF THE HIGHWAY.
DRILLER'S LOG: P.V.A.C.D. (PECOS VALLEY ARTESIAN CONSERVANCY DISTRICT), APRIL AND MAY 1963 T.D.: 533 FT. CASING: 13 3/8 IN. TO 260 FT., 10 3/4 IN. FROM 229 TO 416 FT. WATER: 418 TO 430 FT., 432 TO 467 FT., 487 TO 512 FT. ORIGINAL FLOW: 1150 GPM OPEN INTERVAL: 416 FT. TO BOTTOM LITHOLOGY: 0 TO 97 FT., ALLUVIUM; 97 TO 189 FT., GATUNA FORMATION; 189 TO 393 FT., ARTESIA GROUP; 393 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/10/74	1.6	1641	
03/27/75	4.3	1926	

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NOTE: No tritium measurements available at this time for the well at Map # WP3.

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP4

DESCRIPTION LOCATION # 11.25.15.334 CLARDY (OASIS) WELL RA 61 OR 59-S APPROXIMATELY 4 MILES EAST OF NM 2 ON NM 255, SOUTHEAST OF ROSWELL, N.M. AND 1 MILE NORTH OF NM 255 ON UNMARKED ROAD. APPROXIMATELY 1 MILE NORTHWEST OF OASIS, N.M. ON WEST END OF LARGE IRRIGATION POND WHICH SERVES AS MAIN WATER SUPPLY FOR DAIRY FARM.
DRILLER'S LOG: PEARSON BROS., MARCH 1926 T.D.: 780 FT. CASING: 12 1/2 IN. TO 613 FT. WATER: 740 TO 750 FT., 760 TO 765 FT., 775 FT. TO BOTTOM ORIGINAL FLOW: 6600 GPM OPEN INTERVAL: 613 FT. TO BOTTOM LITHOLOGY: 0 TO 100 FT., ALLUVIUM; 100 TO 410 FT., GATUNA FORMATION; 410 TO 605 FT., ARTESIA GROUP; 605 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/25/73	1.5	1556	PUMPING 2000 GPM T=20.5 C PH=7.30
03/23/74	3.9	1618	PUMPING 3015 GPM (METER) H2S SMELL
06/12/74	26.4	1648	PUMPING 2119 GPM (METER)
08/24/74	1.8	1709	FLOWING 300 GPM T=19.9 C
11/02/74	1.6	1742	T=20.0 C
05/20/75	6.7	1848	
10/04/75	5.6	1985	FLOWING 400 GPM

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP4

DESCRIPTION LOCATION # 11.25.15.343 CLARDY (OASIS) WELL RA 1102 (O-21)
APPROXIMATELY 4 MILES EAST OF NM 2 ON NM 255 SOUTHEAST OF ROSWELL, N.M., AND 1 MILE NORTH OF NM 255 ON UNMARKED DIRT ROAD. APPROXIMATELY 1 MILE NORTHWEST OF OASIS, N.M. ON EAST END OF LARGE IRRIGATION POND WHICH SERVES AS MAIN WATER SUPPLY FOR DAIRY FARM.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
DRILLER'S LOG: M.S. BRUNING, JANUARY AND FEBRUARY, 1931 T.D.: 843 FT.
CASING: 12 1/2 IN. TO 643 FT. WATER: 150 TO 200 FT., 630 TO 690 FT., 720 TO 843 FT. OPEN INTERVAL: 643 FT. TO BOTTOM LITHOLOGY: 0 TO 100 FT., ALLUVIUM; 100 TO 400 FT., GATUNA FORMATION; 400 TO 617 FT., ARTESIA GROUP; 617 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/25/73	9.0	1555	PUMPING 1850 GPM T=20.55 C PH=7.20
03/23/74	4.3	1612	PUMPING 1750 GPM
06/12/74	2.1	1649	PUMPING 1900 GPM
08/24/74	2.4	1708	PUMPING 1750 GPM T=19.8 C
11/02/74	3.2	1723	T=20.0 C
02/21/75	3.7	1793	
07/21/75	6.5	1896	
10/04/75	7.7	1986	PUMPING

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP4

DESCRIPTION LOCATION # 11.25.23.111 CLARDY (OASIS) WELL RA 62
APPROXIMATELY 4 MILES EAST OF NM 2 ON NM 255, SOUTHEAST OF ROSWELL, N.M. AND 1 MILE NORTH OF NM 255 ON UNMARKED ROAD. APPROXIMATELY 1 MILE NORTHWEST OF OASIS, N.M.
DRILLER'S LOG: SHROCK DRILLING CO., JUNE 1957 T.D.: 847 FT. CASING: 13 3/8 IN. TO 629 FT. WATER: 622 TO 635 FT., 635 TO 650 FT., 810 TO 847 FT. ORIGINALLY FLOWING OPEN INTERVAL: 629 FT. TO BOTTOM LITHOLOGY: 0 TO 82 FT., ALLUVIUM; 82 TO 385 FT., GATUNA FORMATION; 385 TO 614 FT., ARTESIA GROUP; 614 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/25/73	11.4	1557	T=20.6 C PH=7.10
03/24/74	5.7	1616	FLOWING 489 GPM (METER)
06/12/74	5.8	1647	PUMPING 1793 GPM (METER)
08/24/74	3.7	1707	FLOWING 326 GPM (METER) T=20.0 C
11/02/74	12.6	1722	T=20.0 C
02/21/75	0.8	1794	
05/20/75	8.1	1847	
07/21/75	9.2	1895	
10/04/75	8.8	1984	PUMPING 1304 GPM (METER)

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP5

DESCRIPTION

LOCATION # 11.24.23.440 SOUTH SPRING RANCH & CATTLE CO. WELL PA 986 (S-116)
APPROXIMATELY 4 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2.
DRILLER'S LOG: GRAY COGGIN, JANUARY THROUGH APRIL, 1923 T.D.: 535 FT.
CASING: 15 1/2 IN. TO 90 FT., 12 1/2 IN. FROM 90 FT. TO 388 FT. WATER:
335 TO 390 FT., 455 TO 465 FT., 507 TO 530 FT. OPEN INTERVAL: 388 FT. TO
BOTTOM LITHOLOGY: 0 TO 110 FT., ALLUVIUM; 110 TO 200 FT., GATUNA
FORMATION: 200 TO 383 FT., ARTESIA GROUP: 383 FT. TO BOTTOM, SAN ANDRES
FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	11.2	1551	PH=7.40
05/26/73	5.0	1562	T=19.6 C PH=7.40
07/21/75	11.8	1894	
10/04/75	7.5	1987	PUMPING 900 GPM

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MAP # WP5

DESCRIPTION

LOCATION # 11.24.24.433 O.M. VAUGHN WELL RA 986-A
APPROXIMATELY 4 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2, 1 MILE EAST OF NM 2.
DRILLER'S LOG: PEARSON BROS. AND ED SHROCK, JANUARY 1948 T.D.: 531 FT.
CASING: 13 IN. TO 382 FT. WATER: 384 TO 389 FT., 504 TO 509 FT.,
521 TO 535 FT., 570 TO 575 FT. OPEN INTERVAL: 382 FT. TO BOTTOM
LITHOLOGY: 0 TO 155 FT., ALLUVIUM; 155 TO 270 FT., GATUNA FORMATION; 270 TO
398 FT., ARTESIA GROUP; 398 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/26/73	12.2	1563	PUMPING 1700 GPM (ESTIMATE) T=19.85 C PH=7.4

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP5

DESCRIPTION

LOCATION # 11.24.25.312 ALLISON WELL RA 1015
APPROXIMATELY 7 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2.
INFORMATION FROM DAN RABINOWITZ'S DISSERTATION, 1972:
OWNER: MRS. B.T. ALLISON ELEVATION: 3574 FT. DEPTH: 669 FT.
PRODUCTION INTERVAL: 369 FT. TO 669 FT. FORMATION: MULTIPLE FORMATION
TYPE: MULTIPLE AQUIFER
JUDGING FROM THE DRILLER'S LOGS OF THE OTHER ALLISON WELLS AND THE T.U.'S, THE PRODUCING HORIZON OF THIS WELL IS NOW BELIEVED TO BE THE PRINCIPAL AQUIFER (MOSTLY SAN ANDRES FORMATION), RATHER THAN 'MULTIPLE' FORMATIONS AS REPORTED EARLIER.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS	
03/24/73	3.8	1549	PUMPING 1900 GPM (METER)	PH=7.3
04/09/74	8.4	1638	PUMPING 1450 GPM (METER)	T=20.2 C
06/12/74	7.4	1650	PUMPING 1400 GPM (METER)	
08/24/74	4.2	1704	T=20.0 C	

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP5

DESCRIPTION
LOCATION # 11.24.25.341 ALLISON WELL RA 1015/1012-S-COMB-8
APPROXIMATELY 5 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
DRILLER'S LOG: PEARSON BROS. AND J.E. SHROCK, JANUARY AND FEBRUARY, 1952
T.D.: 678 FT. CASING: 13 IN. TO 461 FT. WATER: 485 TO 570 FT., 607 TO 617 FT., 641 TO 675 FT. OPEN INTERVAL: 413 FT. TO BOTTOM
LITHOLOGY: 0 TO 180 FT., ALLUVIUM; 180 TO 285 FT., GATUNA FORMATION; 285 TO 485 FT., ARTESIA GROUP; 485 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/18/68	20.5	1807	SUPPLEMENTAL TO LAST REPORT
10/05/68	8.8	1809	SUPPLEMENTAL TO LAST REPORT
07/16/72	14.7	1426	PUMPING
03/24/73	7.9	1542	PUMPING 1900 GPM (METER) PH=6.84
05/26/73	6.2	1559	PUMPING 1850 GPM T=20.5 C PH=7.50
04/09/74	3.9	1639	
06/12/74	27.4	1651	PUMPING 1700 GPM
08/24/74	0.8	1705	PUMPING 1850 GPM T=20.0 C
03/28/75	11.6	1836	
05/20/75	11.6	1849	
07/21/75	10.9	1897	
08/27/75	6.7	1953	PUMPING 1700 GPM

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP5
DESCRIPTION LOCATION # 11.24.26.224 ALLISON WELL RA 1012
APPROXIMATELY 5 MILES SOUTHEAST OF ROSWELL, N.M. ON NM 2.
DRILLER'S LOG: J.R. STANLEY, JULY 1913 T.D.: 592 FT. CASING: 10 IN.
TO 446 FT. WATER: 465 TO 475 FT., 507 TO 511 FT., 537 TO 555 FT.
OPEN INTERVAL: 446 FT. TO BOTTOM LITHOLOGY: 0 TO 120 FT., ALLUVIUM;
120 TO 240 FT., GATUNA FORMATION; 240 TO 395 FT., ARTESIA GROUP; 395 FT. TO
BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	8.2	1550	PUMPING 1900 GPM (METER) PH=7.30
05/26/73	18.8	1561	PUMPING 1900-2000 GPM (ESTIMATE) T=20.7 C PH=7.40
04/09/74	4.5	1640	PUMPING 1800 GPM
06/12/74	36.9	1652	PUMPING 1800 GPM
08/24/74	1.2	1706	PUMPING 1900 GPM T=19.9 C
03/28/75	9.8	1837	
07/21/75	10.1	1898	

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP6

DESCRIPTION: LOCATION # 11.25.21.333 TIERRA VUELTA, INC. WELL RA 20-S4 (FORMERLY RA 651) APPROXIMATELY 4 MILES ON NM 255 EAST FROM NM 2 TO THE SOUTHEAST OF [illegible], [illegible]. DRILLER'S LOG OF PROBABLY THE SAME WELL (RA 651, LOCATION # 11.25.21.[illegible], BUT DIFFERENT DEPTHS, OWNER, ETC. THAN THOSE REPORTED) J.Q. CUMMINS, [illegible] JUNE 1909 T.D.: 761 FT., HOWEVER, CASED DOWN TO 810 FT. AND LOGGED [illegible] TO 952 FT. (?) CASING: 10 IN. FROM 0 TO 174 FT. AND 8 IN. [illegible] 0 TO [illegible]. (?) WATER: 640 TO 644 FT., 713 TO 717 FT., 733 TO 739 FT. ORIGINAL FLO[illegible] OPEN INTERVAL: 636 TO 952 FT. (?) LITHOLOGY: 0 TO 112 FT., ALL[illegible] TO 260 FT., GATUNA FORMATION; 260 TO 631 FT., ARTESIA GROUP; 631 FT. TO [illegible], SAN ANDRES FORMATION

PLUGGING RECORD: C.G. YOUNG, NOVEMBER 1970 T.D.: 836 FT., HOWEVER, PLUGGED WITH CEMENT BACK TO 815 FT. DUE TO SALT CONTAMINATION.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/28/75	7.1	1838	
07/21/75	10.9	1894B	

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP7
DESCRIPTION LOCATION # 11.25.29.444 GLENN WHEELER WELL , RA 544
APPROXIMATELY 2 MILES EAST OF NM 2 ON NM 255, SOUTHEAST OF ROSWELL, N.M., AND
1 MILE EAST OF NM 255 ON UNMARKED DIRT ROAD.
DRILLER'S LOG: SPERRY AND BRANNING, FEBRUARY 1928 T.D.: 925 FT.
CASING: 10 IN. TO 577 FT. WATER: 596 TO 603 FT. (NO INCREASE IN WATER BELOW
603 FT.) OPEN INTERVAL: 577 FT. TO BOTTOM LITHOLOGY: 0 TO 292 FT.,
ALLUVIUM AND GATUNA FORMATION; 292 TO 505 FT., ARTESIA GROUP; 505 FT. TO BOTTOM,
SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	9.8	1552	PUMPING 1200 GPM RUN 10 MIN. NEW PUMP PH=7.45

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS wP#

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MAP # wP8
DESCRIPTION

LOCATION # 13.26.03.114   MAX WIGGINS WELL   RA 555
APPROXIMATELY 2 MILES EAST OF DEXTER, N.M. ON NM 190 AND 2 MILES NORTH OF NM 190
ON UNMARKED DIRT ROAD.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
WELL ABANDONED IN 1968 APPARENTLY DUE TO INTRUSION OF SALINE WATER (H2S SMELL,
TURBID WATER, CORRODED CASING)
DRILLER'S LOG: PASABO AND KUPE DRILLING CO., JUNE 1952   T.D.: 1150 FT.
CASING: 16 IN. TO 55 FT., 10 3/4 IN. FROM 55 TO 753 FT., 8 5/8 IN. LINER FROM
660 TO 794 FT.   WATER: 794 TO 814 FT., 833 TO 936 FT., 982 TO 1030 FT., 1080
TO 1090 FT. 1097 TO 1145 FT.   OPEN INTERVAL: 794 FT. TO BOTTOM   [illegible]Y:
0 TO 767 FT., ALLUVIUM, GATUNA FORMATION, AND ARTESIA GROUP (REMARKABLE [illegible]
OF GYPSUM AND ANHYDRITE); 767 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
08/08/67	11.4	1310	SUPPLEMENTAL TO LAST REPORT
09/06/63	5.1	1305	SUPPLEMENTAL TO LAST REPORT

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP9
DESCRIPTION LOCATION # 13.24.34.441 VILLA SOLANO WELL RA 1017-A
APPROXIMATELY 15 MILES SOUTH OF ROSWELL, N.M. ON US 285 AND 5.5 MILES WEST OF US 285 ON NM 559.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/21/75	3.6	1910	

MAP # WP10
DESCRIPTION LOCATION # 14.26.10.222 HAGERMAN CITY WELL RA NOT KNOWN
HAGERMAN, N.M. USUALLY SAMPLED FROM HOSE AT FIREHOUSE.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/14/74	4.6	1664	
08/24/74	5.4	1702	T=22.0 C
12/18/74	0.0	1763	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP 4 WP11
DESCRIPTION

LOCATION # 15.26.04.141 J.A. (JAKE) JOHNSON WELL RA 633
APPROXIMATELY 5 MILES SOUTH OF HAGERMAN, N.M. ON NM 2 AND 1 MILE EAST OF NM 2
ON DIRT ROAD.
DRILLER'S LOG: LEONARD GEORGE, APRIL AND MAY 1965 T.D.: 1220 FT.
CASING: 13 3/8 IN TO 1023 FT. WATER: 1023 FT. TO BOTTOM OPEN INTERVAL:
1023 FT. TO BOTTOM LITHOLOGY: 0 TO 20 FT., SOIL AND CALICHE; 20 TO [illegible] FT.,
REDBEDS AND ANHYDRITE; 851 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
06/14/74	2.1	1665	DISCHARGE=1000 GPM
08/24/74	5.6	1701	NOT PUMPING OR FLOWING, SAMPLED FROM TANK T=21.2 C
12/18/74	0.0	1764	
02/21/75	2.4	1791	
08/27/75	10.3	1954	

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

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MAP # WP12

DESCRIPTION LOCATION # 15.26.13.121 POLLARD WELL RA 165
APPROXIMATELY 7 MILES SOUTH OF HAGERMAN, N.M. ON NM 2, TURN EAST FROM NM 2 AT POWER TRANSFORMER STATION AND CONTINUE EAST FOR APPROXIMATELY 3.5 MILES ON DIRT ROAD.
ONE OF THE SEVEN 'LONG RECORD' WELLS OF THE LAST REPORT.
DRILLER'S LOG: SHROCK DRILLING CO., JULY AND AUGUST 1955 T.D.: 1381 FT.
CASING: 13 3/8 IN. TO 172 FT., 10 3/8 IN. FROM 172 TO 973 FT., 8 3/8 IN. FROM 973 TO 1223 FT., PERFORATED FROM 1166 TO 1223 FT. WATER: 932 TO 947 FT. (FRESH WATER), 1214 TO 1230 FT., 1350 TO BOTTOM WATER DEPTH UPON COMPLETION: 3 FT. OPEN INTERVAL: 1166 FT. TO BOTTOM LITHOLOGY: 0 TO 872 FT., ALLUVIUM, GATUNA FORMATION, AND ARTESIA GROUP (REMARKABLE AMOUNT OF GYPSUM AND ANHYDRITE); 872 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/14/67	25.2	1811	SUPPLEMENTAL TO LAST REPORT
08/16/67	28.7	1814	SUPPLEMENTAL. SAMPLED AFTER PUMPING SEVERAL HOURS
01/26/68	4.9	1806	SUPPLEMENTAL TO LAST REPORT
10/09/68	43.1	1815	SUPPLEMENTAL TO LAST REPORT
04/09/74	3.0	1573	NOT PUMPING, SAMPLED FROM TANK FILLED THAT MORNING
06/14/74	4.3	1666	NOT PUMPING, SAMPLED FROM TANK
08/24/74	8.3	1700	SAMPLED FROM TANK T=22.2 C
12/18/74	0.0	1765	FLOWING
02/21/75	0.0	1800	T=23.5 C
04/25/75	5.5	1885	
08/27/75	5.8	1955	SAMPLED FROM TANK

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WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP13

DESCRIPTION

LOCATION # 16.26.20.433 PARKHAM AND LIVINGSTON WELL RA 558-COMB-952
APPROXIMATELY 4 MILES NORTH OF ARTESIA, N.M. ON NM 2 AND 0.5 MILES WEST OF NM 2
ON UNMARKED ROAD.
DRILLER'S LOG: THERE ARE TWO POSSIBLE LOGS FOR THIS WELL. THE LOG USED HERE IS
FOR THE PARKHAM AND LIVINGSTON WELL. THERE IS ANOTHER WELL WITH LOCATION #
11.26.20.430 AND RA 558, WHICH IS HOW THIS WELL WAS REPORTED IN MAY 1975,
HOWEVER, THIS OTHER WELL WAS DRILLED IN 1907 AND THE DEPTH DOES NOT CORRESPOND
TO THAT REPORTED.
MYRON BRUNING, NOVEMBER 1953 THROUGH JANUARY 1954 T.D.: 1063 FT.
CASING: 13 3/8 IN. TO 750 FT., 10 3/4 IN. LINER FROM 740 TO 905 FT., SLOTTED
OVER ENTIRE LENGTH WATER: 760 TO 785 FT., 960 TO 970 FT., 1010 TO 1025 FT.
WATER DEPTH UPON COMPLETION: 10 FT. OPEN INTERVAL: 740 FT. TO BOTTOM
LITHOLOGY: 0 TO 750 FT., ALLUVIUM, GATUNA FORMATION, AND ARTESIA GROUP
(REMARKABLE AMOUNT OF GYPSUM AND ANHYDRITE); 750 FT. TO BOTTOM, SAN ANDRES
FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	2.9	1873	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP13

DESCRIPTION

LOCATION # 16.26.29.143 L.T. LEWIS WELL RA 1117
APPROXIMATELY 1/2 MILE WEST OF NM 2, NORTH OF ARTESIA, N.M., 1 MILE NORTH OF
JUNCTION OF US 285 AND NM 2.
DRILLER'S LOG: MYRON BRUNING, MAY 1952 T.D.: 1079 FT. CASING: 13 3/8
IN. TO 210 FT., 10 3/4 IN. FROM 210 TO 774 FT., 8 3/4 IN. FROM 768 TO 956 FT.,
SLOTTED ALONG ENTIRE LENGTH WATER 956 FT. (FIRST ENCOUNTERED)
WATER DEPTH UPON COMPLETION: 415 FT. OPEN INTERVAL: 774 FT. TO BOTTOM
LITHOLOGY: 0 TO 125 FT., ALLUVIUM; 125 TO 460 FT., GATUNA FORMATION; 460 TO 768
FT., ARTESIA GROUP; 768 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	7.1	1874	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP14

DESCRIPTION

LOCATION # 17.26.10.333 V.L. GATES WELL RA 307
APPROXIMATELY 0.5 MILES EAST OF US 285 IN ARTESIA, N.M. ON US 82, AT NORTHWEST
CORNER OF INTERSECTION AT THIS POINT.
DRILLER'S LOG: PEARSON BROS., MAY AND JUNE 1926 T.D.: 1263 FT. CASING:
12 1/2 IN. TO 452 FT., 10 IN. FROM 447 TO 930 FT. (FIRST 5 FT. OF 10 IN.
CASING INSIDE LAST 5 FT. OF 12 1/2 IN. CASING, NO SEAL) WATER: 1086 TO
1106 FT. (FIRST FLOW) OPEN INTERVAL: 930 TO 1263 FT. LITHOLOGY: 0 TO
177 FT., ALLUVIUM; 177 TO 373 FT., GATUNA FORMATION; 373 TO 779 FT., ARTESIA
GROUP; 779 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	22.6	1530	T=19.9 C PH=7.00
04/09/74	3.1	1578	
06/14/74	6.0	1668	
08/24/74	8.4	1698	
08/28/75	10.2	1958	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP14

DESCRIPTION

LOCATION # 17.26.10.433 MRS. M.J. SULLIVÁN WELL RA 397
APPROXIMATELY 1.5 MILES EAST OF US 285 IN ARTESIA, N.M. ON US 82, NORTH SIDE OF ROAD.
DRILLER'S LOG: PEARSON BROS. AND J.E. SHROCK, JANUARY AND FEBRUARY 1954
T.D.: 1095 FT. CASING: 13 3/8 IN. TO 200 FT., 10 IN. FROM 200 TO 800 FT., 8 IN. CASING FROM 800 TO 1035 FT. WATER: 815 TO 830 FT., 1040 FT. TO BOTTOM
OPEN INTERVAL: 1035 TO 1095 FT. LITHOLOGY: 0 TO 260 FT, ALLUVIUM; 260 TO 380 FT., GATUNA FORMATION; 380 TO 798 FT, ARTESIA GROUP; 798 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/11/73	4.1	1601	T=23.8 C PH=7.18
04/09/74	5.4	1630	T=23.2 C
06/14/74	1.8	1673	FLOWING 600 GPM
03/28/75	10.4	1833	
08/28/75	9.0	1960	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP14

DESCRIPTION LOCATION # 17.26.11.433 BLAINE HAINES WELL PA 777
APPROXIMATELY 2.5 MILES EAST OF US 285 IN ARTESIA, N.M. ON US 82, NORTH SIDE OF ROAD.
DRILLER'S LOG: BOB JOHNSON, APRIL AND MAY 1947 T.D.: 1034 FT. CASING: 13 IN. TO 117 FT., 10 3/4 IN. FROM 117 TO 760 FT., 8 5/8 IN. LINER TO 283 FT., 6 5/8 IN. LINER FROM 283 FT. TO 370 FT.(?) WATER: 814 TO 831 FT., 975 TO 1008 FT. OPEN INTERVAL: 760 FT. TO BOTTOM(?) LITHOLOGY: 0 TO 240 FT., ALLUVIUM; 240 TO 350 FT., GATUNA FORMATION; 350 TO 751 FT., ARTESIA GROUP; 751 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	17.9	1535	T=23.0 C PH=7.28
12/18/74	0.0	1770	
03/28/75	6.4	1835	
08/28/75	9.4	1962	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP15

DESCRIPTION LOCATION # 17.26.14.211 G.E. SHARP WELL RA 895
APPROXIMATELY 2.5 MILES EAST OF US 285 IN ARTESIA, N.M. ON US 82, SOUTH SIDE OF ROAD AT THE OASIS STORE.
DRILLER'S LOG: MYRON BRUNING, FILED APRIL 1952 T.D.: 1013 FT. CASING: 10 3/4 IN. TO 806 FT., 8 3/4 IN. FROM 806 TO 990 FT., PERFORATED OVER ENTIRE LENGTH WATER: 863 TO 870 FT. ORIGINALLY FLOWING OPEN INTERVAL: 806 FT. TO BOTTOM LITHOLOGY: 0 TO 801 FT., ALLUVIUM, CATUNA FORMATION, AND ARTESIA GROUP; 801 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	58.5	1534	PUMPING 557 GPM (METER) T=23.6 C PH=7.30
04/09/74	6.0	1631	T=23.0 C
06/14/74	0.0	1674	
08/28/75	8.8	1961	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP15

DESCRIPTION

LOCATION # 17.26.15.133 JACKSON/ROWLEY WELL RA 2050-COMB-2871
APPROXIMATELY 1 MILE EAST OF US 285 IN ARTESIA, N.M. ON US 82, AND 0.5 MILES SOUTH OF US 82 ON UNMARKED ROAD.
DRILLER'S LOG: SHROCK DRILLING CO., APRIL 1955 T.D.: 1231 FT. CASING: 13 3/8 IN. TO 207 FT., 10 3/4 IN. FROM 207 TO 793 FT., 8 3/8 IN. FROM 793 TO 1025 FT., PERFORATED FROM 793 TO 1012 FT. WATER: 1016 TO 1030 FT. WATER DEPTH UPON COMPLETION: 42 FT. OPEN INTERVAL: 793 TO 1012 FT. AND 1025 FT. TO BOTTOM LITHOLOGY: 0 TO 209 FT., ALLUVIUM; 209 TO 300 FT., GATUNA FORMATION; 300 TO 788 FT., ARTESIA GROUP; 788 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/12/73	12.9	1602	PUMPING 800 GPM T=24.0 C PH=7.10
06/14/74	2.9	1671	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP15

DESCRIPTION

LOCATION # 17.26.15.413 W.M. JACKSON ('REMARKABLE CHIMNEY') WELL RA 1578
APPROXIMATELY 1.5 MILES EAST OF 285 IN ARTESIA, N.M. ON US 82 AND 3/4 MILE SOUTH OF US 82 ON UNMARKED ROAD.
DRILLER'S LOG: THERE ARE TWO LOGS FOR LOCATION # 17.26.15.410, NEITHER OF WHICH GIVE AN RA #. BOTH WERE DRILLED IN THE EARLY 1900'S TO 850 FT. IN 1974 OR 1975, THIS WELL WAS REPORTED AS 850 FT. DEEP WITH THE PRODUCTION INTERVAL FROM 653 TO 850 FT. THE WELL CONSTRUCTION IS NOT GIVEN SINCE IT IS PROBABLY DIFFERENT FROM EITHER OF THE TWO OLDER WELLS, HOWEVER, THE LOGS OF THE TWO OLDER WILL BE USED TO DETERMINE THE LITHOLOGY OF THIS WELL, SINCE THEY ARE PROBABLY VERY SIMILAR, IF NOT THE SAME.
LITHOLOGY: 0 TO 120 FT., ALLUVIUM; 120 TO 375 FT., GATUNA FORMATION; 375 TO 751 FT., ARTESIA GROUP; 751 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	6.4	1635	T=18.0 C
06/14/74	3.4	1676	
08/24/74	4.6	1695	T=18.0 C

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP16

DESCRIPTION LOCATION # 17.26.29.111 DON MENEFEE WELL RA 1925-S
APPROXIMATELY 1 MILE WEST OF US 285 IN ARTESIA, N.M. ON US 82, AND 2 MILES SOUTH OF US 82 ON UNMARKED ROAD.
DRILLER'S LOG: PEARSON BROS. AND SHROCK, APRIL AND MAY 1952 T.D.: 1150 FT.
CASING: 13 3/8 IN. TO 222 FT., 10 3/4 IN. FROM 222 TO 700 FT., 8 1/4 IN. FROM 680 TO 860 FT., PERFORATED OVER ENTIRE LENGTH WATER: 705 TO 732 FT., 828 TO 835 FT., 912 TO 916 FT., 955 TO 965 FT., 972 TO 1040 FT., 1055 TO 1108 FT., 1128 TO 1150 FT. WATER DEPTH UPON COMPLETION: 63 FT. OPEN INTERVAL: 700 FT. TO BOTTOM LITHOLOGY: 0 TO 330 FT., ALLUVIUM; 330 TO 420 FT., GATUNA FORMATION; 420 TO 666 FT., ARTESIA GROUP; 666 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	4.2	1575	
07/21/75	15.6	1906	
08/28/75	8.3	1963	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

****

MAP # NOT GIVEN ONE DUE TO INSUFFICIENT LOCATION.
DESCRIPTION LOCATION # NOT KNOWN GEORGE MAYO WELL RA NOT KNOWN
ADDRESS: GEORGE MAYO 1211 CHISUM STREET ARTESIA, N.M. 88210
DEPTH REPORTED IN APRIL 1974 AS 1000 FT.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
04/09/74	5.9	1634	PUMPING 1000 GPM
06/14/74	0.0	1675	PUMPING 900 GPM
08/24/74	3.1	1694	PUMPING 770 GPM T=21.6 C

****

MAP # WP17
DESCRIPTION LOCATION # 18.26.18.322 VANDIVER WELL RA 3181
APPROXIMATELY 6 MILES SOUTH OF ARTESIA, N.M. ON US 285, AND 1.5 MILES WEST OF
US 285 ON NM 229.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
07/21/75	11.8	1908	

****

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

MAP # WP17

DESCRIPTION

LOCATION # 18.26.18.332 F.F. THORPE WELL RA 747
APPROXIMATELY 1.5 MILES WEST OF US 285 SOUTH OF ARTESIA, N.M. ON NM 229.
DRILLER'S LOG: SHROCK DRILLING CO., FEBRUARY AND MARCH 1962 T.D.: 1061 FT.
CASING: 13 3/8 IN. TO 575 FT. WATER: 660 TO 696 FT, 800 TO 819 FT., 963 TO
1055 FT. OPEN INTERVAL: 575 FT. TO BOTTOM LITHOLOGY: 0 TO 215 FT,
ALLUVIUM; 215 TO 390 FT., GATUNA FORMATION; 390 TO 615 FT., ARTESIA GROUP;
615 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/28/75	7.0	1830	PUMPING 1100 GPM
07/21/75	5.6	1907	

MAP # WP17

DESCRIPTION

LOCATION # 18.26.18.411 VANDIVER WELL RA 3181-S6
APPROXIMATELY 6 MILES SOUTH OF ARTESIA, N.M. ON US 285, AND 2 MILES WEST AND
SOUTH ON NM 229.
REPORTED AS A DEEP WELL IN MAY 1975.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
05/20/75	11.1	1876	

WELLS PRODUCING FROM THE PRINCIPAL AQUIFER

MAP SYMBOL IS WP#

****

MAP # WP18
DESCRIPTION LOCATION # 19.26.05.323 POWELL WELL RA NOT KNOWN
APPROXIMATELY 11 MILES SOUTH OF ARTESIA, N.M. ON US 285, 1/2 MILE WEST OF ROAD.
PRODUCING INTERVAL REPORTED AS 567 TO 905 FT. IN JANUARY 1972.

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/11/72	19.8	A-1	

****

WELLS PRODUCING FROM THE ALLUVIUM AND PRINCIPAL AQUIFERS

MAP SYMBOL IS WAP#

MAP # WAP1
DESCRIPTION

LOCATION # 10.24.22.110 JOHN M. HOLLEY WELL RA 896-B
APPROXIMATELY 3 MILES NORTH OF ROSWELL, N.M. ON US 285 AND 1.1 MILES EAST OF US 285 ON BERRENDO ROAD (NM 431). REPORTED IN MARCH 1973 AS NEAR THE RIO HONDO, LIMESTONE EXPOSED 0.25 MILES FROM WELL LOCATION.
DRILLER'S LOG: CALVIN STEPRETT, MARCH THROUGH APRIL, 1966 T.D.: 306 FT.
CASING: 10 3/4 IN. TO 234 FT. WATER: 242 TO 262 FT., 275 TO 286 FT., 292 TO 300 FT. WATER DEPTH UPON COMPLETION: 65 FT. OPEN INTERVAL: 234 FT. TO BOTTOM LITHOLOGY: 0 TO 17 FT., ALLUVIUM; 17 TO 237 FT., GATUNA FORMATION; 237 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
03/24/73	14.2	1490	PUMPING 1000 GPM (METER) PH=7.33

MAP # WAP2
DESCRIPTION

LOCATION # 14.23.24.433 ROSS CASAVEZ WELL RA 3021-S
APPROXIMATELY 9.5 MILES WEST OF US 285 ON NM 13, SOUTHEAST OF ROSWELL, N.M.
DRILLER'S LOG: RANDOLF JOHNSTON, APRIL THROUGH JULY 1961 T.D.: 397 FT.
CASING: 13 3/8 IN. TO 303 FT. WATER: 210 TO 217 FT., 270 TO 275 FT., 351 TO 376 FT., 387 TO 392 FT. WATER DEPTH UPON COMPLETION: 200 FT.
OPEN INTERVAL: 303 FT. TO BOTTOM LITHOLOGY: 0 TO 283 FT., ALLUVIUM AND GATUNA FORMATION; 283 FT. TO BOTTOM, SAN ANDRES FORMATION

DATE COLLECTED	T.U.	SAMPLE #	COMMENTS
01/16/72	43.2	1422	

Appendix B

OBSERVATION WELL LOGS

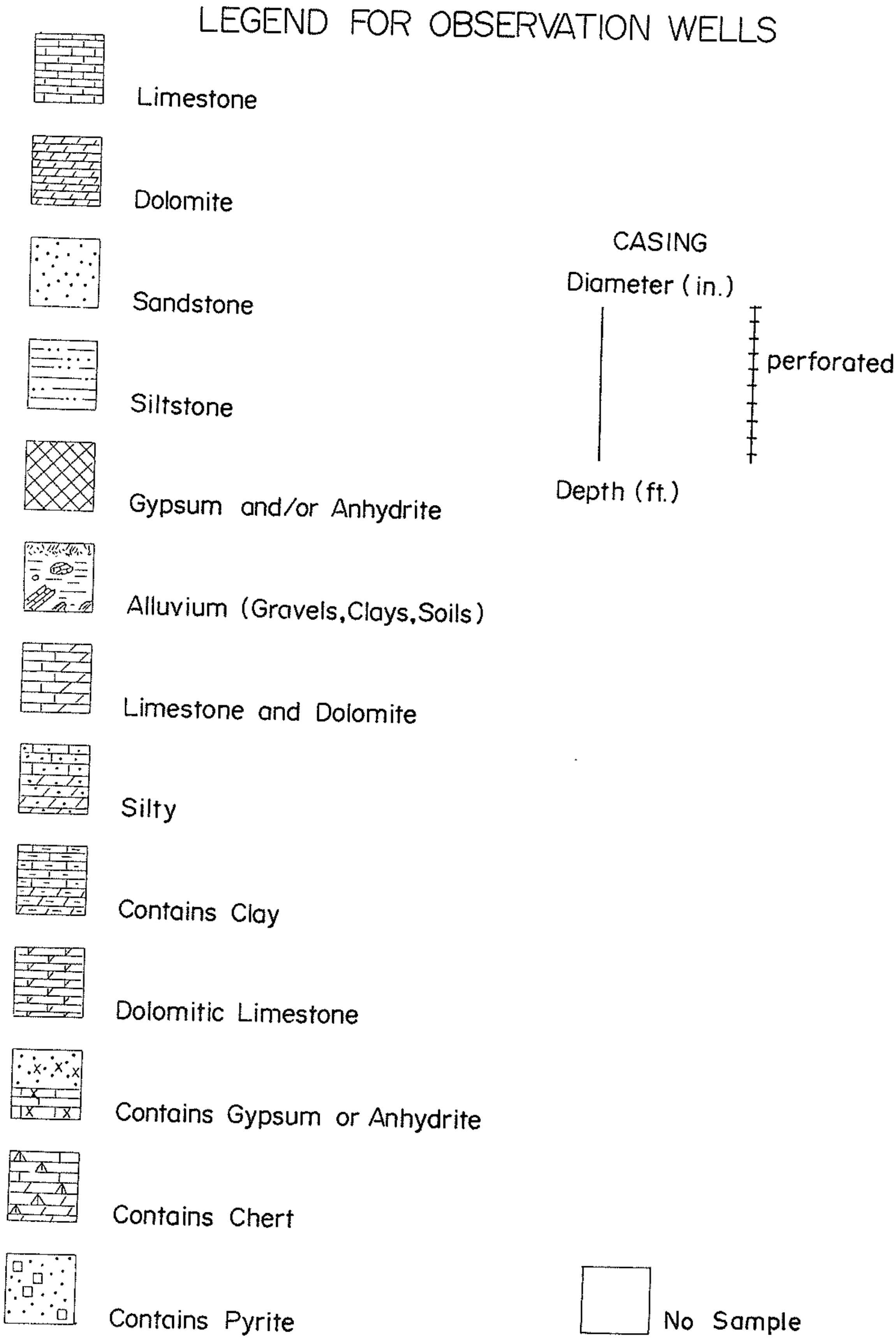

Fig. B1. PVACD Observation wells. Legend

P.V.A.C.D. OBSERVATION WELL NO. 1

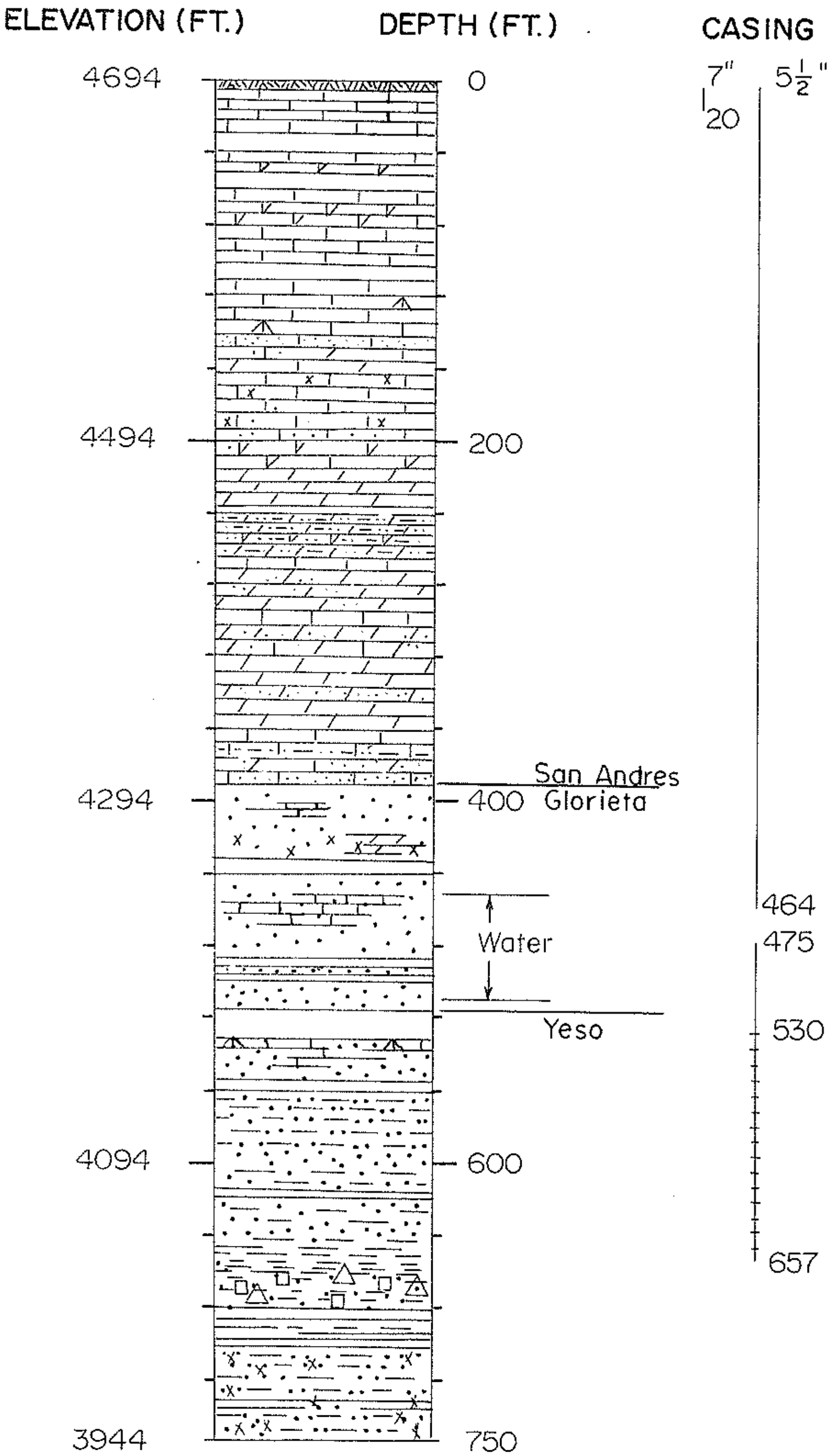

Fig. B2.

PVACD Observation well # 1: 7.20.16.333
(After a log from Crawford and Borton, 1958).

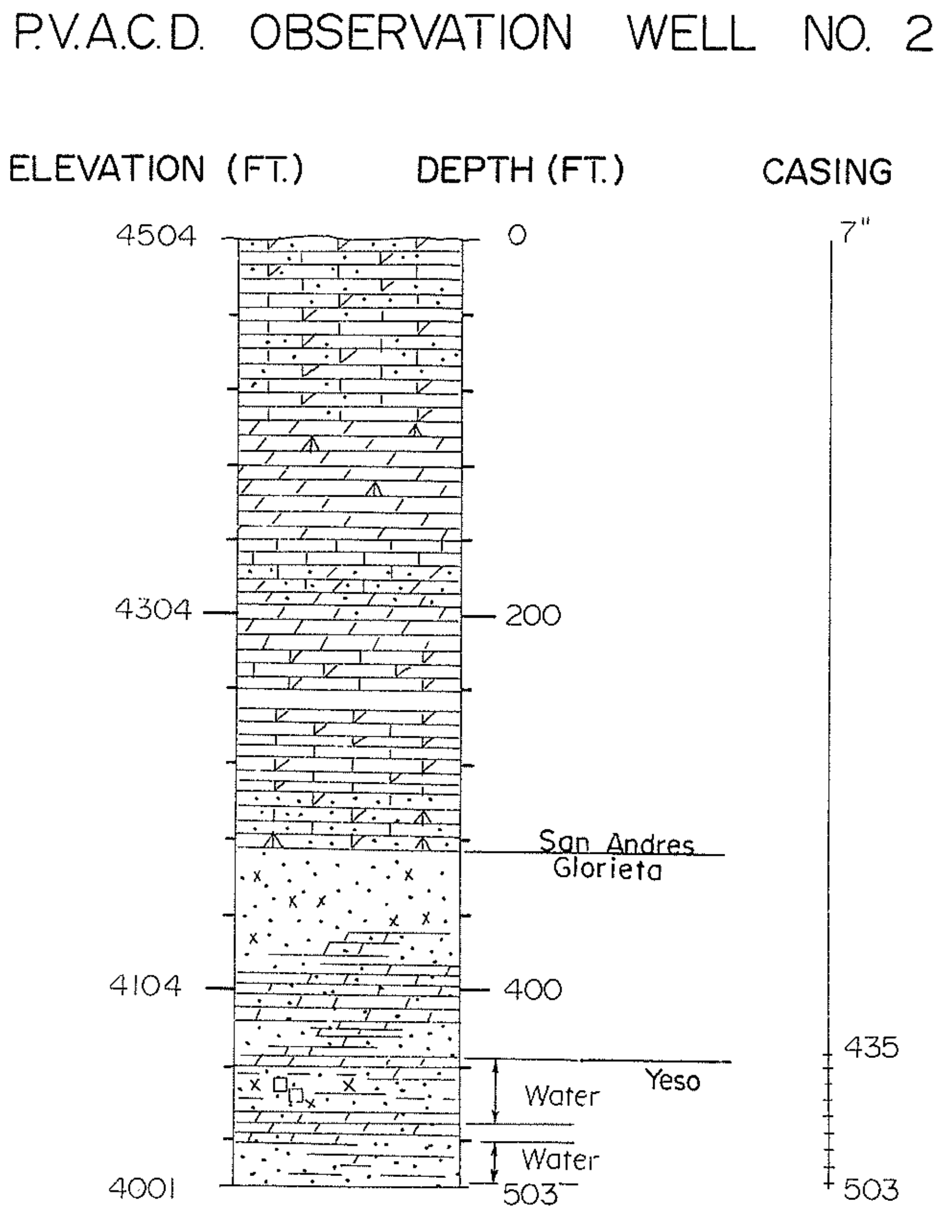

Fig. B3.

PVACD Observation well # 2: 10.20.16.444
(After a log from Crawford and Borton, 1958).

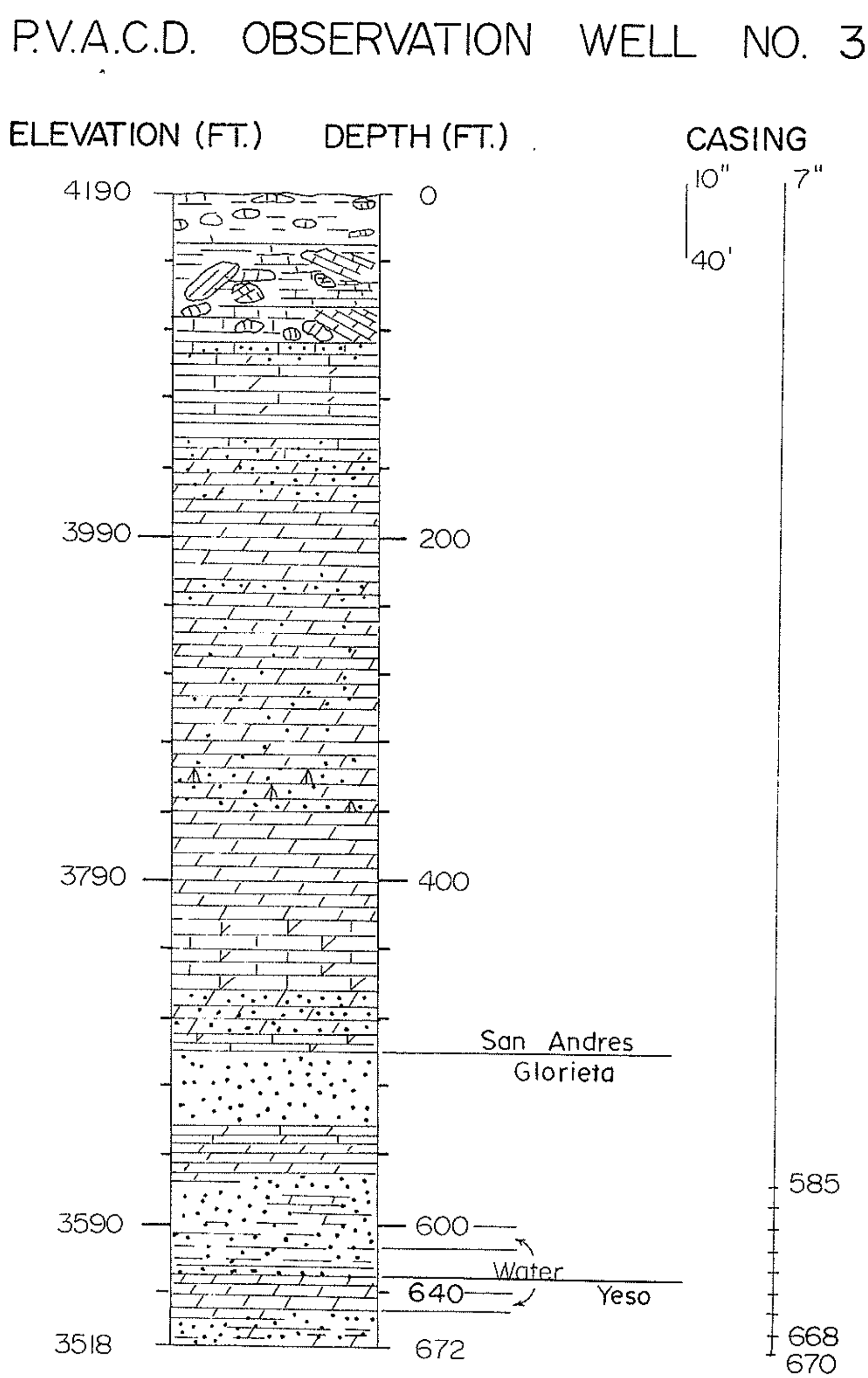

Fig. B4.

PVACD Observation well # 3: 10.21.16.222
(After a log from Crawford and Borton, 1958).

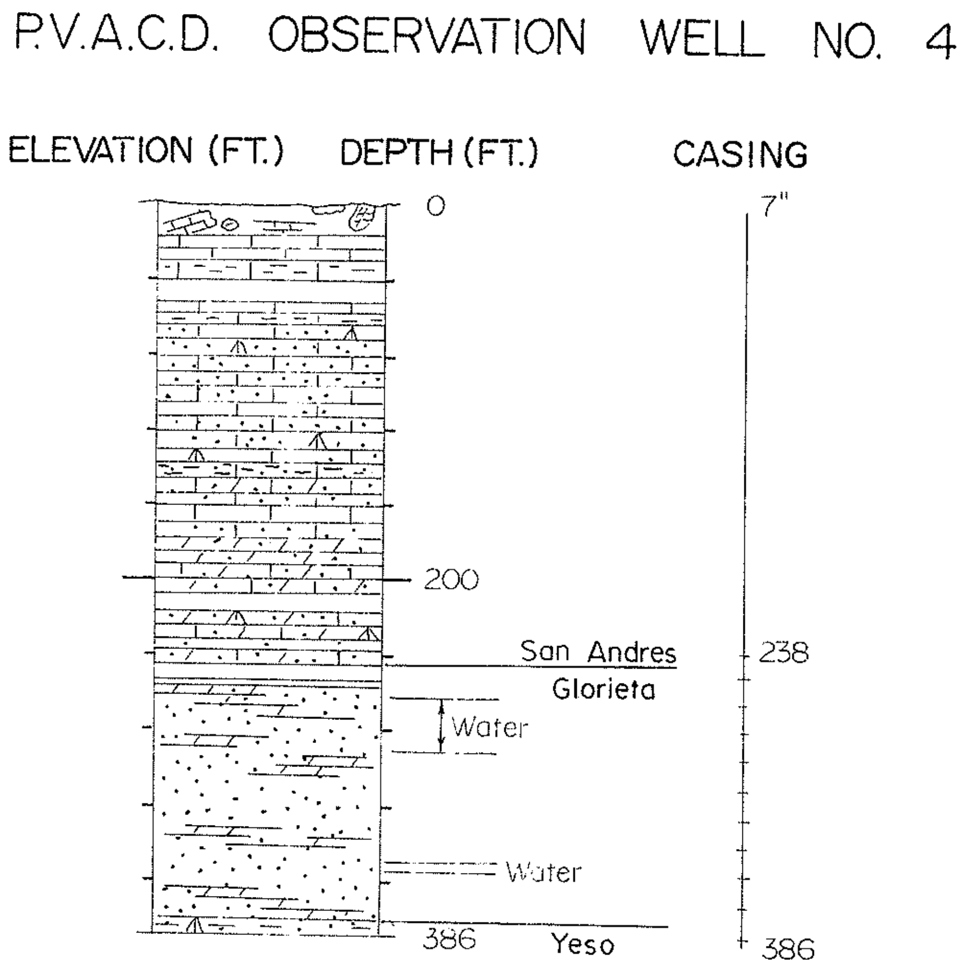

Fig. B5.

PVACD Observation well # 4: 13.20.13.222
(After a log from Crawford and Borton, 1958).

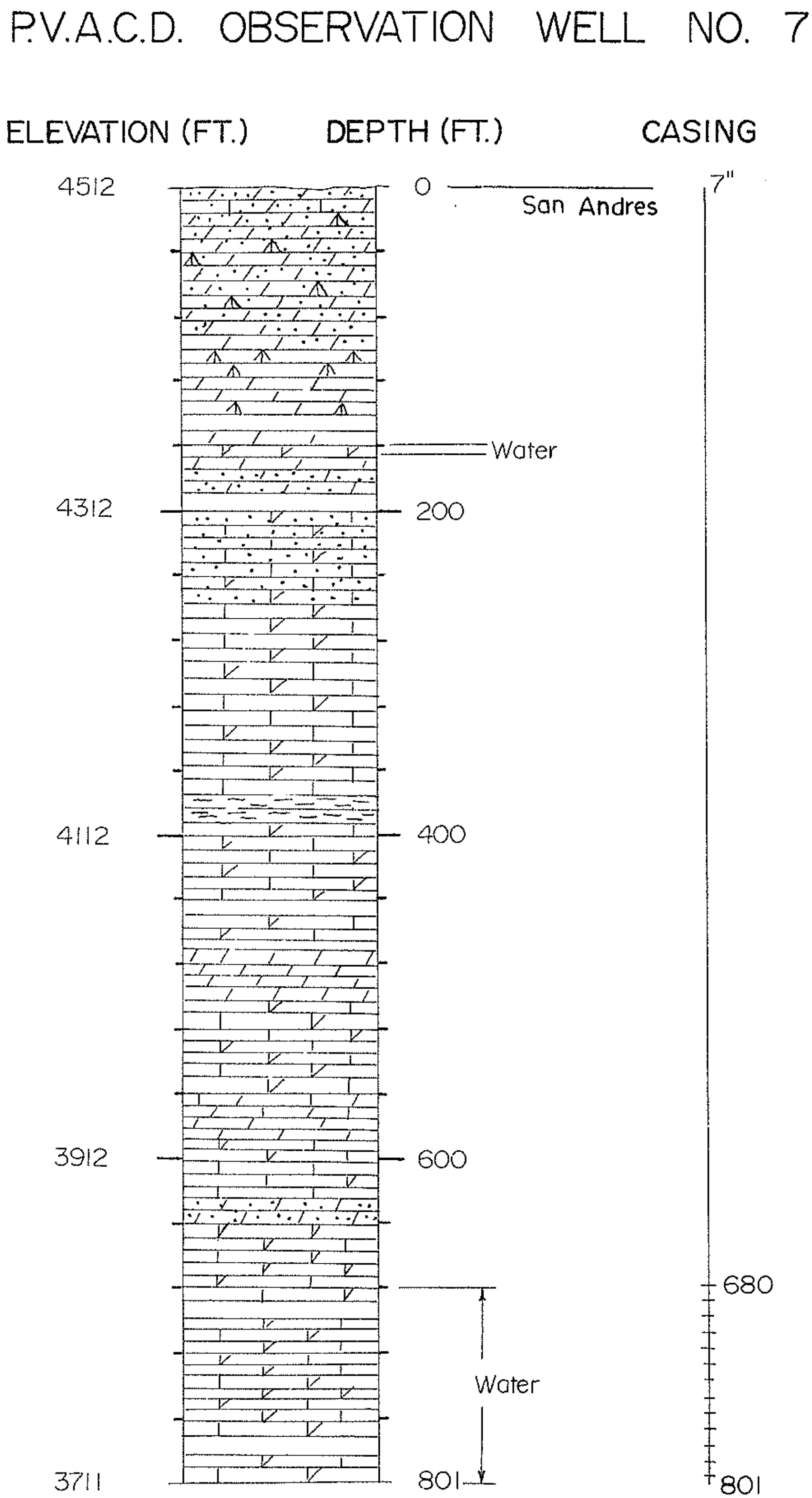

Fig. B6.

PVACD Observation well # 7: 17.20.18.434
(After a log from Crawford and Borton, 1958).

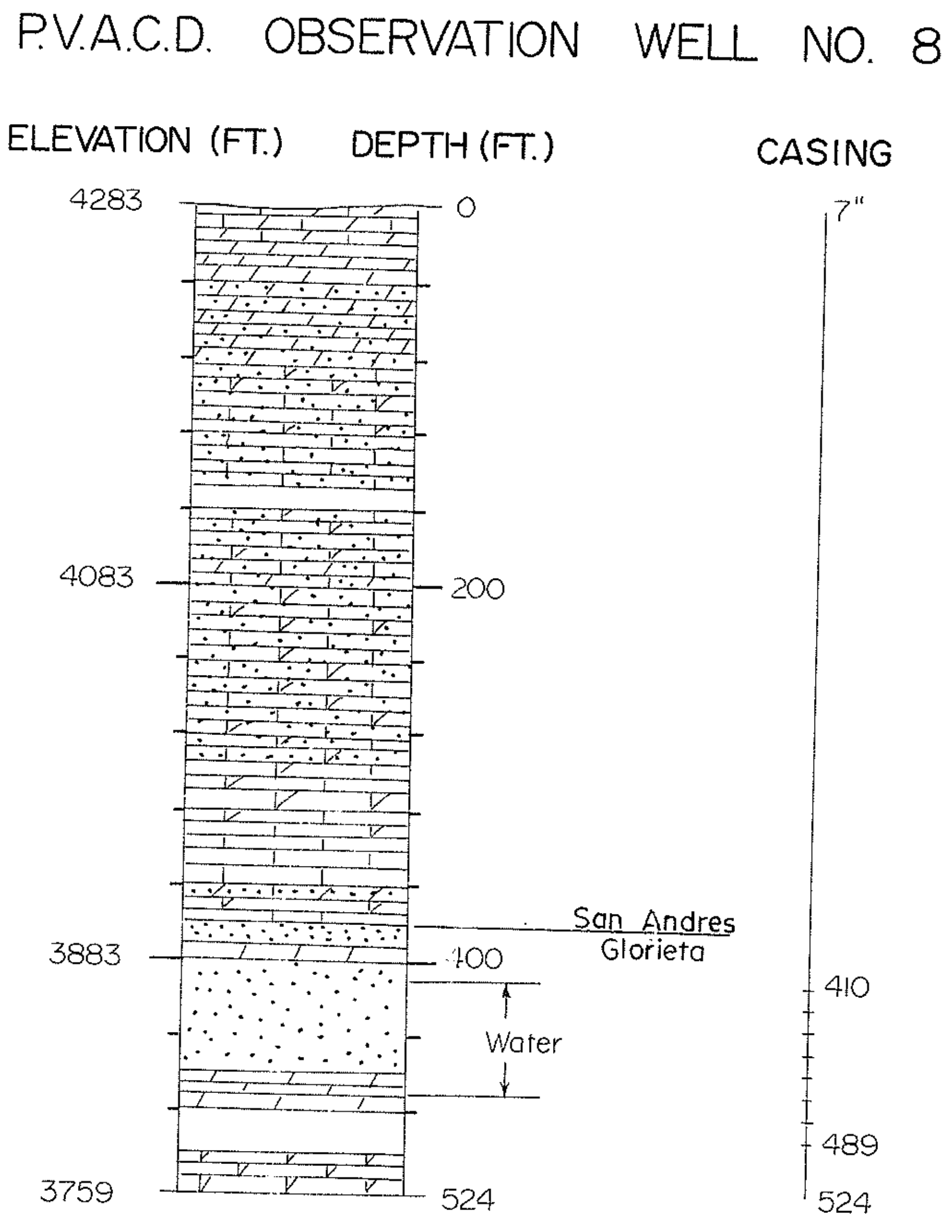

Fig. B7.

PVACD Observation well # 8: 11.21.18.333
(After a log from Crawford and Borton, 1958).

P.V.A.C.D. OBSERVATION WELL NO. 9

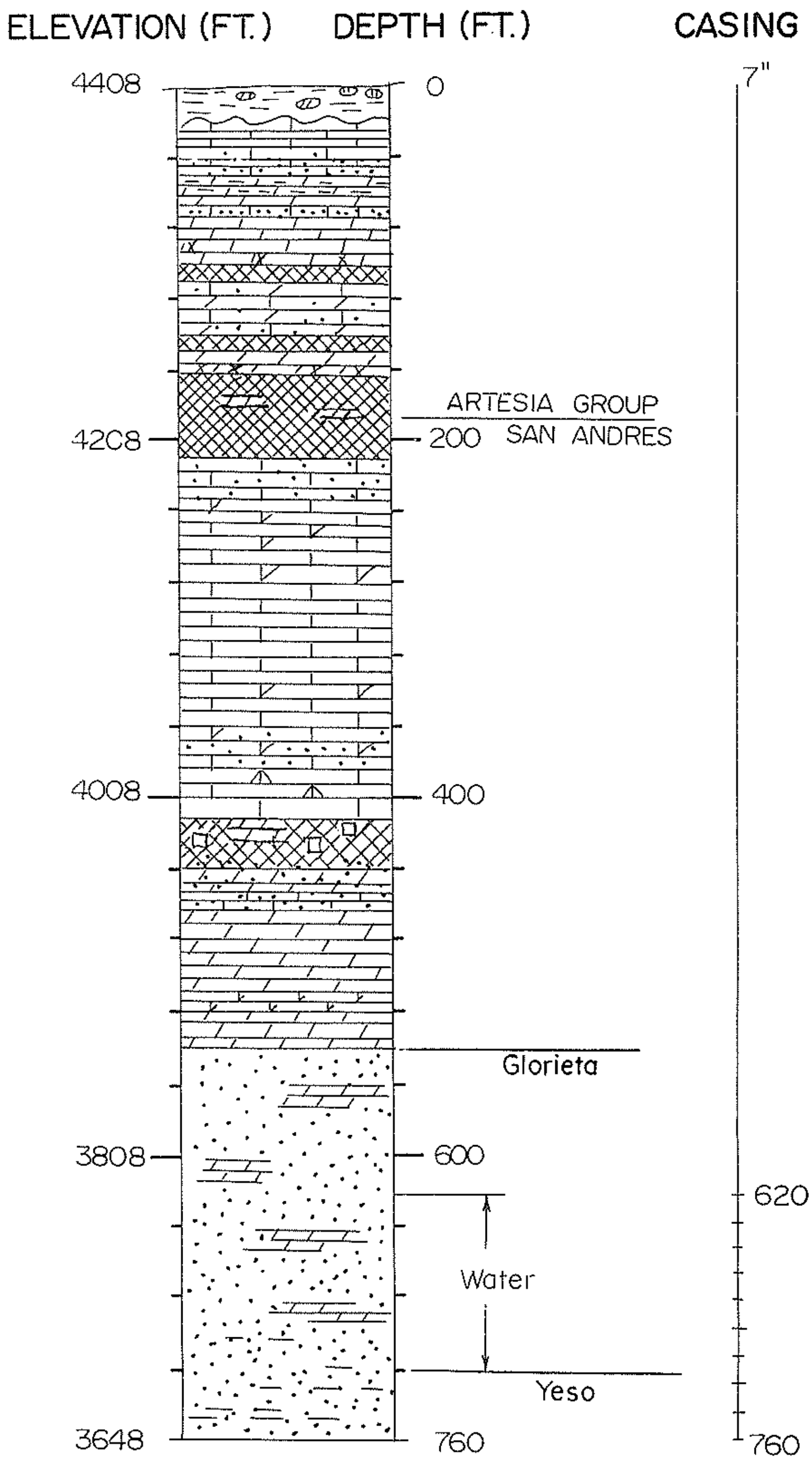

Fig. B8.

PVACD Observation well # 9: 4.21.33.111
(After a log from Crawford and Borton, 1958).

Appendix C

AREAL PRECIPITATION

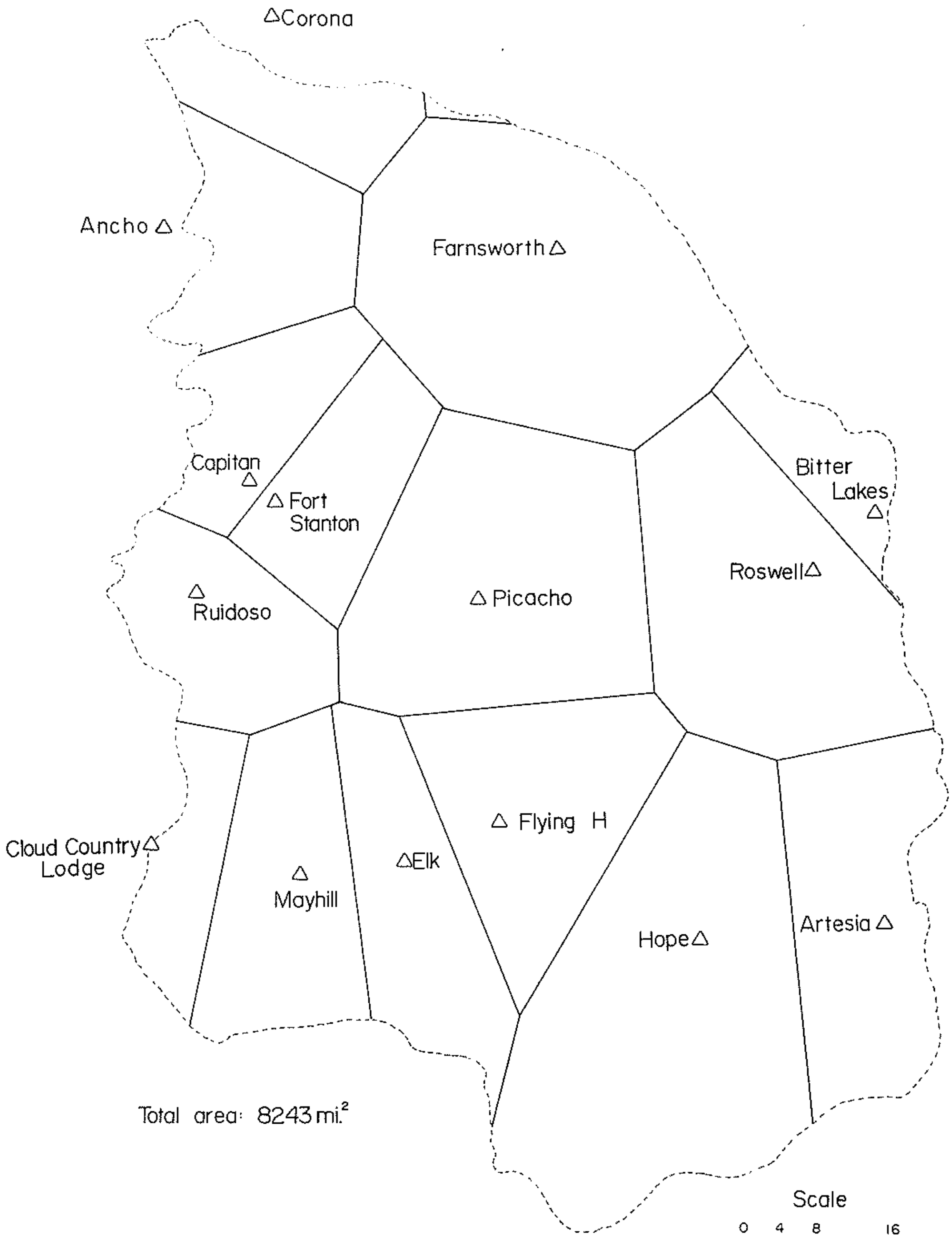

Fig. C1.

Thiessen polygons used for computation of areal precipitation.

Precipitation Listing

1955-1974

1955 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP[1]
ANCHO	0.48	0.05	0.23	0.23	0.49	0.67	3.04	3.69	0.74	0.58	0.10	0.56	3996.48
ARTESIA	0.44	0.0	0.0	0.15	0.63	0.34	3.95	0.45	1.34	1.85	0.24	0.0	5605.83
BITTER LAKES	0.25	0.0	0.02	0.33	1.39	0.34	4.56	1.55	4.81	2.02	0.0	0.0	3010.16
CAPITAN	0.48	0.04	0.56	0.31	0.31	0.71	4.28	1.77	3.60	0.68	0.01	0.10	3726.50
CLOUD COUNTRY L	2.37	0.55	3.82	0.0	0.81	0.44	10.48	5.37	0.55	2.06	0.16	0.22	6144.05
CORONA	0.15	0.10	0.30	0.10	0.93	0.28	5.10	2.71	0.93	1.00	0.03	0.51	3095.70
ELK	0.81	0.0	0.30	0.19	0.06	0.31	9.02	2.80	2.39	1.76	0.07	0.0	8217.43
FARNSWORTH RANCH	0.13	0.01	0.09	0.54	0.38	0.49	2.42	0.51	2.80	0.11	0.0	0.10	8156.07
FLYING H	0.60	0.0	0.0	0.16	1.23	0.05	7.64	1.25	4.80	2.24	0.14	0.0	10304.58
FORT STANTON	0.34	0.0	0.69	1.86	0.27	0.77	4.94	2.09	2.56	0.84	0.0	0.14	4970.07
HOPE	0.35*	0.0*	0.07*	0.23*	1.19*	0.0*	6.72*	0.86*	3.83*	2.22*	0.14*	0.03*	19440.52
MAYHILL	1.02	0.16	0.81	0.01	0.17	0.57	9.92	1.53	1.65	1.52	0.06	0.09	8404.79
PICACHO	0.21	0.0	0.12	0.07	0.09	0.26	8.56	2.27	2.78	1.02	0.05	0.0	13856.14
ROSWELL	0.29	0.0	0.10	0.19	0.41	0.15	2.25	0.61	2.95	1.71	0.05	0.0	7351.24
RUIDOSO	1.12	0.86	3.12	0.17	0.61	0.64	5.12	2.87	1.60	1.77	0.04	0.59	7218.88

ANNUAL MEAN PRECIPITATION IN INCHES: 13.77

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6053242.00

1) AXP: Area in mi^2 x Precipitation in inches

*) Data Synthesized by stepwise regression program BMO02R Revised March 27, 1973

Health Science Computing Faculty, U.C.L.A.

1956 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.87	1.77	0.0	0.20	0.24	0.90	2.56	0.84	0.0	0.83	0.0	0.08	3050.72
ARTESIA	0.05	0.45	0.0	0.04	0.91	2.08	0.81	1.68	0.12	0.87	0.0	0.0	4184.97
BITTER LAKES	0.02	1.30	0.0	0.0	0.15	0.0	0.53	0.57	0.0	0.54	0.0	0.0	612.67
CAPITAN	0.24	1.03	0.0	0.07	0.42	2.40	2.27	1.68	0.03	0.83	0.05	0.10	2644.80
CLOUD COUNTRY L	1.16	2.25	0.0	0.57	0.0	1.42	6.01	3.84	0.02	1.55	0.0	0.90	4057.88
CORONA	0.53	1.10	0.05	0.13	0.63	1.90	2.97	1.30	0.0	1.21	0.0	0.01	2519.40
ELK	0.03	1.53	0.03	0.15	0.77	1.05	1.52	1.91	0.30	0.96	0.0	0.30	3967.20
FARNSWORTH RANCH	0.03	0.48	0.05	0.45	0.40	1.56	1.28	0.95	0.0	0.28	0.0	0.03	5928.76
FLYING H	0.0	1.56	0.05	0.0	0.0	0.0	1.08	2.35	0.30	0.50	0.0	0.14	3408.31
FORT STANTON	0.10	1.64	0.0	0.04	0.92	0.66	3.54	1.37	0.0	1.01	0.0	0.09	3213.91
HOPE	0.05*	1.81*	0.03*	0.08*	0.0*	0.51*	0.96*	2.15*	0.10*	0.54*	0.0*	0.12*	7905.47
MAYHILL	0.13*	1.56*	0.06*	0.30*	0.66*	1.48*	2.65*	3.17*	0.15*	1.08*	0.0*	0.47*	5587.20
PICACHO	0.0	1.60	0.0	0.02	1.28	0.98	1.32	0.73	0.05	0.34	0.0	0.18	5837.00
ROSWELL	0.02	1.42	0.03	0.03	0.40	0.04	0.54	1.13	0.16	0.54	0.0	0.04	3671.40
RUIDOSO	0.43	2.06	0.0	0.26	0.57	1.78	4.43	3.28	0.56	1.05	0.0	0.29	5736.90

ANNUAL MEAN PRECIPITATION IN INCHES: 7.56

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 3324081.00

1957 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.29	1.31	1.48	0.73	0.59	0.18	1.58	2.82	0.34	2.37	1.60	0.40	5037.92
ARTESIA	0.15	0.28	0.26	0.06	0.88	0.07	0.60	0.47	0.07	2.48	0.64	0.0	3558.12
BITTER LAKES	0.09	0.35	0.97	0.02	0.30	0.38	0.51	1.43	0.0	3.02	0.61	0.0	1512.36
CAPITAN	0.49	0.76	1.26	0.34	2.81	0.03	5.89	4.32	0.21	4.07	0.96	0.12	5165.39
CLOUD COUNTRY L	1.50	2.74	3.51	1.01	0.56	0.40	3.02	7.02	0.41	4.72	2.40	0.34	5327.26
CORONA	0.46	0.84	1.10	1.47	1.15	0.85	1.51	3.49	0.95	3.83	1.51	0.07	4393.64
ELK	0.12	0.60	0.49	0.83	0.90	0.21	2.25	6.55	0.35	3.62	2.45	0.0	8523.68
FARNSWORTH RANCH	0.0	1.06	0.90	0.50	1.28	0.28	1.05	2.63	0.0	1.51	0.52	0.0	10469.48
FLYING H	0.0	0.53	0.70	0.95	0.54	0.02	1.72	3.44	0.11	5.23	1.60	0.0	8443.96
FORT STANTON	0.56	0.56	1.10	0.24	0.73	0.05	6.09	5.40	0.14	3.02	0.73	0.03	6396.94
HOPE	0.04*	0.58*	0.44*	0.59*	0.39*	0.0*	1.15*	1.89*	0.87*	5.11*	0.39*	0.03*	14269.63
MAYHILL	0.11	0.90	0.73	0.55	0.75	0.36	5.04	7.84	0.51	4.24	1.43	0.0	10732.79
PICACHO	0.05	0.86	0.32	0.33	1.54	0.20	1.95	3.29	0.68	2.00	1.15	0.05	11162.14
ROSWELL	0.09	0.64	0.80	0.31	0.43	0.06	0.87	1.23	1.18	2.91	0.80	0.0	7866.07
RUIDOSO	1.36	1.24	1.25	0.72	1.37	1.45	4.88	6.64	0.45	3.24	1.70	0.27	9582.28

ANNUAL MEAN PRECIPITATION IN INCHES: 13.88

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6103578.00

1953 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.88	0.32	3.54	1.88	0.83	1.25	1.95	2.08	4.32	0.75	0.52	0.70	6999.35
ARTESIA	1.44	1.14	2.67	1.19	0.14	2.97	1.34	2.06	4.76	1.79	0.70	0.01	12065.36
BITTER LAKES	1.43	0.79	2.27	0.91	0.37	0.03	0.51	1.83	3.36	1.29	0.39	0.02	2600.40
CAPITAN	1.25	0.54	3.07	1.21	1.40	1.34	1.96	1.10	3.72	0.53	0.41	0.63	4976.39
CLOUD COUNTRY L	3.16	3.28	7.31	1.06	0.65	1.25	4.66	7.51	4.78	3.06	0.85	0.23	8656.19
CORONA	1.07	1.00	2.72	1.88	0.46	1.80	3.20	1.61	4.81	1.87	0.73	0.82	5602.34
ELK	1.18	1.33	2.23	0.68	0.91	2.42	3.07	2.77	4.14	3.33	0.60	0.20	10607.02
FARNSWORTH RANCH	0.70	0.89	3.63	1.00	0.31	2.62	1.67	4.82	6.05	0.88	0.0	0.10	24392.88
FLYING H	1.05	1.02	2.07	0.64	1.12	0.50	2.44	3.10	3.34	3.30	0.36	0.0	10776.84
FORT STANTON	0.88	0.37	3.31	0.69	1.59	1.15	4.53	1.75	3.41	0.74	0.21	0.43	6554.72
HOPE	0.0*	1.16*	1.04*	0.0*	0.82*	0.70*	2.07*	2.66*	3.85*	3.25*	0.42*	0.07*	19937.71
MAYHILL	1.29	2.14	3.15	0.56	0.95	1.47	2.68	0.91	2.86	2.35	0.14	0.15	8951.99
PICACHO	0.63	1.00	2.44	0.69	0.60	1.06	1.66	1.80	4.77	2.70	0.13	0.32	15934.38
ROSWELL	1.57	0.84	1.93	0.84	0.77	0.20	0.66	1.27	3.56	0.98	0.19	0.25	11022.54
RUIDOSO	1.41	1.95	4.58	1.09	1.35	2.46	3.56	1.94	5.15	1.41	1.22	0.39	10338.88

ANNUAL MEAN PRECIPITATION IN INCHES: 19.35

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 8504893.00

1959 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.0*	0.52	0.0	0.54	1.18	2.56	3.29	2.68*	0.0*	0.91*	0.24*	1.57*	4964.32
ARTESIA	0.0	0.13	0.01	0.19	2.48	0.31	2.15	0.29	0.0	0.23	0.04	0.28	3647.67
BITTER LAKES	0.0	0.0	0.0	0.67	1.75	1.95	4.79	2.18	0.24	0.24	0.0	0.73	2472.35
CAPITAN	0.08	0.32	0.13	0.73	0.67	3.12	4.47	2.93	0.18	0.76	0.0	0.77	4106.40
CLOUD COUNTRY L	0.04	1.31	0.10	0.05	0.32	1.53	8.34	6.90	0.05	0.64	0.06	1.22	4822.73
CORONA	0.27	0.77	0.18	1.80	1.61	2.91	1.65	5.20	0.09	1.15	0.09	1.37	4360.50
ELK	0.0	0.21	0.10	0.12	1.30	1.35	2.06	3.66	0.12	0.41	0.03	1.07	4839.52
FARNSWORTH RANCH	0.0	0.15	0.0	0.98	1.28	2.18	1.96	4.83	0.27	1.05	0.0	1.75	15548.20
FLYING H	0.0	0.22	0.0	0.18	2.71	0.02	1.65	3.23	0.0	0.25	0.0	0.97	5251.87
FORT STANTON	0.08	0.32	0.26	0.65	1.41	2.12	3.78	5.60	0.0	0.59	0.0	0.95	5405.68
HOPE	0.01*	0.20*	0.03*	0.93*	2.64*	0.78*	2.24*	2.11*	0.0*	0.30*	0.02*	0.70*	12330.27
MAYHILL	0.0	0.41	0.19	0.17	1.69	2.42	3.56	4.78	0.10	0.40	0.19	0.88	7099.20
PICACHO	0.02	0.04	0.0	0.48	1.50	1.52	2.26	3.09	0.06	0.37	0.11	1.30	9653.50
ROSWELL	0.02	0.10	0.03	0.59	1.44	0.82	2.98	1.87	0.16	0.52	0.24	0.75	8034.88
RUIDOSO	0.05	1.56	0.39	0.42	0.94	2.18	5.27	5.18	0.06	0.64	0.01	1.81	7608.89

ANNUAL MEAN PRECIPITATION IN INCHES: 12.16

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 5343778.00

1960 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	1.43	0.24	0.10	0.0	1.07	2.24	3.69	1.30	0.79	1.12	0.06	0.77	4714.08
ARTESIA	0.82	0.18	0.14	0.29	0.16	1.18	3.74	0.74	0.20	3.26	0.11	1.69	7468.47
BITTER LAKES	0.97	0.15	0.02	0.0	0.93	1.23	5.42	0.64	0.57	4.28	0.0	1.37	3069.26
CAPITAN	0.58	0.34	0.05	0.0	1.19	2.32	2.77	0.54	0.85	1.37	0.05	1.33	3306.00
CLOUD COUNTRY L	4.16	1.77	0.43	0.14	1.04	1.47	6.93	2.23	0.92	1.59	0.11	2.21	5278.44
CORONA	0.85	0.38	0.14	0.0	0.64	1.80	4.09	3.34	1.23	2.03	0.22	1.20	4059.60
ELK	0.60	0.38	0.28	0.02	0.42	1.80	5.19	2.80	1.87	1.55	0.0	2.32	7994.71
FARNSWORTH RANCH	0.45	0.26	0.10	0.0	0.95	2.75	7.09	0.08	0.79	3.26	0.0	1.76	18819.23
FLYING H	0.54	0.40	0.18	0.0	0.26	2.07	3.57	0.32	0.82	2.08	0.24	1.43	6776.79
FORT STANTON	0.48	0.17	0.0	0.0	3.12	2.22	3.58	2.10	0.91	1.31	0.0	1.50	5278.77
HOPE	0.0*	0.42*	0.03*	0.0*	0.0*	0.33*	4.41*	0.48*	0.50*	2.07*	0.06*	1.18*	11783.64
MAYHILL	1.00	0.49	0.33	0.11	0.49	3.08	5.21	2.64	0.55	2.42	0.06	2.27	8956.79
PICACHO	0.24	0.14	0.17	0.02	1.01	1.61	4.29	0.99	0.29	1.75	0.02	2.16	11395.62
ROSWELL	1.26	0.43	0.04	0.0	1.03	1.24	3.31	0.16	0.45	3.53	0.0	2.12	11453.03
RUIDOSO	2.75	0.81	0.17	0.02	0.69	1.88	4.33	1.15	0.59	1.29	0.15	1.90	5134.70

ANNUAL MEAN PRECIPITATION IN INCHES: 14.13

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6212745.00

1961 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.65	0.12	1.23	0.67	0.28	2.39	1.62	3.55	2.75	0.55	1.19	2.88	6579.84
ARTESIA	0.71	0.16	0.45	0.0	0.48	0.99	0.99	1.10	0.27	0.14	1.41	0.30	4179.00
BITTER LAKES	0.43	0.05	0.76	0.11	0.17	0.64	0.79	1.40	1.25	0.55	2.02	0.23	1664.65
CAPITAN	0.52	0.10	1.11	0.23	0.61	1.39	2.24	3.59	3.61	0.21	1.57	0.81	4637.10
CLOUD COUNTRY L	1.69	0.10	2.75	0.03	0.50	4.23	6.44	4.10	2.77	0.25	2.68	5.10	7016.55
CORONA	0.68	0.31	1.08	1.33	0.85	0.90	1.69	6.11	3.17	0.40	3.04	1.26	5309.09
ELK	0.58	0.13	0.58	0.05	0.37	1.64	0.98	4.03	1.52	0.15	2.68	0.18	5980.96
FARNSWORTH RANCH	0.45	0.10	1.64	0.41	0.01	1.55	1.37	3.10	1.40	0.46	1.25	0.47	13137.95
FLYING H	0.81	0.0	0.93	0.0	0.30	1.30	2.43	1.88	0.26	0.15	1.97	0.40	5934.67
FORT STANTON	0.59	0.06	0.20	0.0	0.73	1.17	2.05	3.71	3.11	0.0	0.29	0.22	4160.59
HOPE	0.26*	0.0*	0.44*	0.12*	0.05*	0.01*	1.81*	1.84*	0.31*	0.20*	0.86*	0.30*	7706.59
MAYHILL	0.90	0.19	0.43	0.21	0.22	2.30	1.50	5.61	1.51	0.25	2.82	0.91	3087.99
PICACHO	0.29	0.10	1.29	0.13	0.48	0.93	1.21	4.75	1.92	0.19	1.10	0.28	11377.66
ROSWELL	0.68	0.04	0.81	0.02	0.44	0.62	1.08	1.37	0.44	0.44	1.62	0.29	5625.39
RUIDOSO	0.89	0.14	1.12	0.08	0.37	2.98	2.93	4.97	4.42	0.08	1.76	5.40	9804.59

ANNUAL MEAN PRECIPITATION IN INCHES: 12.40

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 5450796.00

1962 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.67	0.15	0.08	0.62	0.0	1.43	4.01	1.30	3.67	0.99	1.09	0.55	5358.08
ARTESIA	0.45	0.41	0.11	0.67	0.66	0.92	3.31	0.21	2.31	1.39	0.25	0.62	6752.07
BITTER LAKES	0.52	0.44	0.12	0.12	0.18	1.10	4.13	0.76	3.49	0.82	0.35	0.41	2450.68
CAPITAN	0.59	0.22	0.80	0.60	0.04	2.69	4.34	1.31	4.08	1.08	0.71	0.31	4863.29
CLOUD COUNTRY L	3.13	0.91	1.36	0.50	0.22	1.72	9.61	2.19	4.41	1.50	1.54	1.38	6519.62
CORONA	0.55	0.08	0.80	0.58	0.0	2.01	5.18	1.31	3.10	0.77	0.41	0.63	3932.10
ELK	0.53	0.60	0.50	0.55	0.0	1.21	7.43	0.55	5.84	1.73	0.85	0.83	9567.66
FARNSWORTH RANCH	0.45	0.10	0.08	0.10	0.0	1.60	5.63	1.93	3.28	0.90	0.60	0.50	16322.92
FLYING H	0.34	0.0	0.47	0.05	0.15	1.08	4.49	0.0	3.78	0.95	1.33	0.32	7658.74
FORT STANTON	0.62	0.26	0.49	0.89	0.0	3.31	2.86	0.36	4.31	0.89	0.25	0.80	5158.72
HOPE	0.13*	0.0*	0.08*	0.0*	0.01*	0.53*	4.58*	0.76*	3.95*	0.98*	0.15*	0.52*	14530.66
MAYHILL	1.21	0.57	0.90	0.78	0.0	1.30	5.64	1.67	5.27	2.13	0.77	1.10	10243.18
PICACHO	0.30	0.53	0.08	0.41	0.0	0.62	3.46	0.10	3.36	0.73	0.44	0.55	9500.84
ROSWELL	0.38	0.51	0.12	0.09	0.21	0.97	3.44	1.31	3.51	0.50	0.62	0.15	9967.54
RUIDOSO	1.62	0.26	1.04	0.33	0.28	1.98	7.22	1.31	5.46	1.12	1.11	1.50	9059.68

ANNUAL MEAN PRECIPITATION IN INCHES: 14.79

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6500565.00

1963 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.19*	0.41	0.16	0.46	0.07	0.0	0.0*	0.0*	0.0*	0.0*	0.0*	0.0*	474.72
ARTESIA	0.08	0.68	0.0	0.11	0.92	1.39	0.18	2.11	0.10	0.17	0.16	0.05	3552.15
BITTER LAKES	0.17	0.57	0.0	0.10	1.82	1.11	0.03	2.13	1.65	0.0	0.49	0.02	1593.73
CAPITAN	0.26	0.31	0.0	0.37	0.09	0.19	1.43	2.83	1.59	0.59	0.15	0.19	2320.00
CLOUD COUNTRY L	2.07	1.37	0.04	0.59	0.24	0.78	5.49	9.23	1.96	1.59	0.68	0.40	5596.75
CORONA	0.48	0.32	0.27	0.08	0.56	0.54	1.21	3.58	2.08	0.34	0.26	0.44	2718.30
ELK	0.75	0.71	0.0	2.33	1.30	1.11	2.37	4.71	1.20	1.03	0.26	0.0	7317.28
FARNSWORTH RANCH	0.10	0.61	0.0	0.0	0.55	0.16	0.0	2.00	0.80	0.85	0.0	0.02	5476.84
FLYING H	1.16	0.55	0.0	0.09	1.05	2.00	1.05	5.31	0.39	0.61	0.0	0.0	6947.49
FORT STANTON	0.39	0.58	0.0	0.0	0.0	0.0	2.54	2.70	2.39	0.15	0.08	0.04	3042.41
HOPE	0.29*	0.60*	0.01*	0.23*	0.77*	0.0*	0.49*	3.93*	0.50*	0.65*	0.09*	0.05*	9459.22
MAYHILL	1.01	0.50	0.01	0.0	0.90	0.65	5.39	3.70	1.74	0.86	0.11	0.02	7147.20
PICACHO	0.32	0.21	0.0	0.05	0.69	0.69	0.68	1.90	1.55	0.43	0.27	0.01	6106.39
ROSWELL	0.44	0.77	0.0	0.16	0.88	0.60	0.21	2.26	0.62	0.15	0.05	0.16	5317.20
RUIDOSO	1.61	1.22	0.02	0.38	0.08	0.30	4.14	8.24	3.10	0.41	0.32	0.15	7788.29

ANNUAL MEAN PRECIPITATION IN INCHES: 9.08

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 3992418.00

1964 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.23*	1.55*	0.57*	1.03	3.05	0.06	1.51	3.88	1.06	0.0	0.12	0.63	5037.92
ARTESIA	0.0	0.23	0.32	0.02	0.81	1.71	0.10	0.80	0.71	0.0	0.17	0.28	3074.55
BITTER LAKES	0.54	0.87	0.03	0.0	0.63	0.67	0.22	0.15	2.40	0.0	0.28	0.09	1158.36
CAPITAN	0.21	0.76	0.35	0.21	1.27	0.02	3.60	3.31	2.31	0.02	0.14	0.13	3575.70
CLOUD COUNTRY L	0.51	1.60	1.44	0.71	0.95	0.78	6.39	3.16	4.65	0.0	0.19	0.93	4879.98
CORONA	0.17	1.57	0.59	0.44	1.80	0.29	3.42	1.14	1.86	0.0	0.42	0.11	3011.55
ELK	0.22	1.26	0.70	0.15	0.27	0.0	2.14	1.12	2.33	0.0	0.11	0.54	4101.76
FARNSWORTH RANCH	0.01	1.20	0.50	0.10	0.18	1.20	0.0	1.02	1.75	0.0	0.10	0.27	6811.07
FLYING H	0.17	0.41	0.33	0.0	0.0	0.51	0.30	1.05	2.25	0.0	0.0	0.54	3163.64
FORT STANTON	0.12	0.79	0.38	0.10	0.64	0.0	3.02	2.34	2.04	0.19	0.0	0.13	3344.25
HOPE	0.0*	0.43*	0.13	0.0	0.28	1.30*	0.03*	0.97*	2.27*	0.06*	0.10*	0.38*	7395.84
MAYHILL	0.27	0.95	0.78	0.15	1.23	0.17	2.19	1.42	3.02	0.0	0.16	0.70	5299.20
PICACHO	0.31	0.47	0.28	0.09	0.28	1.57	1.02	1.69	4.55	0.04	0.15	0.28	9535.54
ROSWELL	0.80	1.25	0.15	0.02	0.30	1.10	0.17	0.57	2.05	0.0	0.33	0.24	5891.12
RUIDOSO	0.36	1.67	0.88	0.33	1.20	0.0	4.34	1.55	5.80	0.44	0.14	0.71	5793.79

ANNUAL MEAN PRECIPITATION IN INCHES: 8.88

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 3902622.00

1965 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.41	0.63	0.21	0.55	1.23	0.54	5.06	1.70	2.20	0.44	0.10	1.37	5313.92
ARTESIA	0.02	0.36	0.06	0.05	0.82	0.84	1.64	2.05	0.67	0.11	0.05	1.03	4596.89
BITTER LAKES	0.13	0.34	0.08	0.95	0.47	0.85	2.82	1.64	1.08	0.0	0.31	0.38	1782.85
CAPITAN	0.20	0.77	0.27	0.52	1.58	1.59	4.45	2.55	3.18	0.17	0.29	0.67	4709.59
CLOUD COUNTRY L	1.74	2.90	2.09	0.82	0.51	2.56	5.70	6.88	3.39	1.08	0.53	5.73	7769.96
CORONA	0.32	0.88	0.82	0.87	1.10	0.91	4.36	2.28	1.91	0.60	0.21	1.44	4003.50
ELK	0.02	1.05	0.44	0.57	1.41	2.04	1.11	1.65	4.36	0.15	0.05	1.18	6509.92
FARNSWORTH RANCH	0.0	0.15	0.0	0.25	2.18	2.40	1.32	0.90	0.66	0.33	0.25	0.25	9350.44
FLYING H	0.0	0.76	0.38	0.98	2.33	2.68	2.51	3.28	3.22	0.0	0.08	0.64	9593.33
FORT STANTON	0.0	0.65	0.21	0.39	0.90	2.23	3.13	3.67	3.18	0.20	0.0	0.81	5271.91
HOPE	0.0*	0.35*	0.12*	0.73*	2.55*	0.0*	2.32*	2.46*	1.53*	0.06*	0.02*	0.47*	13809.73
MAYHILL	0.11	1.15	0.26	0.77	0.93	4.47	2.95	4.81	4.31	0.38	0.05	1.34	10334.38
PICACHO	0.0	0.91	0.19	0.83	0.47	2.99	2.71	1.45	2.91	0.12	0.0	0.44	11691.96
ROSWELL	0.12	0.84	0.21	0.38	0.35	1.09	1.50	0.83	0.76	0.05	0.08	0.47	5637.91
RUIDOSO	1.77	2.32	1.15	1.11	1.71	6.39	4.96	5.39	4.32	0.67	0.83	4.19	13575.88

ANNUAL MEAN PRECIPITATION IN INCHES: 13.82

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6077442.00

1966 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.56	0.44	0.02	0.09	0.19	1.34	2.44	2.20	0.84	0.43	0.81	0.48	3657.92
ARTESIA	0.50	0.03	0.58	1.23	0.39	1.07	0.40	6.67	0.59	0.0	0.0	0.0	5841.62
BITTER LAKES	0.32	0.0	0.45	2.41	1.25	0.76	0.46	3.61	0.82	0.0	0.0	0.0	1985.76
CAPITAN	0.63	0.10	0.24	1.01	0.19	2.11	0.0*	2.64*	0.44*	0.0*	0.72*	0.26*	2418.60
CLOUD COUNTRY L	1.59	1.64	1.22	0.96	0.0	3.15	3.81	6.27	3.15	0.0	1.15	1.59	5617.36
CORONA	0.46	0.63	0.10	0.0	0.19	3.47	1.38	7.68	0.96	0.09	0.30	1.26	4212.59
ELK	0.62	0.15	0.20	3.27	0.61	4.69	1.22	5.85	1.36	0.10	0.05	0.07	8440.13
FARNSWORTH RANCH	0.22	0.0	0.0	0.45	0.63	0.45	0.95	6.10	0.02	0.0	0.10	0.10	9705.52
FLYING H	0.36	0.0	0.11	2.76	0.31	2.27	0.31	9.44	0.65	0.0	0.0	0.0	9229.17
FORT STANTON	0.91	0.22	0.20	0.82	0.0	4.21	0.50	3.42	0.34	0.0	0.0	0.20	3711.26
HOPE	0.03*	0.0*	0.15*	1.00	0.0	1.82	0.0	8.54	1.07	0.0	0.0	0.0	16792.93
MAYHILL	0.33	0.46	0.74	2.43	0.40	3.59	3.18	5.56	1.63	0.11	0.36	0.04	9283.18
PICACHO	0.45	0.01	0.0	2.62	0.18	1.42	0.77	4.75	0.95	0.0	0.0	0.02	10030.66
ROSWELL	0.53	0.03	0.25	1.97	0.54	2.35	0.15	2.89	0.97	0.0	0.0	0.0	8169.92
RUIDOSO	1.19	1.27	0.54	1.29	0.25	3.33	1.16	4.35	0.97	0.05	1.16	0.95	6438.89

ANNUAL MEAN PRECIPITATION IN INCHES: 12.92

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 5681882.00

1967 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.0	0.84	0.39	0.12	0.11	2.83	2.48	3.95	1.13	0.0	0.54	1.99	5291.84
ARTESIA	0.0	0.15	0.09	0.0	0.16	0.46	0.67	2.06	0.68	0.0	0.65	0.49	3229.77
BITTER LAKES	0.0	0.08	0.08	0.0	0.29	5.88	1.23	3.16	1.15	0.0	0.15	1.48	2659.50
CAPITAN	0.10*	0.32*	0.14*	0.35*	0.24*	1.94*	1.96*	3.45*	0.70*	0.0*	0.38*	0.88*	3033.40
CLOUD COUNTRY L	0.0	1.45	0.28	0.08	0.02	2.65	2.64	7.95	4.67	0.02	1.01	5.26	5960.86
CORONA	0.08	0.80	0.30	0.0	0.0	3.05	2.54	4.26	0.99	0.21	0.40	1.22	3531.75
ELK	0.05	0.48	0.01	0.14	0.35	1.51	2.17	1.87	2.95	0.01	0.59	1.32	5312.80
FARNSWORTH RANCH	0.0	0.27	0.20	0.03	0.13	1.20	2.25	1.93	0.84	0.0	0.10	0.48	7994.68
FLYING H	0.10	0.25	0.10	0.17	0.30	4.02	2.38	1.10	2.42	0.0	0.20	0.76	6714.20
FORT STANTON	0.0	0.30	0.0	0.0	0.0	2.26	2.07	5.00	0.60	0.0	0.15	0.90	3869.04
HOPE	0.0	0.25	0.0	0.0	0.0	1.50	0.71	4.12	0.71	0.0	0.52	0.80	10702.22
MAYHILL	0.0	0.50	0.10	0.13	0.76	3.42	2.61	4.48	4.85	0.19	0.73	1.58	9287.98
PICACHO	0.03	0.33	0.06	0.0	0.11	3.56	1.08	2.93	1.24	0.07	0.20	0.55	9132.66
ROSWELL	0.0	0.20	0.07	0.0	0.11	3.55	0.97	4.00	0.85	0.02	0.22	1.07	9334.64
RUIDOSO	0.0	1.04	0.12	0.48	0.28	2.87	3.84	5.84	2.24	0.02	0.64	3.47	3127.59

ANNUAL MEAN PRECIPITATION IN INCHES: 11.43

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 5023082.00

1968 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.79	0.58	2.01	0.23	0.58	0.53	1.99	2.70	0.0	0.91	1.66	0.90	4739.84
ARTESIA	1.73	0.81	0.81	0.27	1.11	0.01	3.94	2.37	0.03	1.05	1.41	0.26	8238.59
BITTER LAKES	2.15	1.18	1.63	0.01	0.61	0.43	5.15	1.95	0.0	0.30	0.61	0.23	2807.25
CAPITAN	0.53*	0.38*	0.68*	0.22*	0.52*	0.63*	4.61*	2.00*	0.20*	0.0*	0.88*	0.37*	3485.80
CLOUD COUNTRY L	1.49	2.07	3.85	0.11	0.28	0.64	5.21	6.05	0.76	0.62	3.14	2.87	6203.61
CORONA	0.74	0.65	1.20	0.0	0.21	0.38	4.63	1.84	0.05	1.21	0.69	0.76	3151.80
ELK	1.16	0.96	1.46	0.10	0.27	0.26	7.13	6.89	0.07	0.78	1.52	0.20	9651.18
FARNSWORTH RANCH	1.30	1.25	0.84	0.05	0.55	0.35	4.42	4.38	0.22	0.40	0.57	0.20	15634.27
FLYING H	1.07	1.04	0.90	0.13	0.60	0.0	7.90	1.04	0.0	0.51	0.92	0.0	8028.59
FORT STANTON	0.50	1.20	0.60	0.0	0.0	0.0	6.15	2.58	0.10	0.0	0.31	1.10	4301.22
HOPE	0.19	1.24	0.98	0.0	0.0	0.0	7.00	2.53	0.0	0.0	0.93	0.18	16221.14
MAYHILL	0.83	1.04	1.38	0.22	0.58	1.12	9.58	3.77	0.04	0.97	1.24	0.63	10271.97
PICACHO	1.38	1.01	1.09	0.13	0.98	0.27	5.65	3.51	0.11	0.46	0.89	0.23	14107.57
ROSWELL	1.50	1.17	1.93	0.06	0.57	0.60	5.50	2.67	0.10	0.41	1.11	0.22	13368.96
RUIDOSO	0.96	1.85	1.86	0.27	0.50	1.85	4.29	2.14	0.95	0.78	1.39	1.85	7289.09

ANNUAL MEAN PRECIPITATION IN INCHES: 15.47

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6800038.00

1969 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.24	0.68	0.89	0.40	2.03	0.28	2.77	2.97	2.54	1.80	0.06	1.55	5965.27
ARTESIA	0.02	0.30	0.44	0.69	0.54	0.11	1.86	1.47	1.55	4.03	0.09	1.10	7283.40
BITTER LAKES	0.0	0.34	0.61	0.61	0.32	0.35	1.70	0.40	3.52	3.54	0.03	2.11	2665.41
CAPITAN	0.10*	0.60*	0.59*	0.18*	1.98*	0.63*	2.56*	2.50*	1.21*	1.94*	0.35*	1.39*	4068.70
CLOUD COUNTRY L	1.44	1.66	1.56	0.03	2.56	0.29	4.21	7.13	5.22	1.40	0.19	1.78	5290.62
CORONA	0.09	0.61	1.19	0.56	2.37	1.26	3.01	3.74	2.71	2.40	0.88	1.51	5184.14
ELK	0.0	0.21	0.86	0.15	0.91	1.15	2.68	5.29	3.19	2.29	0.18	1.98	8764.95
FARNSWORTH RANCH	0.05	0.80	0.95	0.25	0.39	0.22	1.95	1.60	2.59	2.92	0.21	1.10	14020.28
FLYING H	0.0	0.67	0.19	0.10	0.84	0.50	2.61	2.48	2.16	2.24	0.30	0.61	7226.30
FORT STANTON	0.0	0.90	0.50	0.10	1.90	0.0	3.10	2.85	1.10	1.60	0.22	1.82	4832.87
HOPE	0.0	0.61	0.40	0.08	0.72	0.0	2.37	0.0	4.70	2.51	0.0	0.54	14828.98
MAYHILL	0.0	0.15	0.52	0.08	1.66	1.04	5.54	9.17	3.81	1.78	0.22	1.43	12191.98
PICACHO	0.0	0.67	0.47	0.05	0.87	1.50	2.69	5.37	3.30	1.59	0.0	1.07	15786.82
ROSWELL	0.01	0.47	1.14	0.44	0.10	0.35	1.32	0.71	2.67	4.34	0.0	1.78	11250.52
RUIDOSO	0.40	0.92	0.67	0.17	1.65	1.25	3.86	4.87	3.25	1.45	0.60	2.85	8556.59

ANNUAL MEAN PRECIPITATION IN INCHES: 15.64

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6875552.00

1970 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.0	0.23	1.26	0.0	0.33	1.55	2.98	1.35	0.10	0.75	0.07	0.59	3389.28
ARTESIA	0.0	0.44	0.71	0.06	2.93	0.86	0.34	1.71	2.36	0.54	0.05	0.0	5970.00
BITTER LAKES	0.0	0.16	0.29	0.0	0.49	2.64	1.69	0.52	0.78	0.52	0.05	0.23	1451.89
CAPITAN	0.32*	0.22*	0.35*	0.08*	0.0*	2.08*	1.11*	1.71*	0.21*	0.93*	0.0*	0.21*	2093.80
CLOUD COUNTRY L	0.40	0.13	1.84	0.10	0.04	2.51	4.44	3.31	1.02	1.03	0.05	0.46	3510.57
CORONA	0.02	0.38	1.42	0.05	0.99	1.62	2.37	2.29	0.25	0.90	0.13	0.26	2723.40
ELK	0.01	0.81	0.46	0.0	0.49	2.66	0.97	2.41	0.80	0.66	0.05	0.13	4384.80
FARNSWORTH RANCH	0.0	0.26	0.36	0.25	0.22	0.52	3.40	3.10	0.50	0.95	0.10	0.0	10394.16
FLYING H	0.0	0.42	0.43	0.0	0.10	2.20	3.05	1.68	4.65	0.62	0.0	0.0	7482.35
FORT STANTON	0.26	0.27	0.23	0.0	0.06	2.51	2.08	1.82	0.11	0.81	0.0	0.17	2853.76
HOPE	0.0	0.36	0.43	0.0	0.0	1.75	0.83	0.40	2.39	0.66	0.0	0.0	8477.26
MAYHILL	0.0	0.33	0.35	0.02	0.71	2.55	2.31	6.31	1.87	0.83	0.0	0.35	7502.40
PICACHO	0.01	0.34	0.42	0.02	0.16	2.37	0.63	2.46	0.55	0.89	0.09	0.17	7282.77
ROSWELL	0.01	0.28	0.51	0.02	0.48	2.72	2.07	0.52	0.97	0.78	0.09	0.18	7283.71
RUIDOSO	0.50	0.42	2.05	0.04	0.0	2.06	2.62	2.08	0.33	1.47	0.05	0.65	4785.30

ANNUAL MEAN PRECIPITATION IN INCHES: 9.65

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 4244549.00

1971 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.43	0.24	0.02	0.43	0.0	0.45	1.95	2.61	1.35	2.22	1.39	2.11	4857.60
ARTESIA	0.02	0.02	0.03	0.32	0.10	0.75	1.06	5.26	2.04	0.55	0.90	0.48	6883.41
BITTER LAKES	0.02	0.21	0.01	0.29	0.18	0.07	3.29	4.63	1.95	0.94	0.74	0.36	2499.93
CAPITAN	0.28*	0.52*	0.14*	0.37*	0.63*	1.00*	4.27*	2.88*	1.17*	1.71*	0.92*	1.18*	4370.30
CLOUD COUNTRY L	0.15	2.00	0.0	1.54	0.27	2.94	4.23	3.21	2.26	4.44	0.74	2.12	5473.09
CORONA	0.57	0.65	0.37	0.19	0.0	0.04	2.67	4.40	1.48	1.57	1.49	1.54	3817.35
ELK	0.28	0.18	0.0	0.49	0.03	0.52	2.34	4.15	2.95	1.55	0.56	0.32	6203.68
FARNSWORTH RANCH	0.07	1.25	0.12	0.12	0.90	0.10	1.48	5.44	3.17	1.94	0.86	0.75	17441.95
FLYING H	0.22	0.15	0.0	0.59	0.35	0.32	2.99	2.44	4.09	0.79	0.61	0.89	7647.36
FORT STANTON	0.21	0.53	0.0	0.05	0.0	0.64	4.36	3.89	1.06	1.42	1.34	1.57	5169.01
HOPE	0.0	0.0	0.0	0.0	0.0	0.0	4.32	2.52	2.49	0.68	0.25	0.75	13685.43
MAYHILL	0.34	0.39	0.0	0.89	0.15	1.25	4.20	3.47	3.92	2.86	0.63	0.40	8879.98
PICACHO	0.09	0.16	0.02	0.49	0.05	0.70	4.15	3.87	1.64	1.60	0.57	0.46	12392.40
ROSWELL	0.18	0.23	0.11	0.26	0.0	0.18	1.88	3.62	1.57	0.76	0.45	0.80	8473.76
RUIDOSO	0.35	1.65	0.20	0.50	0.59	0.78	5.27	4.81	2.52	2.70	1.45	2.15	8958.29

ANNUAL MEAN PRECIPITATION IN INCHES: 14.16

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 6226845.00

1972 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.47*	0.10*	0.0*	0.20*	0.63*	4.14*	2.96*	2.37*	2.88*	2.33*	0.89*	0.96*	6598.23
ARTESIA	0.01	0.06	0.0	0.0	0.70	1.42	1.79	2.09	3.67	1.36	0.61	0.35	7199.82
BITTER LAKES	0.15	0.0	0.0	0.0	0.88	1.37	1.20	6.27	3.63	1.18	0.55	0.73	3144.12
CAPITAN	0.62*	0.15*	0.14*	0.05*	0.0*	2.57*	3.49*	3.12*	2.68*	4.59*	0.41*	0.72*	5376.59
CLOUD COUNTRY L	3.75	0.56	0.0	0.0	0.89	2.42	5.68	4.91	5.27	5.68	1.16	2.33	7476.94
CORONA	0.41	0.22	0.04	0.0	0.70	1.99	3.96	3.79	3.09	3.66	0.72	0.76	4931.69
ELK	0.54	0.0	0.0	0.0	0.62	1.60	1.41	6.56	5.63	3.68	0.51	0.42	9730.07
FARNSWORTH RANCH	0.07	0.08	0.0	0.0	1.70	10.30	2.76	5.22	4.61	2.39	0.50	0.05	29783.64
FLYING H	0.50	0.0	0.0	0.0	1.01	1.76	2.48	8.93	5.03	2.58	0.50	0.28	13126.82
FORT STANTON	0.61	0.10	0.0	0.0	0.28	3.35	4.09	4.43	2.55	3.67	0.83	0.90	7137.32
HOPE	0.0	0.0	0.0	0.0	1.43	1.64	1.12	3.55	3.62	2.82	0.51	0.15	18446.12
MAYHILL	0.74	0.0	0.0	0.0	0.39	2.91	2.14	6.81	6.42	3.44	0.75	0.90	11759.98
PICACHO	0.19	0.0	0.02	0.0	1.06	2.98	1.50	5.68	5.98	2.51	0.50	0.48	18768.18
ROSWELL	0.20	0.0	0.03	0.0	0.16	2.06	5.43	3.35	3.25	1.27	0.49	0.0*	13706.55
RUIDOSO	0.55	0.55	0.0	0.0	0.0	4.35	4.38	5.07	4.97	4.63	0.68	1.45	10385.69

ANNUAL MEAN PRECIPITATION IN INCHES: 20.33

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 8937161.00

1973 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.56*	0.68*	0.45*	0.33*	1.04*	1.38*	2.69*	2.19*	0.11*	0.33*	0.23*	0.20*	3749.92
ARTESIA	1.09	2.22	1.13	0.05	1.12	1.38	1.49	0.67	1.33	0.79	0.02	0.0	6740.13
BITTER LAKES	1.46	1.49	1.35	0.29	0.66	0.73	2.52	0.03	0.95	0.39	0.07	0.0	1958.18
CAPITAN	0.10*	0.30*	0.14*	0.65*	2.25*	1.13*	1.82*	1.81*	1.25*	0.0*	0.40*	0.07*	2876.80
CLOUD COUNTRY L	2.30	1.06	5.07	0.37	1.18	1.56	5.00	2.40	0.34	0.14	0.98	0.41	4765.48
CORONA	0.50	0.76	0.44	0.26	1.13	1.92	2.89	1.27	0.25	0.25	0.22	0.0	2521.95
ELK	0.97	1.68	0.41	0.25	0.77	0.98	2.76	1.51	0.77	0.27	0.0	0.0	4811.68
FARNSWORTH RANCH	0.72	0.75	0.48	0.31	1.07	1.06	2.92	1.41	1.60	0.12	0.0	0.0	11233.44
FLYING H	1.10	1.27	0.57	0.06	0.84	1.63	2.46	1.60	0.62	0.33	0.0	0.0	5963.12
FORT STANTON	0.12*	0.30*	0.52*	0.0	1.07	0.87	2.36*	1.82	1.14	0.0	0.23	0.0	2891.49
HOPE	0.62	1.53	0.99	0.05	0.78	0.0	2.38	1.42	0.91	0.84	0.0	0.0	11833.36
MAYHILL	1.38	1.53	0.49	0.13	1.15	0.75	3.15	4.16	0.27	0.10	0.22	0.05	6422.39
PICACHO	0.81	1.12	0.79	0.17	0.96	0.64	2.66	0.68	0.97	0.09	0.0	0.0	7983.21
ROSWELL	0.73	0.92	1.48	0.15	0.73	0.97	2.26	1.27	2.55	0.51	0.01	0.02	9790.39
RUIDOSO	1.35	1.87	2.93	0.96	1.86	2.25	5.33	2.76	0.35	0.01	0.67	0.15	7991.08

ANNUAL MEAN PRECIPITATION IN INCHES: 11.10

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 4881732.00

1974 MONTHLY PRECIPITATION

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AXP
ANCHO	0.56*	0.50*	0.09*	0.25*	0.66*	0.55*	2.26*	2.78*	4.59*	2.59*	1.05*	0.98*	6204.47
ARTESIA	0.17	0.10	0.18	0.05	0.36	0.20	0.46	1.95	7.11	7.02	0.20	0.71	11050.46
BITTER LAKES	0.21	0.10	0.45	0.17	0.48	0.19	0.20	5.66	5.68	4.19	0.15	0.69	3579.48
CAPITAN	0.94*	0.52*	0.44*	0.05*	0.01*	0.84*	1.23*	2.05*	3.40*	2.48*	0.42*	0.80*	3822.20
CLOUD COUNTRY L	3.01	0.99	0.80	0.07	0.07	1.21	5.86	5.03	4.70	5.22	0.83	1.77	6769.23
CORONA	0.50	0.59	0.12	0.10	0.73	0.74	2.22	4.17	4.84	3.54	0.19	0.73	4722.59
ELK	0.44	0.24	0.0	0.38	0.0	0.07	3.08	5.44	10.03	5.20	0.0	1.63	12300.63
FARNSWORTH RANCH	0.31	0.12	0.22	0.0	0.0	0.25	1.01	1.03	5.25	4.36	0.56	0.88	15053.23
FLYING H	0.31	0.0	0.05	0.30	0.30	0.0	0.18	4.32	13.13	5.13	0.0	1.25	14207.92
FORT STANTON	0.99	0.62	0.33	0.0	0.0	0.36	1.80	2.05	3.27	2.02	0.0	1.03	4294.36
HOPE	0.36	0.09	0.12	1.37	0.39	0.23	1.12	4.90	9.36	4.80	0.15	0.74	29372.04
MAYHILL	0.50	0.15	0.06	0.23	0.20	0.49	5.06	3.39	9.21	6.40	0.11	2.23	13454.38
PICACHO	0.40	0.27	0.0	0.60	0.01	0.0	1.12	2.57	6.29	4.70	0.25	0.95	15409.67
ROSWELL	0.24	0.01	0.11	0.50	0.0	0.03	0.31	6.48	6.47	3.81	0.09	0.60	15740.53
RUIDOSO	1.97	1.30	0.60	0.0	0.10	0.58	3.01	3.88	4.50	6.49	0.70	1.15	9469.19

ANNUAL MEAN PRECIPITATION IN INCHES: 20.07

TOTAL VOLUME OF PRECIPITATION IN ACRE-FT: 8824008.00

Appendix D

SURFACE RUNOFF

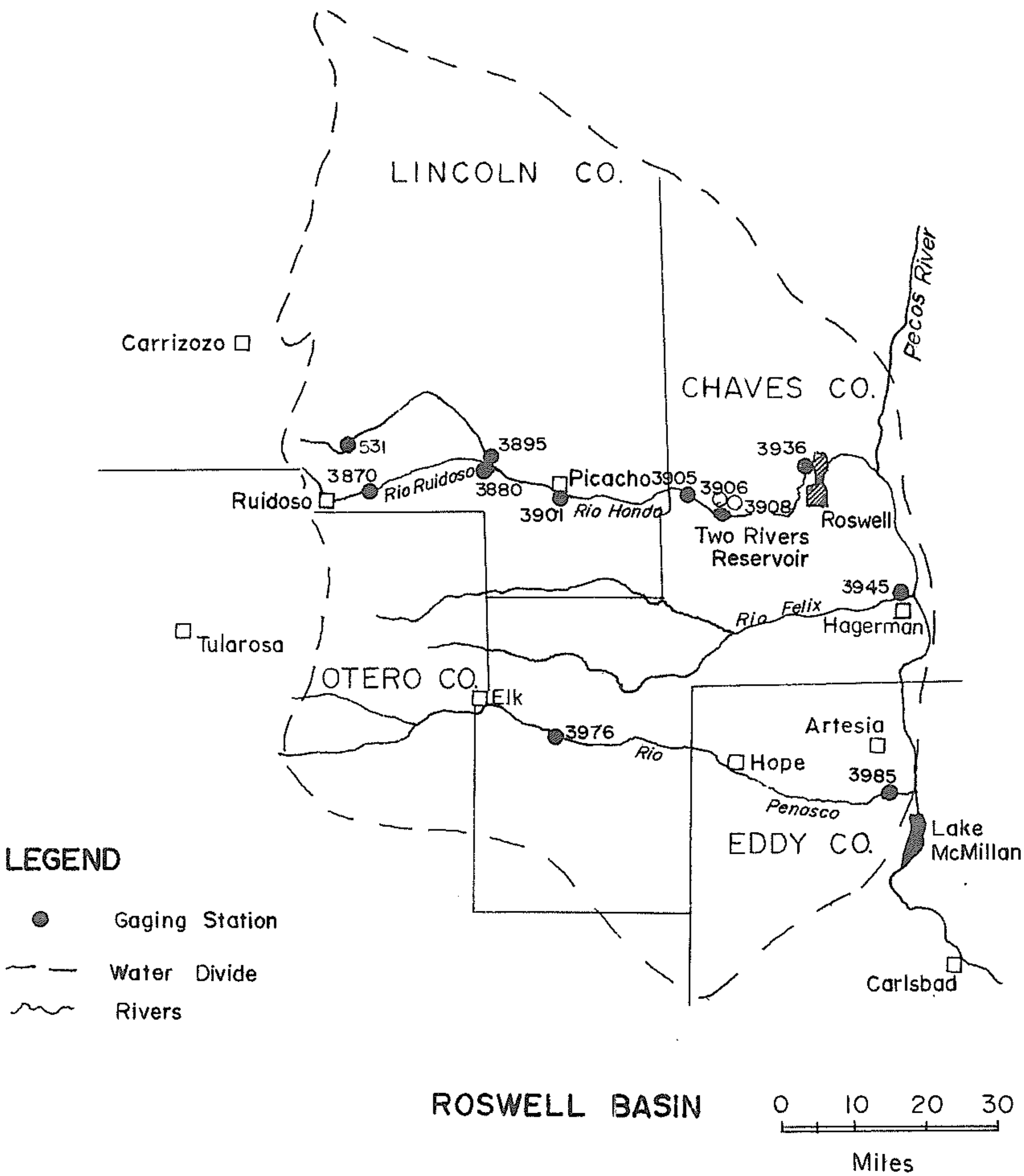

Fig. D1.

Location of stream gauges.

Table D1. - Yearly Discharge (Acre-feet) for the Rivers Hondo, Felix, and Penasco.

Year	Rio Hondo (3905) Diamond A Ranch	Rio Felix (3945) old highway bridge	Rio Penasco (3985) Dayton	Σ (3 stations)
1940	2,100	*6,040	-	-
1941	*177,900	67,900	-	-
1942	56,550	22,880	-	-
1943	10,480	7,370	-	-
1944	11,360	4,370	-	-
1945	3,350	2,370	-	-
1946	13,010	12,740	-	-
1947	7,480	485	-	-
1948	16,070	5,340	-	-
1949	32,160	38,630	-	-
1950	20,040	10,260	-	-
1951	1,540	376	-	-
1952	5,690	920	294	6,904
1953	5,270	795	1,350	7,415
1954	15,790	52,140	18,200	86,130
1955	16,320	22,910	5,160	44,390
1956	2,410	613	447	3,470
1957	12,680	9,400	2,420	24,500
1958	25,760	6,340	4,930	37,030
1959	3,250	1,840	0	5,090
1960	3,550	9,570	3,110	16,230
1961	1,570	1,940	545	4,055
1962	10,320	7,760	6,700	24,780
1963	1,280	6,520	426	8,226
1964	1,280	0	944	2,224
1965	30,470	11,130	2,630	44,230
1966	8,970	21,130	20,170	50,270
1967	6,600	1,340	456	8,396
1968	16,250	7,150	13,620	37,020
1969	9,400	2,590	3,570	15,560
1970	790	85	167	1,042
1971	6,620	5,370	658	12,648
1972	19,170	23,940	3,310	46,420
1973	17,290	1,850	14	-
1974	10,770	41,020	23,460	-

*Revised

Table D2. - Yearly Discharge (Acre-feet) of Rio Ruidoso at Hollywood.

Year	Discharge
1954	3,820
1955	8,290
1956	3,180
1957	7,440
1958	17,120
1959	3,890
1960	6,410
1961	4,100
1962	15,210
1963	7,700
1964	2,590
1965	10,780
1966	14,540
1967	6,750
1968	16,565
1969	11,420
1970	5,530
1971	6,320
1972	13,890
1973	21,000
1974	9,930

Table D3. - Monthly Discharge (Acre-feet) of Rio Ruidoso at Hollywood and at Hondo.

Month	Hollywood (3870)	Hondo (3880)
1953		
Oct	230	54
Nov	205	60
Dec	202	60
1954		
Jan	203	77
Feb	214	118
Mar	224	80
Apr	306	77
May	211	244
Jun	95	183
Jul	152	108
Aug	566	583
Sep	641	389
Oct	728	778
Nov	278	45
Dec	197	92
1955		
Jan	257	132
Feb	201	56
Mar	555	45
Apr	1,060	53
May	613	62
Jun	168	56
Jul	1,220	2,480
Aug	2,140	2,330
Sep	809	842

Table D4. - Monthly Discharge (Acre-feet) of Rio Hondo at Picacho and Diamond-A Ranch.

Month	Picacho (3901)	Diamond-A Ranch (3905)
1957		
Oct	1710	1400
Nov	1470	1160
Dec	1330	972
1958		
Jan	1070	252
Feb	779	85
Mar	3200	1870
Apr	9450	8220
May	7160	6220
Jun	374	28
Jul	667	61
Aug	1310	589
Sep	3590	2800
Oct	3020	3200
Nov	1730	1470
Dec	1200	966
1959		
Jan	871	327
Feb	778	0
Mar	488	0
Apr	400	0
May	310	0
Jun	783	32
Jul	605	266
Aug	3580	2540
Sep	583	81

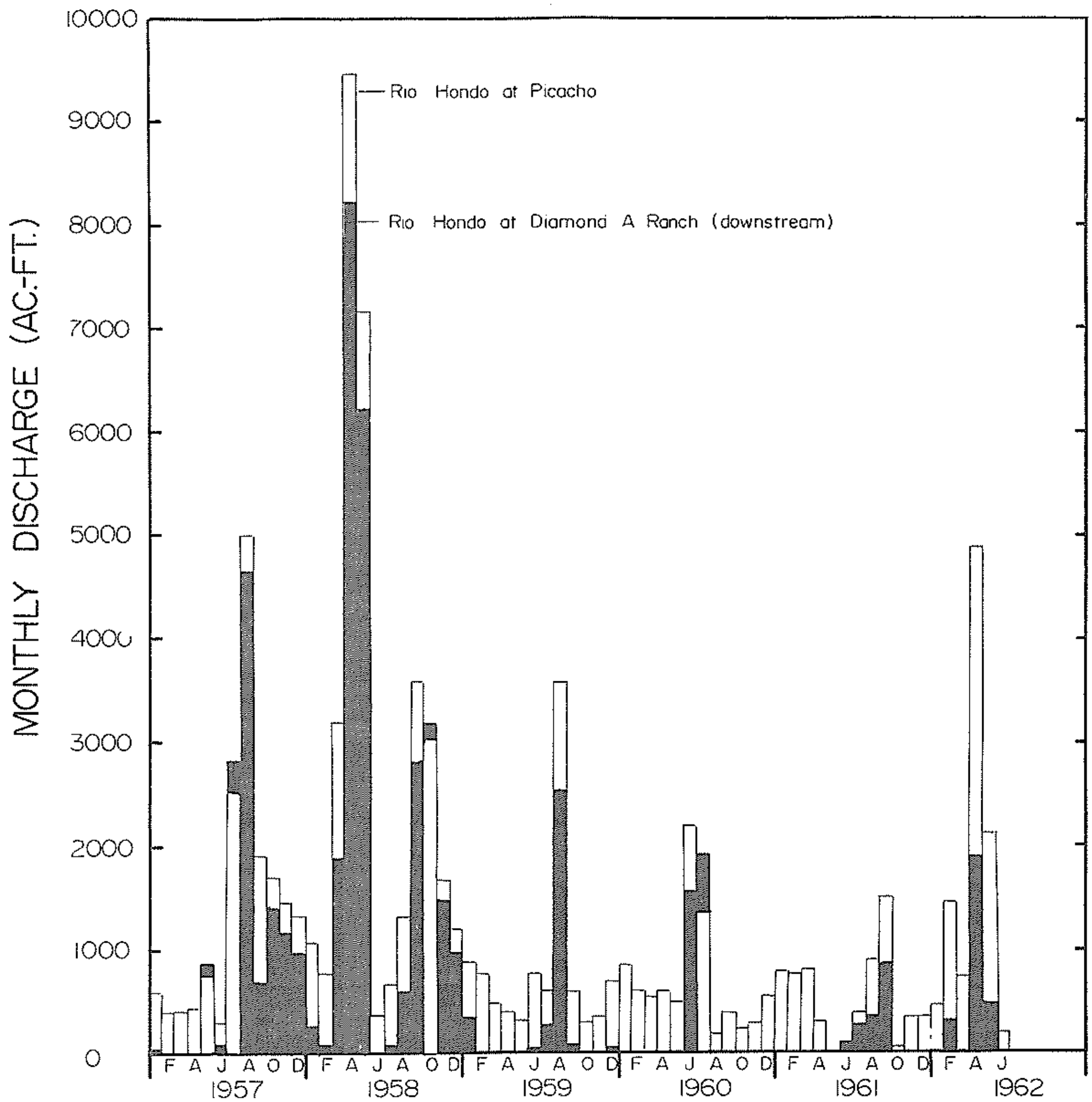

Fig. D2.

Comparison of monthly discharges through Rio Hondo at Picacho and Diamond-A Ranch, 1959 to 1962.

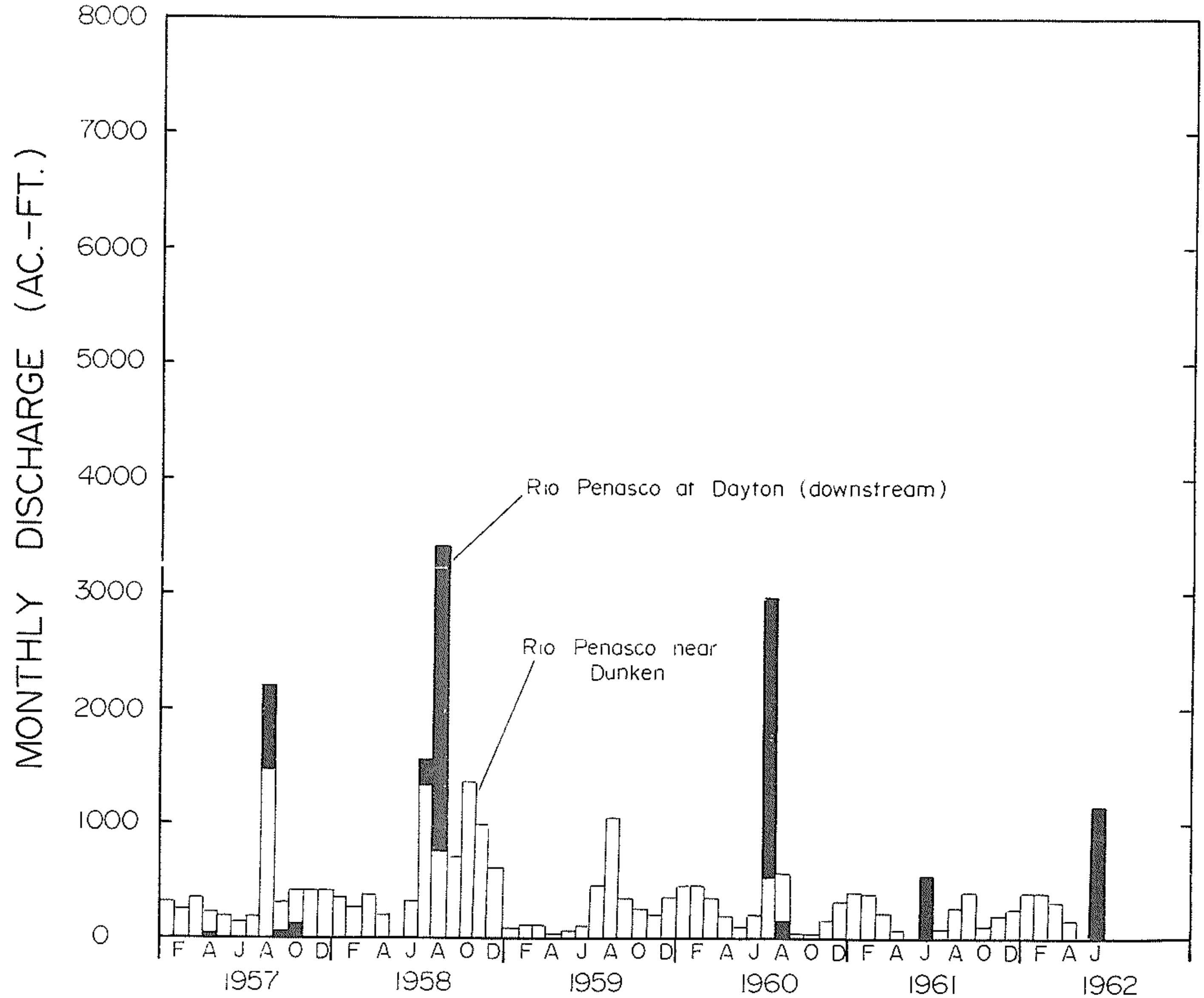

Fig. D3. Comparison of monthly discharge through Rio Penasco at Dunken and Dayton, 1959 to 1962.

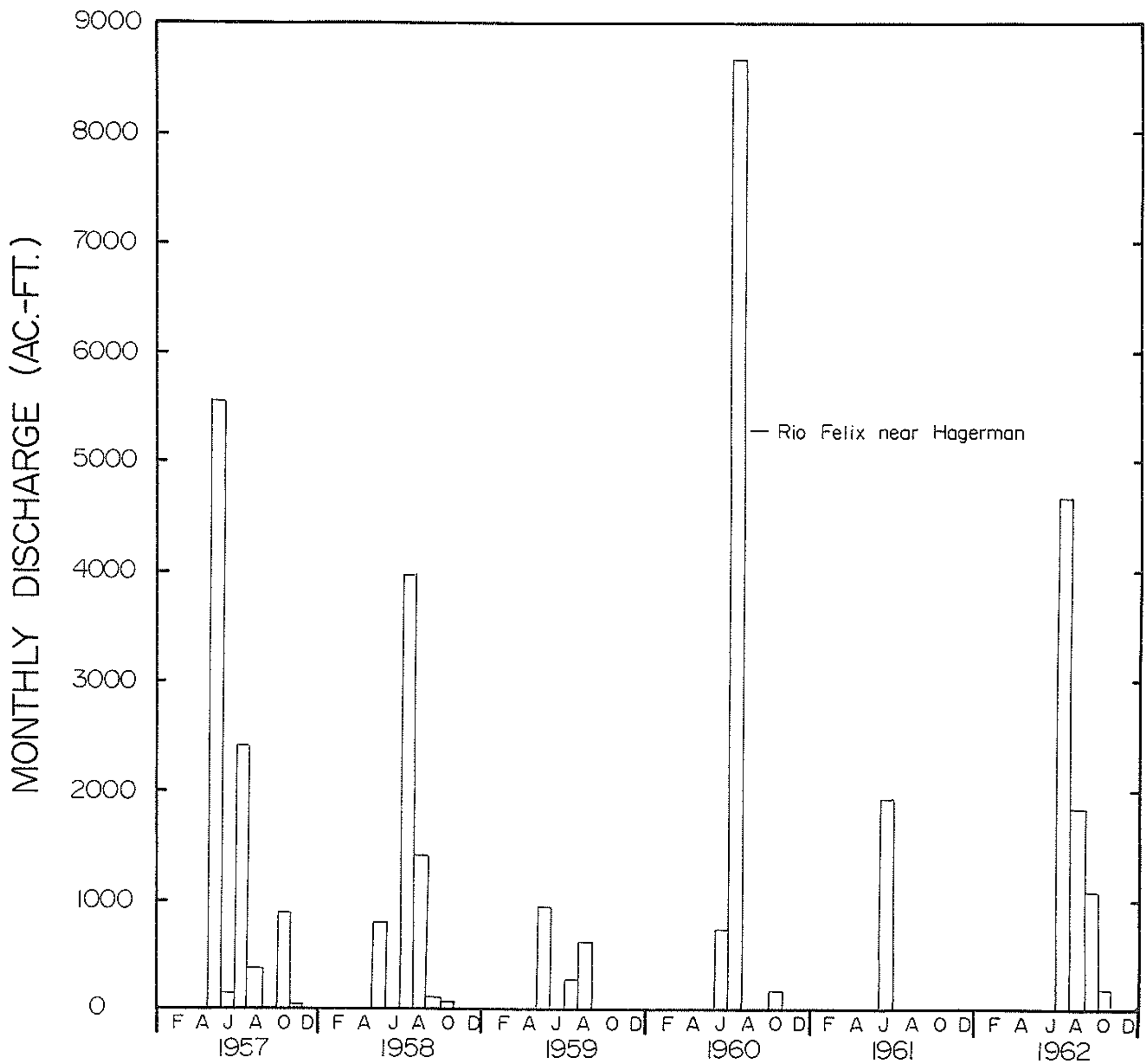

Fig. D4. Monthly discharge through Rio Felix at Hagerman, 1959 to 1962.