New Mexico Bureau of Mines and Mineral Resources

Open-File Report 372

PRELIMINARY WORK FOR A HYDROLOGIC REPORT ON HIDALGO COUNTY, NEW MEXICO

by

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PREFACE

This study grew out of three smaller Bureau studies in or including Hidalgo County. One was a Tech masters thesis on Quaternary Lake Animas (Fleischhauer, 1977). Another was a compilation of geological/geophysical information for alluvial basins in New Mexico (Stone and others, 1979). The other was a hydrogeologic study of Animas Valley done as part of the U.S. Geological Survey's Southwest Alluvial Basins Regional Aquifer Systems Analysis (O'Brien and Stone, 1981, 1982a, b, 1983). Once these Animas Valley studies were completed, we reasoned (erroneously) that it should take relatively little more effort to compile information on the remaining valleys and thus prepare a county-wide report.

The hydrologic work on Animas Valley was conducted 1981 through 1982. Most data on the rest of the county were compiled in 1983. In June 1984, O'Brien left the Bureau but planned to complete the report. However, other demands on his time prohibited this and in January 1987 the responsibility for report preparation was transferred to me. Additional field work on Pyramid Mountain wells was done in 1990. As I too am leaving the Bureau without completing the study, this document is offered to 1) preserve work done to date, 2) provide a starting place should completion be undertaken by someone else and 3) serve as a source of water-resource information for the area in the meantime.

W. J. Stone

December 1990

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ABSTRACT

Hidalgo County, in extreme southwestern New Mexico, is characterized by typical arid-semiarid, basin-and-range terrain. The continental divide bisects area. Although the hydrology of each of the basins has been previously studied to some extent, most of these efforts are more than 25 years old and there is no comprehensive report on the county.

Ground water is recharged mainly in the mountain ranges. From there flow is toward the adjacent basins and then along their axes to discharge points, often outside the county boundaries. The main aquifer is bolson fill of Quaternary age. It consists of interbedded gravel, sand, silt, and clay. Thickness of water-yielding sediments may be as much as 2,600 ft. Average transmissivity is on the order of tens of thousands of gpd/ft. Depth to water ranges from <20 to >400 ft, but averages approximately 100 ft along the basin axes. In most areas, management of ground-water development (declaration of underground water basins) has reduced or stabilized water-level declines associated with earlier periods of excessive pumping.

Water chemistry varies with location. Major cations are calcium and sodium whereas major anions are bicarbonate, sulfate, and chloride. Sodium adsorption ratios are generally <10. Fluoride and boron concentrations are excessive in some areas.

Ground water is used mainly for irrigation, stock watering, copper smelting, and domestic or municipal supplies. Geothermal waters are used to heat greenhouses in Animas Valley.

INTRODUCTION

Hidalgo County occupies the southwesternmost corner of the state (Fig. 1). This sparsely populated area (1.8 persons/mi^2) has had a colorful geologic and human history. Rocks of the area record ancient seas and volcanoes. The mountains and valleys attest to the past restlessness of the earth's crust. Several abandoned shorelines mark the extent of ice-age lakes. Fossilized bones in the lake deposits reveal that mammoths once roamed their shores. Since then, Apaches, soldiers, miners, railroaders, cowboys, farmers and vintners have called this land home.

Scarcity of water was a critical factor in the early human history of the area. Because of its aridity, it was long overlooked and avoided, except by the most hardy and adaptable souls. The Apaches, who were the native human inhabitants, survived through their nomadic way of life. If one mountain spring dried up, they simply moved camp to another. By contrast, the non-Indian activities (agriculture, mining, railroad settlements and ranching) were stationary and required reliable, permanent water supplies. The best supplies were found in the intermontane valleys. As mineral deposits in the mountains were depleted or railroad operations changed, activity centers shifted. In some cases only vague records or ghost towns (for example, Shakespeare and Steins) are all that mark their passing.

Today the area is a curious blend of this historic past and modern marvels. For example, the county boasts a major gas pipeline, geothermal greenhouses, a massive copper smelter, and tens of thousands of acres of irrigated agriculture on the desert valley floor. A main interstate highway and principal railway replace the Butterfield

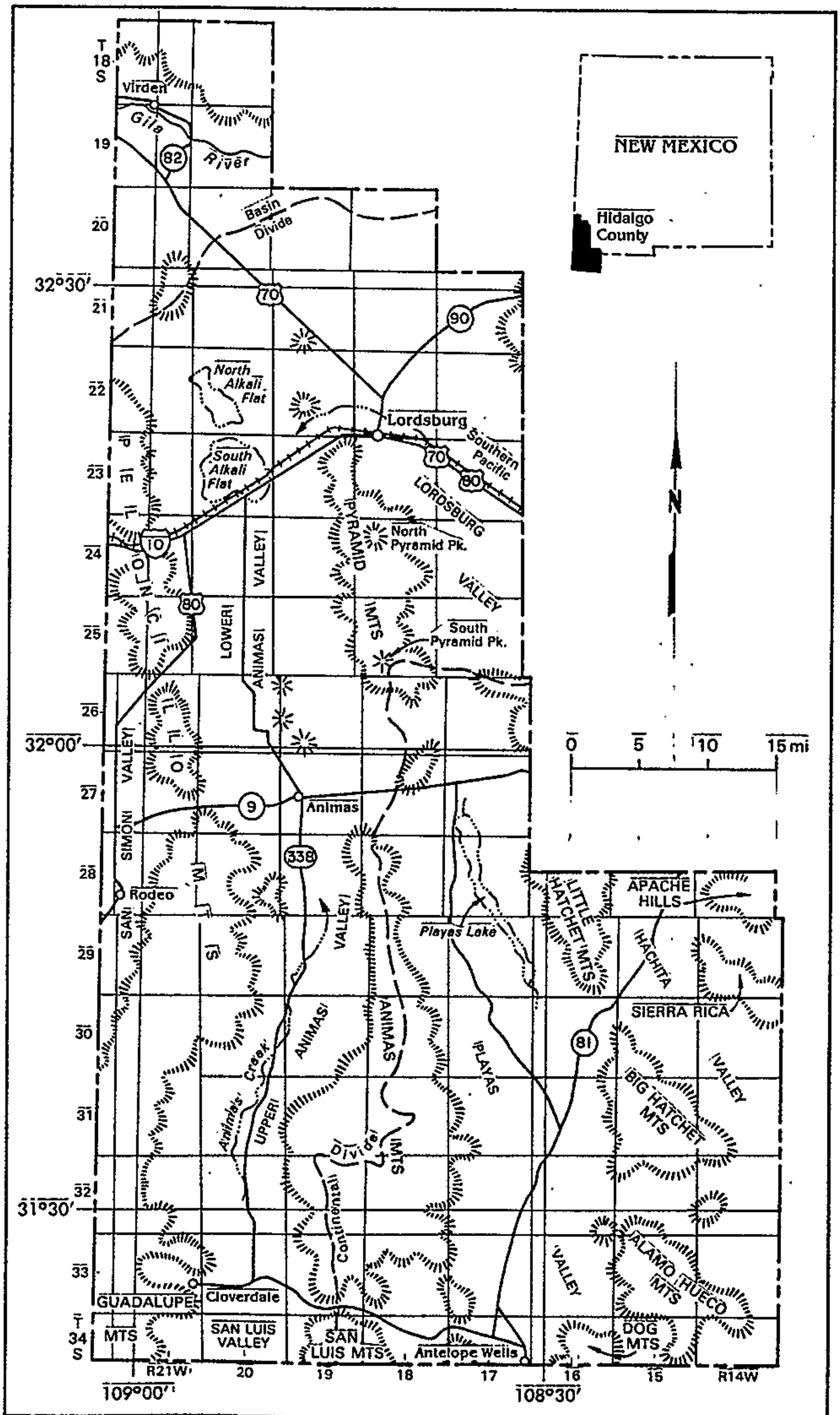

Figure 1. Location of places and features of interest, Hidalgo County.

stage and horse trails as the main routes of ground travel.

PROBLEM AND PURPOSE

Water is just as important now as it was in the pioneering days. It sustains the various agricultural, industrial, and municipal endeavors of the county. However, because of the arid setting, water is scarce. Only in the northern panhandle is there a perennial stream: the Gila River (Fig. 1). Thus, most of the water used in the county comes from the ground. An understanding of the ground-water systems of the county is essential for their effective use and management.

Agricultural and industrial developments have induced stresses on the water resources of the county. For example, as a result of heavy pumping of ground water for various uses, water levels have dropped markedly. Reeder (1957) documented this in the Animas Valley. In response to this increased ground-water use, the State Engineer designated several areas as declared basins (Fig. 2). Ground-water withdrawal in such basins is subject to approval by the State Engineer Office, Deming (Fig. 3). Nonetheless, annual monitoring data show that water levels continue to decline (U.S. Geological Survey/Office of the State Engineer, annual water-level observation data). In an attempt to slow the rate of ground-water depletion, the Deming and Hidalgo Soil and Water Conservation Districts are studying irrigation efficiency in the region (Margo, 1989). New water uses include irrigation of vineyards and a winery supply. In addition to use for irrigation, water is also being withdrawn for geothermal energy (Animas Valley) and copper smelting (Playas Valley).

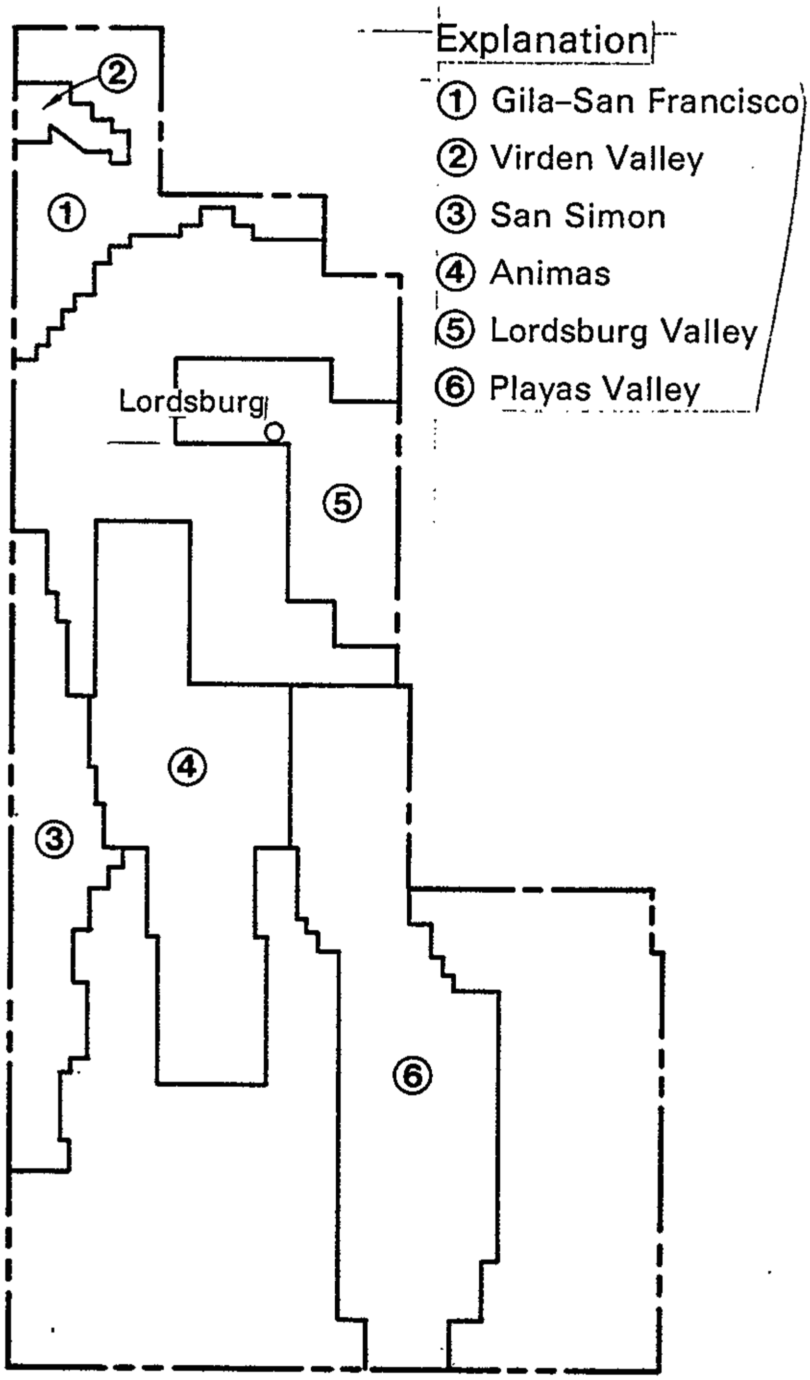

Figure 2. Declared underground water basins, Hidalgo County.

Figure 3. State Engineer Office, Deming

As the more populated areas of the country run out of landfill sites, they look longingly at the wide-open spaces of the western states. Hidalgo County has already been targeted. In 1989 an eastern-based company looked into purchasing land for such a facility in Lordsburg Valley. Although the physical setting of the county permits disposal of a modest volume of locally generated waste, it could not survive a large influx of transported material. In areas where readily workable unconsolidated sediments lie at the surface, ground water is too shallow and too fresh to even consider exposing them to such a facility. Sites with deeper and/or more saline ground water are available elsewhere. Local protest eventually forced abandonment of this project. A compilation of available hydrogeologic information is needed to exclude future disposal-site projects.

A 321,703-ac property known as the Gray Ranch, was purchased by The Nature Conservancy in January 1990 for establishment of the Animas Mountain Wildlife Refuge (Thompson, 1990). The 500 mi^2 area, approximately centered on the Animas Mountains, straddles the continental divide. It extends from the Mexican border to just south of the town of Animas.

A wide variety of concerns have been raised by area residents regarding impact of these plans on the area. Some involve water-resource pressures. Grazing will reportedly be allowed to continue, but at a reduced capacity. Existing watering systems should suffice. However, the projected influx of 70,000 tourists per year would require additional supplies. Better understanding of both the regional and local hydrologic systems will be required.

Several excellent reports have been published on the individual basins in Hidalgo

County. The information they give is valid and useful. It is considered beyond the scope of this report to repeat the information they contain. However, as the most recent hydrologic study in the county, other than those in the Animas Valley (O'Brien and Stone, 1981, 1982, 1983), is more than twenty-five years old (Trauger and Herrick, 1962) and the last attempt to integrate the hydrology of the various basins is more than seventy years old (Schwennesen, 1918), it was felt that an overview, emphasizing new information, would be of use.

The purpose of this report is to present observations on the geology and hydrology of Hidalgo County and to offer interpretations of these observations as regards the water resources of the region. The geologic controls of the hydrologic phenomena and their implications for managing water quantity and quality will also be addressed. A particular goal of this document is to make such information available prior to the preparation of a formal Bureau Hydrologic Report.

APPROACH AND DATA SOURCES

The scale and focus has varied throughout the project. Work began with a study of Quaternary Lake Animas in the Animas Valley (Fleischhauer and Stone, 1982). Next came a compilation of available geologic and geophysical data for the entire county (Stone and others, 1979). Then a comprehensive hydrogeologic study was made of Animas Valley, the major basin in the county. This included compilation of available hydrogeologic information, as well as collection of supplementary data in the field (O'Brien and Stone, 1981, 1982). Based on the geologic, geophysical, and hydrologic data, a conceptual model was formulated. This was used to construct two-dimensional, finite-difference flow models for both steady-state and transient conditions (O'Brien and Stone, 1983 and 1984). Finally, available hydrologic data were compiled and reconnaissance level hydrogeologic studies were made of the other basins in the county. Supplementary field measurements were obtained in these areas where possible.

Data sources include published geologic, geophysical, and hydrologic reports, unpublished U.S. Geological Survey seismic profiles, the files of the Deming Office of the New Mexico State Engineer, and field observations. Published sources are discussed under Previous Works below. Specific sources of well-records or water analyses are indicated on listings in the Tables at the end of this report.

PREVIOUS WORKS

This study was made easier by the various previous works on the geology and hydrology of the region. These are referenced where appropriate in the text. However, a summary of major works is useful at the outset.

Various geologic works cover most of the area. The only geologic maps of the entire county are the state geologic map by Dane and Bachman (1965) and the Highway Geologic Map (Clemons, 1983). The general geology of southwestern New Mexico was reviewed by Clemons and Mack (1988). Zeller (1959, 1962), Zeller and Alper (1965), Soule (1972) and Drewes (1986) addressed the geology of the Animas Mountains. Zeller (1958, 1966, 1970, and 1975) and Thompson and Jacka (1981) studied the Big Hatchet Mountains extensively. Zeller (1959) made a reconnaissance map of the Dog Mountains.

Geology of the Little Hatchet Mountains has been given by Lasky (1938, 1947), Zeller (1970) and Thorman (1977). Geologic works on the Peloncillo Mountains include those by Gillerman (1958), Wrucke and Bromfield (1961), Armstrong and others (1978), Drewes and Thorman (1980a, b), and Hayes and others (1983). Flege (1959) and Thorman and Drewes (1978) gave the geology of the Pyramid Mountains. Geology of the Virden Valley was presented by Elston (1960) and Morrison (1965). Winn (1981) made a gravity map for the region. De Angelo and Keller (1988) discussed gravity and aeromagnetic anomalies in the region. Structural history has been addressed by Thorman and Drewes (1978), Elston and others (1979), Drewes (1982), and Mack and Clemons (1988). Areal volcanism was described by Elston (1965), Deal and others (1978), McIntyre (1988), and Hoffer (1988). Quaternary climate and features of the area were studied by Fleischhauer (1977 and 1978), van Devender and Spalding (1979) and Fleischhauer and Stone (1982). Raines and others (1985) discussed the economic significance of a limonite anomaly on Lordsburg Mesa. Beard and Brookins (1988) and McLemore (1988) addressed metallic deposits and production in the region. The petroleum potential has been summarized by Kottlowski and others (1969), Thompson (1976) and Thompson and others (1978).

Hydrologic studies have been previously made to some extent of all the major valleys or basins (Table 1). The earliest known investigation is that by Schwennesen (1918). It covered the Animas, Hachita, Playas and San Luis basins. Another early Hidalgo County study is that by McClure (1938). Reeder (1957), Summers (1967), Arras (1979), Hawkins (1981), Hawkins and Stephens (1981) and O'Brien and Stone (1981,

Table 1. Locating water-resource information for Hidalgo County by area.

Area	This Report		Previous Publications						
	Text	Tables 9,10	S[1]	R[2]	D[3]	T/H[4]	T[5]	O/S[6]	Other[7]
Alamo Hueco Mts.									
Animas Mts									
Animas Valley	x	x	x	x				x	a-d
Apache Hills			x						
Big Hatchet Mts					x	x			
Dog Mts									
Gila Valley		x					x		e
Guadalupe Mts			x						
Hachita Valley		x	x			x			
Little Hatchet Mts					x		x		
Lordsburg Valley		x	x				x		f,g
Peloncillo Mts									
Playas Valley		x	x		x				h
Pyramid Mts	x	x							
San Luis Mts									
San Luis Valley		x	x						
San Simon Valley		x							i-q
Sierra Rica						x			
Whitewater Mts					x				

[1] Schwennesen (1918)
[2] Reeder (1957)
[3] Doty (1960)
[4] Trauger and Herrick (1962)
[5] Trauger (1972)
[6] O'Brien and Stone (1981, 1982a,b, 1983)
[7] a - Summers (1967)
b - Arras (1979)
c - Hawkins (1981)
d - Hawkins and Stephens (1981)
e - Turner and others (1941)
f - Turner (1960)
g - Loeltz and others (1962)
h - United Geophysical Corp. (1956)
i - Schwennesen (1919)
j - Cushman and Jones (1946)
k - DeCook (1952)
l - White (1963)
m - White and Hardt (1965)
n - White and others (1965)
o - Couse (1967)
p - Wilson and White (1976)
q - Freethey and others (1986)

1982a, b, and 1983) reported on various hydrologic aspects of the Animas Valley. Turner and others (1941) and Dinwiddie and others (1966) reported on water resources of the Gila River Valley. Trauger and Herrick (1962) studied central Hachita Valley. Loeltz and others (1942) and Turner (1960) studied the Lordsburg Valley. United Geophysical Corporation (1956) and Doty (1960) presented results of work on the Playas Valley. The San Simon Basin was first studied by Schwennesen (1918). More recent works there include those by Cushman and Jones (1946), DeCook (1952), White (1963), White and Hardt (1965), White and Smith (1965), Couse (1967) Freethey and others (1986) and Freethey and Anderson (1986).

Various workers have studied the geothermal resources of the Animas Valley. These include Kintzinger (1956), Jiracek and Smith (1976), Dellechaie (1977), Smith (1978), Landis and Logsdon (1980), Mizell (1980), Logsdon (1981), and Elston and others (1983). Swanberg (1980) and Witcher (1988) addressed the geothermal systems in the larger region of southwestern New Mexico and southeastern Arizona, including those in Hidalgo County.

ACKNOWLEDGMENTS

We wish to than John Hawley (Bureau), Dan Stephens (New Mexico Tech), Dave Hawkins (Hargis and Associates, Inc.), Kelly Summers (City of Albuquerque) and Dave Wilkins (U.S. Geological Survey) for helpful discussions of various stages of the work. Fred Trauger, John W. Hawley, and Sam Thompson III provided useful reviews, illustrations or discussions of this report. Work on the Animas Valley was funded under contract with the U.S. Geological Survey (agreement no. 14-08-0001-18817) as part of their Southwest Alluvial Basins Regional Aquifer System Analysis project. The tremendous task of computerizing well and water chemistry data processing was carried out by Sharon Boyd and Lori Leser (while undergraduate student assistants, NM Tech). Water analyses were performed under the direction of Lynn Brandvold (Bureau). Robert Eveleth (Bureau) provided data on mineral production and the railroad in Hidalgo County. Lynne McNeil typed all versions of the report. Roger Ford, SCS-Albuquerque, kindly provided a draft of their report on the potential for improving irrigation practices in Hidalgo and Luna Counties. Finally, the cooperation of land owners, ranchers and ranch managers is gratefully acknowledged, especially that of Bob Hughes, Justin Kipp, Dan Puckett, Joe Rouse and Richard Searle.

USING THIS REPORT

The following comments on organization and contents are intended to help the reader make maximum use of this report. Specific information on the various maps and tables should clarify their preparation and facilitate their use. The glossary is offered to assist the layman in understanding the more technical aspects of the report.

WELL NUMBERING SYSTEM

The system of numbering wells in this report is that used by the New Mexico State Engineer. It is based on the Public Land Survey System (township, range, section). In this system, each well or spring has a unique location number consisting of four parts separated by periods: 23.18.20.213. The first part (on the left) refers to the township, the second designates the range, and the third identifies the section (Fig. 4). All wells and springs in the study area are south of the New Mexico base line and west of the New Mexico principal meridian but letters designating compass directions are given for clarity. The fourth part locates the well or spring within the section to the nearest 10-acre tract as follows: each section is divided into quarters which are assigned numbers such that the northwest quarter is number 1, the northeast quarter is number 2, the southwest quarter is number 3, and the southeast quarter is number 4. Each quarter section is then divided into quarters that are numbered in the same manner. Each quarter-quarter section is similarly divided and numbered. If the location of a well or spring cannot be determined to one of the sub-section designations, zero is entered in the appropriate position in the right-hand or fourth part of the number. A well designated 23.18.20.213 is located in the SW1/4 NW1/4 NE1/4 sec. 20, T. 23 S., R. 18 W. (Fig. 3). A spring located in the NW1/4 sec. 31, T. 24 S., R. 19 W. would be numbered 24.19.31.100.

ELEVATIONS OF WELLS

Ground-surface elevation is critical to determining water-level elevation. For various reasons, ground elevations are sometimes not reported or reported incorrectly. Reasons include improper well location, nonavailability of detailed topographic maps, reliance on an uncalibrated or otherwise faulty altimeter, incorrect measurement from bench marks or even typographical errors.

In an attempt to correct or standardize ground-surface elevations used in this

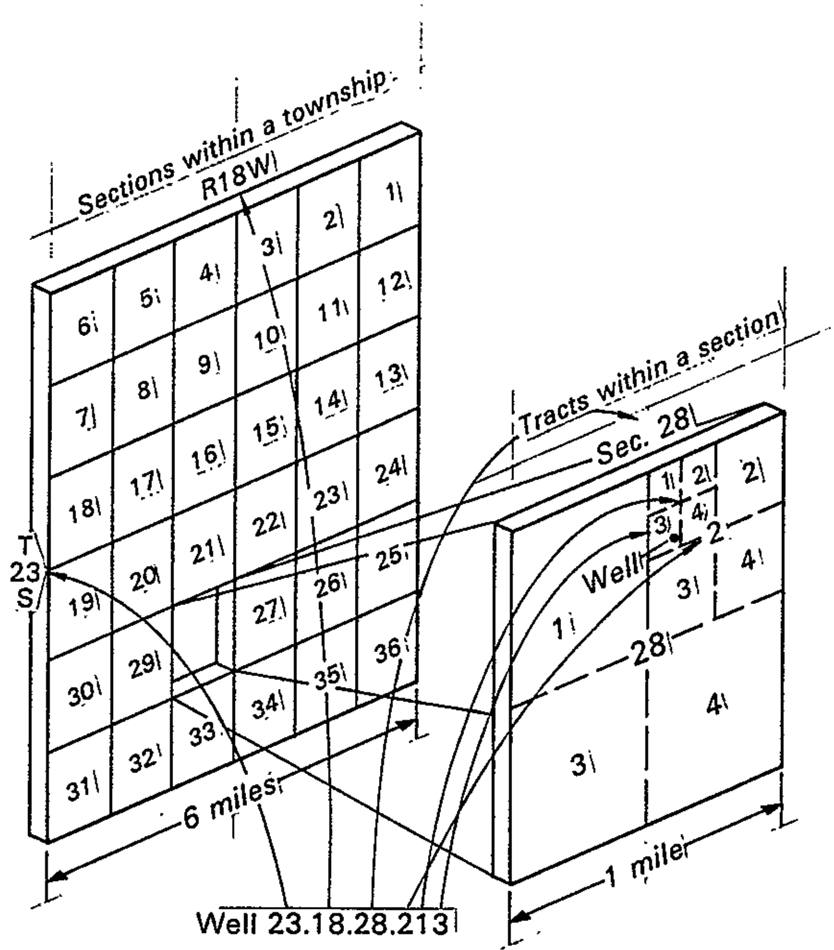

Figure 4. Method of numbering wells used in New Mexico.

report, the following procedures were adopted whenever elevation was suspect or not assigned. Wells located only to the nearest quarter-section were plotted at the center of that quarter-section. Wells located to the nearest section were assigned to the center of a quarter-section based on the well location map in the source, if available. The assignment of an elevation to a well within a quarter-section depended on the amount of relief in the quarter-section. If there was less than 20 ft of relief in a quarter-section then the elevation of the nearest contour line or spot elevation was assigned. If the well location was equidistant between either two contour lines or a contour line and a spot elevation then the mean value of these known elevations was used. In cases where the relief in a quarter-section exceeded 20 ft, the well location was refined by reference to the well location map in the source and the well was assigned an elevation following the criteria stated above. If the relief in a quarter-section exceeded 50 ft, then a well elevation was not assigned.

FINDING INFORMATION

For discussion purposes, the county may be subdivided into areas (Table 1). Most human activity is restricted to the intermontane valleys of the county. Consequently, hydrologic data are fairly abundant for those areas, but almost lacking for the bordering mountains.

There are several ways to quickly find information on a specific locality. If township/range/section are known, go to Table 10 and look for entries on other wells with a similar location. If only general area of interest is known, check Table 1 to see if it is covered in this report. If the area is not known, the reader may determine this from the location map (Fig. 1), using township and range of the area of interest. To learn the water level or water chemistry in a given area, search the appropriate table (10 or 11) using the location (legal description) in well-number format (Fig. 4). The table of contents shows the overall organization of the report and location of general topics.

ILLUSTRATIONS

The geologic map (Plate 1) is a basic illustration. It shows the distribution of rocks and unconsolidated sediments at the earth's surface in Hidalgo County. The legend describes the nature of the material in each unit. See the glossary for the meaning of the various rock types or ranks employed and Fig. 8 for water-yielding characteristics.

The water-well map (Plate 3) shows location of wells in Table 10, which should be consulted for water depth, etc. As flow is generally from areas of higher elevation to those of lower elevation, the map can be used to learn general ground-water flow direction.

A chart for converting inch-pound units into the metric system is given on the last page.

REGIONAL SETTING

Hidalgo County is unique in two respects. It embodies the southernmost extent of the state and is the only place where old Mexico lies not only to the south, but also to the east (Fig. 1). Arizona bounds Hidalgo County on the west and Grant County bounds it on the north and all but a small portion of the eastern margin, where it abuts against Luna County.

PHYSIOGRAPHY

Hidalgo County lies entirely in the Mexican Highlands section of the Basin and Range physiographic province. The region is characterized by rugged mountain ranges and nearly flat intermontane basins with playas (Fig. 1). Elevation ranges from approximately 3,700 ft, where the Gila River crosses the state line into Arizona, to 8,531 ft atop Animas Peak. Maximum relief in the county is 4,831 ft. Most mountains rise above 5,000 ft. Valley floors slope, but generally lie below 4,200-4,500 ft.

Major peaks include Animas Peak (8,531 ft), Center Peak (7,020 ft), and Gillespie Mountain (7,309 ft), in the Animas Mountains, Big Hatchet Peak (8,441 ft) in the Big Hatchet Mountains (Fig. 5), Pierce Peak (6,159 ft) in the Alamo Hueco Mountains, and North Pyramid Peak (6,008 ft) and South Pyramid Peak (5,910 ft) in the Pyramid Mountains. Minor uplands include Black Mountain, Lordsburg Mesa, Tabletop Mountain, and Tank Mountain.

Major basins include the Animas Valley, Gila Valley, Hachita Valley, Lordsburg Valley, Playas Valley, and San Simon Valley.

The continental divide splits Hidalgo County into unequal parts. The western part is drained by the Lower Colorado River and accounts for 64% of the area. The remaining

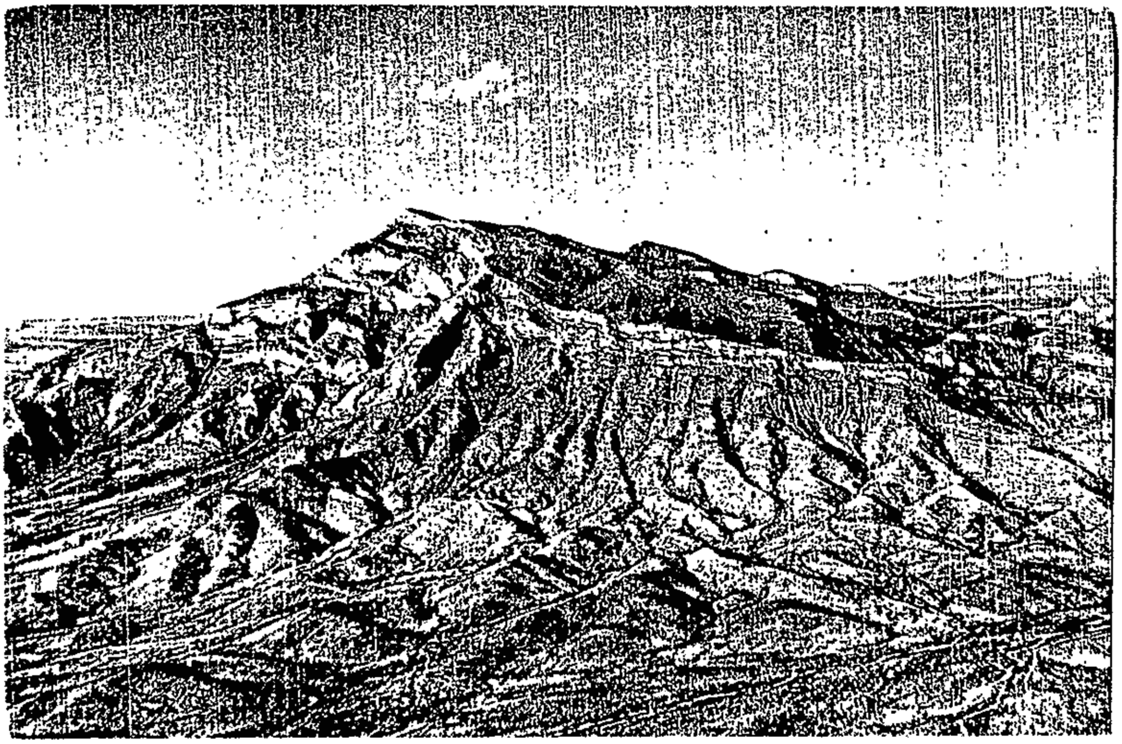

Figure 5. Big Hatchet Peak (frontispiece, Zeller, 1965).

36% of the area east of the divide is drained by the Rio Grande (State Engineer Office, 1974). Drainage does not necessarily reach these rivers. Except for the northern panhandle, which is crossed by the Gila River, drainage is by ephemeral streams into closed basins (Fig. 6). Large playas occupy the lowest portions of the valley floors. North and South Alkali Flats in the Animas Valley are characterized by alkaline soils and salt-loving plants as a result of salt buildup from ponded runoff (Fig. 7).

CLIMATE

Hidalgo County lies in a northern extension of the Chihuahuan Desert (Mueller, 1988). It has a continental, arid to semiarid climate (Maker and others, 1970). Available climatic data show that precipitation varies with elevation across the county (Table 2). Mean annual precipitation ranges from 6.92 to 23.45 in/yr. According to Gabin and Lesperance (1977), rainiest months are July, August, and September with monthly means ranging from 1.01 in (Sept., Playas) to 5.96 in (August, Skeleton Canyon). During this time, brief but often intense showers and thunderstorms occur as a result of a northward flow of moist air from the Gulf of Mexico. Precipitation is low in the spring and in the month of November. Lowest monthly precipitation for stations with more than 1 yr of record is 0.03 in (May, Playas; Gabin and Lesperance, 1977). Annual snowfall averages 4-6 in in the northern two-thirds of the county and 16 in or more in the southern mountain areas (Maker and others, 1970).

Pan evaporation data are available only for Animas. Based on 3 yrs of record, it averages 101.60 in/yr, or nearly ten times mean annual precipitation (Table 2). For other

Figure 6. Typical ephemeral stream draining Little Hatchet Mountains, east of Granite Pass; near Twelvemile Wells, SE sec. 20, T29S, R15W.

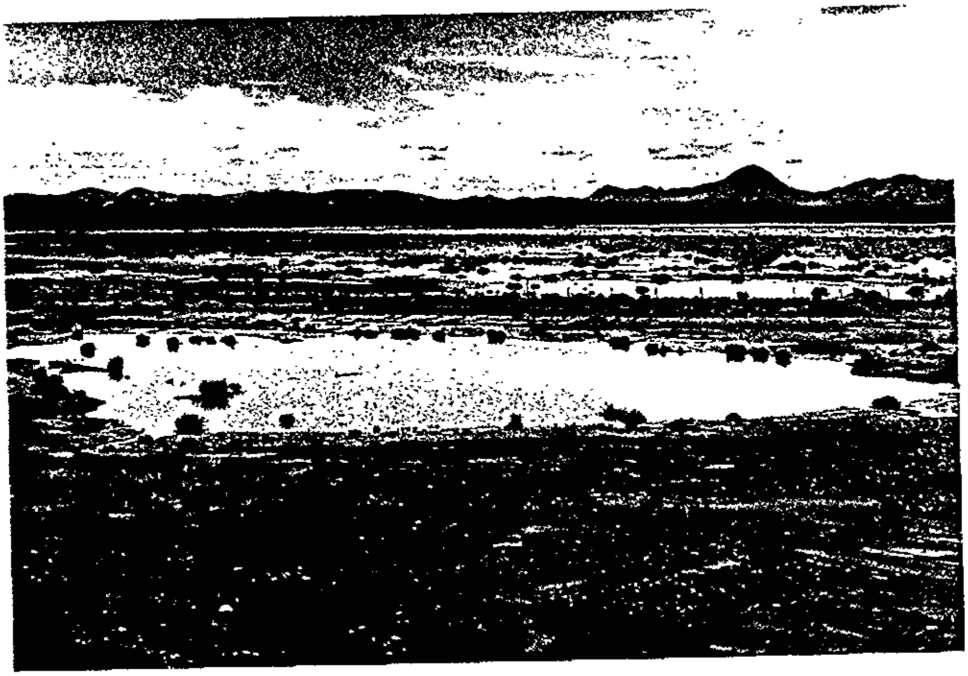

Figure 7. Typical playa: South Alkali Flat in lower Animas Valley, north of Interstate 10.

Table 2. Summary of climatic data, Hidalgo County (Gabin and Lesperance, 1977, except Butler Ranch which is from written comm. Marx Brook, 1979); Lat = latitude, Long = longitude, Elev = elevation, P = mean annual precipitation, YR = years of record, T = mean annual temperature, ET = evapotranspiration calculated as by Blaney and Criddle (1962), ND = no data. Years of record are not concurrent, nor do they necessarily extend to the date of compilation.

Station	Lat	Long	Elev (ft)	P (inches)	YR	T (°F)[1]	YR	ET (inches)
Animas	31°57′	108°49′	4415	10.76	45	60.1	22	49.73[2]
Butler Ranch	31°47′	108°48′	4523	11.48	20	ND	ND	ND
Cloverdale	31°25′	108°55′	5230	13.41	6	ND	ND	ND
Cloverdale Ranger Station	31°26′	108°59′	5400	22.53	9	ND	ND	ND
Culberson Ranch	31°23′	108°38′	4888	14.18	8	ND	ND	ND
Dunagan Ranch	31°41′	108°50′	4828	14.86	6	ND	ND	ND
Eick Ranch	31°29′	108°56′	5300	15.26	22	57.1	15	42.67
Gray Ranch	31°31′	108°52′	5100	14.09	6	55.6	3	41.36
Lordsburg	32°18′	108°39′	4250	10.99	81	61.1	27	51.58
Playas	31°57′	108°54	4425	10.69	4	ND	ND	ND
Road Forks	32°13′	108°58	4195	6.92	6	ND	ND	ND
Rodeo	31°50′	109°02′	4118	11.06	51	61.0	23	51.26
Rodeo Airport	31°56′	108°59′	4126	8.97	13	61.7	12	52.59
Skeleton Canyon	31°38′	108°58′	5500	23.45	2	56.6	1	42.00
Skeleton Canyon A	31°35′	108°55′	5150	8.97	1	ND	ND	ND
Virden	32°41′	108°59′	3775	9.52	30	ND	ND	ND

[1]Gabin and Lesperance did not give temperature ranges.
[2]A pan evaporation value of 101.6 inches was also reported for this station.

stations Gabin and Lesperance (1977) calculated potential evapotranspiration using the procedure given by Blaney and Criddle (1962). These range from 41.36 in/yr at Gray Ranch to 52.59 in/yr at Rodeo (Table 2). Although less than the rate indicated by the limited pan-evaporation data, these values represent four to five times the annual precipitation.

By subtracting the potential evapotranspiration value from the mean annual precipitation value, water surplus or deficit may be obtained. All stations in the region show a net deficit; that is, potential evapotranspiration is greater than available precipitation. Winter months may, however, be characterized by temporary surpluses of water, due to lower temperatures and evapotranspiration at these times.

Mean annual temperature is fairly uniform across the county, hovering around 60°F. Based on data from Lordsburg for 1946-1960, lowest temperature is 2°F (reached in both Jan. and Dec.) and the highest temperature is 100°F (reached in July). Last time of freezing temperatures is in April and first time of freezing temperatures is in late October/early November (Maker and others, 1970). The length of the growing season ranges from approximately 170 days at higher elevations to more than 200 days at lower elevations.

Average relative humidity normally ranges from nearly 65% in the early morning to only 35% in the afternoon (Maker and others, 1970). Cooler temperatures result in higher humidity in the mountains. Lowest values occur in the Spring. Morning values at Rodeo average approximately 40% and afternoon values average approximately 20% (Maker and others, 1970).

Table 3. Distribution of vegetation in Hidalgo County by soil type (compiled from Maker and others, 1970).

	SOIL ASSOCIATION							
	Eba-Cloverdale-Eicks	Verhalen-Glendale-Mimbres-Comoro	Mojave-Stellar	Graham-Rockland	Nickel-Upton-Tres Hermanos	Rockland-Lehman	Mondale-Playas	Sonoita-Yturbide-Hap
TREES								
pinyon	X					X		
live oak						X		
juniper	X					X		
cottonwood		X						
SHRUBS AND FORBS								
yucca			X		X	X		X
wolfberry			X			X		
winterfat			X	X				
white thorn	X							
vine mesquite	X	X		X			X	
tarbush			X		X		X	
shadscale							X	
sandsage			X					
rabbitbrush							X	
mormon tea	X		X					X
mesquite	X		X				X	X
iodine bush							X	
giant sacaton		X						
four-wing saltbush	X							
desert saltbush							X	
creosote bush			X	X	X	X		
chamiza							X	
broom snakeweed			X		X			
Arizona cottontop			X					
Apache plume						X		
alkali sacaton		X					X	
CACTI								
various	X				X	X		X
GRASSES								
tobosa	X	X	X	X	X		X	
three-awns	X	X	X		X	X		X
spike dropseed				X				
sideoats grama	X				X	X		X
sand dropseed			X	X		X		X
saltgrass							X	
ring muhly	X							
mesa dropseed				X				
little bluestem						X		
Indian ricegrass						X		
galleta						X		
fluffgrass	X							X
dropseed			X					
cane beardgrass	X							
bush muhly			X	X		X		X
burrograss		X	X		X		X	
buffalo grass		X						
blue grama	X		X		X	X		
black grama	X		X	X	X	X		X

Hondale-Playas Association is a deep, moderately fine to fine textured soil on nearly level to gently sloping alkali flats in the lowest portions of Animas, Lordsburg, Playas, and Hachita Valleys. The Sonoita-Yturbide-Hap Association is a deep, coarse and moderately fine textured gravelly soil on gentle to moderately sloping old alluvial fan surfaces in a small area northeast of Lordsburg.

Vegetation is typical of the arid Southwest. Although plant cover varies across the county, similar landscape settings have similar vegetation. Maker and others (1970) summarized the characteristic vegetation for each soil association, which is also a reflection of setting. This information has been tabulated to show distribution of vegetation by soil type (Table 3). No plants occur in all soil associations but some occur in several. Other plants are unique to a given soil on setting.

GENERAL GEOLOGY

Although the age of rocks and unconsolidated sediments at or near the surface in Hidalgo County ranges from Precambrian to Quaternary, the geologic record is incomplete (Fig. 8). Deposits of Silurian, Triassic, Jurassic, and Eocene age are missing (Thompson and others, 1978). These intervals were apparently characterized by nondeposition or were followed by periods of erosion that removed all trace of their rock record.

MOUNTAINS

The mountain ranges consist of Precambrian granodiorite, Paleozoic carbonates,

Age	Symbol (Plate 1)		Lithostratigraphic Unit	Description (thickness, ft)	Hydrogeologic Unit	Water-Resource Potential
Quaternary	Qab		bolson fill; alluvial, eolian, lacustrine deposits	gvl, sd, st, cly (≤1000)	Bolson Aquifer	excellent
Quat./Tert.	QTa		fan/pediment deposits	gvl, sd (<1000?)	Bolson Aquifer	excellent
Quat./Tert.	QTb		flows, plugs, cinders	basalt (<100?)	gen. above water table	gen. above water table
Quat./Tert.	QTg		Gila Conglomerate	uncons/cons gvl, sd, slt, cly (to 2000?)	Gila Aquifer	locally useful, poorly known
Tertiary	Tv*		volcanic rocks	felsic tuff (to 6500)	Younger Bedrock	unknown
Tertiary	Ti		dikes, stocks	rhyolite (<100-?)	Younger Bedrock	unknown
Tert./L. Cret.	TKs		Ringbone Fm.	cgl, mdst (650)	Younger Bedrock	unknown
Tert./L. Cret.	TKv		volcanic rocks	andesite (1000?)	Younger Bedrock	unknown
E. Cretaceous	K		Mojado Fm. U-Bar Fm. Hell-To-Finish Fm.	ss (5200) ls (3500) mdst (1275)	Younger Bedrock	unknown
Permian	Pz	ℙP	Concha Ls. Sherer Fm. Epitaph Dol. Colina Ls. Earp Fm.	dol (1375) ss (5-20) dd (150-1520) ls (350-500) mdst (1000)	Older Bedrock	unknown except for petroleum tests
Pennsylvanian	Pz	ℙP	Horquilla Ls.	ls (3245-3530)	Older Bedrock	unknown except for petroleum tests
Mississippian	Pz	MD	Paradise Fm. Escabrosa Ls.	ls (320) ls (1260)	Older Bedrock	unknown except for petroleum tests
Devonian	Pz	MD	Percha Sh.	mdst (280)	Older Bedrock	unknown except for petroleum tests
Ordovician	Pz	O€	Montoya Dol. El Paso Ls.	dol (385) ls/dol (915-1070)	Older Bedrock	unknown except for petroleum tests
Ord./Camb.	Pz	O€	Bliss Ss.	qtzite (200-325)	Older Bedrock	unknown except for petroleum tests
Precambrian	p€		crystalline rocks	granite, gneiss (?)	Older Bedrock	

* Various units prefixed Tv are mapped in Hidalgo County

Figure 8. Hydrogeologic column for Hidalgo County. Geology modified from Thompson and others (1978); thicknesses from Lasky (1938), Zeller (1965), Deal and others (1978), and O'Brien and Stone (1982).

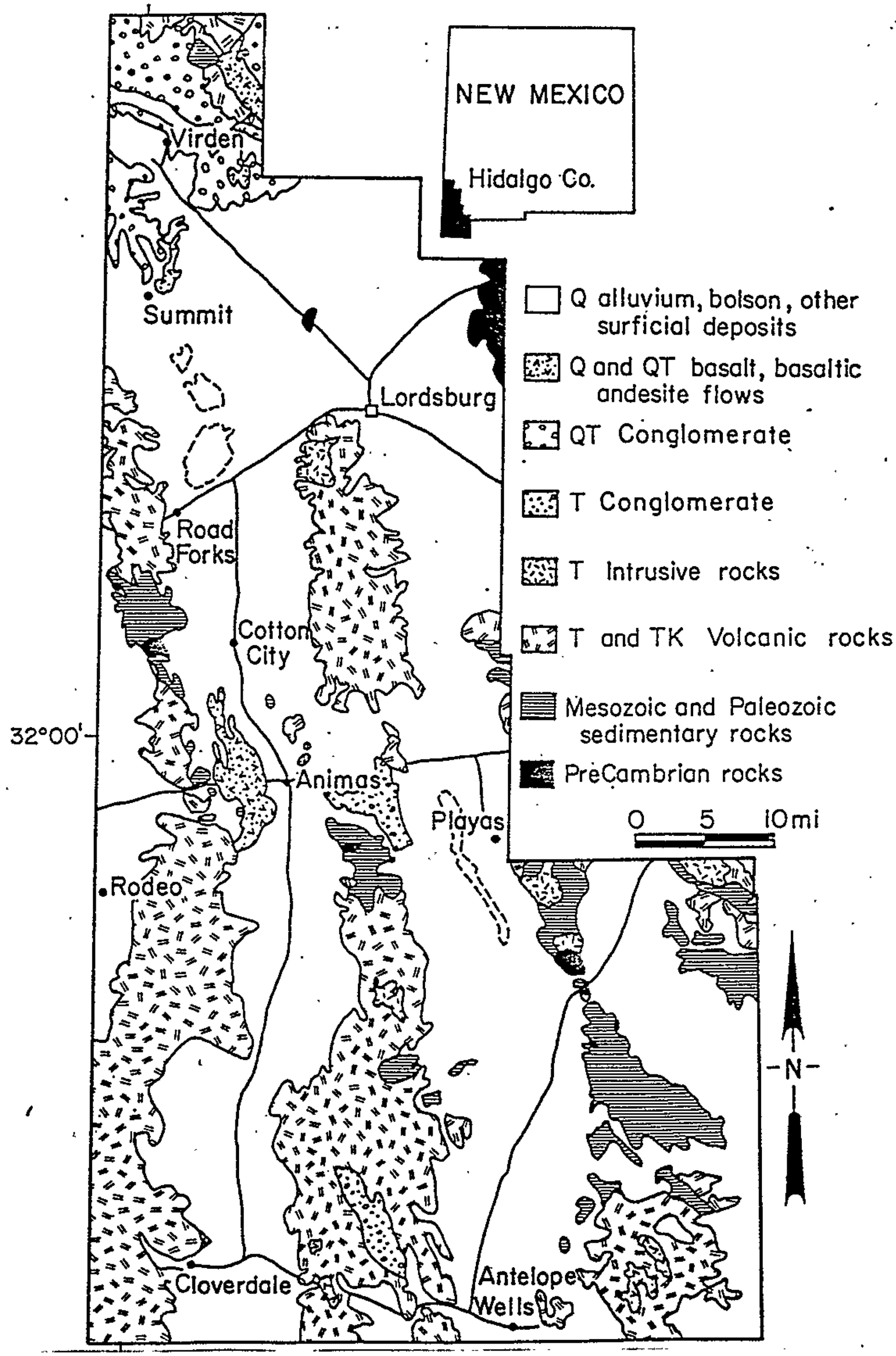

Figure 9. General geologic map of Hidalgo County as compiled from Dane and Bachman (1965), Clemons (1983), Drewes and Thorman (1980a, b) by O'Brien and Stone (1984).

Mesozoic sedimentary rocks, and Cretaceous and Tertiary volcanic, plutonic and sedimentary rocks (Fig. 9 and Plate 1). Tertiary intrusive rocks include a 34.9 m.y. old stock in the Animas Mountains, a 30-33 m.y. old quartz-monzonite-porphyry stock in the Peloncillo Mountains, and a 56 m.y. old granodiorite stock in the northern Pyramid Mountains. Tertiary volcanic rocks have been dated in the Peloncillo Mountains near Road Forks at 41.7 m.y. and in the northern Pyramid Mountains southwest of Lordsburg at 67 m.y. The Pyramid Mountains are chiefly composed of Oligocene rhyolitic to andesitic rocks (Fig. 10). Two Quaternary/Tertiary basalt flows west of the town of Animas have been dated at 4.4 m.y. and 0.14 m.y.

VALLEYS

By contrast, the valleys are filled with Quaternary/Tertiary sedimentary rocks and Quaternary sediments. These include alluvial fan deposits as well as fluvial, eolian and lacustrine facies. Older bedrock units underlie this basin fill material (Fig. 8). The Gila Conglomerate, reported in oil tests, represents an earlier phase of valley filling. A gravity-anomaly map (Fig. 11) indicates concentrations of thickest fill.

SUBSURFACE UNITS

Oil and gas wells are an excellent source of information on subsurface geology, depth to bedrock and water-producing zones. Some unsuccessful petroleum wells are even converted to ranch wells, if they encounter significant fresh-water flows. Data on petroleum wells may be obtained from published reports, the files of the Oil

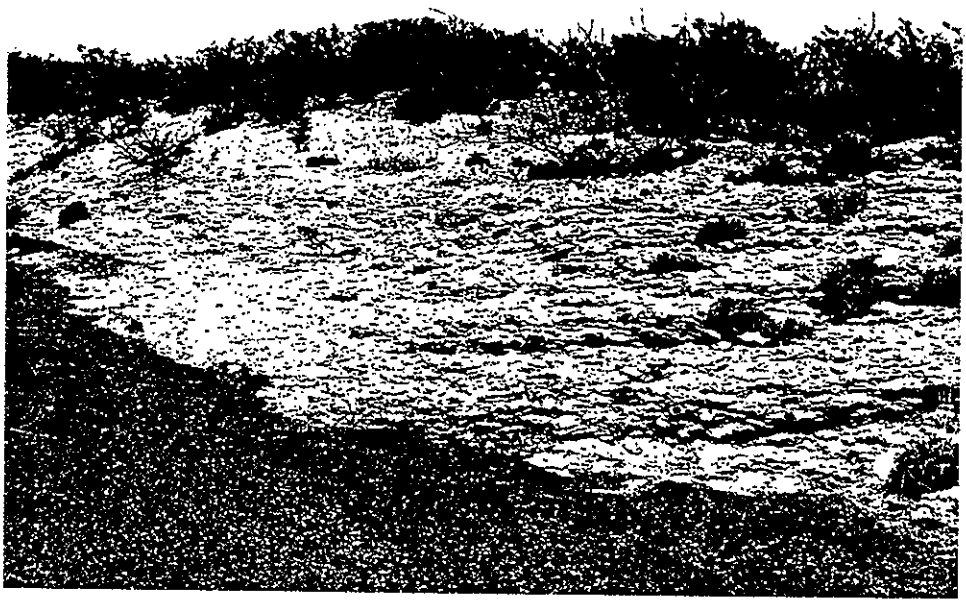

Figure 10. Outcrop of volcanic breccia along Bluebird Draw, east side of Pyramid Mountains, NW sec. 30, T23S, R18W.

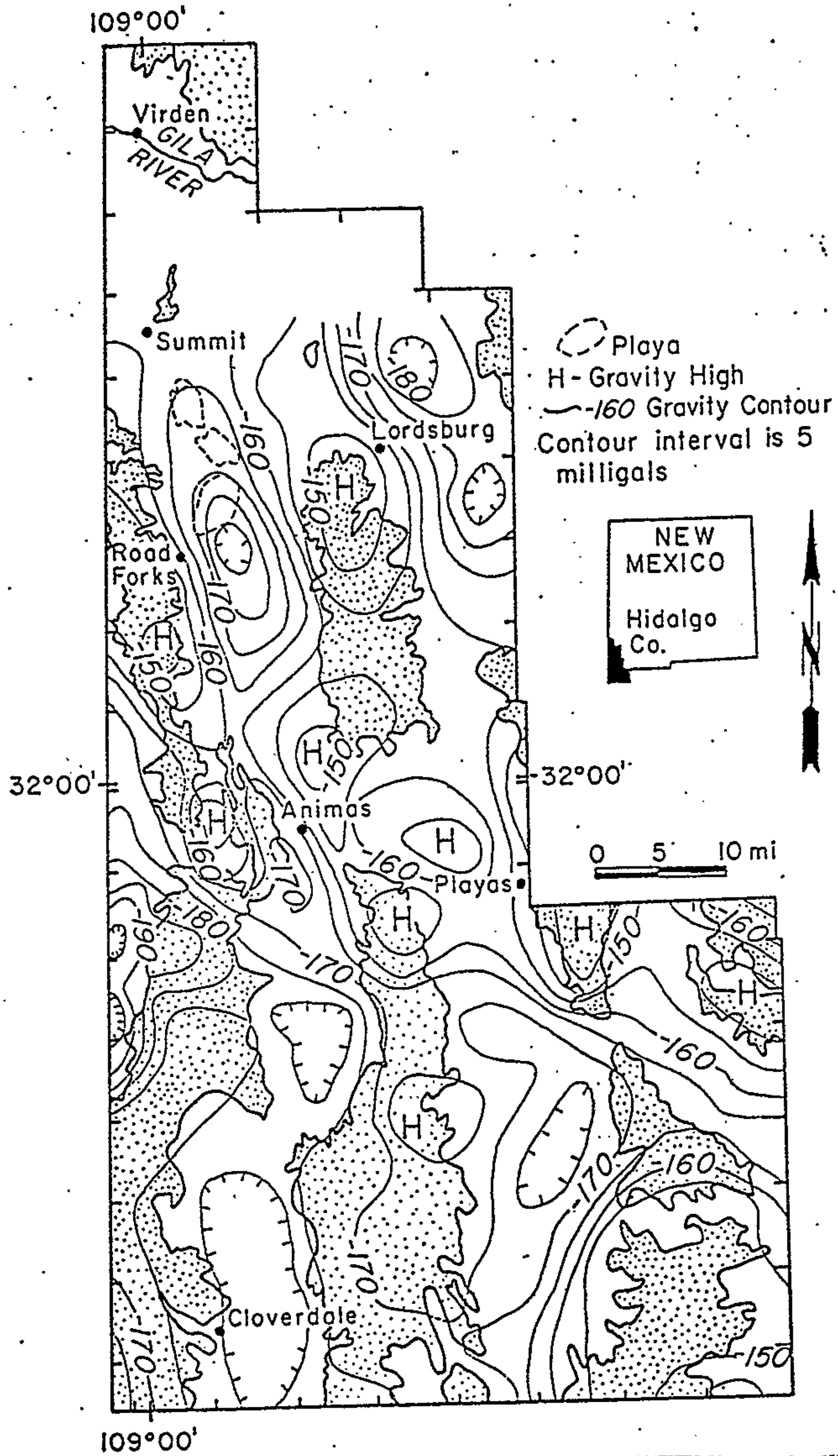

Figure 11. General Bouguer gravity anomaly map of Hidalgo County as modified from Lance and others (1982) by O'Brien and Stone (1984). Gravity highs generally correspond to shallow bedrock, whereas lows equate to deep bedrock or thick basin fill.

Conservation Division or the Bureau of Mines and correspondence with the operators involved.

Several published reports, reviewing results of petroleum exploration in the region, give valuable subsurface information. Zeller (1969) compiled descriptions and interpretations of strata tapped by deep oil tests in the Big Hatchet Mountains area. A more regional summary by Kottlowski and others (1969) includes findings in key Hidalgo County wells. Thompson and others (1978) focused on the Pedregosa Basin but gave subsurface geology for other parts of the county as well.

Bureau Petroleum Exploration Map No. 23 shows 30 wells in Hidalgo County. However, less information than this would indicate is actually available as records for very early wells, tight holes and stratigraphic tests are sketchy. Table 4 summarizes available subsurface data for other wells.

Of special interest are oil tests that make water. Such wells provide insight into the water potential of bedrock units not normally penetrated by water wells. An example is Iverson Estate State No. 1-36 in Hachita Valley (NW, sec 36, T29S, R15W). This well, drilled by Phillips Petroleum in 1984, encountered fresh water (chloride content 200-500 ppm) in highly fractured Horquilla Limestone, between 1107 and 1450 ft (Tom Earley, Phillips Petroleum, oral communication, 19 April 1984). Maximum flow rate was 100+ bbl/hr or 70 gpm (1 bbl = 42 gal). The zone was plugged and drilling continued to 8,000 ft. As this was a stratigraphic test, no logs or reports are required by the state and further information is not available at this time.

Table 4. Subsurface geology from petroleum wells, Hidalgo County. Not all formation tops may be reported; KB = Kelly bushing, DF = drill floor; GL = ground level.

Location, Name, Date	Elevation (ft)	Depth to top (ft)	TD (ft)	Source*
Sec 35, T22S, R20W Buffalo Oil and Gas No. 1	--	0 - clay and gravel 340 - black muck 344 - blue clay, gravel, cement	700 Quaternary	1
NE Sec 31, T24S, R19W Cockrell No. 1 Federal Pyramid 9-30-69	4244 KB	0 - Quaternary deposits 385 - Gila Conglomerate(?) 1890 - Tertiary volc. rocks 5795 - Mississippian sed. rocks 7340 - Precambrian rocks	7404 Precambrian	2
SE Sec 4, T26S, R17W Powers Operating Co. No. 1 State 12-3-72	4372 GL	0 - volcanic wash 920 - Tertiary volc. rocks 1180 - Cretaceous sed. rocks 3930 - Tertiary intr. rocks	4005 Tertiary intrusives	1,3
SE Sec 25, T27S, R17W Arthur B. Ramsey 1 Ramsey 25 State 7-2-89	4513 GL	0 - Quaternary deposits 1021 - Tertiary volc. rocks	1854 Permian	4
NW Sec 36, T29S, R15W Phillips Iverson Estate State No. 1-36 1983	3628 GL	1107-1450 - highly fractured zone in Horquilla Ls. (Pennsylvanian) produced 70 gpm; cased over and drilled on	13,000 ?	1,4
SW Sec 28, T29S, R15W Beal No. 1 Fed 4-28-54	4356 GL(?)	0 - Quaternary deposits 310 - Permian sed. rocks	414 Permian	1
SE Sec 16, T30S, R14W Exploration Funds Norman Jones 1 State A 7-1-70	4460 GL	0 - Quaternary deposits 100 - Tertiary volc. rocks Plugged back to 1000 ft for water well.	2350 Tertiary	1
SW Sec 12, T30S, R15W Hachita Dome No. 1 Tidball-Berry Federal 5-23-57	4349 DF	0 - Quaternary deposits 21 - Mississippian sed. rocks 2723 - Precambrian	2726 Precambrian	2
SW Sec 12, T30S, R15W Bill J. Grahm 1 Hatchet Fed 11-22-78	4331 GL	1410 - Ordovician sed. rocks	2455 Ordovician	1
NE Sec 14, T30S, R17W Cockrell No. 1 Playas 6-11-70	4455 KB	0 - Quaternary deposits 100 - Gila Conglomerate 2480 - Permian sed. rocks 7030 - Precambrian(?)	7086 Precambrian	2

Table 4 cont'd.

Location, Name, Date	Elevation (ft)	Depth to top (ft)	TD (ft)	Source*
NE Sec 12, T31S, R17W Cockrell No. 1 State - 1225 11-24-70	4480 KB	0 - Quaternary deposits 150 - Gila Conglomerate 2465 - Tertiary volc./sed.(?) rocks 2595 - Permian sed. rocks	4005 Permian	2
NE Sec 3, T31S, R18W KCM Co. No. 1 Forest Fed. 1-22-70	5156 KB	0 - Permian sed. rocks	4464 meta. Pennsylvanian	2
NE Sec 25, T32S, R16W Humble No. 1 State BA 12-24-58	4587 KB	0 - Quaternary deposits 230 - Cretaceous sed. rocks 995 - Permian sed. rocks	1485 Ordovician	2
NE Sec 16, T33S, R14W Midwest Refining No. 1 State 11-8-61	4535 DF Water at 122 ft (20 gpm) and 135 ft; converted to water well.	100 - Malpais	14585 Ordovician	1
SW Sec 10, T33S, R20W Arco 1 Fitzpatrick 4-5-85	5165 GL	690-4508 - Tertiary volc. rocks 5582 - pre Tertiary	10793 ?	1

* 1 = scout card, Bureau Petroleum Section
2 = Thompson and others (1978)
3 = Thorman (1977)
4 = phone call to operator

HISTORY

The deeper units (Paleozoic and Mesozoic) record a complex depositional history (Thompson and others, 1978). Paleozoic strata consist mainly of carbonate rock (limestone and dolostone) and occasional sandstone or mudstone intervals. These represent deposition under alternating shallow marine and nonmarine conditions. Cretaceous rocks include conglomerate, much sandstone, mudstone and minor limestone. These too reflect alternating shallow marine and nonmarine environments in the county.

Most structural features in Hidalgo County formed in response to one of two separate tectonic events: the Laramide Orogeny and Basin-and-Range faulting. The main phase of Laramide deformation occurred in Late Cretaceous time (approximately 75 m yrs ago) and consisted of compressional deformation with extensive thrust faulting, originally along northwest trending basement faults (Drewes, 1982). This thrusting was followed by widespread magmatism. The northwest-southeast trending exposure of Precambrian, Paleozoic, and Mesozoic rocks corresponds roughly to the thrust zone shown on Figure 9 and the northwest-southeast trend of gravity highs shown on Figure 8. After the Laramide, tensional conditions dominated. The region was topographically high during Eocene time and detritus of the accompanying deep erosion was carried out of the region. Basin-and-Range tectonism (mid to late Tertiary) was characterized by east-west tensional stress. This produced block faulting, emplacment of granitic plutons, and renewed volcanism with formation of cauldron complexes. Elston et al. (1979) delineated approximate limits of cauldron-outer-ring-fracture zones associated with Tertiary volcanics in Hidalgo County (Fig. 12). Delineation of the major faults in Figure

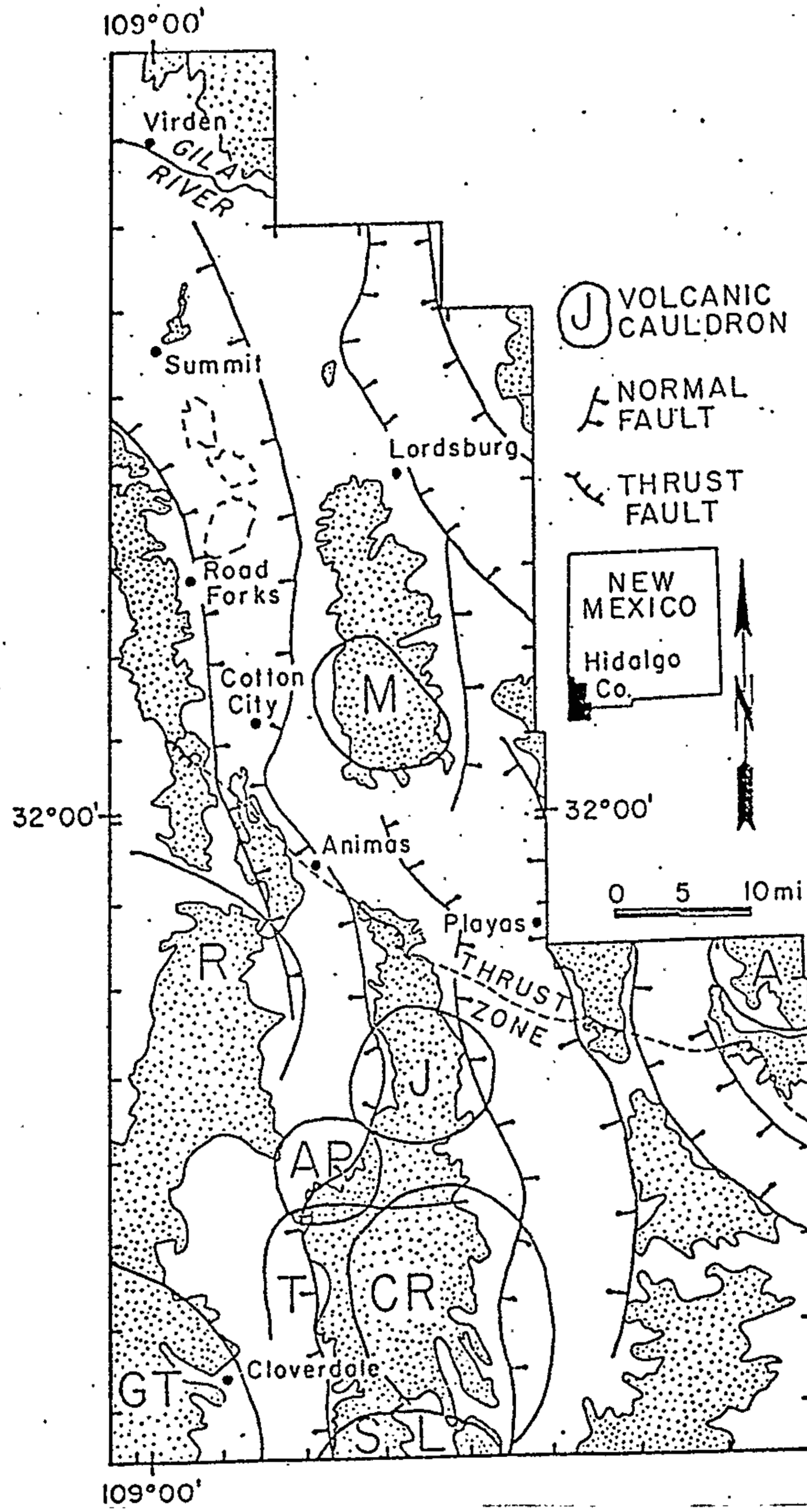

Figure 12. General tectonic map of Hidalgo County as compiled from Elston and others (1979), Thompson (1981) and Lohse (1982) by O'Brien and Stone (1984). Cauldrons designated by letters: AP = Animas Peak, CR = Cowboy Rim, GT = Geronimo Trail, J = Juniper, M = Muir, R = Rodeo, SL = San Luis and T = Tullous.

9 is based on published geologic maps, Landsat imagery, complete and residual Bouguer gravity anomalies, and seismic refraction profiles. High-angle normal faulting characterized the latest stages of this tectonic event. The interval since the Pleistocene has been one of minor faulting and erosion.

In response to wetter conditions in the Quaternary, lakes developed in the valleys. Such pluvial lakes have been recognized mainly in the Animas and San Luis Valleys. Lake Animas, which occupied the Animas and western Lordsburg Valleys, had three major stands, based on shoreline features (Fig. 13). At its highest stage (Late Pleistocene) this lake was 17 mi long, 8 mi wide, 50 ft deep, and covered an area of 150 mi^2 (Fleischhauer and Stone, 1982). The middle and lower shorelines represent Holocene phases of the lake (6,000-3,000 yrs BP). A large delta formed where Animas Creek entered the south end of the lake. San Luis Valley was the site of a smaller ancient lake (Schwennesen, 1918). Some striking shoreline features are well displayed there.

Such lakes may have existed in the other basins but the evidence is less obvious and they have been little studied. Schwennesen (1918) suggested the area of ephemeral lakes in Playas Valley was the site of an ancient lake and reported a possible abandoned shoreline along the southern margin of Hachita Valley as well.

ECONOMY AND WATER USE

POPULATION

The 1980 census (U.S. Department of Commerce, 1982) shows that the population

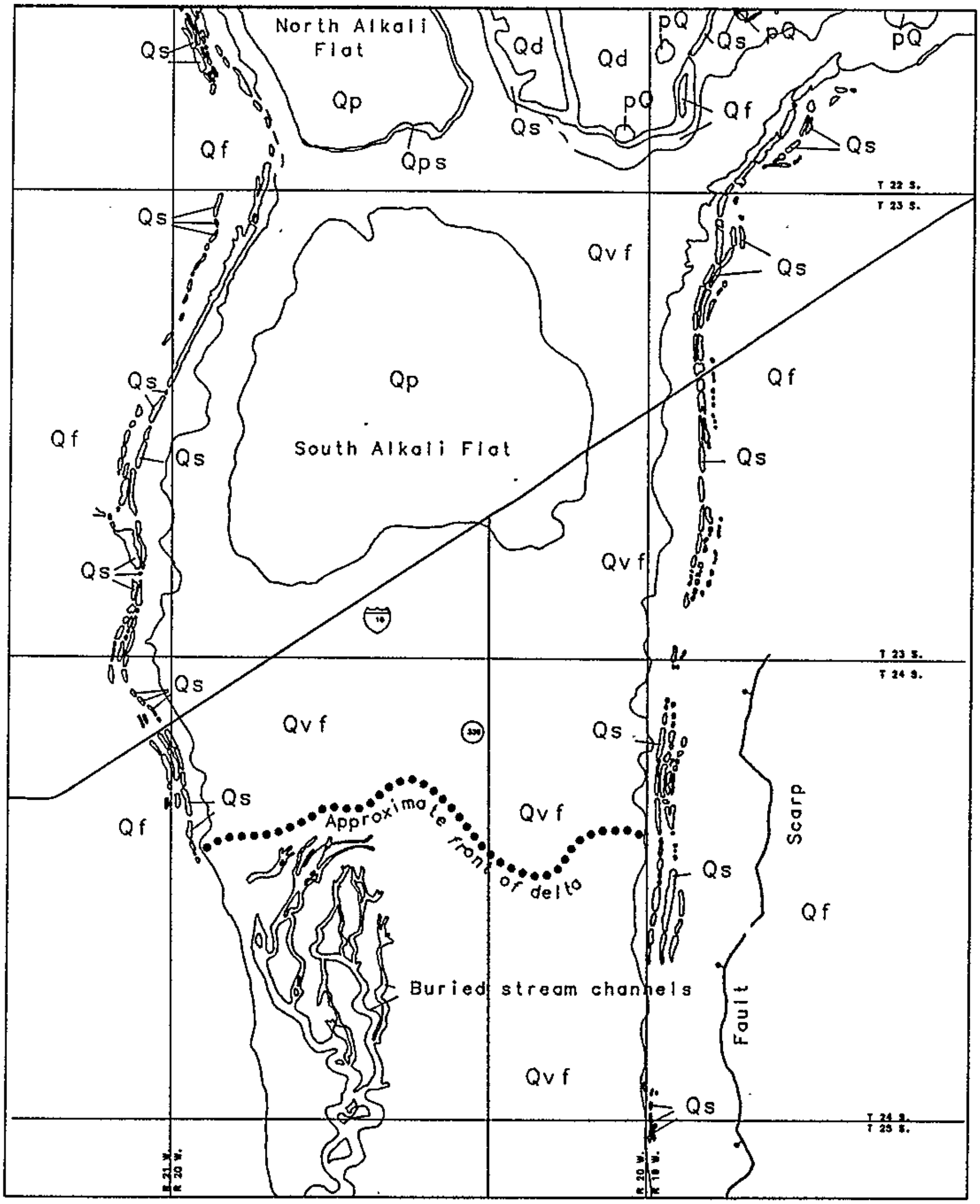

Figure 13. Shoreline features of ancient Lake Animas (modified from Fleischhauer and Stone, 1982); Qd = dune deposits, Qps = plays shore ridge deposits, Qvf = valley flat deposits (over lake deposits), Qs = shore ridge deposits of Lake Animas, Qf = alluvial fan deposits.

of Hidalgo County has varied with the economy. In 1960 the population was 4,961. The 1970 figure was down 5% from this or 4,734. But by 1980, the county experienced a population increase of 28% to 6,049. This is attributed to the construction of the new Hidalgo copper smelter (and creation of local jobs) at Playas in 1976. The 1980 population was divided nearly equally between urban and rural residents.

Most of the population is centered in Lordsburg, the county seat and only incorporated municipality. Lordsburg was founded in 1880 when the Southern Pacific--the nation's second transcontinental railroad--reached that point. In fact, it was named for the engineer in charge of the construction crew (Pearce, 1975). The population of Lordsburg has decreased slightly, but steadily, over the past 20 years: 3,436 in 1960, 3,429 in 1970, and 3,195 in 1980.

Other communities include Animas, Antelope Wells, Cotton City, Playas, Road Forks, Rodeo, and Virden. Populations of most of these surviving towns were not counted in the census. However, data for the farming village of Virden show that its population has steadily increased over the past 20 yrs: 135 in 1960, 151 in 1970, and 246 in 1980. Cloverdale, Shakespeare, Steins, and Summit are essentially ghost towns (Fig. 14).

LAND OWNERSHIP

The economy of an area is reflected to a large extent by its land ownership and administration. Five ownership categories are recognized in Hidalgo County (Table 5). Private land is the largest category (957,970 ac). Federal land (BLM and Forest Service)

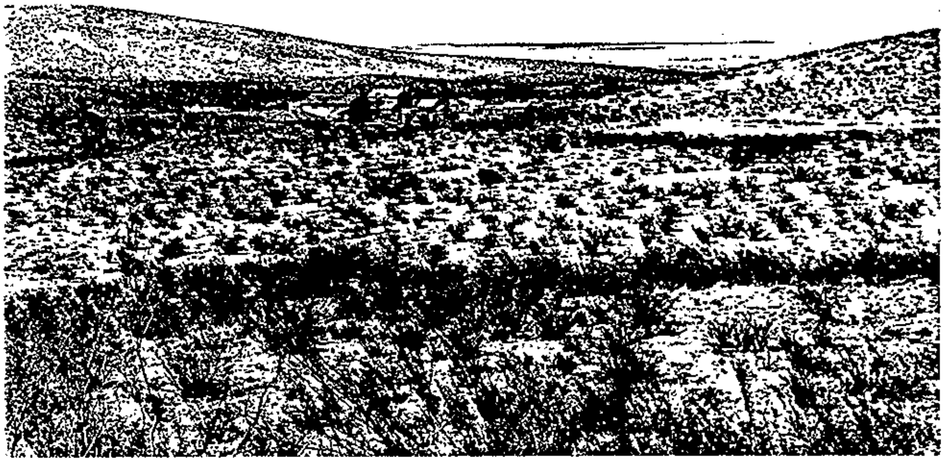

Figure 14. Shakespeare: ghost town of mining activity in 1880's, in northern Pyramid Mountains (NW sec. 7, T23S, R18W).

is a close second, totaling 882,679 ac. The next largest category covers less than half this area (state land with 354,431 ac).

AGRICULTURE

Agriculture is by far the largest single land use in Hidalgo County (Table 6). During years of adequate precipitation, and under good management, a fair to high amount of forage is available for livestock and wildlife in most areas (Maker and others, 1970). Grazing accounts for 96% of the total acreage in the county. Water is generally pumped for stock by windmills (Fig. 15).

Irrigation is practiced on only a small percentage (1.5%) of the land, but provides much of the income (Fig. 16). This involves more than 40,000 ac (Lansford and others, 1990). Largest areas of irrigation occur in the Animas and Virden Valleys. Major irrigated crops include cotton, grain, sorghum, and alfalfa. Irrigation also produces minor amounts of small grains, corn, beans, sugar beets, and vegetable crops. Newest crops are Christmas trees and grapes. Two vineyards (approximately 100 acres total) have operated in the Cotton City area for the past 5-6 yrs. A winery located on the eastern edge of the county processes grapes from a vineyard in adjacent Grant County. Some irrigation water is also devoted to maintaining pasture.

Geothermal resources and technology have given rise to a new hot-house industry in Hidalgo County (Gerard, 1987). As of August 1987, three separate greenhouses heated by geothermal energy were operating in the county. These are all located in the Animas Valley, where an extensive reservoir of geothermal fluids exists (see Animas

Table 5. Land ownership by river basin in Hidalgo County, 1966-67 (NMISC/SEO, 1974).

Category	Acreage Lower Colorado	Rio Grande	Total	% of Total
Private	582,920	375,050	957,970	43
BLM	515,749	300,710	816,459	37
State	232,751	121,680	354,431	16
Forest Service	77,220	0	77,220	3
TOTALS	1,408,640	794,400	2,206,080	100

Table 6. Land use by river basin in Hidalgo County, 1968-70 (NMISC/SEO, 1974).

Category	Acreage Lower Colorado	Rio Grande	Total	% of Total
Grazing	1,338,476	783,707	2,122,383	96
Irrigated cropland	29,190	6,040	35,230	1.5
Inland waters	11,648	4,426	16,074	1
Commercial timber	11,666	0	11,666	0.5
Urbanized	10,470	0	10,470	0.5
Roads and Recreation	7,190	3,067	10,251	0.5
TOTALS	1,408,640	797,440	2,206,080	100

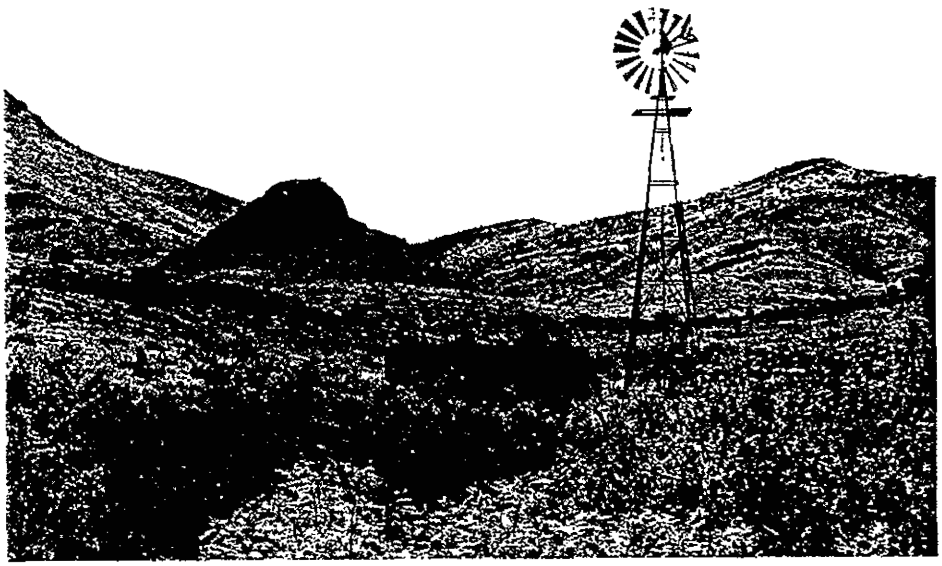

Figure 15. Typical livestock water supply well: Negrohead Well, SE sec. 24, T24S, R19W, west side Pyramid Mountains, Joe Rouse Ranch.

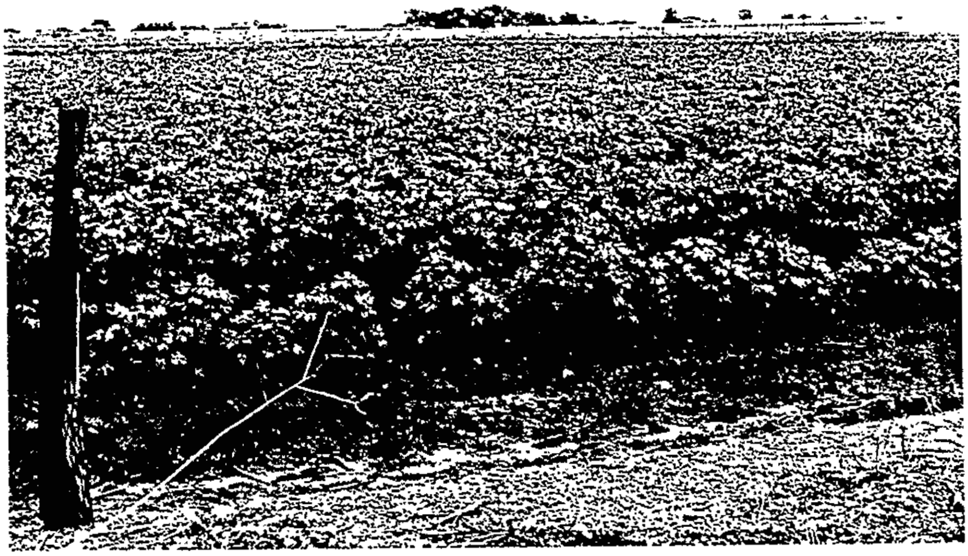

Figure 16. Irrigated crops in Gila River valley east of Virden.

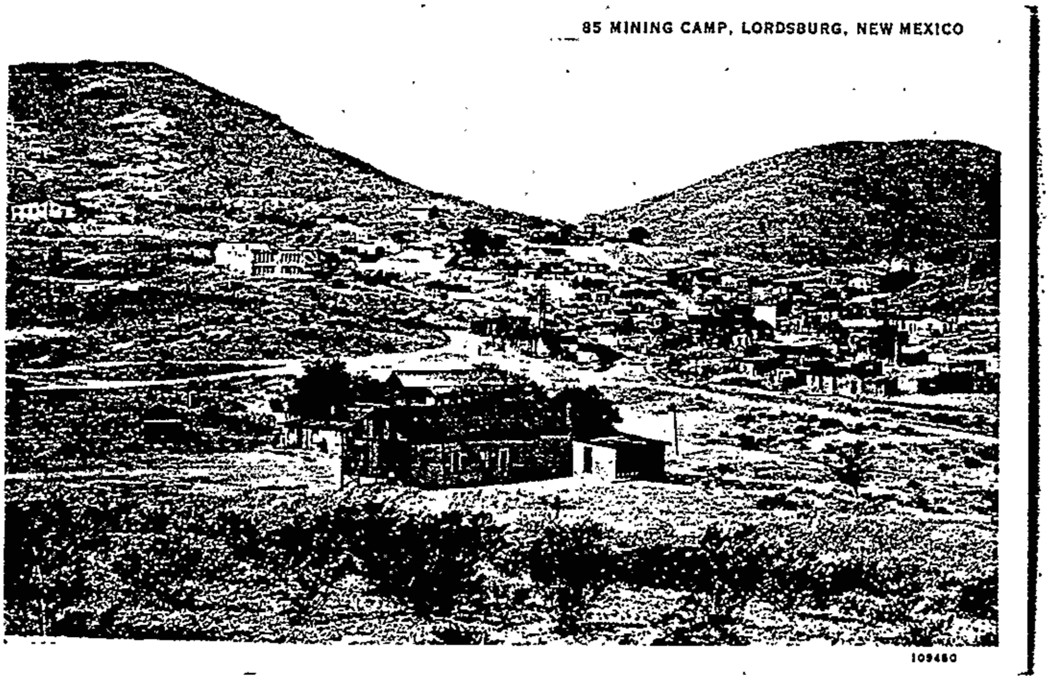

Figure 17. Mining camp of Valedon, just southwest of Lordsburg at northeast edge of Pyramid Mountains ca. 1930 (from postcard provided by R. W. Eveleth).

Valley - Geothermal Resources).

MINERAL EXTRACTION

Although mining is not represented in the land-use figures above, it has long been an important part of the economy (Fig. 17). The acreage devoted to mineral extraction is small, but the value of resources produced is significant. In 1974, probably the peak of production in recent years, $4,342,000 worth of copper, stone, sand and gravel, silver, clay, zinc, and lead (in order of value) were produced in Hidalgo County (U.S. Bureau of Mines, 1977). Mining activity declined sharply in 1975 and has continued to be depressed to the present (1988). For comparison, only $164,000 worth of silver, gold, stone, clay, lead, and copper (in order of value) were produced in 1984 (U.S. Bureau of Mines, 1986).

In addition to mining, Hidalgo County is also the site of a major copper smelter. Phelps Dodge Corporation's Hidalgo Smelter is located in the Playas Valley, approximately 42 miles southeast of Lordsburg (Fig. 18). In 1978, daily production included approximately 500 t of fine refined copper, 2,200 t of sulfuric acid, and 1,350 t of slag (Kotovsky, 1978). The smelter is also site of a new town, Playas, constructed for the approximately 400 Phelps-Dodge employees. It includes a commercial center with a store, medical clinic, bank, and post office.

OTHER ACTIVITIES

Several other activities contribute to the economy. The main line of the Southern

Figure 18. Hidalgo copper smelter of Phelps-Dodge Corporation, in Playas Valley.

Pacific Railroad, a major east-west line, crosses the northern part of the county, passing through Lordsburg. Numerous motels, campgrounds, and restaurants cater to the travelers on Interstate 10, which generally parallels the railroad across southern New Mexico. Various state and federal government agencies maintain offices in Lordsburg as well. Antelope Wells, 73 miles southeast of Lordsburg in Playas Valley, is an international border crossing (Fig. 19).

WATER USE

Ground water is the main source of supply for these various activities. In 1985, groundwater withdrawals totalled 40,732 af as compared to 1301 af for surface water (Table 7). Depletions are high: 22,859 af for ground water and 1213 af for surface water. Put another way, approximately 50% of the ground water pumped is depleted whereas nearly 100% of the surface water diverted is depleted.

Specific amounts devoted to various uses are shown in Table 6. Most (80%) of the water withdrawn goes to irrigation. The next largest category (14%) is mineral extraction. According to Wilson (1986) per capita water consumption in Lordsburg for 1985 was 242 gpd, that in Rodeo was 112 gpd (46% of the Lordsburg rate) and that in rural areas was only 60 gpd (25% of the Lordsburg rate).

GENERAL GROUND-WATER HYDROLOGY

Ground water occurs beneath the water table throughout the county. However, the water table is usually shallower, and yields are better in the intermontane basins and

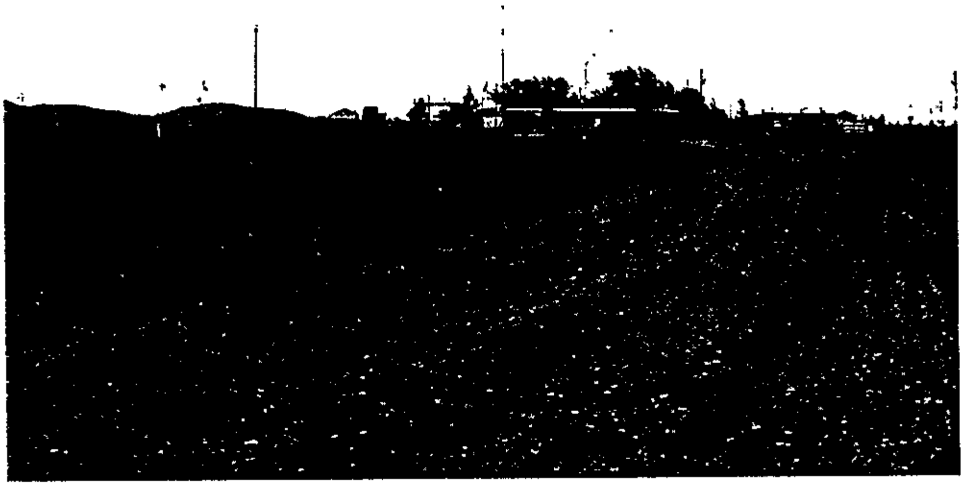

Figure 19. International border crossing, Antelope Wells, New Mexico.

Table 7 - Water use in Hidalgo County, 1985 (modified from Wilson, 1986); W = withdrawals, TW = total withdrawals; D = depletions; TD = total depletions; < less than

USE	GROUND WATER					SURFACE WATER				
	W (af)	% of TW	D (af)	% of TD	% of W	W (af)	% of TW	D (af)	% of TD	% of W
Urban	836	2	418	2	50	0	0	0	0	0
Rural	199	<1	101	<1	50	0	0	0	0	0
Irrigated Agriculture	33,351	82	16,461	72	49	267	20	179	15	67
Livestock	266	<1	265	1	100	244	19	244	20	100
Stockpond Evaporation	0	0	0	0	0	780	60	780	64	100
Commercial	153	<1	96	<1	63	0	0	0	0	100
Mineral Extraction	5,663	14	5,423	24	95	0	0	0	0	0
Power	36	<1	36	<1	100	0	0	0	0	0
Fish & Wildlife	228	<1	59	<1	26	0	0	0	0	0
Reservoir Evaporation	0	0	0	<1	0	10	1	10	1	100
TOTALS	40,732		22,859		56	1,301		1,213		93

stream valleys than in the mountain ranges. Thus most wells are drilled in the valleys. As most valleys are declared basins and reports are required for wells drilled in declared basins, data are fairly abundant for those areas. By contrast, information for wells in the mountains is essentially nonexistent. A field inventory of wells in the Pyramid Mountains affords some appreciation of ground-water resources of such areas.

GENERAL GROUND-WATER OCCURRENCE

A hydrogeologic column for Hidalgo County is given in Figure 8. Only two materials are classified as aquifers, based on available information: the bolson fill of the major basins and the alluvium of the Gila River Valley. Distribution of these aquifers is shown on Plate 1.

The major aquifer is the basin-fill material of Quaternary age, concentrated in the valleys (bolson aquifer of Fig. 8). The bolson aquifer consists of alluvial, fluvial, and lacustrine deposits. More specifically, it includes interbedded gravel, sand, silt and clay. Geologic and geophysical data suggest the total thickness of the fill may be as much as 6,000 ft. Thickness of water-yielding sediments may be as much as 2,600 ft.

As might be expected of basin-fill deposits, the aquifer lithology is quite variable. Schwennesen (1918) noted that it is difficult to correlate units between even relatively closely spaced wells. The reason is that sediment type varies with depositional environment. Lateral shifting of environments is common and thus a horizontally and vertically variable stratigraphic record is produced.

The Gila Valley aquifer is restricted to the channel and floodplain of the Gila

River in the northern or panhandle region of the county. It consists of gravel, sand and silt. Additional information is given in the section on the Gila Valley below.

The stratigraphic column includes other potentially water-bearing units as well (Fig. 8). The Gila Conglomerate, immediately underlying the basin fill, consists of better indurated tuffaceous conglomerate and sandstone. Thickness and hydrologic properties of the Gila and other younger bedrock units in Hidalgo County are unknown. The older bedrock of Fig. 8 includes the entire Paleozoic section. These units are lumped together because, except for the occasional oil test, nothing is known of their water-yielding characteristics.

As wells encounter water before reaching bedrock in the valleys and few wells have been drilled into bedrock in the mountains, and even fewer tested, little is known of the water-yielding characteristics of the pre-Quaternary materials. However, based on the general rock types involved, they are not believed to be conducive to good wells (Figure 8). The Paleozoic carbonate rocks, Cretaceous clastic rocks, and Tertiary volcanics are fairly tight, having significant porosity/permeability only where fractured.

Geologic mapping provides the nature and distribution of these materials at the surface (Plate 1). The main source of geologic information for these units in the subsurface is oil tests. Zeller (1965), Kottlowski and others (1969), and Thompson and others (1978) summarized exploration activity and reported the depth to tops of rock units involved. Additional information is also available in the Petroleum Records section of the Bureau. Water-yielding oil tests are discussed above.

Aquifer properties are not well documented. Average transmissivity values are on the order of tens of thousands of gpd/ft. Available information is discussed by area below.

Water-level data presented in this report (Tables 10, 12) were selected so as to represent conditions since those reported by previous workers. In some basins new data were gathered in the field or compiled from agency files. In others, only older published data were available. Water depth varies with location relative to recharge areas (mountain fronts) and discharge areas (irrigation pumping centers). Although well records show depth to water ranges from <20 to >400 ft, it is commonly near the 100-ft mark.

GENERAL GROUND-WATER MOVEMENT

Ground-water movement includes recharge, flow, and discharge. More specifically, flow is from recharge areas toward discharge areas.

The aquifers are recharged by seepage from ephemeral streams and overland flow along the mountain fronts, seepage from perennial streams, precipitation on the valley floors, irrigation return flow, and possibly underflow from adjacent basins. Recharge rates are largely unquantified. Table 8 gives reported values for the region.

Ground-water movement is topographically controlled. In Hidalgo County ground water moves from recharge areas in the mountain ranges, toward valleys, thence along their area and finally to discharge areas. Flow direction varies from basin to basin (Plate 1).

Some of the valleys extend beyond the county boundary and discharge areas lie

Table 8. Reported recharge values for basins and mountains adjacent to the Animas Valley.

Location	Drainage Area (mi^2)	Mean Annual Precipitation (in/yr)	Ground-water Recharge (ac-ft/yr)	Percent of Precipitation	Source
Basins					
San Simon, AZ	309	9	15,000	10	White, Hardt (1965)
Willcox, AZ	550	11	75,000	23	Brown, Schumann (1969)
Cienega, AZ	113	20	6,900	6	Geraghty and Miller (1970)
Cienega, AZ	113	20	4,800	4	Nuzman (1970)
Cienega, AZ	113	20	19,558	16	Kafri et al. (1976)
Cienega, AZ	113	20	15,700	13	Kafri et al. (1976)
Animas, NM	112	11	1,180	2	Hawkins (1981)
Mountains					
Peloncillo Mtns	34	9	2,500	16	O'Brien and Stone (198_)
Pyramid Mtns	65	11	3,000	8	O'Brien and Stone (198_)

elsewhere. Others lie wholly within the county and discharge is to adjacent basins. Such interbasin is difficult to assess due to lack of piezometers in intervening saddle areas. Flow direction in such areas no doubt reverses periodically with fluctuations in precipitation and recharge.

GENERAL GROUND-WATER QUALITY

We think of water chemistry as water quality when considering suitability for an intended use. Major uses include irrigation, stock watering, copper smelting, and domestic/municipal supply. The various dissolved constituents in a ground water make up its chemistry. Water quality varies considerably throughout the county (Tables 11, 13). Water quality can also vary within a basin, depending on aquifer composition, distance from recharge area (time in contact with aquifer), and mixing with other ground waters (fresh or mineralized). Some new analyses for major dissolved constituents were made (Table 13). No organic, bacterial or trace-element analyses were made. A trace-element study for Animas Valley is summarized (Table 9).

Hot water has been reported at various places in the county (Elston and others, 1983). Potential was great enough in Animas Valley for designation of a Known Geothermal Resource Area (KGRA). More information is given on this in the following section. Hot water was also encountered in a well on the Muir Ranch (NE, NE, sec 10, T23S, R17W) in the Playas Valley. Water with a temperature of 120°F was reported from a depth of 1200 ft in a well on the Cooke farm near Lordsburg. Other favorable geothermal targets in Hidalgo County include areas south of the KGRA and the San

Table 9. Range of trace-element concentrations, Animas Valley ground waters and prescribed standards (none if blank).

Element	Concentrations (mg/Kg)[1]		Standards (mg/L)[2]		
	Low	High	Public Health	Livestock	Irrigation
Ag (silver)	<0.03	<0.06	0.05		
Al (aluminum)	<1.0	<2.5	5.0		
As (arsenic)	0.002	0.031	0.1		
B (boron)	0.01	0.78	1.0	5	0.75
Ba (barium)	<0.20	<0.70	1.0		
Br (bromine)	0.12	1.52			
Cd (cadmium)	<0.01	<0.02	0.01		
Co (cobalt)	<0.14	<0.15		0.05	
Cr (chromium)	<0.1	<0.14	0.05	1.0	0.1
Cu (copper)	<0.10	0.69	1.0		
Fe (iron)	<0.10	74.58	1.0		
Hg (mercury)	<0.0002	0.0009	0.002		
Li (lithium)	<0.1	0.11			5.0[3]
Mn (manganese)	<0.05	0.08	0.2		
Mo (molybdenum)	<0.5	<0.5			1.0
Ni (nickel)	<0.03	<0.16			0.2
P (phosphorus)	0.01	0.14			
Pb (lead)	0.001	867.5	0.05		
Sb (tin)	<0.5	3.19			
Se (selenium)	<0.002	0.016	0.05		0.02
SiO_2 (silica)	0.95	149.7			
Sr (strontium)	<0.02	0.47			
Zn (zinc)	<0.02	2.68			

[1] compiled from Logsdon (1981, Tables A1.3, A1.4, A1.5)
[2] EPA (1976) unless indicated
[3] Hem (1970)

Simon Valley near Rodeo.

ANIMAS VALLEY

The Animas Valley lies between the Peloncillo Mountains on the west and the Pyramid and Animas Mountain ranges on the east (Fig. 1). Drainage is toward the valley axis then northerly by means of Animas Creek, which soaks into the ground south of the town of Animas. Runoff from the mountain flanks accumulates in the low areas at the north end of the valley to form North and South Alkali Flats (Fig. 1).

GROUND-WATER OCCURRENCE

In terms of ground-water use the Animas Valley is probably the most developed area in the county. The main aquifer is the bolson fill deposits. These consist of interbedded gravel, sand, silt, and clay (Plate 1). A 415-ft deep test hole in SW, NE, NE, sec 6, T22S, R20W shows a typical sequence of basin-fill sediments (Fig. 20). The hole penetrated (in descending order) 60 ft of silt-coarse sand, 65 ft of predominantly clay, 95 ft of sand and gravel, 20 ft of pebbly clay, and 175 ft of silty clay (O'Brien and Stone, 1982, hole T-1). Fragments of volcanic rock are abundant in samples from this hole. The source was presumably the Pyramid and/or Peloncillo Mountains as both include outcrops of flows and pyroclastics.

Sieve analysis of samples from this and another test hole 50 ft away by O'Brien and Stone (1982) show typical textures of the bolson aquifer (Fig. 21). Median grain sizes are in the fine or coarse sand range. The coarse sands are better sorted than the

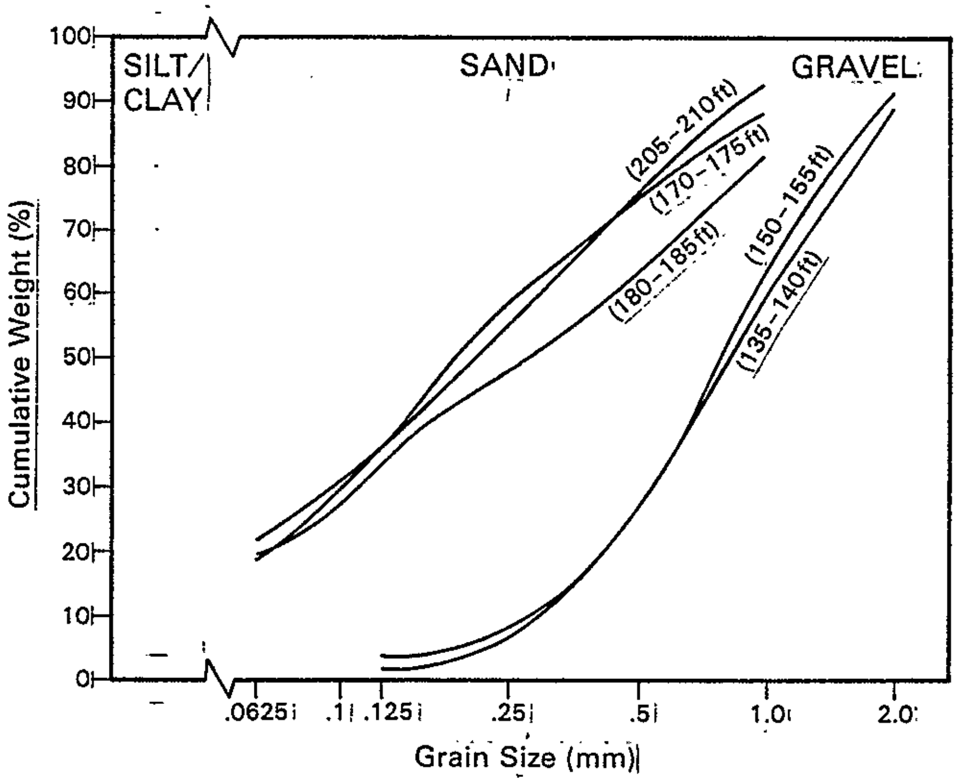

Figure 21. Texture of bolson aquifer, test well T-2, NE sec. 6, T22S, R20W (modified from O'Brien and Stone, 1982b).

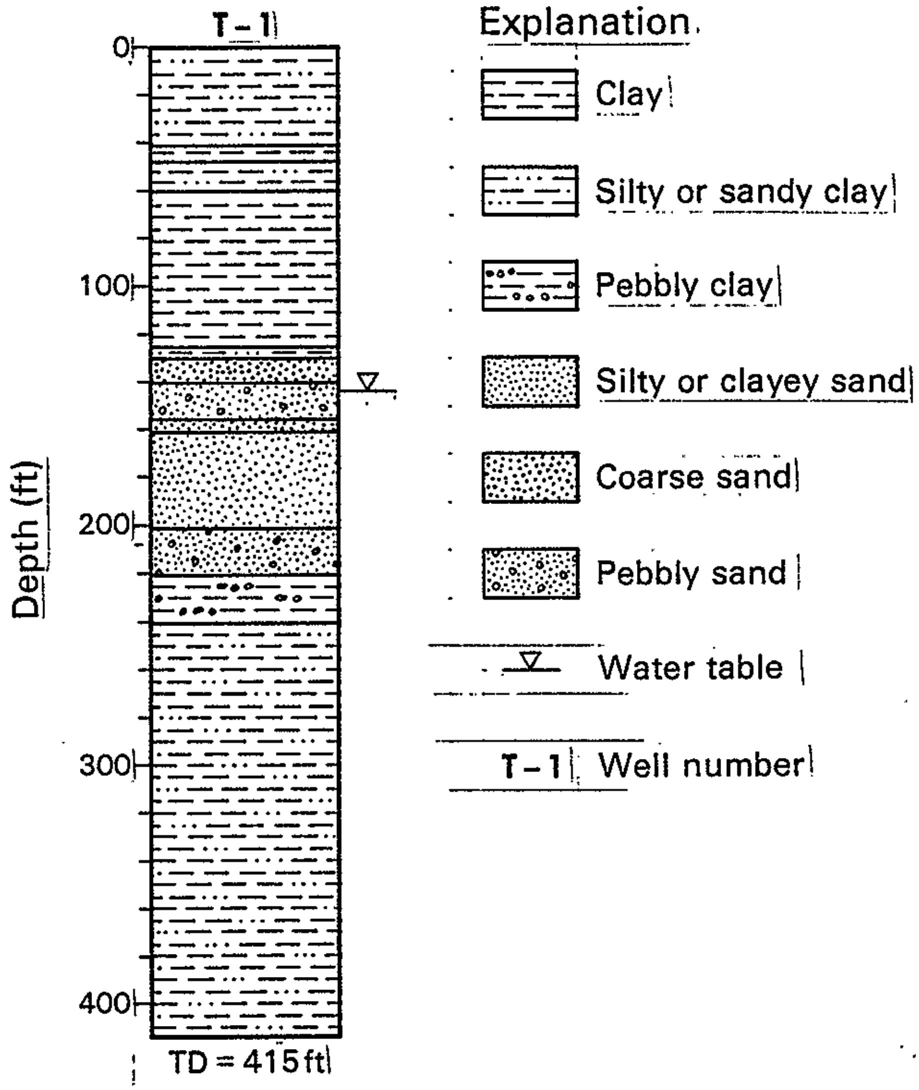

Figure 20. Lithologic log of test well T-1, NE sec. 6, T22S, R20W (modified from O'Brien and Stone, 1982b, Appendix A).

fine sands. Grain shape varies from angular to rounded; most are intermediate (subangular-subrounded).

Because suitable aquifer material is found in one area does not mean it will be in another, owing to the shifting environments of deposition. O'Brien and Stone (1982) found that even clay horizons, which presumably represent stable periods of lacustrine deposition over broad regions of the valley, could not be correlated across the basin (Plate 2).

Although hydraulic parameters of the bolson aquifer are poorly known, previous workers have reported some values. Reeder (1957) gave transmissivities for the Animas Valley ranging from 2,940 to 32,890 ft2/day and averaging 6,685 ft2/d. Arras (1979) reported a pumping test from which a T of 3,560 ft2/d was calculated. Summers (1967) determined an average T of 8,250 ft2/d for the irrigated part of the Animas Valley. Reeder (1957) calculated storage coefficients for the Animas Valley ranging from 0.07 to 0.14 and averaging 0.11. Summers (1967) computed storage coefficient to be 0.06-0.07.

The best record of pre-development water-table conditions is that reported by Schwennesen (1918). Extensive pumping of water for irrigation resulted in water-level declines, especially in the Animas Valley. Water level dropped at least 20 ft over an area extending from the southern part of T27S to the northern part of T24S (Reeder, 1955). Greatest decline was in sec 35, T25S, R20W. Current management of ground-water development has reduced or stabilized water-level declines (Figs. 22 and 23). More recent water levels are given in Tables 10 and 12.

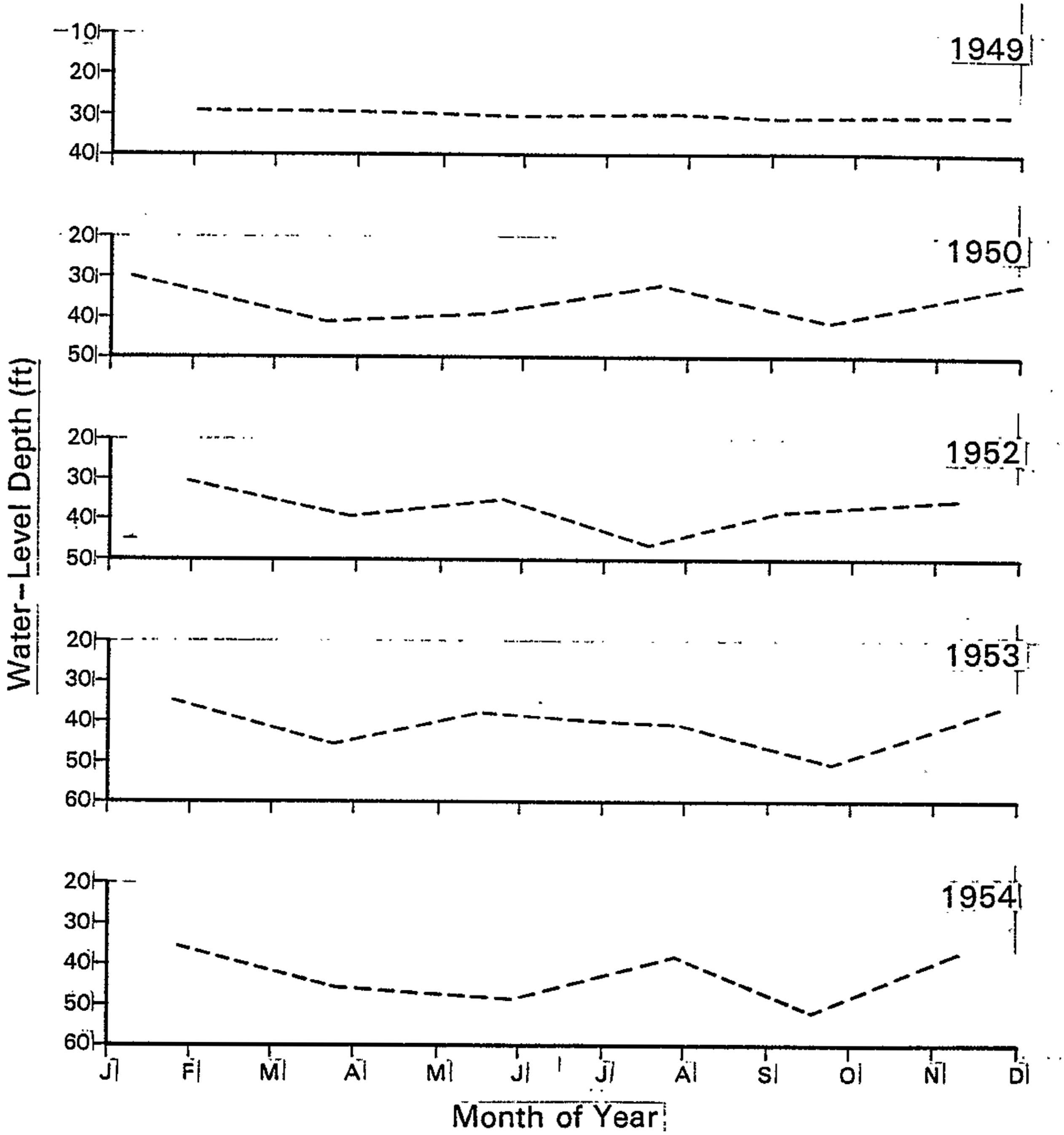

Figure 22. Comparison of five annual hydrographs for well 24.20.01.444, Animas Valley; dashed lines indicate projections through missing measurements (data from USGS/SEO annual observation well network).

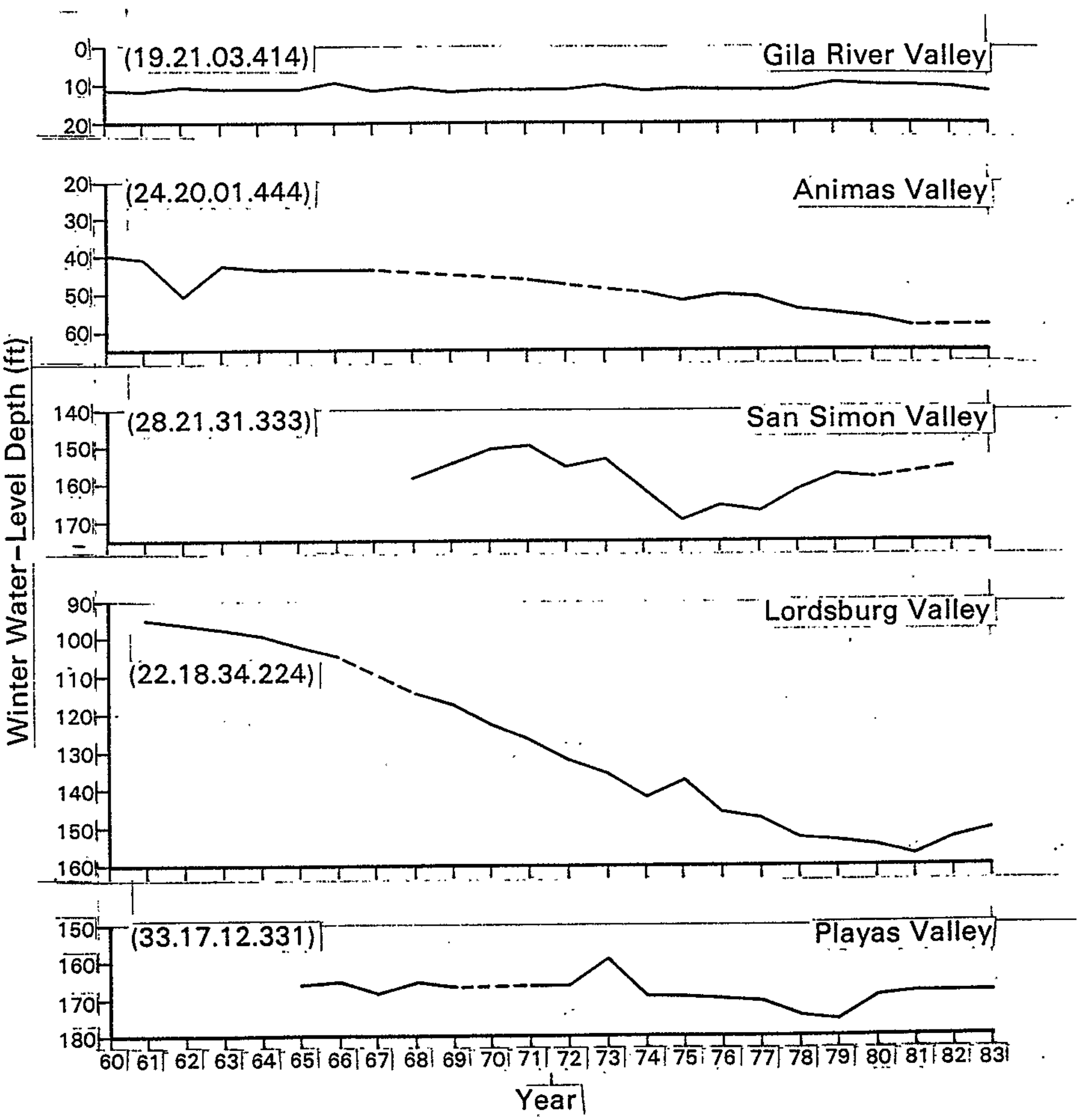

Figure 23. Comparison of winter water levels for selected wells in Hidalgo County basins, 1960-1983; dashed lines indicate projections through missing measurements (data from USGS/SEO annual observation well network).

GROUND-WATER MOVEMENT

Ground water movement generally follows topography. Most water flows from mountain and valley recharge areas toward the Gila River Valley, where it discharges. Locally, ground water flow is diverted toward artificial discharge areas or pumping centers. The significant zones of depression shown in Figure 24 capture ground-water flow in those areas.

Recharge measurements were not made. However, in modeling the hydrologic system of the Animas Valley, O'Brien and Stone (1983) used mountain-front recharge values of 2,500 ac-ft/yr (16% of the 9 in. annual precipitation) for the Peloncillo Mountains and 3,000 ac-ft/yr (8% of the 11 in. annual precipitation) for the Pyramid Mountains. These were based on an equation derived by the USGS (Jack Dewey, written communication, 1982).

These values are within the ranges of recharge values reported for nearby areas (Table 8). The reported values represent 2-23% of average annual precipitation. For comparison, recharge based on a chloride mass-balance approach, in other parts of the state represents <1-3% of average annual precipitation (Stone, 1986).

Water levels are so similar in the Animas and Playas Valleys that interbasin flow is difficult to determine (Plate 3). The lack of specially constructed piezometers or even wells in the saddle area between the basins hinders analysis. If flow does occur, it is probably minor and the direction probably changes with differences in precipitation and recharge events in the two basins.

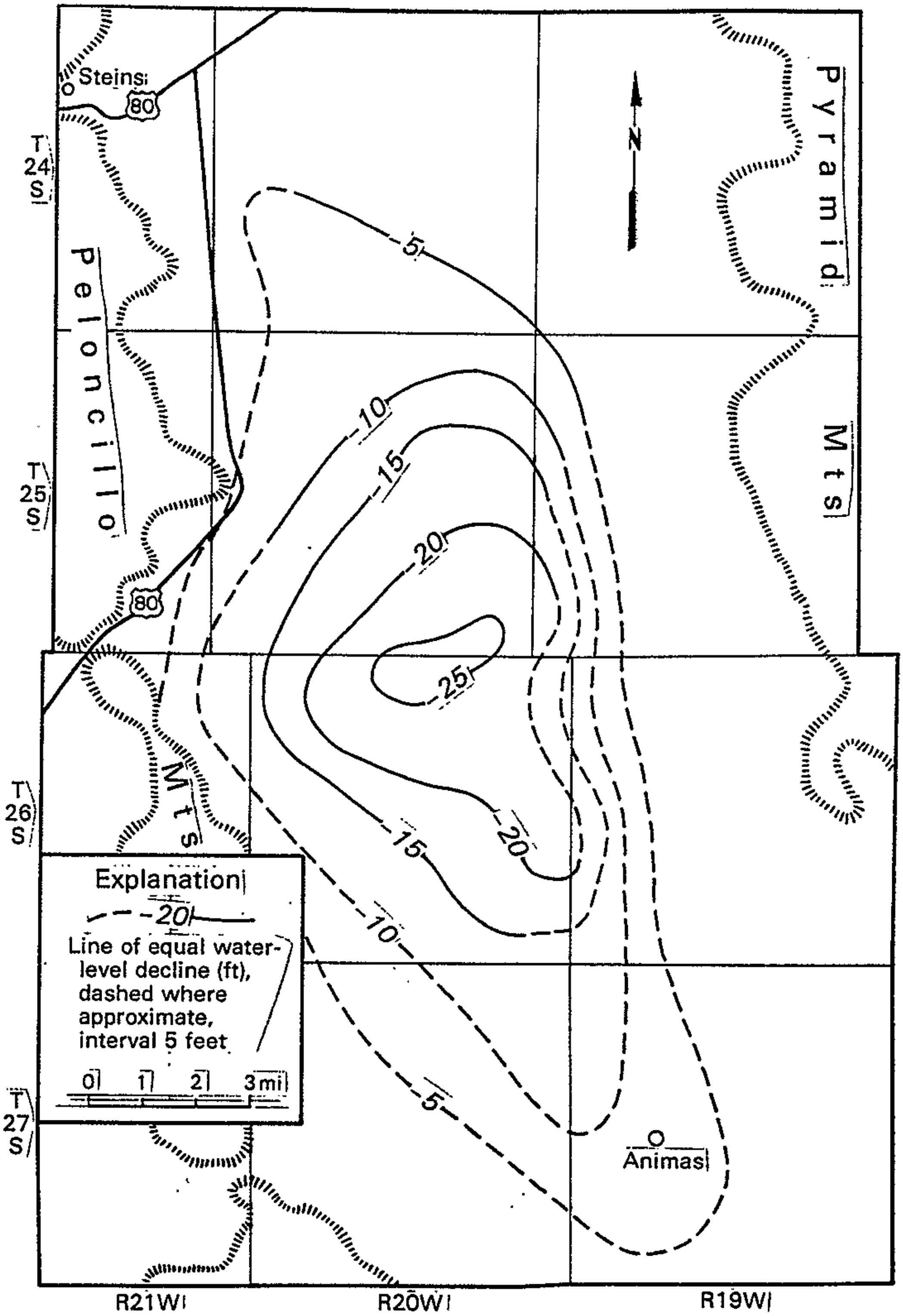

Figure 24. Water-level decline in lower Animas Valley, April 1948-January 1955 (modified from Reeder, 1957).

GROUND-WATER QUALITY

A general indication of ground-water quality is salinity or dissolved constituents. The two measures of salinity are total dissolved solids (TDS), determined in the laboratory, and specific conductance (SC), determined in both the field and the lab. The relationship between the two was determined for Animas Valley: TDS = 0.717 SC - 14.2 (O'Brien and Stone, 1982). In Animas Valley, Sc ranges from 204 to 7,672 μmhos/cm (Plate 4; Table 11). Values >750 μmhos represent a salinity hazard. Freshest water occurs in southern (upgradient) and basin-center locations: 300-500 μmhos. Downgradient and central areas of the Animas Valley are characterized by SC values of 1800-3000 μmhos. Highest values are associated with the KGRA: 442-7672 μmhos.

The specific ions present or the concentration of those ions varies along flowpaths. For example, the major cation in Animas Valley waters is calcium or sodium, depending on location. Calcium comes from weathering of carbonate sedimentary rocks (limestone and dolostone). Sodium comes from clays. Calcium dominates in the recharge areas, whereas sodium dominates in downgradient areas, as a result of cation exchange. Similarly, the major anion in Animas Valley waters is bicarbonate, sulfate, or chloride, depending on location. Bicarbonate comes from the atmosphere, soil, and weathering of carbonate rocks. Sulfate results from the weathering of sulfate minerals followed by oxidation. Chloride comes mainly from recharging precipitation, dust, or solution of evaporite deposits. Bicarbonate characterizes recharge waters, sulfate joins bicarbonate in middle valley areas, and chloride is added in the lower (northern) part of the valley.

Cations and anions can be used to classify water chemistry. Ground water in the upper (southern) part of the valley would be classified as mainly calcium-bicarbonate water. That of the middle valley (excluding the KGRA) is sodium/bicarbonate-sulfate water. In the KGRA the water is of the sodium-sulfate type. The lower (northern) part of the Animas Valley is characterized by sodium/sulfate-chloride ground water.

The potential for water to participate in cation exchange with clay minerals is indicated by the sodium-adsorption ratio (SAR):

$$SAR = Na^{+}/(Ca^{+2} + Mg^{+2}/2), \text{ where}$$

ion concentrations are expressed as milliequivalents/liter. SAR has been determined for the Animas (O'Brien and Stone, 1982). It varies with location within a valley (Fig. 25). Values were generally <10; only values >18 indicate a salinity hazard.

Various other constituents or parameters must be considered in determining the usefulness of a ground water. For example, fluoride exceeds the standard of 1.5 ppm for public supplies in some areas (Table 11). This can lead to mottling of tooth enamel, especially in children. Hardness is also a problem with many waters. Values in the moderately hard (75-150) to hard (150-300) categories have been reported (O'Brien and Stone, 1982). Fortunately, it is the temporary or carbonate type of hardness and can be treated. Trace-metal data were available only for the KGRA (Logsdon, 1981). Table 9 summarizes ranges of concentrations and compares them with standards. Most concentrations are within standards but maximum values reported exceed limits in the case of chromium, iron and lead.

Deposition of minerals in pore space by circulating ground water (cementation) can reduce porosity and permeability. WATEQF, a computer program developed by

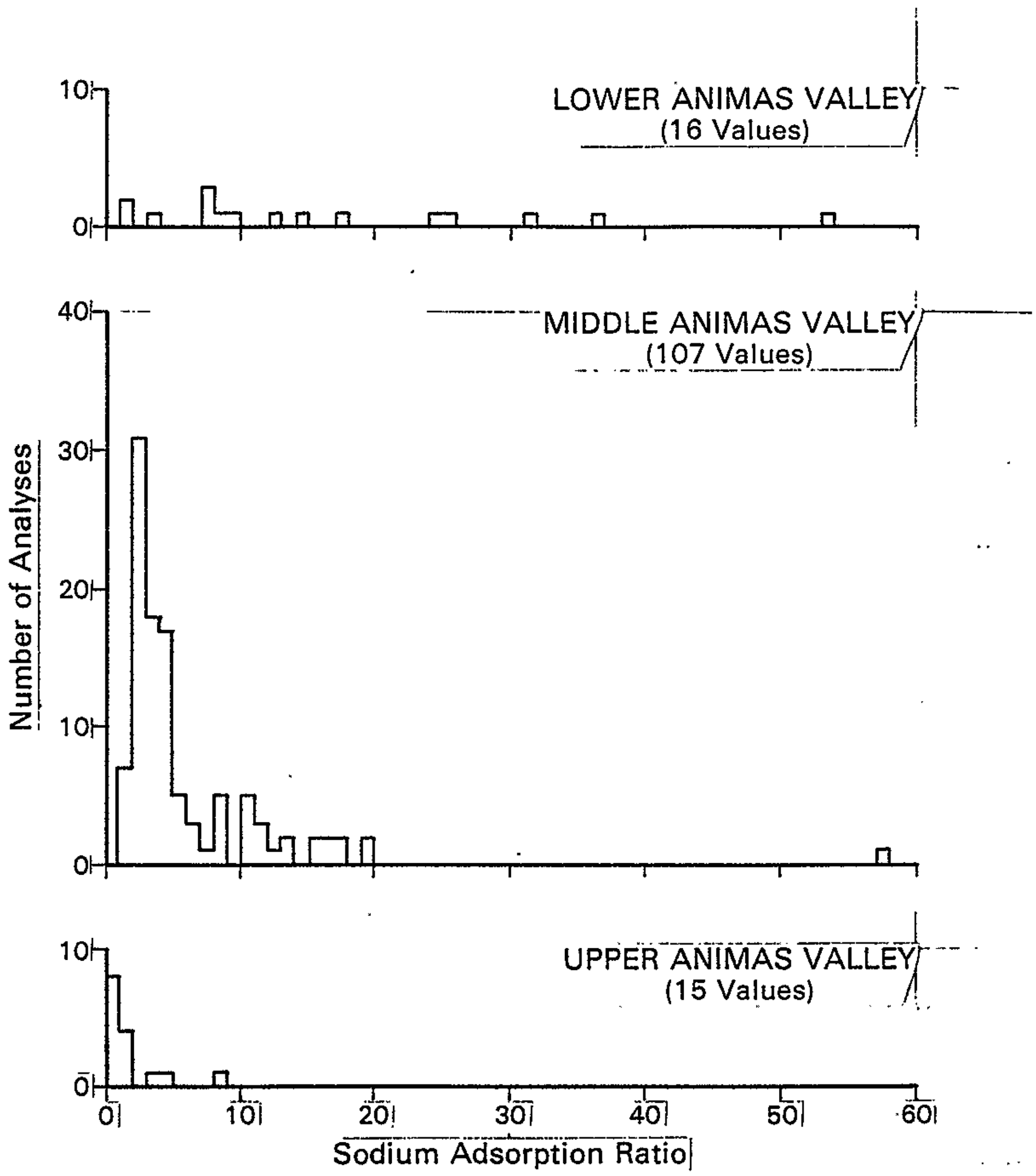

Figure 25. Sodium adsorption ratio for ground water samples from Animas Valley (O'Brien and Stone, 1982b).

Plummer and others (1978) to calculate the inorganic chemical equilibrium of waters, was applied to ground waters in the Animas Valley to learn of potential cementation problems (O'Brien and Stone, 1982a). Results are shown in Figure 26. This showed that upper Animas Valley ground water is saturated or supersaturated with respect to silica and thus quartz should be a common cement in the aquifer there. In the middle and lower parts of the valley, waters are saturated or supersaturated with respect to both silica and calcium carbonate. Quartz and calcite should be cementing the aquifer in those areas. Such cements not only reduce yields of the aquifer, they also make drilling more difficult. Furthermore, the same chemical conditions that lead to cementation might result in scale formation in well screens and casing. Available data did not allow for analysis of the potential for zeolite, iron oxide or hydroxide cements in Animas Valley aquifers.

ALKALI FLATS

The alkali flats in the lower (northern) Animas Valley are typical playas, that is, periodically flooded low-lying areas on the floor of an arid valley (Fig. 7). As playas occur at the lowest elevations in the basins, they may develop under either of two different hydrologic regimes. Flooding may be due to the accumulation of discharged ground water or merely the ponding of surface runoff.

In 1985 these areas were the subject of exploration for underground brine. Economic accumulations of brine or evaporites are most likely beneath playas developed under a discharge regime. This follows from the fact that, even before evaporation,

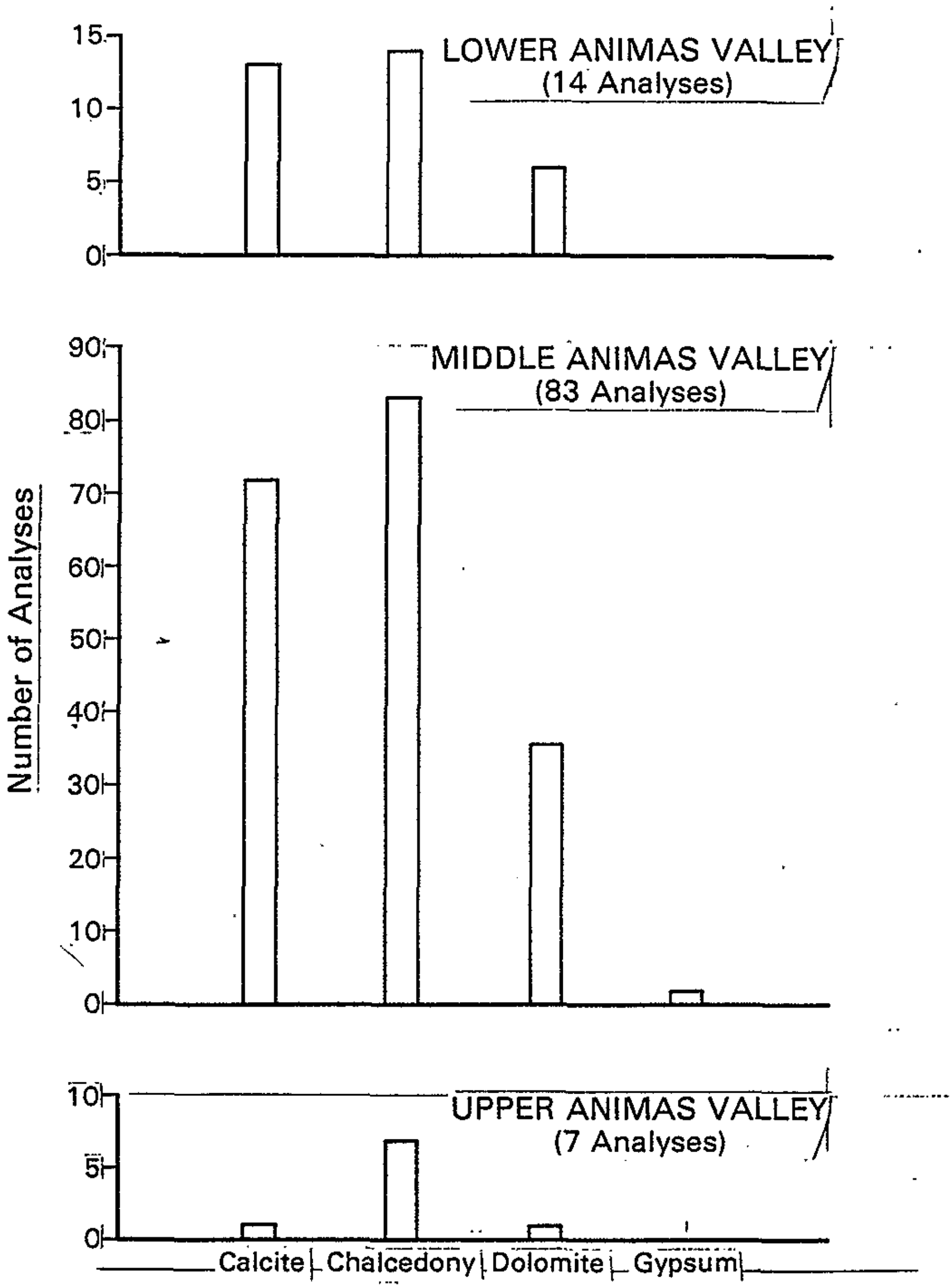

Figure 26. Results of evaluating Animas Valley ground-water samples with WATEQF, a computer program that determines what mineral species the water is saturated or supersaturated with (O'Brien and Stone, 1982b).

ground water generally contains more dissolved solids than runoff.

Predictably the exploration was unsuccessful. The company was surprised that holes were dry even to 100 ft or more and that they encountered evaporites, not even gypsum. The reason is that these playas formed under a runoff regime, discharge being via the subsurface the Gila River outside the valley to the north. Use of available data (O'Brien and Stone, 1981, 1982a, b, and 1983) could have saved these drilling costs.

HYDROLOGIC MODEL

Computer models test conceptual hydrologic models and presumed aquifer properties. The two-dimensional, finite-difference ground-water flow code developed by the USGS (Trescott and others, 1976) was applied to the Animas Valley for this purpose (O'Brien and Stone, 1983). Aquifer parameters were assigned based on all available geological and geophysical data (O'Brien and Stone, 1984). More specifically, transmissivity values were adjusted in view of apparent gravity data/aquifer thickness relationships (Fig. 27).

Steady-state conditions were simulated first using water levels from Reeder (1957). Model calibration was considered complete when simulated water levels were within 25 ft of observed water levels. The model matched steady-state water levels fairly well (Fig. 28).

Next the model was applied to transient conditions using drawdown data for April 1948 to January 1955 (Reeder, 1957). Calibration was considered done when simulated drawdown contours were within 10 ft of observed contours. A reasonable match was

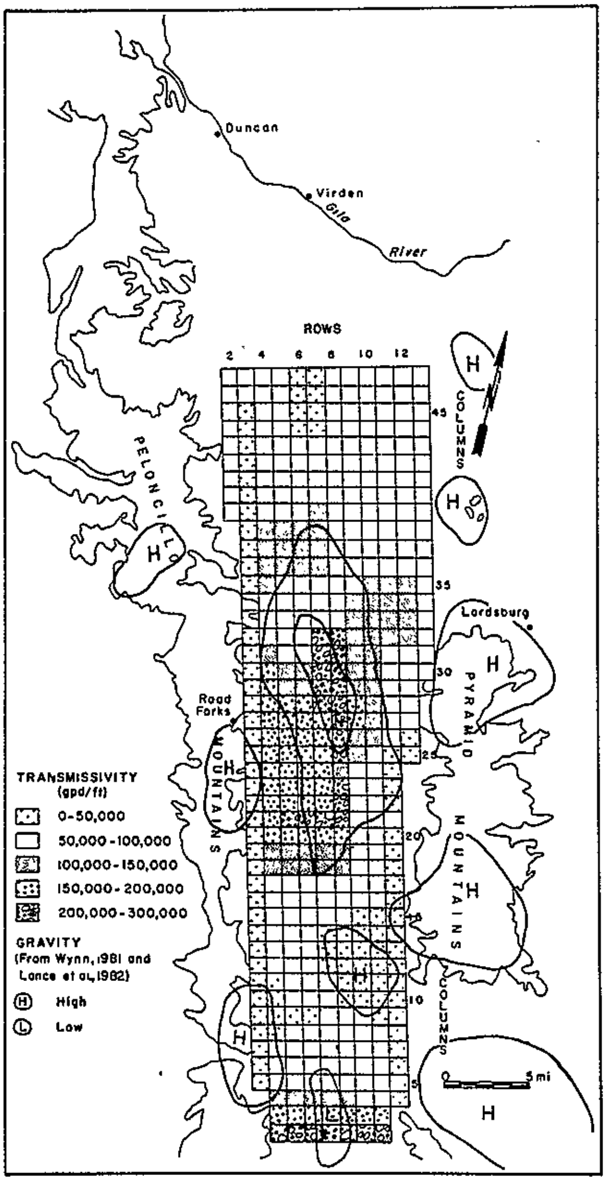

Figure 27. Grid and assigned transmissivity values (based in part on gravity data shown) for two-dimensional, finite-difference computer model of the hydrologic system in Animas Valley (O'Brien and Stone, 1984).

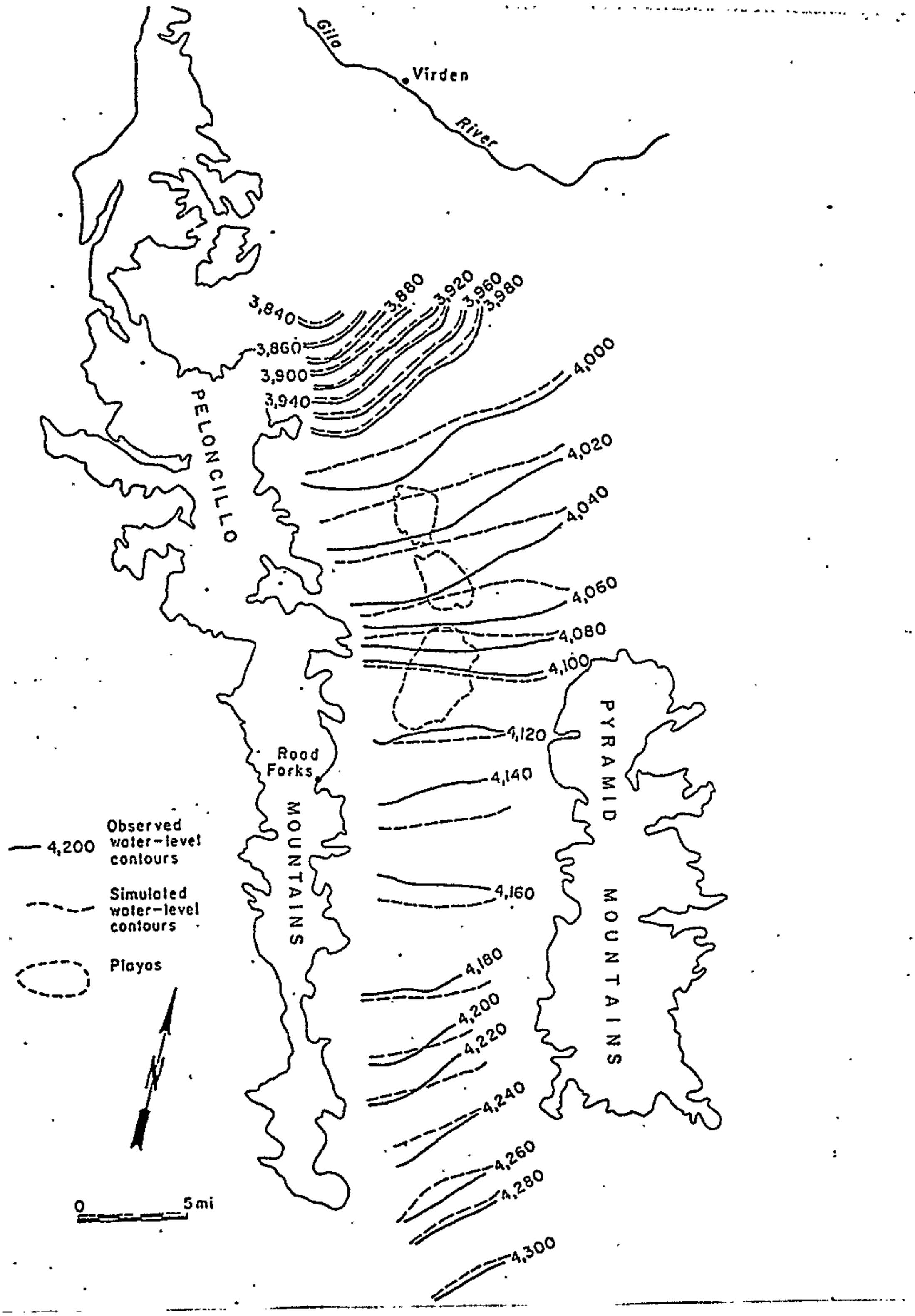

Figure 28. Results of calibrating steady-state model for Animas Valley (O'Brien and Stone, 1984).

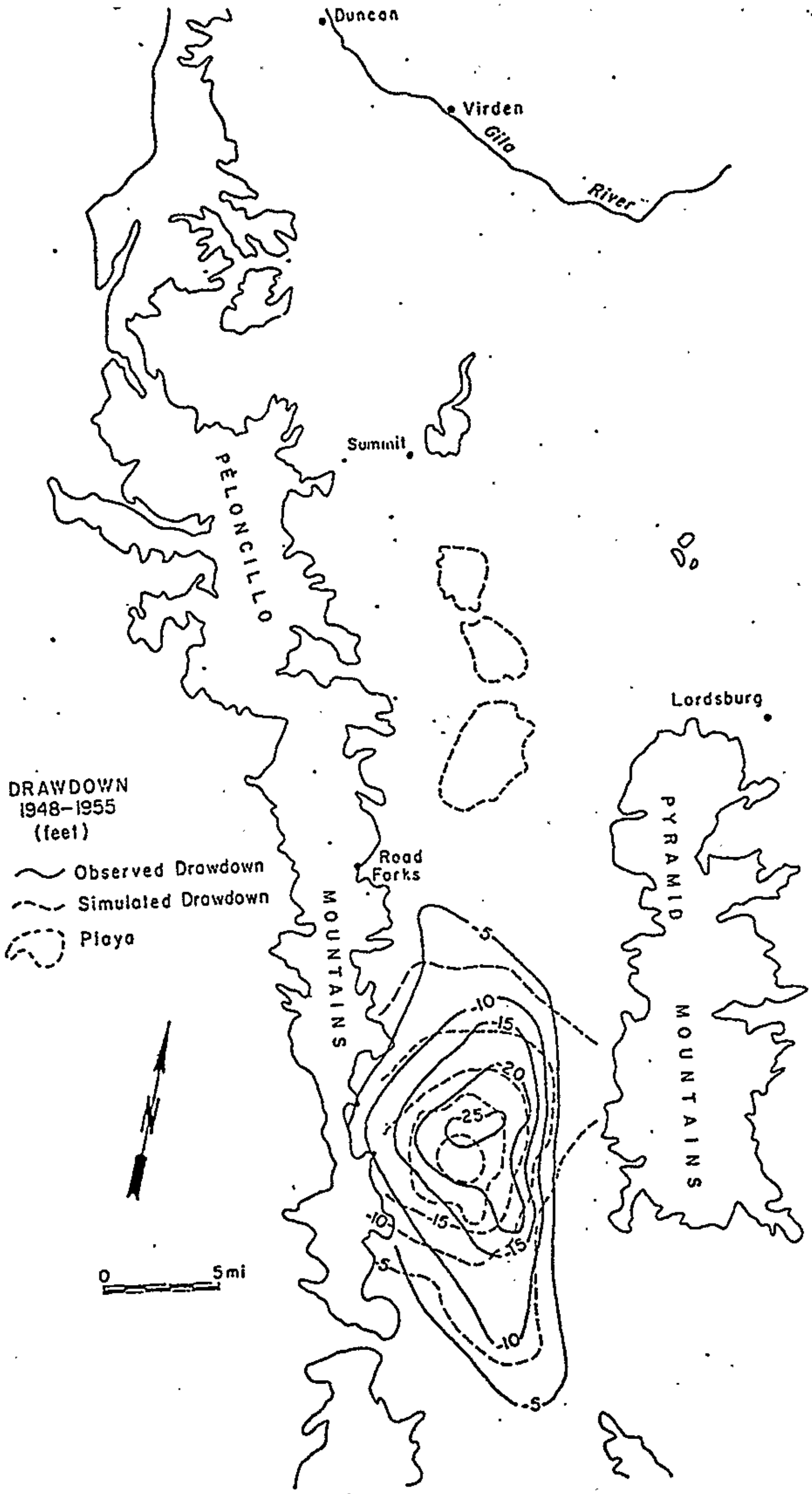

Figure 29. Results of calibrating transient model for Animas Valley, April 1948-January 1955 data (O'Brien and Stone, 1984).

achieved (Fig. 29).

For verification of the transient model, drawdown data for the period April 1948 to April 1981 were used. These came from Reeder (1957) and the USGS/SEO annual water-level monitoring network. The model did better for drawdowns in the center of pumpage than for outlying areas (Fig. 30).

GEOTHERMAL RESOURCES

Various aspects of the geothermal phenomena in the Animas Valley have been well covered by previous workers and no attempt will be made to repeat their findings here (see Previous Works above). However, a brief description of the resource, taken largely from Elston and others (1983), is presented for completeness.

In 1948, while drilling for water in NE, sec 7, T25S, R19W, boiling water was encountered in rhyolite at a depth of 87 ft. Kintzinger (1956) mapped temperature 1 m below the surface adjacent to the hot well and was the first to show the broad extent of the hot spot (approximately 2 mi^2). Since then other hot wells have been drilled and the area appears to be even larger (Lansford and others, 1981). The anomaly has been designated as the Lightning Dock Known Geothermal Resource Area or KGRA (Fig. 31).

The hot wells seem to lie at the northeast end of a deep, fault zone along which hot water flows. The water is apparently heated (to nearly 485°F) by deep basaltic magma. Near the hot wells, the hot water rises along a conduit formed by the intersection of the fault and the ring-fracture zone of the Muir cauldron. By mixing with

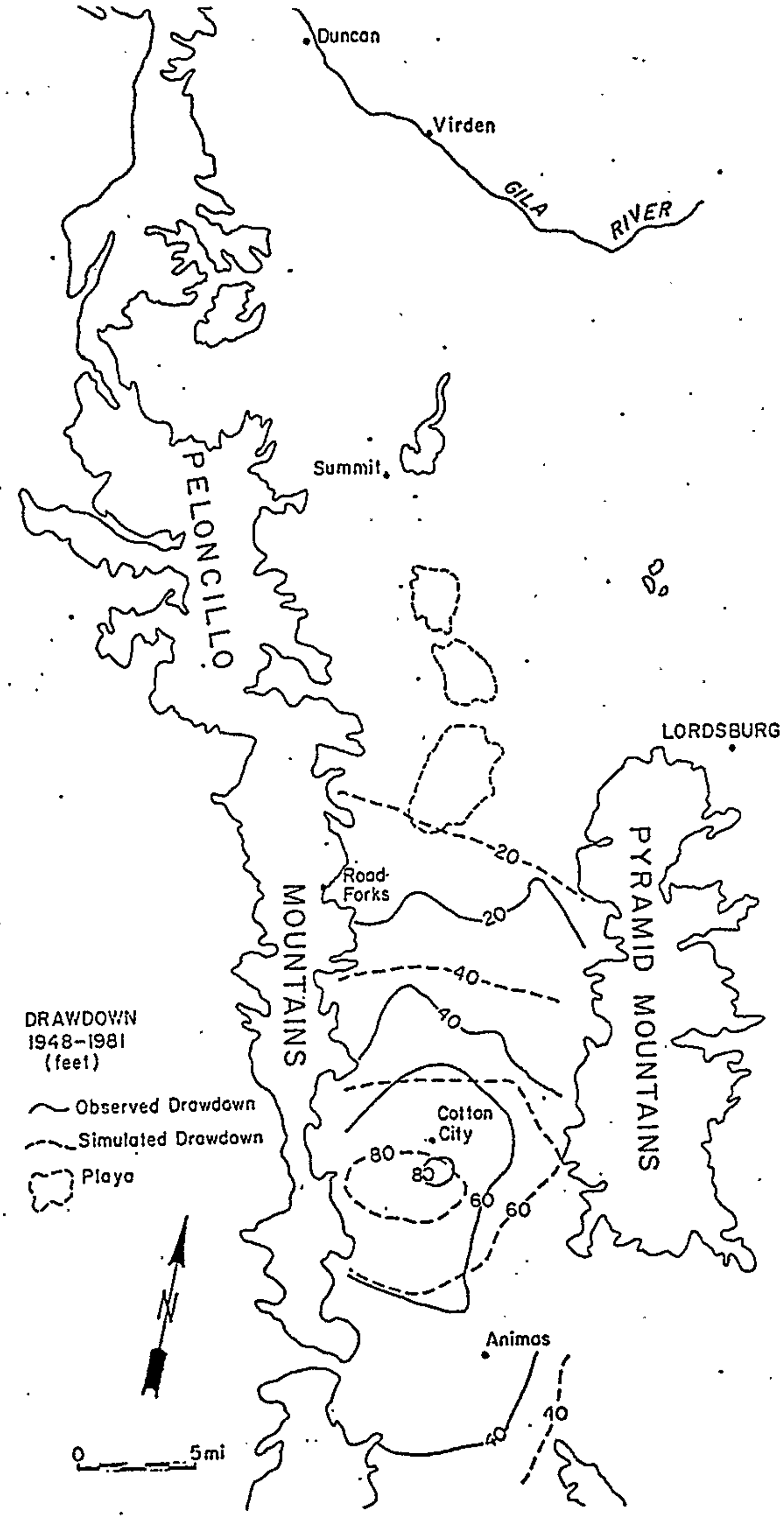

Figure 30. Results of running transient model for April 1948-April 1981 data (O'Brien and Stone, 1984).

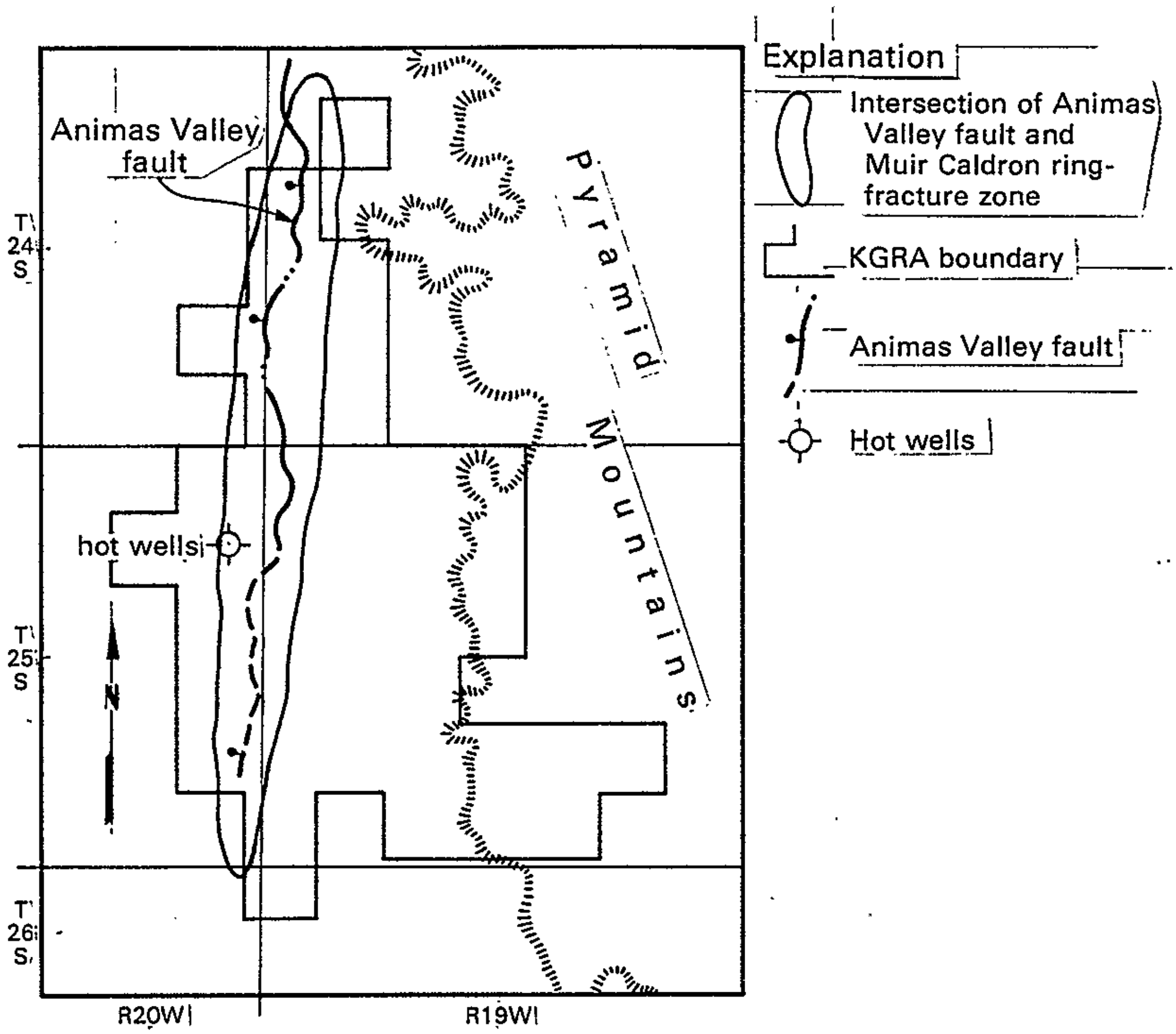

Figure 31. Location of Lightning Dock KGRA and geothermal area near Hot Wells, Animas Valley

normal ground water the hot water is cooled (330°F). Geochemical modeling has suggested the hot water is a blend of 25% deep geothermal fluid and 75% cold ground water (Elston and others, 1983). Ground-water temperatures in the KGRA are shown in Figure 32.

Owing to the relatively low temperature and small volume of hot water, the principal use is space-heating, especially of greenhouses. There were 5 ac of greenhouses in 1981 (Elston and others, 1983). One of these began to use geothermal energy as early as 1968 (Scanlon, 1981). In this operation the 215°F water produced from a depth of 60 ft has to be constantly blended with cold water to prevent the formation of steam. There are now three geothermal greenhouses in the county (Gerard, 1987). The new industry has boosted the economy by providing 20 new jobs and capital investments of nearly $1 million (Wood, 1986).

OTHER AREAS

Some new information was obtained or compiled for most other areas. In some cases this only supplemented a substantial data base. In others, it was the first available information. Those valleys or basins for which there are published reports and few or no new data to present are not included here. Information for such areas should, however, be summarized in the final Hydrologic Report.

GILA VALLEY

The Gila Valley lies north of the Animas Valley, in the northern tip or panhandle

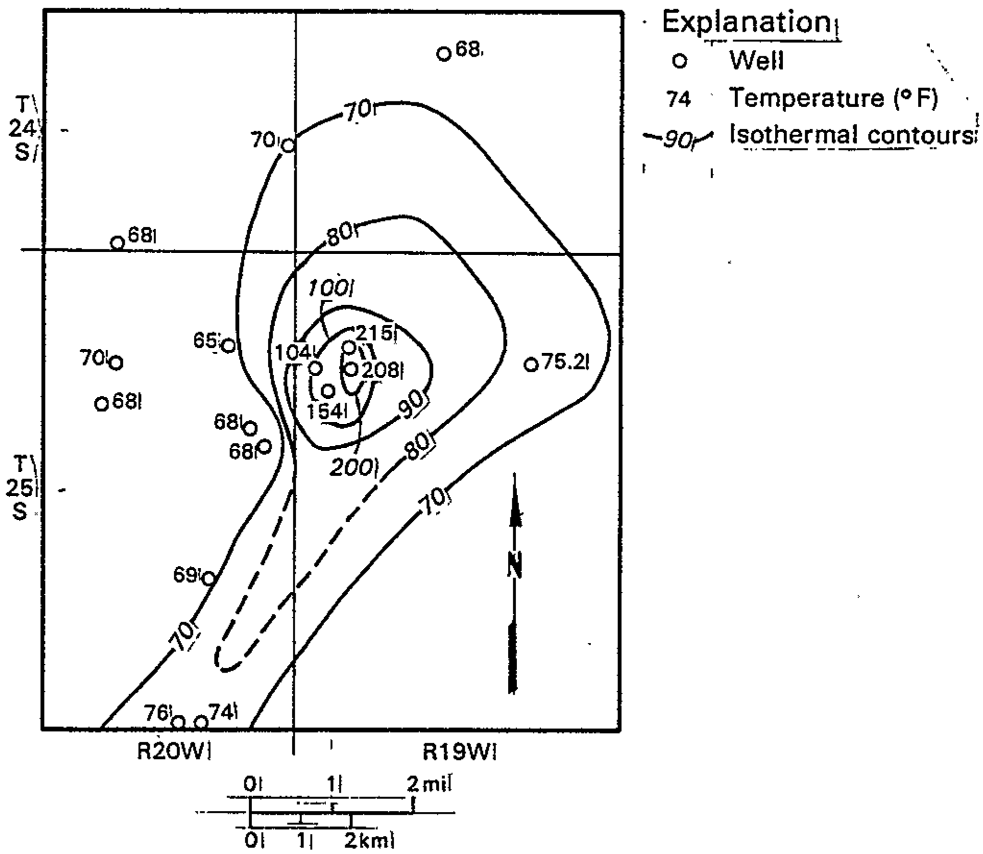

Figure 32. Ground-water temperatures (°F) in the Lightning Dock KGRA, Animas Valley (Lansford and others, 1981).

of the county. It is drained by the Gila River that flows northwesterly into Arizona. Trauger (1972) covered the Grant County portion of the valley. An older Arizona publication (Turner and others, 1941) is the only report on the Hidalgo County part of the valley.

The main aquifer is the alluvium underlying the floodplain of the Gila River. It consists of gravel, sand, and silt. According to Morrison (1965), the upper part of this unit is mainly silt and sand with thin stringers of gravel, whereas the lower part is more gravely. Thickness is several feet along the valley margins, approximately 75 ft in the center of the floodplain, and 100 ft or more where the channel scoured deep into the underlying Gila Formation (Morrison, 1965). The Gila Valley aquifer can be expected to be lithologically variable for the same reasons given under general hydrology above. Terraces above the valley consist of similar material but are probably above the water table in most places.

The Gila Conglomerate (Tertiary/Quaternary) crops out in the valley walls (Fig. 35) and underlies the alluvium on the floodplain. Where saturated this unit is also an aquifer. Table 7 shows only one well tapping this unit. Wells may be completed in both it and the Gila valley aquifer, where the saturated thickness of the overlying alluvium is small.

PYRAMID MOUNTAINS

The Pyramid Mountains lie south of Lordsburg and separate the northern (lower) part of Animas Valley from Lordsburg Valley (Fig. 1). The continental divide cuts across their southern tip at South Pyramid Peak. This range is the only mountain area where wells were extensively inventoried.

A field survey of 20 some wells on both sides of the range shows most are used for stock watering. Yields are low but sufficient for pumping by windmills. The main material tapped is fractured bedrock. As shown on the geologic map (Plate 1), most of this is volcanic rock of Cretaceous to Tertiary age. Welded tuff or volcanic breccia was evident near most of the wells (Fig. 10).

Table 12 shows well and water-level depths in the area. Depth was difficult to determine because most well heads were tightly sealed and there was no access for a water-level probe. Based on meager measurements and interviews with ranchers, values range from 25 ft or less (often hand dug) to 800 ft. Depth of most wells is near the 100 ft mark.

Not all areas yield water. It was reported that several wells in this fractured medium (some in abandoned mine shafts or prospect pits) only make water shortly after precipitation events, presumably in response to rapid infiltration along cracks. At the Linn Wells (sec 33, T24S, R18W) there was evidence of three dry holes and drilling underway of a fourth was reportedly unsuccessful. The reason is probably that some of the volcanic units are less permeable (less brittle and fractured) than others.

Flow is from mountain slopes toward ephemeral stream valleys or major valleys and from higher slopes toward lower slopes. Too few data were obtained to accurately plot water-level contours in this area (Plate 3).

Quality of water from these mountain wells is generally excellent (Table 13).

Table 12. Records for miscellaneous wells not in Table 10 (mostly Pyramid Mountains area). Column heads/abbreviations as in Table 10.

WELL NO.	QUAD	WELL NAME	C DATE	TYPE	TD (ft)	GSE	WL DEP(ft)	WL DATE	WL ELEV	AQUIFER[1]	ML	PS	USE[2]	SC (μmhos)[3]	YIELD (gpm)
23S.18W.16.231	PYRA	Cedar Mtn		Drld	500 R	4675	<500 R	3/90	>4175	TV	P	W	(S)		2-3 R
23S.18W.20.442	LORD	(unnamed)		Dug		4448	22	3/90	4426	Qal/Tv	P	W	S		
23S.18W.21.314	LORD	Kennedy		Drld						Qal/Tv	P	W	S	1500	
23S.18W.30.332a	LORD	R. Searle (old)	1950's	Drld	(pump at 120 R)	4570	~70 R	3/90	4500	Qal/Tv			S		2-3 R
23S.18W.30.332b	LORD	R. Searle (new)	1980	Drld	230 R	4570	220 R	3/90	4350	Qal/Tv			D,S	1600*	25-30 R
23S.18W.30.111	LORD	Green King		Dug		4610	56 R	3/90	4554	Tv	(P)	(W)	(S)		
23S.19W.07.224	GARY	Fox				4191	31	3/78	4160	Qal	P	W	S		
23S.19W.24.433	GARY	Gamco Mine		Dug-shaft	(pump at 80 R)	4690	~40 R	3/90	4650	Tv			S		
23S.19W.35.210	GARY	Old Spring			110 R	4560	~30 R	3/90	4530	Qal/Tv	P	W	S		
24S.17W.26.111	MUIR	Muir Ranch	1882	Dug						Qal					
			1920	Drld	140 R	4253	117 R	10/90	4136	Qal	S	E	D,S	470*	
24S.18W.07.233	PYRA	Pyramid			(pump at 120 R)	4775	~60 R	3/90	4715	Qal/Tv	WM	W	S		~5 R
24S.18W.18.114	PYRA	Mansfield Seep			~20 R	4661	<20 R	3/90	>4641	Qal					
24S.18W.22.233(?)	PYRA	New Dry			800 R	4680?	>800	3/90	<3880?	Tv					
24S.18W.33.411	PYRA	Linn		Drld		4657	64	10/90	4593	Tv	(S)	E	S		
24S.18W.35.231	PYRA	Bass			~200 R	4555	150 R	10/90	4405	Qal/Tv				*	
24S.19W.01.244	PYRA	Last Chance			(pipe to 110 R)		varies R			Tv					>5 R
24S.19W.02.222	GARY	Robt. E. Lee Mine			(pump at 150 R)					Tv					30-40 R
24S.19W.13.332	SWAL	Joe Rouse Ranch	1932	Drld	210 R		(pump at 110 R)			Tv				*	
24S.19W.24.442	PYRA	Negrohead								Qal/Tv			S	500*	
24S.19W.24.333	SWAL	South								Qal/Tv			S	520T*	
25S.18W.06.211	PYRA	Goat Camp								Tv			S	1050	
25S.18W.07.421	PYRA	Graham								Tv			S	1050*	
25S.18W.11.123	PYRA	Uhl			206 R	4684	117 R	10/90	4567	Qal/Tv			S	500*	
25S.18W.17.232	PYRA	Red		Dug						Tv			S	500*	
29S.15W.04.213	HACH	Eightmile								Qal			S	800T	
29S.15W.20.431	HACH	Twelvemile								Qal				675	

[1] Qal = alluvium (Quaternary), Tv = volcanic rocks (Tertiary)
[2] parentheses indicate use before abandonment
[3] asterisk indicates analysis available (Table 13)

Table 13. Analyses of waters not in Table 11 (mostly Pyramid Mountains area). Column heads same as in Table 11. Values are in Mg/L unless specified; pH units are dimensionless.

WELL NO.	WELL NAME	DATE	CA	MG	NA	K	HCO_3	SO_4	CL	F	NO_3	TDS	SC (µmhos)	HARD (ppm $CaCO_3$)	PH
23S.18W.30.332b	R. Searle (new)	10/90	148	60	43	4.5	258	436	39	0.7	56	919	170	617	7.1
24S.17W.26.111	Muir Ranch	10/90	32	3.4	80	5.9	182	78	26	0.2	9	326	480	94	7.7
24S.18W.35.231	Bass	10/90	44	8.7	72	6.3	289	26	21	0.4	18	341	520	520	7.3
24S.19W.13.332	J. Rouse Ranch	6/90	49	6.0	77	6.0	285	28	21	0.6	42	369	580	147	7.2
24S.19W.24.442	Negrohead	6/90	42	5.2	76	2.2	280	18	17	0.8	12	313	460	126	6.8
24S.19W.24.333	South	6/90	19	7.5	101	2.6	297	25	21	0.8	5	330	650	78	8.2
25S.18W.07.421	Graham	10/90	124	28	75	6.8	316	126	101	>0.2	47	666	1020	425	6.8
25S.18W.11.123	Uhl	10/90	65	17	41	2.3	265	36	34	0.4	25	353	580	232	7.1
25S.18W.17.232	Red	10/90	52	22	55	3.3	256	63	40	<0.2	9	372	600	220	7.4
34S.16W.18.341	Antelope Wells	8/88	26.3	4.1	52.2	2.1	139	60	6.7	2.0	<0.1	196	290	83	7.9

Field measurements of specific conductance range from 470-1600 μmhos/cm. Total dissolved solids range from 313.919 mg/L.

Lab analyses show few wells exceed public health standards. Main water-quality problems are elevated total dissolved solids content, hardness and, in a few cases, elevated nitrate or sulfate. Most of these waters were used for stock consumption and were within limits for that. In the one case of elevated nitrate where humans were the main consumers, they were advised of the danger of methemaglobinemia ("blue-baby" syndrome). Well-head pollution or percolation from septic-tank or feed-lot effluent was the likely source of the elevated nitrate.

ADDITIONAL WORK NEEDED

Various parts of the Hidalgo County study are complete and pertinent sections of this report could be transferred directly to a Hydrologic Report (HR) with little or no modification. These include Introduction, Using This Report, Regional Setting, Economy/Water Use, General Hydrology, Animas Valley, and Pyramid Mountains and Glossary. Some up-dating, based on the 1990 census or water-use results data may be required. Also, figures prepared for this document should be suitable for the HR. Plates would require the addition of color. A base map, showing some topographic contours would help i plotting water-level contours. Such a map could be produced from separates for existing USGS 7.5' topo sheets. Plates 1 and 3 should be revised to incorporate the new base, if produced.

A continuation of the field inventory of mountain wells initiated in this study would provide the water-level information needed to check suspected ground-water-flow patterns. Ideally this should include all mountain areas: the Alamo Hueco, ANimas, Big Hatchet, Dog, Guadalupe, Little Hatchet, Peloncillo and San Luis Mountains, as well as Apache Hills and Sierra Rica. However, the step-up in air-traffic surveillance along the international border has led to an increase in overland drug smuggling, making such field work increasingly dangerous, especially in the more remote or southern ranges. Fortunately there is little population growth or demand for new ground water in that portion of the area and existing data (for the valleys) may suffice.

Modeling the hydrology of other basins in the study area may also be instructive. It could provide insight as to interbasin connections. The weakest part of previous modelign efforts was input for recharge. A chloride mass-balance study of recharge in major Hidalgo County settings, as done elsewhere by Sonte (1986), would provide realistic values for this parameter.

Ground-water quality concerns now extend beyond normal dissolved constituents. Contamination by pesticides and leaking underground storage tanks is an increasing possibility. Thus, some samples should be submitted for analysis of organic content. Also, trace-metal content of waters should be evaluated in the vicinity of some of the various mines and mills in the county (active and abandoned).

CONCLUSIONS

Although incomplete, the information gathered for this report affords a better understanding of the water resources of this arid landscape. Several conclusions regarding the geologic controls of the hydrologic systems and water supply in Hidalgo County may be drawn.

GEOLOGIC CONTROLS

The geologic setting significantly controls the hydrologic phenomena in Hidalgo County. More specifically, it influences the occurrence, movement, and quality of ground water in the region.

The physiography significantly controls ground-water occurrence, that is, where aquifers are located, their shape, texture, and extent. The basin-and-range setting dictates that consolidated rock and thus fairly high runoff will characterize the mountain ranges, that porous material and fairly high recharge will occur on alluvial fan surfaces, and that a fairly shallow ground-water reservoir will be maintained in the adjacent basins. Furthermore, the mountains and basins will be elongated essentially perpendicular to the direction of major storms. Variations in well yields are due in large part to natural variations in texture of the alluvial aquifers. Texture is in turn a result of the energy of the depositional environment that produced the sediment.

Geology also influences ground-water movement. Water flows from mountain recharge areas first toward basins and thence toward discharge areas, often a lower part of the basin or a cross-cutting river valley. Rate of movement depends not only on climate (as it controls the amount of water available for recharge) and pumping (artificial discharge) but also hydraulic conductivity of the aquifer (controlled by texture of the material). Interbasin movement is enhanced or hindered by the absence or presence of rock barriers in otherwise suitable gaps in the mountain ranges.

Ground-water quality is also controlled in part by geologic parameters. The mineral make-up of the aquifer determines the dissolved species that will be present. Any factors controlling flow direction also control water chemistry. Fresher water is generally associated with upgradient areas, higher salinity with downgradient areas.

The tectonic framework of the area is responsible for the geothermal phenomena. Subsurface conditions are apparently favorable for the existence of magmatic heat sources. Faults and fractures serve as conduits for and direct the flow of the hot water.

WATER SUPPLY

Suitability of a supply involves both quantity and quality considerations. The bolson aquifer is extensive, thick, and characterized by good yields. Aside from some minor, treatable exceptions, water quality is quite good. Based on land ownership, water-use, and development trends, as well as the current regulatory framework, the aquifer should provide a reliable supply for many years to come.

If greater ground water volumes are required, deeper drilling could test the potential of buried bedrock units or recharge could be enhanced. In the case of deeper units, oil wells suggest there may be some potential. Regarding recharge enhancement, the playas that form in Animas Valley near the interstate could be drained so that the ultimate destiny of the runoff water is recharge not evapotranspiration. This might be accomplished by installation (during a dry period) of some perforated pipe, extending through the finer sediments that currently keep the runoff on the surface. Catchment surfaces in the mountains and sediment filters might also be required.

Wet years, such as 1988, not only reduce pumping requirements, they almost certainly provide significant recharge. Whether the climate shifts experienced by broad regions of North America in 1988 are signals of the onset of permanent changes remains to be seen. Alternatively, wet or dry years may simply be natural excursions from the norm. Molles and DAhm (1990) showed strong correlation between increased spring flows of the Gila River and El Niño years (periods of elevated sea-surface temperature/reduced barometric pressure in the eastern tropical Pacific). Should southwestern New Mexico become more arid as zones shift northward, more ground water would be required, and the supply as defined here could become much more stressed than at present.

GLOSSARY

Hydrogeology has a language all its own. The following list includes terms most likely to be unfamiliar to the nonspecialist as well as terms having more than one meaning among specialists. Definitions of most geologic terms are modified from those given in the American Geological Institute glossary (Gary and others, 1974). Definitions of hydrologic terms are modified from Lohman and others (1972) or Freeze and Cherry (1979).

ALLUVIAL--deposited by running water on broad slopes or aprons, or in valleys adjacent to uplands.

ALLUVIUM--alluvial deposit; usually unconsolidated mixture of gravel, sand, silt, and clay.

ANDESITE--volcanic igneous rock with quartz, more calcium feldspar than any other type, and iron/magnesium minerals.

AQUIFER--consolidated or unconsolidated deposit having sufficient saturated permeable material to yield significant quantities of water to wells or springs; a material which both stores and transmits water.

AQUITARD--(also CONFINING BED) consolidated or unconsolidated material of low hydraulic conductivity which stores but doesn't readily transmit water; overlying an aquifer and responsible for the confinement of water within it.

ARTESIAN (also CONFINED)--term applied to ground water under pressure so that it rises above the level at which it is encountered in drilling a well; also applied to wells in which this rise occurs and to aquifers that produce it. The rise is not necessarily to the ground surface; if it is, well is said to be flowing artesian.

CALCITE--mineral consisting of calcium carbonate (CaCO3); main mineral in limestone.

CARBONATE ROCK--chemical sedimentary rock composed of the carbonate radical (CO_3^-), for example, limestone, $CaCO_3$ and dolostone, $CaMg(CO_3)_2$.

CAULDRON--volcanic subsidence crater.

CLAY--sediment composed of particles less than 0.00016 inch in diameter; finest textural class.

CONFINED--see ARTESIAN.

CONFINING BED--see AQUITARD.

CONTINENTAL DIVIDE--topographic boundary separating watersheds; in New Mexico, refers to boundary between Colorado River and Rio Grande drainage basins.

DECLARED BASIN--an area of specified boundaries within which well drilling and water extraction are regulated by the New Mexico State Engineer in order to protect the water rights of others.

DISCHARGE--loss of water from, or movement of water out of, an aquifer; the process by which ground water is depleted.

DRAWDOWN--lowering of the water table or potentiometric surface for an aquifer in response to pumpage or artesian flow from wells.

EOLIAN--deposited by the action of the wind.

EPHEMERAL--said of a stream or lake bed that carries or holds water only in direct response to precipitation events; also the flow of such streams.

EVAPOTRANSPIRATION--combined loss to the atmosphere of ground or soil water from an area through processes of evaporation from the soil and transpiration by plants.

EXTRUSIVE--same as VOLCANIC.

FELDSPAR--common mineral composed mainly of potassium, sodium, or calcium aluminum silicate.

FLUVIAL--deposited by running water in discrete channels as associated with rivers and streams.

FORMATION--fundamental unit used in the local stratigraphic classification of rocks, as on geologic maps.

FRESH--see TOTAL DISSOLVED SOLIDS.

GEOLOGY--study or science of the natural processes and products of the earth.

GEOTHERMAL--pertaining to the natural heat of the earth's interior.

GRANODIORITE--plutonic igneous rock with more sodium feldspar and iron/magnesium minerals than quartz monzonite.

GRANITE--plutonic igneous rock in which quartz constitute 10-50% of the light minerals and potassium/sodium feldspar is 65-90% of total feldspar.

GRAVEL--sediment composed of particles greater than 0.08 inch in diameter; coarsest textural class.

GROUND WATER--subsurface water, especially water in saturated materials that exist below the water table.

GROUP--combination of two or more formations.

GYPSUM--common mineral composed of hydrous calcium sulfate ($CaSO_4$); may occur in layers with limestone, shale, or other evaporites.

HEAD----height (above a datum) of a column of water that can be supported by the static fluid pressure at a given point.

HOLOCENE--latest epoch of Quaternary Period (10,000 yrs ago-present).

HYDRAULIC CONDUCTIVITY--volume of water (at existing viscosity) that will move in unit time, under a unit hydraulic gradient, through a unit area of saturated material. Sometimes reported as gpd/sp ft; if gals are converted to cubic ft (ft3), unit become ft/day, as a result of algebraic cancellation.

HYDRAULIC GRADIENT--change in head per unit of distance in a given direction.

HYDROGEOLOGY--study or science of the geologic controls of hydrologic phenomena.

HYDROLOGY--study or science of the occurrence and behavior of water in nature.

IGNEOUS--formed by cooling from molten material.

INTERMITTENT--said of a stream along which perennial flow is restricted to certain reaches; also the flow of such a stream.

INTRUSIVE--same as PLUTONIC.

LACUSTRINE--deposited by settling out of standing water associated with temporary or permanent lakes.

LIMESTONE--sedimentary rock consisting of >50 percent calcite.

LITHOLOGY--physical character of a rock expressed in terms of texture, mineralogy, color, and structure.

MEMBER--subdivision of a formation.

METAMORPHIC--formed by metamorphism, that is, alternation of pre-existing rock through changes in temperature, pressure, and chemical conditions.

MINERAL--naturally occurring, inorganic substance, with a characteristic set of physical properties, and a fixed chemical composition or fixed range of composition.

PAN EVAPORATION--potential evaporation; amount of water (usually depth in inches) that could be lost to the atmosphere from a pan in which a fixed water level is maintained.

PERENNIAL--said of a stream that flows year round; also the flow of such a stream.

PERMEABILITY--measure of the relative ease with which a porous medium transmits a liquid.

PIEZOMETER--well constructed for measuring water level or hydraulic head at a specific horizon.

PLAYA--flat-floored, unvegetated, periodically flooded area in a desert region.

PLEISTOCENE--earliest epoch of Quaternary period; most recent episode of extensive glaciation in North America and Europe (1,000,000-10,000 yrs before present).

PLUTONIC--igneous rock formed at depth.

PLUVIAL LAKES--prehistoric lake formed in the period of heavy precipitation, such as the Pleistocene ice age; now largely extinct or greatly reduced.

PORPHYRY--texture of igneous rocks in which there are two or more sizes of crystals.

POROSITY--percent of total volume of a rock, soil, or unconsolidated sediment taken up by pores.

POTENTIOMETRIC SURFACE--surface that represents the static head for a given aquifer.

PUMPING-TEST--test of a well to determine the hydrologic properties of the aquifer penetrated; involves pumping to remove (or injection to add) a known volume of water; accompanied (drawdown or pumping test) or followed (recovery test) by monitoring the water level at selected time intervals to determine the rate of the aquifer's response to the induced change.

QUARTZ--common mineral composed of crystalline silica (silicon dioxide, SiO_2).

QUATERNARY--latest period of geologic time scale (1,000,000 yrs ago-present.

QUARTZ-MONZONITE--plutonic igneous rock in which quartz constitutes 10-50% of the light minerals and potassium/sodium feldspar is 35-65% of total feldspar.

RECHARGE--addition of water to, or movement of water into, an aquifer; the process by which ground water is replenished.

RECOVERY TEST--see PUMPING TEST

RELIEF--difference in elevation between high and low points in an area.

RHYOLITE--extrusive igneous rock; volcanic equivalent of granite.

ROCK--naturally occurring aggregate of minerals.

SALINE--see TOTAL DISSOLVED SOLIDS.

SAND--sediment composed of particles 0.0025-0.08 inch in diameter; medium textural class .

SEDIMENTARY--formed by deposition of sediment.

SILT--sediment composed of particles 0.00016-0.0025 inch in diameter; textural class between clay and sand.

SOIL ASSOCIATION--basic mapping unit for soils.

SPECIFIC CAPACITY--relationship of discharge of a well and the drawdown of the water level in it. Measured as gpd/ft of drawdown; if gals are converted to ft^3, unit becomes ft^2/d.

SPECIFIC CONDUCTANCE--electrical measure of salinity (in microsiemens); the reciprocal of resistance. Specific conductance times 0.7 gives general approximation of the total dissolved solids in mg/L.

SPECIFIC STORAGE--volume of water released from or taken into storage per unit volume of porous medium, per unit change in head.

SPECIFIC YIELD--volume of water that will drain from a porous medium under the influence of gravity; equal to porosity minus specific retention.

STOCK--small body of plutonic igneous rock.

STORAGE COEFFICIENT--volume of water released from or taken into storage per unit surface area of porous medium, per unit change in hydraulic head.

THRUSTING--low angle (45° or less) faulting in which older rock mass is shoved up and over younger rock mass.

TOTAL DISSOLVED SOLIDS--physical measure of salinity; amount (mg/L) of residue obtained by oven drying a water sample. Water is often classified by this parameter:

<1,000 mg/L	= fresh
1,000-3,000 mg/L	= slightly saline
3,000-10,000 mg/L	= saline

10,000-35,000 mg/L = very saline

>35,000 mg/L = brine

TRANSMISSIVITY--rate at which water is transmitted through a cross section of material having the dimensions unit width and total thickness as height, under a unit hydraulic gradient; also hydraulic conductivity times the thickness of the material. Sometimes reported as gpd/ft of width; if gals are converted to ft^3, unit becomes ft^2/d.

UNCONFINED--term applied to ground water in a water-table aquifer or one not overlain by a confining bed; also applied to such an aquifer.

VOLCANIC--igneous rock formed at the surface.

WATER TABLE--that surface in an unconfined aquifer at which water stands in wells; roughly corresponds to the top of the saturated zone. Specifically, the surface formed by points at which water pressure equals atmospheric pressure.

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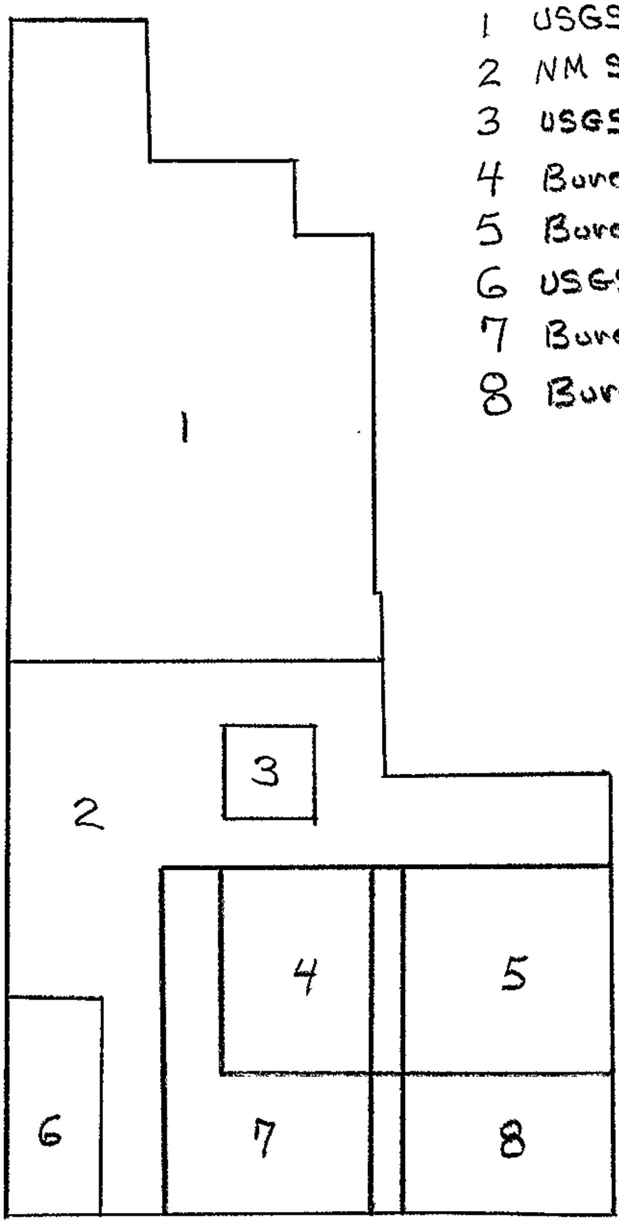
Source of Geologic Data



1 USGS MI I 1310-C
2 NM State Map
3 USGS MI 1686
4 Bureau Bull. 84
5 Bureau Circ. 146
6 USGS MF 1425-A
7 Bureau Geol. Map 17
8 Bureau Geol. Map 8

Table 10

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HIDALGO COUNTY
WELL RECORDS

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	ASF	WL DEP	WL DATE	WL ELE	AQUIFER	ML	PS	USE	SRCE	P
	18S	20W	12.142	CANA	MARTIN	1956		88.9	4560	75.05	3/7/56	4484.95	QTg?	P	W	S,H	GWSI	*
	18S	21W	31.340	DUNC	JACOB		DRLD	70	3270	12.5	1/3/83	3257.5	Qal	T	E	A	GSSE	
	18S	21W	32.432	DUNC	BWAF		DRLD	96	3720	29.65	1/3/83	3690.35	Qal	T		A	GSSE	*
	18S	21W	34.343	CANA	BONINE	4/54		102	3520	71	5/3/55	3449	Qal	J	E	I,H	GWSI	*
*	19S	20W	16.222	CANA	VIFDEN	1955			4080	97.7	8/18/55	3982.3	QTg	F	W	S	GWSI	*
	19S	20W	17.133	CANA	SUNSET	1953		70	3800			3800	Qal	T	D	I	GWSI	
	19S	20W	18.113	CANA	JOHNS	6/47		81	3840	19.25	1/21/58	3820.75	Qal	T		I	GWSI	
	19S	20W	18.113	CANA	JOHNS		DRLD	81	3852	14.52	1/3/83	3836.98	Qal	T		A	GSSE	*
	19S	20W	18.320	CANA	DONALDSON				3800			3800	Qal				OS	*
	19S	21W	02.332	CANA	CLOUSE	12/47		88	3040	18.35	1/22/58	3021.65	Qal	T	G	I	GWSI	*
	19S	21W	03.434	CANA	JONES		DRLD	72	3753	11.83	1/3/83	3741.17	Qal	T	E	A	GSSE	*
	19S	21W	12.434	CANA	DONALD	10/51		83	3800			3800	Qal	T	E	I	GWSI	
	19S	21W	13.322	CANA	DONALDSON				3780	80.04	6/29/55	3699.96	Qal	P			OS	*
	19S	21W	22.340	CANA	OSCAR			295	4100		6/16/55	4100	Qal	P			OS	*
*	20S	18W	29.132	CANA	BURGER	1955		530	4560	471.96	8/17/55	4088.04	Qal	P	E	S	GWSI	
	20S	18W	29.132	REDR	BERGER			480	4560	471.96	8/17/55	4088.04	Qal	P			OS	*
Y	20S	19W	15.312	CANA	UNKNOWN			361	4237			4237	Qal				GWSI	
	20S	19W	15.321	CANA	FULLER	1/17		361.3	4340	335.6	5/20/54	4004.4	Qal	P			OS	*
	20S	20W	16.220	CANA	DAY	4/47		245	4207	221.52	6/16/55	3985.48	Tv	P			OS	*
*	20S	20W	30.140	CANA	FULLER				4253	266	7/6/55	3987	Tv	P			OS	*
	20S	21W	01.140	CANA	DAY	4/47		350	4160	323.07	6/15/55	3836.93	Qal	P			OS	*
	20S	21W	12.430	CANA	BACKER			421	4160	316.9	7/6/55	3843.1	Qal	P			OS	*
	20S	21W	17.130	DUNC	DAY			171	4000			4000	QTg	S			OS	
	20S	21W	22.334	CANA	DAY			235	4067	209.7	6/15/55	3857.3	QTg	P			OS	*
	21S	18W	18.130	CULB	BERGER				4454	483	6/16/55	3971	Qal	P			OS	*
	21S	18W	18.131	CULB	CULBER				4454	376.4	5/20/81	4078	Qal				FO	*
	21S	18W	31.444	CULB	UNKNOWN				4350		5/20/81	4350	Qal				FO	
	21S	19W	21.313	NINE	CULBER			280	4253	270	5/20/81	3983	Qal				FO	*
	21S	20W	01.133	CANA	UNKNOWN				4260	232.58	1/7/83	4027.42	Qal	T		S	GSSE	*
	21S	20W	01.322	CANA	DAY				4250	253	6/4/20	3997	Qal				FO	*
*	21S	20W	01.400	CANA	DAY				4250			4250	Qal	P			OS	
	21S	20W	02.142	CANA	BROWN			35	4245	250.22	1/7/83	3994.78	Qal	N			GSSE	*
	21S	20W	17.144	SUMM	UNKNOWN				4245	238.63	1/7/83	4006.37	Qal			S	GSSE	*
*	21S	20W	17.324	SUMM	DAY				4240	240.42	6/4/85	4000	Qal				FO	*
	21S	20W	24.130	SUMM	DAY				4200	183.63	6/15/55	4016.37	Qal	P			OS	*
	21S	20W	34.130	SUMM	DAY	1955			4170	133.6	6/15/55	4006.4	Qal	T	W	S	GWSI	
*	21S	20W	34.323	SUMM	DAY RANCH				4190		3/4/81	4190	Qal				FO	
*	21S	20W	34.400	SUMM	UNKNOWN				4215	250	10/13	3965	Qal				OS	*
	21S	21W	01.400	CANA	LAZY B			300	4320	300	10/13	4020	Tv				OS	*
	21S	21W	15.441	SUMM	DAY				4220		5/21/81	4220	Qal				FO	
*	21S	21W	25.[illegible]	SUMM	[illegible]			[illegible]	4195	200	10/13	3995	Qal				OS	*

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	ASE	WL DEP	WL DATE	WL ELE	AQUIFER	WL	PS	USE	SRCE	P
*	21S	21W	30.444	SAN	UNKNOWN				4358	557.25	6/4/81	3801	Qal				FO	*
*	21S	21W	33.243	SUMM	DAY			26	4183		3/6/81	4183	Qal				FO	
	21S	21W	35.440	SUMM	DAY			400	4172	375	6/14/85	3797	Qal				OS	*
	22S	18W	17.424	CULB	REYN				4217	139.56	1/7/83	4077.44	Qal	PL	W	A	GSSE	*
	22S	18W	16.130	CULB	BERGER	1955			4455	483.2	6/16/55	3972.8	Qal			S	GWSI	
	22S	18W	18.240	CULB	PARSON			800	4229	180	1/5/83	4049	Qal			A	GSSE	*
	22S	18W	18.424	CULB	CULBER			585	4220	177.55	1/5/83	4042.45	Qal			A	GSSE	*
	22S	18W	19.224	CULB	UNKNOWN				4200	112	5/19/81	4088	Qal				FO	*
	22S	18W	19.232	CULB	BROWN				4195	166.78	1/7/83	4028.22	Qal	T	G	A	GSSE	*
	22S	18W	20.241	CULB	SHUM		DRLD	383	4213	178.14	1/5/83	4034.86	Qal	T	E	A	GSSE	*
	22S	18W	20.242	CULB	SHUM			483	4215	173.28	1/5/83	4041.72	Qal			A	GSSE	
	22S	18W	20.413	CULB	SHUMWA	1959		244	4190	122.14	5/6/59	4067.86	Qal	T	E	I	GWSI	
	22S	18W	20.413	CULB	SHUM			338	4193	155.34	1/7/83	4037.66	Qal	T	E	A	GSSE	*
	22S	18W	20.442	CULB	BROWN			500	4190	164.57	1/7/83	4025.43	Qal	S	E	D	GSSE	*
	22S	18W	22.241	CULB	AUSTIN			636	4245	138.08	1/5/83	4106.92	Qal			A	GSSE	*
	22S	18W	22.244	CULB	AUSTIN			600	4245	141.03	1/5/83	4103.97	Qal			A	GSSE	
	22S	18W	23.143	CULB	WINON			485	4260	144.82	1/7/83	4115.18	Qal	T	G	A	GSSE	*
	22S	18W	23.233	CULB	WINON			600	4270	152.18	1/5/83	4117.82	Qal			A	GSSE	*
	22S	18W	23.312	CULB	YACO			500	4250	131.87	1/7/83	4118.13	Qal	T	G	A	GSSE	
	22S	18W	24.133	CULB	UNKNOWN				4290	179.62	1/7/83	4110.38	Qal		W	S,D	GSSE	*
	22S	18W	28.211	LORD	CITY OF L			325	4195	157.55	1/10/83	4037.45	Qal	T	E	A	GSSE	*
	22S	18W	28.220	LORD	FLETCH			445	4195	93.2	1/10/83	4101.8	Qal	T	B	A	GSSE	*
	22S	18W	28.320	LORD	CITY OF			528	4190	160.68	1/10/83	4029.32	Qal	T	E	P	GSSE	*
	22S	18W	29.210	LORD	BAKER	1955			4185	109.75	6/7/55	4075.25	Qal	T	E	S,I	GWSI	
	22S	18W	30.221	LORD	REYNOLDS				4180		5/19/81	4180	Qal				FO	
	22S	18W	34.132	LORD	FLOWER	10/79		230	4200	180	10/79	4020	Qal			D,S	OS	*
	22S	18W	34.141	LORD	UMPHR	8/80		249	4200	174	8/80	4026	Qal			D	OS	*
	22S	18W	34.224	LORD	BARR		DRLD	233	4189	149.77	1/5/83	4039.23	Qal	T	E	A	GSSE	*
	22S	18W	34.224A	LORD	RALEY			580	4190	149.24	1/6/83	4040.76	Qal			A	GSSE	
	22S	18W	09.444	CULB	REYNOLD				4294			4294	Qal				FO	
	22S	19W	01.433	NINE	CULBER				4274	183.78	1/7/83	4090.22	Qal	PL	W	S	GSSE	*
	22S	19W	05.322	NINE	LARS				4216	148.21	1/7/83	4067.79	Qal	PL	W	S	GSSE	*
*	22S	19W	12.221	NINE	CULBER				4262	191	5/20/81	4072	Qal				FO	*
	22S	19W	12.241	NINE	CULBER				4240	157.72	1/7/83	4082.28	Qal	T	E	D,S	GSSE	*
	22S	19W	13.342	NINE	BOX M				4180	189.9	3/6/81	3991	Tv?				FO	*
	22S	19W	20.211	NINE	CLAYTON				4187	136.27	1/7/83	4050.73	Tv?			S	GSSE	*
	22S	19W	22.244	NINE	UNKNOWN				4180	128.39	1/7/83	4051.61	Qal			S	GSSE	*
*	22S	20W	06.322	SUMM	BOX M			193	4160	149	6/3/81	4011	Qal				FO	*
*	22S	20W	18.411	SUMM	BOX M			300	4158	275	3/6/81	3883	Qal				FO	*
*	22S	20W	19.423	SUMM	UNKNOWN				4158	150.61	1/7/83	4007.39	Qal			S	GSSE	*
*	22S	20W	20.142	NINE	LARSEN			185	4177		3/6/81	4177	Qal				FO	
	22S	20W	23.244	NINE	LARSON			183	4187	160	4/3/81	4027	Qal				FO	*
*	22S	20W	26.433	NINE	LARSON				4170	98.1	5/12/81	4073	Qal				FO	*
	22S	21W	10.312	SUMM	CLAYTON			47	4230			4230	Qal				FO	
*	22S	21W	13.234	SUMM	LARSON			300	4158	207.8	3/6/81	3951	Qal				FO	*
	22S	21W	33.244	SAN	UNKNOWN				4510	185.5	5/18/81	[illegible]	Qal				FO	*
	[illegible]	21W	[illegible]	[illegible]	LARSON				[illegible]	209	[illegible]	[illegible]	Qal				FO	*

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	ML	FS	USE	SRCE	P
	23S	17W	08.313	LISB	JUNDT			1016	4195	118.9	1/5/83	4076.1	Qal			A	GSSE	*
*	23S	17W	08.430	LISB	COCKE			1200	4210	114.66	1/5/83	4095.34	Qal			A	GSSE	*
	23S	17W	17.224	LISB	COCKE			960	4211	66.48	1/5/83	4144.52	Qal			A	GSSE	*
	23S	17W	18.213	LORD	COCKE			630	4200	112.76	1/5/83	4071.27	Qal			A	GSSE	*
*	23S	17W	25.311	LISB	UNKNOWN				4297	128.75	1/10/83	4170.25	Qal		W	S	GSSE	*
	23S	17W	25.444	LISB	LAYNE	4/55		129	4299	116.95	4/11/55	4182.05	Qal	P	W	S	GWSI	
	23S	18W	01.413	LORD	UNKNOWN				4196	126.91	1/10/83	4069.09	Qal		W	S	GSSE	*
	23S	18W	02.131	LORD	HIGHWAY				4235	190.45	1/10/83	4044.55	Qal	T	E	P	GSSE	*
	23S	18W	02.222	LORD	CITY OF			400	4200	137.39	2/2/76	4062.61	Qal			P	GSSE	*
	23S	18W	02.224	LORD	CITY OF			500	4215	130.5	1/14/74	4094.5	Qal			N	GSSE	*
	23S	18W	02.311	LORD	GOV'T				4250	190.55	1/5/83	4059.45	Qal	T		P	GSSE	*
	23S	18W	02.444	LORD	KOFF				4230	165.98	1/6/83	4064.02	Qal			A	GSSE	*
	23S	18W	03.422	LORD	RICHIN	10/60		225	4245	131.9	10/60	4113.1	Qal			I	GWSI	
	23S	18W	05.443	LORD	WALLACE	1947		128	4355	36.83	11/60	4318.17	Qal	F	W	H	GWSI	
	23S	18W	09.233	LORD	PATE			210	4335	208.05	2/7/80	4126.95	TKi		W	S	GSSE	*
	23S	18W	09.434	LORD	KIPP				4325	78.92	1/10/83	4246.08	Qal		W	S	GSSE	*
	23S	18W	11.114	LORD	KOFF				4270	166.13	1/10/83	4103.87	Qal	T	E	A	GSSE	*
	23S	18W	11.244	LORD	KOFF			600	4240	174.29	1/6/83	4065.71	Qal			A	GSSE	*
	23S	18W	11.422	LORD	KOFF			352	4240	176.62	1/10/83	4063.38	Qal	T	E	A	GSSE	
	23S	18W	12.132	LORD	JONES			336	4225	135.09	1/10/83	4089.91	Qal	T	G	A	GSSE	*
	23S	18W	12.213	LORD	MEDLIN	6/55		300	4210	75.49	8/5/55	4134.51	Qal	T	L	I	GWSI	
	23S	18W	12.213	LORD	HAMILTON				4205	142	1/10/83	4063	Qal			I	GSSE	*
	23S	18W	12.331	LORD	MC DON			312	4245	178.5	1/6/83	4066.5	Qal			A	GSSE	*
	23S	18W	12.333	LORD	McDONA	1957		220	4240	139	4/6/57	4101	Qal	T	L	I	GWSI	
	23S	18W	12.333	LORD	MC DON		DRLD	220	4365	177.52	1/6/83	4187.48	Qal	T		A	GSSE	
	23S	18W	12.413	LORD	CURE			351	4219	146.22	1/10/83	4072.78	Qal	T	E	A	GSSE	*
	23S	18W	12.433	LORD	CURE				4220	145.05	1/10/83	4074.95	Qal			A	GSSE	*
	23S	18W	13.131	LORD	CURETON	1942		322	4245	90	1/20/55	4155	Qal	T	E	I	GWSI	
	23S	18W	13.133	LORD	CURE			327	4254	173.73	1/10/83	4080.27	Qal	T	E	A	GSSE	*
	23S	18W	13.213	LORD	HITSON		DRLD	165	4230	141.49	1/16/80	4088.51	Qal	T		A	GSSE	
	23S	18W	13.213	LORD	HITSON	11/56		166	4230	84.93	1/11/57	4145.07	Qal	T	G	I	GWSI	
	23S	18W	13.233	LORD	HITSON			325	4232	151.53	1/6/83	4080.47	Qal	T	G	A	GSSE	*
	23S	18W	13.431	LORD	BRAY			308	4235	154.22	1/10/83	4080.78	Qal	T	G	A	GSSE	*
	23S	18W	13.433	LORD	BRAY			320	4240	158.28	1/6/83	4081.72	Qal			A	GSSE	
	23S	18W	14.222	LORD	BANCO				4240	125.56	1/10/80	4114.44	Qal	T	E		GSSE	
	23S	18W	20.422	LORD	KIPP				4435	22.2	1/10/83	4412.8	Qal		W	S	GSSE	*
	23S	18W	21.133	LORD	KIPP				4445	27.57	1/10/83	4417.43	Qal		W	S	GSSE	*
	23S	18W	23.110	LORD	UNKNOWN				4311	83.7	1/10/83	4227.3	Qal		W	S	GSSE	*
	23S	18W	25.123	LORD	UNKNOWN				4268	137.75	1/10/83	4130.25	Qal		W	S	GSSE	*
*	23S	19W	27.242	GARY	UNKNOWN				4191	123.04	5/18/81	4068	Qal				FO	*
	23S	19W	31.121	GARY	KERR				4160	59	4/4/81	4101	Qal				FO	*
	23S	20W	12.322	GARY	UNKNOWN				4150	60.5	3/7/81	3990	Qal				FO	*
	23S	20W	25.422	GARY	KERR	4/48	DRLD	150	4150	48.52	1/3/83	4101.48	Qal	T	G	H,A	GSSE	*
	23S	20W	25.424	GARY	KERR	1947		150	4151	35.66	5/3/55	4115.34	Qal	T	E	I	GWSI	
	23S	20W	31.333	MOND	ROBINSON		DUG	40.3	4156	39.19	1/3/83	4116.81	Qal	PL	W	S,D	GSSE	*
	23S	20W	35.444	GARY	KERR	12/50	DRLD	115	4160	88.6	1/3/83	4071.4	Qal	T	E	I,A	GSSE	*
	23S	21W	04.222	BEN	WILLIAMS				[illegible]	[illegible]	[illegible]	[illegible]	QTb				FO	*

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	HL	FS	USE	SRCE	P
	23S	21W	13.244	MOND	WILLIAMS			192	4180	138	4/6/81	4043	Qal				FO	*
*	23S	21W	13.441	MOND	WILLIAMS				4170	124	3/7/81	4047	Qal				FO	*
	23S	21W	27.343	MOND	WILLIAMS				4330	58.44	5/18/81	4272	Tv				FO	*
	23S	21W	27.344	MOND	WILLIAMS				4320	59.6	5/18/81	4263	Tv				FO	*
	23S	21W	33.222	SAN	GUESS			60	4360	32.25	5/18/81	4309	Tv				FO	*
*	23S	21W	34.122	MOND	GUESS	1955		65	4320	59.41	6/28/55	4260.59	Tv	P	W	H,S	GWSI	
*	23S	21W	34.322	MOND	WILLIAMS			130	4360	126	3/7/81	4235	Tv				FO	*
	23S	21W	36.444	MOND	UNKNOWN			110	4156	101	3/7/81	4056	Qal				FO	*
	24S	17W	01.342	MUIR	MC REYNOL		DRLD		4285	99.92	1/11/83	4185.08	Qal	T		A	GSSE	*
	24S	17W	01.344	MUIR	MCREYNOL		DRLD	650	4285	98.92	1/6/83	4186.08	Qal	T	B	A	GSSE	
	24S	17W	03.444	MUIR	KIPP		DRLD	800	4251	68.1	1/6/83	4182.9	Qal	N		A	GSSE	*
	24S	17W	05.144	MUIR	KIPP	1955		183	4255	68.32	7/13/55	4186.68	Qal	T	D	I	GWSI	
	24S	17W	05.144	MUIR	KIPP		DRLD	215	4252	148.89	1/7/81	4103.11	Qal	T	B	A	GSSE	*
	24S	17W	[illegible]	PYRA	HASSEL	1958	DRLD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Qal	T	B	A	GSSE	*
	24S	17W	08.312	MUIR	KIPP			500	4289	149.45	1/6/83	4140.55	Qal			A	GSSE	*
	24S	17W	08.431	MUIR	KIPP		DRLD		4277	148.17	1/6/83	4128.83	Qal	T	B	A	GSSE	*
	24S	17W	09.413	MUIR	KIPP		DRLD		4255	99.65	1/25/73	4155.35	Qal	T	B	A	GSSE	*
	24S	17W	10.244	MUIR	KIPP			960	4254	80.95	1/15/74	4173.05	Qal			A	GSSE	*
*	24S	17W	11.233	MUIR	MITCHELL	5/55		250	4265	78.09	5/21/55	4186.91	Qal	T	L	I	GWSI	
	24S	17W	11.242	MUIR	JONES		DRLD	801	4270	123.61	1/21/80	4146.39	Qal	T		A	GSSE	*
	24S	17W	11.344	MUIR	GORDON		DRLD	600	4266	78.75	1/15/75	4187.25	Qal	T	B	A	GSSE	*
	24S	17W	11.433	MUIR	GORDON	5/55		604	4225	79.36	7/13/55	4145.64	Qal	T	L	I	GWSI	
	24S	17W	11.444	MUIR	KERR			900	4275	118.43	1/7/81	4156.57	Qal			A	GSSE	*
	24S	17W	12.124	MUIR	CLARK			880	4280	115.51	2/3/76	4164.49	Qal			A	GSSE	*
	24S	17W	12.324	MUIR	CLARK			895	4280	124.04	1/7/81	4155.96	Qal			A	GSSE	*
	24S	17W	13.124	MUIR	MC DONALD			1015	4285	124.47	1/15/75	4160.53	Qal			A	GSSE	*
	24S	17W	13.324	MUIR	STEWART	7/60		457	4285	123.62	7/27/60	4161.38	Qal	T	L	I	GWSI	
	24S	17W	13.324	MUIR	STEW			835	4285	130	1/6/83	4155	Qal			A	GSSE	*
	24S	17W	14.224	MUIR	RICHINS			860	4278	121.32	2/3/76	4156.68	Qal			A	GSSE	*
	24S	17W	14.242	MUIR	RICH			602	4278	80.63	1/6/83	4197.37	Qal	T	B	A	GSSE	*
	24S	17W	14.442	MUIR	RICHINS	4/55		420	4265	87.17	5/20/55	4177.83	Qal	T	L	S	GWSI	
	24S	17W	14.442	MUIR	RICH		DRLD	420	4276	82.37	1/6/83	4128.42	Qal	T		A	GSSE	*
	24S	17W	16.133	MUIR	KIPP			500	4290	147.58	1/6/83	4142.42	Qal			A	GSSE	*
	24S	17W	19.222	MUIR	KIPP				4355	210	1/11/83	4145	Qal		W	S	GSSE	*
	24S	17W	24.213	MUIR	KIPP		DRLD	580	4288	134.2	1/6/83	4153.8	Qal	T	B	A	GSSE	*
	24S	17W	24.342	MUIR	KIPP		DRLD	477.9	4285	127.58	1/6/83	4157.2	Qal	T		A	GSSE	*
	24S	17W	25.222	MUIR	KIPP			318	4295	135.85	1/11/83	4159.15	Qal	T	B	A	GSSE	*
	24S	17W	25.244	MUIR	UNKNOWN		DRLD		4295	133.82	1/11/83	4161.18	Qal	T	B	A	GSSE	*
*	24S	17W	25.110	MUIR	KIPP				4253	93.32	1/15/73	4159.68	Qal			S	GSSE	*
*	24S	17W	35.232	MUIR	DIAMOND			130	4263	104.22	1/11/83	4158.78	Qal			S	GSSE	*
	24S	17W	35.441	MUIR	MUIR			210	4265	94.4	1/11/83	4170.58	Qal		W	S	GSSE	*
	24S	18W	11.334	PYRA	LEWIS				4510	157.86	2/6/80	4352.14	Qal	B		S	GSSE	*
	24S	18W	22.144	PYRA	WALKER				4850	106.4	3/6/80	4743.6	Tv	T		I,A	GSSE	*
	24S	18W	33.422	PYRA	LINN	1947		60	4650	47.87	5/18/55	4602.13	QTg	T	W		GWSI	*

C TWP RGE SECTION QUAD WELL NAME C DATE TYPE TD GSE WL DEP WL DATE WL ELE AQUIFER HL FS USE SRCE P

	TWN	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	ALT	WL DEP	WL DATE	WL ELE	AQUIFER	M	RA	USE	SOURCE	F
	24S	19W	06.300	SWAL	UNKNOWN				4150	39	10/13	4111	Qal				OS	*
	24S	19W	07.100	SWAL	UNKNOWN				4164	35	10/13	4129	Qal				OS	*
	24S	19W	07.300	SWAL	UNKNOWN				4150	30	10/13	4120	Qal				OS	*
*	24S	19W	07.442	SWAL	KERR	2/61		150	4228	107	2/61	4121	Qal			D	OS	
	24S	19W	18.300	SWAL	UNKNOWN				4160	33.5	10/13	4126.5	Qal				OS	*
	24S	19W	19.200	SWAL	OWENS			51	2237		10/13	2237	Qal				OS	*
*	24S	19W	20.420	SWAL	UNKNOWN				4268	122.9	2/15/73	4145.1	Qal				SEOD	*
*	24S	19W	20.420	SWAL	KERR			272	4268	134.17	1/3/83	4133.83	Qal			S	GSSE	*
	24S	19W	7.442	SWAL	KERR	2/61		150	4228	107	2/61	4121	Qal			D	OS	
	24S	20W	01.240	SWAL	KERR	3/59		117	4175	56	3/59	4119	Qal			I	OS	
	24S	20W	01.240	SWAL	KERR	3/59		117	4175	56	3/59	4119	Qal			I	OS	
	24S	20W	01.410	SWAL	KERR	7/77		95	4155	57	7/77	4098	Qal			I	OS	*
*	24S	20W	01.422	SWAL	KERR	12/50		112	4160	42.37	1/11/51	4117.63	Qal	T	L	I	GWSI	
*	24S	20W	01.422	SWAL	KERR		DRLD	150	4165	70.72	1/4/79	4094.28	Qal	T		A	GSSE	*
*	24S	20W	01.422	SWAL	UNKNOWN				4155	60.74	2/19/73	4094.26	Qal			I	SEOD	*
*	24S	20W	01.444	SWAL	KERR	1/47		92	4160	45.8	11/9/66	4114.2	Qal	T	L	I	GWSI	
*	24S	20W	01.444	SWAL	KERR	6/47	DRLD	92	4162	58.57	1/3/83	4103.43	Qal	T	B	I,O	GSSE	*
	24S	20W	04.120	STEI	UNKNOWN				4150	25.8	2/16/73	4124.2	Qal				SEOD	*
	24S	20W	04.120	STEI	KERR				4151	25.86	1/3/83	4125.14	Qal	PL	W	S	GSSE	*
*	24S	20W	04.211	STEI	KERR	6/51		67	4151	7	6/51	4144	Qal			D	OS	
*	24S	20W	04.211	STEI	KERR	6/51		67	4150			4150	Qal	P	W	S	GWSI	
	24S	20W	04.211	STEI	KERR				4151	27.5	4/4/84	4123	Qal				FO	*
	24S	20W	04.211	STEI	KERR	6/51		67	4151	7	6/51	4144	Qal			D	OS	
	24S	20W	09.424	STEI	ROARK	11/60		62	4158	50	11/60	4108	Qal				OS	
	24S	20W	09.424	STEI	ROARK	11/60		62	4158	50	11/60	4108	Qal				OS	
	24S	20W	11.310	SWAL	KERR				4155	38	4/4/61	4123	Qal				FO	*
	24S	20W	12.224	SWAL	KERR	4/53		103	4165	39.85	5/25/55	4125.15	Qal	T	E	I	GWSI	
*	24S	20W	12.242	SWAL	KERR	4/53		112	4164	37	4/53	4127	Qal				OS	
	24S	20W	12.242	SWAL	KERR	4/53		112	4164	37	4/53	4127	Qal				OS	
	24S	20W	13.414	SWAL	ROARK	11/60		63	4160	45	11/60	4115	Qal			D	OS	
	24S	20W	14.343	STEI	ROARK	4/73		100	4158	35	4/73	4123	Qal			D	OS	*
*	24S	20W	19.121	STEI	WALKER			300	4180			4180	Qal				FO	
*	24S	20W	19.211	STEI	UNKNOWN				4180	79.2	2/16/73	4100.8	Qal				SEOD	*
	24S	20W	19.230	STEI	UNKNOWN				4185	69.4	2/16/73	4116.6	Qal				SEOD	*
	24S	20W	19.230	STEI	UNKNOWN			300	4155	90.26	1/3/83	4064.74	Qal	PL	W	S,O	GSSE	*
	24S	20W	19.244	STEI	UNKNOWN				4175	64.4	2/16/73	4110.6	Qal				SEOD	*
	24S	20W	19.444	STEI	UNKNOWN				4177	69.8	2/16/73	4107.2	Qal				SEOD	*
	24S	20W	19.444	STEI	WALKER	4/48	DRLD	537	4175	88.89	1/3/83	4086.11	Qal	T	G	A	GSSE	*
	24S	20W	22.112	STEI	ROARK	2/62		65	4165	28	2/62	4137	Qal			D,S	OS	
	24S	20W	22.222	STEI	UNKNOWN				4162	23.01	2/19/73	4140	Qal				SEOD	*
	24S	20W	23.310	STEI	WALTERS	7/74		100	4165			4165	Qal			D	OS	
	24S	20W	25.422	SWAL	BAXTER	1/69		99	4180	53	1/69	4127	Qal			I	OS	
*	24S	20W	25.444	SWAL	UNKNOWN				4181	60.32	1/3/83	4120.68	Qal	T	-	I	GSSE	*
*	24S	20W	26.211	SWAL	KERR			50	4165	53.9	1/3/83	4111.1	Qal			S	GSSE	*
	24S	20W	27.121	STEI	KERR	4/53		125	4170	25	4/53	4145	Qal				OS	
	24S	20W	29.323	STEI	UNKNOWN				4177	56.67	2/16/73	4120.33	Qal				SEOD	*
	24S	20W	29.341A	STEI	SMITH	4/62		490	4180	48	4/62	4132	Qal			I	OS	

	24S	20W	31.221	STEI	MC GHEE	1/74		170	4190	80	1/74	4110	Qal			MWh	OS	*
	24S	20W	31.221	STEI	UNKNOWN				4200	69.9	2/16/73	4130.1	Qal				SEOD	*
	24S	20W	31.221	STEI	UNKNOWN		DUG		4190	76.2	1/3/83	4113.8	Qal			A	GSSE	*
	24S	20W	33.333	STEI	McCANTS	9/54		118	4180			4180	Qal				OS	
	24S	20W	33.333	COTT	UNKNOWN				4186	59.3	2/16/73	4127.7	Qal				SEOD	*
	24S	20W	33.333	STEI	UNKNOWN	9/54		110	4193	64.54	1/3/83	4125.46	Qal			S	GSSE	*
*	24S	20W	34.444	STEI	KERR	8/62		100	4182	50	8/62	4132	Qal			I	OS	
*	24S	20W	34.444	STEI	UNKNOWN				4182	51.44		4130.56	Qal			S	SEOD	*
*	24S	20W	34.444	STEI	KERR	4/51	DRLD	100	4180	56.12	1/3/83	4123.88	Qal	PL	W	S	GSSE	*
	24S	20W	35.214	SWAL	KERR	5/47	DRLD	79	4171	49.79	1/3/83	4121.21	Qal	T	E	A	GSSE	*
	24S	20W	36.222	SWAL	KERR	8/83		145	4180	32	8/83	4148	Qal				OS	
	24S	21W	01.200	STEI	UNKNOWN				4160	33	10/13	4127	Qal				OS	*
*	24S	21W	12.222	SWAL	GRAHAM				4172	59.5	4/4/81	4113	Qal				FO	*
	24S	21W	12.223	STEI	GRAHAM	1940		68.8	4175	46.67	8/15/62	4128.33	Qal	T	W	H	GWSI	
	24S	21W	12.223	SWAL	GRAHAM		DRLD	68.8	4194	46.35	1/24/73	4147.65	Qal		W	D	GSSE	*
	24S	21W	12.223	STEI	GRAHAM				4190	55.61	7/6/55	4134.39	Qal	P			OS	*
	25S	17W	11.323	MUIR	UNKNOWN				4317	58.25	1/6/83	4258.75	Qal				SEOD	
	25S	17W	11.323	MUIR	THORN				4314	58.25	1/6/83	4255.75	Qal			D,S	GSSE	*
	25S	17W	11.400	MUIR	UNKNOWN	10/65		798	4305	68	6/6/83	4237	Qal				SEOD	*
	25S	17W	11.433	MUIR	BERTAG			560	4315	56.35	2/5/76	4258.65	Qal			A	GSSE	*
*	25S	17W	27.110	COYO	THORN				4395	55.66	1/6/83	4339.34	Qal			D,S	GSSE	*
*	25S	19W	07.133	SWAL	FOLK	5/59		283	4195	90.5	4/30/66	4104.5	Qal			I	GWSI	
*	25S	19W	07.143	SWAL	FOLK	4/66		120	4195	30	4/30/66	4165	Qal			H	GWSI	
	25S	19W	07.210	SWAL	MC CANTS	1973		93	4205	38	1973	4167	Qal			D	OS	*
*	25S	19W	07.234	SWAL	McDON	11/51		93	4210	55	7/26/67	4155	Qal			U	GWSI	
*	25S	19W	07.234	SWAL	RICHINS	11/53		83	4205			4205	Qal	T	B	I	GWSI	
*	25S	19W	07.234	SWAL	RICHINS		DRLD	95	4205	68	1/21/70	4137	Qal	T		A	GSSE	*
	25S	19W	07.344	SWAL	FOLK	3/51	DRLD		4197	59.72	1/4/83	4137.28	Qal	T	B	A	GSSE	*
*	25S	19W	07.424	SWAL	BURGETT	2/79		110	4220	86	2/79	4110	Qal			TES	OS	*
*	25S	19W	10.311	SWAL	UNKNOWN				4410	193.2	2/15/73	4216.8	QTg?				SEOD	*
	25S	19W	10.311	SWAL	UNKNOWN	1932			4410	264.62	1/4/83	4145.38	QTg?	PL	W	S	GSSE	*
*	25S	19W	11.100	SWAL	UNKNOWN	8/74		325	4700	180	6/6/83	4375	Tv				SEOD	*
*	25S	19W	24.334	TABL	UNKNOWN		DUG		4820	78.92	1/4/83	4741.08	Tv	PL	W	D,S	GSSE	*
*	25S	20W	01.242	SWAL	HATCH	3/64		205	4183	55	3/64	4128	Qal			I	OS	
*	25S	20W	08.111	STEI	UNKNOWN				4218	100	2/16/73	4118	Qal				SEOD	*
*	25S	20W	08.111	STEI	MC CA	1930	DRLD		4224	105.62	1/3/83	4118.52	Qal	PL	E	S,D	GSSE	*
	25S	20W	10.111	STEI	HEWLETT	3/59		125	4193	56	3/59	4137	Qal			D	OS	
*	25S	20W	10.222	STEI	UNKNOWN				5152	61.29	2/16/73	5090.71	Qal				SEOD	*
*	25S	20W	10.222	STEI	VALLEY				4190	66.54	1/3/83	4123.64	Qal		W	D	GSSE	*
	25S	20W	10.233	STEI	UNKNOWN				4155	66.28	2/16/73	4088.72	Qal				SEOD	*
	25S	20W	10.244	STEI	WALF	4/49		182	4165			4165	Qal	T	E	I	GWSI	
	25S	20W	10.244	STEI	STEWART			60	4197	71.77	1/3/78	4125.23	Qal			D	GSSE	*
	25S	20W	10.244	STEI	UNKNOWN				4196	56.48	2/16/73	4139.52	Qal				SEOD	*
	25S	20W	10.244A	STEI	WRIGHT	4/70		226	4197			4197	Qal			I	OS	
	25S	20W	10.334	STEI	UNKNOWN				4200	71.01	2/16/73	4128.99	Qal			A	SEOD	*
	25S	20W	10.433	STEI	MASSEY			240	4201	75.96	1/5/78	4125.02	Qal	T	E	A	GSSE	*
	25S	20W	10.443	STEI	UNKNOWN				4155	70.1	2/16/73	4084.9	Qal				SEOD	*

P	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	W DEP	W DATE	W ELE	AQUIFER	W	PS	USE	SRCE	R
	25S	20W	11.434	SWAL	WRIGHT	4/66		108	4200	68	4/66	4132	Qal			D	OS	
	25S	20W	12.123	SWAL	McCANTS		DRLD		4187	66.76	1/3/79	4120.32	Qal	T		A	GSSE	
	25S	20W	12.123	SWAL	UNKNOWN				4186	65.67	1/3/83	4121.03	Qal	T		A	GSSE	*
	25S	20W	13.124	SWAL	VECK	12/63		281	4195	96	5/65	4099	Qal			I	OS	
*	25S	20W	13.213	SWAL	WRIGHT	8/49		123	4193	28.38	9/23/48	4165.45	Qal	T	L	I	GWSI	
*	25S	20W	13.213	SWAL	WRIGHT	3/48	DRLD	123	4197	73.74	1/4/83	4123.3	Qal	T	B	A,O	GSSE	*
*	25S	20W	13.214	SWAL	WRIGHT	6/46		206	4195	24.88	4/1/48	4170.12	Qal	T	G	I	GWSI	
*	25S	20W	13.344	SWAL	RUDIGER	2/68		272	4210	76	2/68	4134	Qal			I	OS	
	25S	20W	13.344	SWAL	BUDIGER	2/52		150	4205	62.09	5/18/55	4142.91	Qal	T	E	H	GWSI	
	25S	20W	14.132	STEI	WRIGHT	5/68		275	4210	70	5/68	4140	Qal			I	OS	
	25S	20W	15.211	STEI	DEVT..		DRLD	160	4203	77.14	1/21/76	4125.86	Qal	T	E	A	GSSE	*
	25S	20W	15.342	STEI	TRACEY	5/80		210	4208			4208	Qal			D,S	OS	
	25S	20W	15.342	STEI	TRACEY			210	4300		5/8/80	4300	Qal				SEOD	*
*	25S	20W	15.411	STEI	UNKNOWN				4208	81.93	2/19/73	4127	Qal			S	SEOD	*
*	25S	20W	15.444	STEI	WILLIS	11/72		150	4212	85	11/72	4127	Qal			D	OS	
	25S	20W	16.333	STEI	McCANTS	3/62		350	4215	60	3/62	4155	Qal			I	OS	
	25S	20W	16.333	STEI	MC CA	1/51	DRLD	142	4214	85.67	1/3/83	4128.33	Qal	T	E	D,A	GSSE	*
	25S	20W	16.333	COTT	UNKNOWN				4228	79.22	2/19/73	4148.78	Qal			I	SEOD	*
	25S	20W	20.444	COTT	HATCH	3/57		292	4226	90	3/57	4136	Qal			I	OS	
	25S	20W	22.313	COTT	WRIGHT	4/55		208	4220	76	4/55	4144	Qal			I	OS	
*	25S	20W	22.313	COTT	WRIGHT	5/55		208	4220	66.27	5/3/55	4153.73	Qal	P	L	I	GWSI	
*	25S	20W	22.313	COTT	WRIGHT	3/48		208	4221	96.27	1/3/83	4124.73	Qal	T	B	S	GSSE	*
	25S	20W	22.313	COTT	UNKNOWN				4215	94.72	2/19/73	4120.28	Qal			S	SEOD	*
*	25S	20W	23.443	TABL	MERRELL	3/62		217	4223	83	3/62	4140	Qal			I	OS	
	25S	20W	24.111	TABL	CARBINE	5/80		220	4210	110	5/80	4100	Qal			D	OS	*
	25S	20W	24.132	TABL	RICHINS	7/75		395	4215	112	7/75	4103	Qal			I	OS	
	25S	20W	24.132	TABL	RICHINS			395	4214	90.78	1/3/79	4123.22	Qal			A	GSSE	*
*	25S	20W	24.313	TABL	JUNDT	7/52		195	4220	64.87	11/54	4155.13	Qal	T	E	I	GWSI	
*	25S	20W	24.313	TABL	JUNDT		DRLD	320	4220	118.01	6/4/80	4101.99	Qal	N		A	GSSE	*
	25S	20W	25.113	TABL	RICHINS	3/62		325	4225	130	3/62	4095	Qal			I	OS	
	25S	20W	25.223	TABL	RICHINS	3/77		300	4230	108	3/77	4122	Qal			I	OS	*
	25S	20W	25.242	TABL	RICHINS		DRLD	160	4240	84	1/14/80	4156	Qal	T	E	A	GSSE	*
*	25S	20W	25.244	TABL	RICHINS			280	4249	131.71	1/13/73	4117.29	Qal			A	GSSE	*
	25S	20W	25.314	TABL	RICHINS	4/67		304	4230	120	4/67	4110	Qal			I	OS	
	25S	20W	25.314	TABL	RICH	1/48	DRLD	300	4234	120.9	1/4/83	4113.1	Qal	T	D	A,O	GSSE	*
*	25S	20W	25.334	TABL	RICHINS	3/48		115	4235	54.94	4/1/48	4180.06	Qal	P	D	I	GWSI	
	25S	20W	25.334	TABL	RICHINS		DRLD	350	4240	115.15	1/5/78	4124.85	Qal	T		A	GSSE	*
*	25S	20W	25.444	TABL	RICHINS	11/49		204	4255	69	11/49	4186	Qal	T	E	I	GWSI	
*	25S	20W	25.444	TABL	RICHINS	1959		500	4255	113.45	8/20/65	4141.55	Qal	T	N	I	GWSI	
*	25S	20W	25.444	TABL	RICH	3/48	DRLD	500	4261	139.73	1/4/83	4121.56	Qal	T	G	A	GSSE	*
	25S	20W	26.140	TABL	MERRELL	9/63		108	4225	120	9/63	4105	Qal			D	OS	
	25S	20W	26.144	TABL	MERRELL	4/76		751	4225	112	4/76	4113	Qal			I	OS	*
*	25S	20W	26.244	TABL	CRUM	2/53		186	4230	78.48	5/17/55	4151.85	Qal	T	S	I	GWSI	
	25S	20W	26.244	TABL	MERRELL	4/76		750	4230	110	4/76	4165	Qal			I	OS	*
	25S	20W	26.344	TABL	VECK	3/48	DRLD	120	4230	106.36	1/3/83	4123.64	Qal	T	B	A,O	GSSE	*
	25S	20W	27.144	COTT	UNKNOWN				4224	91.29	2/19/73	4132.71	Qal			I	SEOD	*
	25S	20W	27.222	TABL	BLAIR	4/66		300	4210	90	4/66	4120	Qal			D	OS	

	25S	20W	27.240	TABL	FREDRICK	8/79		392	4225	126	8/79	4099	Qal			D	OS	*
	25S	20W	27.240	COTT	AGUILAR			230	4300	120	10/4/80	4180	Qal				SEOD	*
	25S	20W	27.342	COTT	WRIGHT		DRLD		4225	97.69	1/5/78	4127.31	Qal			A	GSSE	*
	25S	20W	27.342	COTT	UNKNOWN				4225	103.3	2/19/73	4121.7	Qal			I	SEOD	*
	25S	20W	27.400	COTT	PARKER			250	4000	120	4/18/80	3880	Qal				SEOD	*
	25S	20W	27.430	COTT	WRIGHT	3/74		792	4230	120	3/74	4110	Qal			I	OS	*
	25S	20W	27.434	COTT	WRIGHT		DRLD	102	4232	140.63	2/1/72	4090.97	Qal		W	A	GSSE	
	25S	20W	27.434	COTT	WRIGHT	1/53	DRLD		4227	104.89	1/3/83	4122.11	Qal	T	B	I	GSSE	*
	25S	20W	27.434	COTT	UNKNOWN				4230	101.82	2/19/73	4128.18	Qal			I	SEOD	*
	25S	20W	29.410	COTT	LITTLE	5/72		440	4240			4240	Qal			I	OS	
	25S	20W	29.413	COTT	LITTLE			440	4244	123.05	1/4/83	4120.95	Qal			A	GSSE	*
	25S	20W	29.424	COTT	UNKNOWN		DRLD	335	4225	115.46	1/5/83	4109.54	Qal	T	B	A	GSSE	*
	25S	20W	29.424	COTT	UNKNOWN				4235	78.31	2/19/73	4156.69	Qal			I	SEOD	*
	25S	20W	29.424A	COTT	LITTLE	2/63		335	4230	72	2/63	4158	Qal			I	OS	
*	25S	20W	33.434	COTT	UNKNOWN				4235	106.28	1/4/83	4128.72	Qal			A	GSSE	*
	25S	20W	33.434	COTT	UNKNOWN				4240	93.68	2/19/73	4146.32	Qal			I	SEOD	*
	25S	20W	34.134	COTT	TYLER			160	4235	102.83	1/4/83	4132.17	Qal			A	GSSE	*
	25S	20W	34.140	COTT	UNKNOWN				4232	86.77	2/19/73	4145.23	Qal			I	SEOD	*
	25S	20W	34.140A	COTT	TYLER	5/65		900	4230	105	5/65	4125	Qal			I	OS	
	25S	20W	34.144	COTT	TYLER			900	4232	103.18	1/5/78	4128.82	Qal			A	GSSE	*
	25S	20W	34.240	TABL	HATCH	6/71		710	4235	123	6/71	4112	Qal			I	OS	
	25S	20W	34.244	COTT	UNKNOWN				4242	107.26	2/19/73	4134.74	Qal			I	SEOD	*
*	25S	20W	34.333	COTT	ANZALD	2/78		203	4240	103	2/78	4137	Qal			D	OS	*
	25S	20W	34.344	COTT	UNKNOWN				4240	102.59	2/19/73	4137.41	Qal			I	SEOD	*
*	25S	20W	34.444	COTT	UNKNOWN				4236	105.33	2/19/73	4130.67	Qal			I	SEOD	*
	25S	20W	35.223	TABL	VECK	7/53		203	4240	80.63	10/54	4159.37	Qal	T	E	I	GWSI	
	25S	20W	35.241	TABL	VECK		DRLD		4237	121.76	1/3/83	4115.24	Qal			A	GSSE	*
	25S	20W	35.313	TABL	VECK	2/78		480	4237			4237	Qal				OS	
	25S	20W	35.314	TABL	VECK	12/73		305	4237	100	12/73	4137	Qal			I	OS	*
	25S	20W	35.343	TABL	VECK	5/65		541	4240	110	5/65	4130	Qal			I	OS	
	25S	20W	35.343	TABL	VECK		DRLD	200	4240	123.93	1/4/83	4116.07	Qal	T		A	GSSE	*
	25S	20W	35.433	TABL	VECK			260	4242	120.52	1/5/78	4121.48	Qal			A	GSSE	*
	25S	20W	35.444	TABL	VECK			310	4245	134.13	1/4/83	4110.87	Qal			A	GSSE	*
	25S	20W	34.344	COTT	TYLER		DRLD		4240	111.47	1/4/83	4128.53	Qal	T	E	A	GSSE	*
	26S	17W	10.444	COYO	PHELPS			400	4415	168	7/83	4247	Qal				PD	*
	26S	17W	10.444	COTT	UNKNOWN			400	4415	150	1/75	4265	Qal				SEOD	*
	26S	17W	14.240	COYO	O'NEIL	1941		198	4419	173.56	12/53	4245.44	Qal	T	W	S	GWSI	
	26S	17W	14.240	COYO	VICTORIO			198	4490	184.7	1/24/83	4305.3	Qal			S	GSSE	*
	26S	17W	14.240	COYO	O'NEIL				4418	184.7	1/24/83	4233.3	Qal				SEOD	*
	26S	17W	29.444	COYO	PHELPS			400	4326	93	7/83	4233	Qal				PD	*
	26S	17W	29.444	COTT	UNKNOWN			401	4326	81	11/74	4245	Qal				SEOD	*
*	26S	17W	32.400	COYO	UNKNOWN				4320	82.95	1/24/83	4237.05	Qal				SEOD	
	26S	17W	32.400	COYO	VICTORIO			162	4325	82.95	1/24/83	4242.05	Qal			S	GSSE	*
	26S	17W	33.130	COYO	BRIGGS	1925		162	4322	5.34	12/53	4316.66	Qal			H,S	GWSI	
	26S	18W	08.143	S.PY	HEASTON				4900	171	3/15/55	4729	Tv	P			OS	*
	26S	18W	16.310	S.PY	URBAN	7/79		435	4720			4720	QTg			I	OS	
	26S	18W	16.310	S.PY	UNKNOWN	7/79		435	4720		6/6/83	4720	QTg				SEOD	

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	A	FA	USE	SRCE	R
	26S	18W	16.310	S.FY	URQUHAR	3/51		350	4440			4440	QTg				OS	*
	26S	19W	20.222	TABL	UNKNOWN				4440	204.1	2/15/73	4236	Qal				SEOD	*
	26S	19W	20.222	TABL	WAMEL				4440	201.05	9/16/55	4238.95	Qal	P			OS	*
	26S	19W	20.222A	TABL	WAMEL	4/51		350	4440			4440	Qal	P			OS	
	26S	19W	22.123	TABL	UNKNOWN				4510	275.49	2/28/73	4236	Qal				SEOD	*
	26S	19W	24.144	S.FY	UNKNOWN				4618	257.17	1/4/83	4360.83	Tv?			S	GSSE	*
	26S	19W	26.430	TABL	PETERSON	1/73		400	4500	272	1/73	4228	Qal			D,S	OS	*
	26S	19W	26.430	TABL	PETERSON	3/52		400	4500	272	1/73	4228	Qal				OS	*
	26S	19W	31.133	TABL	RICHINS	4/51			4340			4340	Qal				OS	*
	26S	19W	31.333	TABL	RUSH	3/48		200	4344	97.26	1/25/55	4246.74	Qal	T	E	I	GWSI	
	26S	19W	31.333	TABL	UNKNOWN				4343	146.54	1/4/83	4196.46	Qal				SEOD	
	26S	19W	31.333	TABL	EDWARD	5/48	DRLD	200	4341	146.53	1/4/83	4194.74	Qal	T	G	A,O	GSSE	*
	26S	19W	31.333A	TABL	GAUTHI	6/65		950	4340	130	6/65	4210	Qal			I	OS	
	26S	20W	02.344	COTT	WAMEL	8/48	DRLD	535	4260	114.78	1/4/83	4145.22	Qal	T	D	A,O	GSSE	*
	26S	20W	03.331	COTT	ROARK			249	4300	135	9/2/80	4165	Qal				SEOD	*
	26S	20W	03.440	TABL	OWENS			322	4320	115	8/17/80	4205	Qal				SEOD	*
	26S	20W	04.120	COTT	UNKNOWN				4232	105.51	2/19/73	4126.49	Qal			S	SEOD	*
	26S	20W	04.314	COTT	UNKNOWN				4243	114.18	2/19/73	4128.82	Qal			I	SEOD	*
	26S	20W	04.444	COTT	ROAR	3/52	DRLD		4250	124.49	1/4/83	4125.51	Qal	T	G	A	GSSE	*
	26S	20W	04.444	COTT	UNKNOWN				4250	115.56	2/19/73	4134.44	Qal			I	SEOD	*
	26S	20W	05.143	COTT	UNKNOWN				4236	95.37	2/19/73	4140.63	Qal			I	SEOD	*
	26S	20W	05.334	COTT	LEE		DRLD	200	4237	101.21	1/4/83	4135.79	Qal	T	E	A,D	GSSE	*
	26S	20W	05.422	COTT	LEE	1934		277	4238	111.1	1/4/83	4127.33	Qal	T	E	A,S	GSSE	*
	26S	20W	05.422	COTT	UNKNOWN				4236	106.3	2/19/73	4129.7	Qal			I	SEOD	*
	26S	20W	05.443	COTT	LEE			205	4240	113.76	1/4/83	4126.24	Qal			A	GSSE	*
	26S	20W	05.443	COTT	UNKNOWN				4248	103.34	2/19/73	4144.66	Qal			I	SEOD	*
*	26S	20W	08.434	COTT	WEATHE	3/47		125	4250	123.9	3/1/47	4126.1	Qal	T	L	I	GWSI	
	26S	20W	08.434	COTT	WEATH	3/47	DRLD	125	4251	117.41	1/4/83	4133.74	Qal	T	G	A,O	GSSE	*
	26S	20W	08.444	COTT	UNKNOWN				4251	116.64	2/19/73	4134.36	Qal			I	SEOD	*
	26S	20W	09.344	COTT	WOOD			360	4253	127.92	1/4/83	4127.08	Qal			A	GSSE	*
	26S	20W	09.344	COTT	UNKNOWN				4257	119.5	2/19/73	4137.5	Qal			I	SEOD	*
	26S	20W	10.342	TABL	UNKNOWN				4265	103.59	2/20/73	4161.41	Qal			I	SEOD	*
	26S	20W	10.344	COTT	WRIGHT		DRLD	200	4265	100.97	1/13/75	4164.03	Qal	T	G	A	GSSE	*
	26S	20W	10.434	COTT	HUDGEN	12/54		224	4270	99.15	5/9/55	4170.85	Qal	T	E	I	GWSI	
	26S	20W	10.434	COTT	HUDG				4270	116.38	1/4/83	4153.62	Qal			A	GSSE	*
	26S	20W	10.434	TABL	UNKNOWN				4270	111.79	2/20/73	4158.21	Qal			I	SEOD	*
	26S	20W	11.342	TABL	WAMEL		DRLD	140	4275	118.59	1/4/73	4155.63	Qal	T	G	A	GSSE	*
	26S	20W	13.222	TABL	DAVIS	3/55		156	4330	86	3/55	4244	Qal				OS	
*	26S	20W	14.234	TABL	WAMEL	5/49		400	4290	115.72	1/4/83	4174.28	Qal	T		D	GSSE	*
	26S	20W	15.224	COTT	CRAABTREE	7/51	DRLD		4275	123.58	1/4/83	4151.42	Qal	T	E	A	GSSE	*
	26S	20W	15.314	COTT	UNKNOWN				4275	93.94	2/26/73	4181.06	Qal			I	SEOD	*
	26S	20W	15.342	COTT	RAND			290	4278	118.71	1/4/83	4159.29	Qal			A	GSSE	*
	26S	20W	15.344	TABL	UNKNOWN				4273	96.98	2/26/73	4176.02	Qal			I	SEOD	*
	26S	20W	15.444	COTT	CRABTREE	4/48		148	4285	70.71	3/23/48	4214.29	Qal	T	E	I	GWSI	
	26S	20W	15.444	COTT	CRABTREE	4/48	DRLD	148	4284	131.93	1/4/83	4151.3	Qal	T	G	O	GSSE	*
	26S	20W	15.444	TABL	UNKNOWN				4284	107.51	2/26/73	4176.49	Qal			I	SEOD	*
*	26S	20W	17.133	COTT	WEATHER	1/33		200	4247			4247	Qal				OS	

	TWP	RGE	SECTION	QUAD	WELL NAME	DATE	LOG	TD	ELEV	WL DEPTH	WL DATE	WL ELEV	AQUIFER	ML	FE	USE	SRCE	
	26S	20W	22.220	TABL	LEE	8/80		280	4280	130	5/80	4150	Qal			D,S	OS	*
	26S	20W	23.433	TABL	UNKNOWN		DRLD		4298	142.33	1/4/83	4155.67	Qal	T		A	GSSE	*
*	26S	20W	24.333B	TABL	DAVIS	1/59		351	4308	110	1/59	4198	Qal			I	OS	
*	26S	20W	26.422	TABL	WASH	4/51	DRLD	200	4311	149.73	1/?/83	4162.36	Qal	T	E	A	GSSE	*
	26S	20W	29.142	COTT	WASH	1947	DRLD	132	4254	101.68	1/4/83	4152.32	Qal	N		A	GSSE	*
	26S	20W	32.213	COTT	UNKNOWN				4265	112.12	1/5/61	4152.88	Qal			S	GSSE	*
	26S	20W	32.213	COTT	UNKNOWN				4265	107.27	2/26/83	4157.73	Qal			S	SEOD	*
	26S	20W	32.233	COTT	WASHBU	10/72		130	4270			4270	Qal			S	OS	
*	26S	20W	35.111	TABL	WASHBU	11/62		300	4302	108	11/62	4194	Qal			D	OS	
*	26S	20W	35.111	TABL	UNKNOWN				4302	100.58	2/20/73	4203	Qal			S	SEOD	*
	26S	20W	36.224	TABL	WAMEL	2/71		300	4330	145	2/71	4185	Qal			D,S	OS	
	26S	21W	04.444	VANA	ROARK	7/66		230	4200	130	7/66	4060	Qal			I	OS	
	26S	21W	10.121	COTT	UNKNOWN				4238	145.44	1/23/80	4092.56	Tv				GSSE	*
*	26S	21W	12.144	COTT	ROBIN		DRLD	330	4285	139.01	1/3/83	4145.99	Qal		W	S	GSSE	*
	26S	21W	13.430	COTT	PHELPS	2/72		701	4420	80	2/72	4340	Qal			S	OS	
	26S	21W	21.313	COTT	ROBB				4090	178.36	1/13/80	3911.64	Qal				GSSE	*
	26S	21W	30.211	VANA	ROBB				3960	40.35	1/13/80	3919.65	Qal				GSSE	*
	26S	21W	31.241	VANA	ROBB				3970	21.5	1/13/80	3948.5	Qal				GSSE	*
	26S	22W	01.413	VANA	BLM				3880	25.42	1/11/80	3854.58	Qal				GSSE	*
	26S	22W	12.233	VANA	BLM				3875	19.47	1/11/83	3855.53	Qal				GSSE	*
	26S	22W	13.234	VANA	ROBB				3910	28.6	1/10/80	3881.4	Qal				GSSE	*
	26S	22W	24.211	VANA	ROBB		DRLD		3930	59.3	1/10/80	3870.7	Qal				GSSE	*
	27S	17W	06.340	PLAY	AVILA	5/80		170	4335	95	6/6/83	4240	Qal				SEOD	*
	27S	17W	06.430	PLAY	VOWELL	7/82		200	4345	96	6/6/83	4229	Qal				SEOD	*
	27S	17W	07.100	PLAY	HUTCHIN	8/73		170	4345	96	6/6/83	4249	Qal				SEOD	*
	27S	17W	07.110	PLAY	DOCKUM	11/73		162	4345	95	6/6/83	4250	Qal				SEOD	
	27S	17W	07.110	PLAY	BOND	3/75		200	4345	98	6/6/83	4247	Qal				SEOD	
	27S	17W	07.110	PLAY	ROBERT	5/72		170	4345	100	6/6/83	4245	Qal				SEOD	
	27S	17W	07.110	PLAY	BIVENS	6/73		170	4345	125	6/6/83	4220	Qal				SEOD	
	27S	17W	07.120	PLAY	MCCLURE	12/73		174	4345	90	6/6/83	4255	Qal				SEOD	
	27S	17W	07.120	PLAY	HUTCHINS	9/73		170	4345	100	6/6/83	4245	Qal				SEOD	
	27S	17W	07.123	PLAY	JARVIS	11/80		200	4345	105	6/6/83	4240	Qal				SEOD	
	27S	17W	07.124	PLAY	CHURCH	2/80		207	4338			4337.5	Qal				SEOD	
	27S	17W	07.240	PLAY	EWING	1/74		170	4312	60	6/6/83	4252	Qal				SEOD	*
	27S	17W	07.320	PLAY	TAGGARD	7/74		120	4337	60	6/6/83	4277	Qal				SEOD	*
*	27S	17W	07.422	PLAY	S.PACIFIC	1913		82	4316	73.87	3/14/55	4242.13	Qal	F	W	H	GWSI	
*	27S	17W	08.313	PLAY	UNKNOWN				4311	61.79	2/20/73	4205	Qal				SEOD	
	27S	17W	10.223	PLAY	UNKNOWN				4396	141.9	2/27/73	4254.1	Qal				SEOD	
	27S	17W	19.320	PLAY	PD	10/74		404	4313	120	6/6/83	4192.5	Qal				SEOD	
	27S	17W	19.320	PLAY	PD	9/74		329	4312	89	6/6/83	4223	Qal				SEOD	*
*	27S	17W	26.240	PLAY	McDONAL	1926		206	4434	165.89	12/55	4268.11	Qal	P	N	S	GWSI	
*	27S	17W	30.234	PLAY	UNKNOWN				4300	36.71	2/20/73	4263.29	Qal			S	SEOD	*
	27S	17W	30.234	PLAY	VICTORIO			52	4300	37.42	1/16/79	4262.58	Qal				GSSE	*
	27S	17W	31.300	PLAY	PD	3/75		300	4350	101	6/6/83	4249	Qal				SEOD	*
	27S	17W	35.124	PLAY	PD	11/73		300	4357	132	6/6/83	4255	Qal				SEOD	*
	27S	17W	35.324	PLAY	PD	1/73		300	4400	132	6/6/83	4268	Qal				SEOD	
	27S	17W	35.324	PLAY	PD	1/73		300	4400	132	6/6/83	4268	Qal				SEOD	

C	TWP	RGE	SECTION	QQQQ	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	ML	PB	USE	SRCE	C
	27S	17W	35.324	PLAY	PHELPS			300	4407	157	7/83	4250	Qal				PD	*
	27S	17W	35.324	PLAY	UNKNOWN				4400	131.83	2/28/73	4268.17	Qal				SEOD	*
	27S	17W	35.324	PLAY	PHELPS			300	4400	137.48	1/16/74	4262.52	Qal				GSSE	*
	27S	17W	36.424	PLAY	UNKNOWN				4550	297.1	1/24/83	4252.9	Qal				SEOD	
	27S	17W	36.424	PLAY	DODGE				4550	297.1	1/24/83	4252.9	Qal			1	GSSE	*
	27S	17W	36.424	PLAY	UNKNOWN				4550	287.33	2/28/73	4262.67	Qal			TWO	SEOD	*
*	27S	18W	05.334	PLAY	PETERSON			301	4476	225	3/8/81	4251	QTg				FD	*
	27S	18W	05.334	PLAY	UNKNOWN			300	4463	215	6/6/83	4250	QTg				SEOD	*
	27S	18W	07.100	PLAY	HOOTEN	9/80		193	4460	105	9/80	4355	Qal			D	OS	*
	27S	18W	07.100	PLAY	HOOLEA	9/80		193	4450	105	6/6/83	4345	Qal				SEOD	
	27S	18W	11.333	PLAY	UNKNOWN				4470	200	2/28/73	4270	Qal				SEOD	*
*	27S	18W	12.120	PLAY	HOGAN	11/80		200	4380	120	6/6/83	4260	Qal				SEOD	
	27S	18W	12.120	PLAY	HOGAN			200	4375	120	11/80	4255	Qal				SEOD	*
	27S	18W	12.220	PLAY	HENLETT	5/80		163	4360	120	6/6/83	4240	Qal				SEOD	
	27S	18W	12.220	PLAY	BITTLE	5/80		163	4360	113	6/6/83	4247	Qal				SEOD	
	27S	18W	12.220	PLAY	MULLINS	5/80		185	4360	115	6/6/83	4245	Qal				SEOD	
	27S	18W	12.220	PLAY	MULLINS	5/80		185	4350	115	5/80	4235	Qal			D	OS	*
	27S	18W	12.220	PLAY	MULLINS			185	4350	115	5/16/80	4235	Qal				SEOD	*
	27S	18W	12.322	PLAY	CHURCH	7/82		200	4370	120	6/6/83	4250	Qal				SEOD	*
	27S	18W	12.444	PLAY	PHELPS			400	4363	133	7/83	4230	Qal				PD	*
	27S	18W	18.240	PLAY	PETERSON	1/73		400	4475	242	1/73	4233	Qal			D,S	OS	*
	27S	18W	18.243	PLAY	PHELPS				4475			4475	Qal				FD	
	27S	18W	18.244	PLAY	UNKNOWN			400	4480	242	6/6/83	4238	Qal				SEOD	*
	27S	18W	18.244	PLAY	UNKNOWN				4300	242.49	2/28/73	4057.51	Qal				SEOD	*
	27S	18W	18.421	PLAY	EL PASO			1000	4496		3/8/81	4496	Qal				FD	
	27S	18W	22.332	PLAY	UNKNOWN				4500	239.38	2/26/73	4260.62	Qal			TES	SEOD	*
	27S	18W	31.331	PLAY	PHELPS			400	4373	111	7/83	4262	Qal				PD	*
	27S	19W	07.340	PRAT	COLUMB	7/54		155	4375	132	7/54	4243	Qal				OS	
	27S	19W	11.231	PRAT	UNKNOWN				4409	166.6	1/5/83	4242.4	Qal				SEOD	
	27S	19W	11.231	PRAT	PATTEF			300	4413	166.59	1/5/83	4245.91	Qal			A	GSSE	*
	27S	19W	11.233	PRAT	PETERSON	7/33		390	4416	165.49	3/14/55	4250.51	Qal	I	N	I	GWSI	
*	27S	19W	11.333	PRAT	PETERSON	7/78		227	4400	160	1/78	4240	Qal			S	OS	*
	27S	19W	17.330	PRAT	WAMEL	9/73		508	4400	238	9/73	4162	Qal			I	OS	*
	27S	19W	18.300	PRAT	TOWNSEND	3/80		250	4393	170	3/80	4223	Qal			D	OS	*
	27S	19W	18.400	PRAT	CATHEY	9/78		311	4400	175	9/78	4225	Qal			D	OS	*
*	27S	19W	19.100	PRAT	ADAMS	1/76		300	4401	190	1/76	4211	Qal			D	OS	*
	27S	19W	19.222	PRAT	PURSLEY			260	4400	169	4/13/80	4231	Qal				SEOD	*
*	27S	19W	19.433	PRAT	MASSEY	5/65		800	4416			4416	Qal			I	OS	
	27S	19W	19.433	PRAT	MASSEY	2/35		300	4416	148.84	5/13/55	4267.16	Qal	T	N	I	GWSI	
	27S	19W	19.433	PRAT	MASSEY		DRLD	150	4415	183.9	1/4/80	4231.32	Qal				GSSE	*
	27S	19W	20.110	PRAT	SHIMAS	1/78		486	4402	190	1/78	4212	Qal				OS	*
	27S	19W	20.144	PRAT	BAPTIST	11/66		300	4405	147	11/66	4258	Qal			D	OS	
	27S	19W	20.313	PRAT	O'BRIEN			12	4405		3/8/81	4405	Qal				FD	
	27S	19W	20.322	PRAT	MASSEY	3/71		800	4405	170	3/71	4235	Qal			I	OS	
*	27S	19W	20.343	PRAT	GAUF	2/49	DRLD	358	4414	177.58	1/5/83	4236.42	Qal	N		A	GSSE	*
	27S	19W	20.433	PRAT	MEDLI	6/49	DRLD		4421	175.27	1/5/83	4244.73	Qal	T		H,O	GSSE	*
	27S	19W	20.443	PRAT	MEDLIN	1/33		300	4425	144.25	1/25/35	4283.75	Qal	T	L	Y	GWSI	

	27S	19W	20.433	PRAT	UNKNOWN				4417	176.27	1/1/83	4242.73	Qal				SEOD	*
	27S	19W	21.100	PRAT	STATE	7/72		300	4400	160	7/72	4240	Qal			D	OS	
	27S	19W	21.110	PRAT	BARNES	5/80		308	4400	180	5/80	4220	Qal			D	OS	*
	27S	19W	21.110	PRAT	BARNES			308	4410	180	5/16/80	4230	Qal				SEOD	*
	27S	19W	22.100	PRAT	RITTER	3/75		285	4450	170	3/75	4280	Qal			D	OS	*
	27S	19W	22.132	PRAT	O'BRIEN			400	4450	203	3/8/81	4244	Qal				FO	*
	27S	19W	22.340	PRAT	GRAY	4/80		252	4450	205	4/80	4245	Qal			D,S	OS	*
	27S	19W	22.410	PRAT	RAINS			400	4470	235	2/11/81	4235	Qal				SEOD	*
	27S	19W	23.142	PRAT	O'BRIEN			400	4450	207.5	3/8/81	4243	Qal				FO	*
%	27S	19W	29.334	PRAT	GAUTH	12/54		308	4437	138	12/54	4299	Qal			I	OS	
	27S	19W	30.213	PRAT	UNKNOWN				4415	172.89	1/5/83	4242.11	Qal				SEOD	
	27S	19W	30.213	PRAT	NEAL			800	4418	172.89	1/5/83	4245.11	Qal			A	GSSE	*
	27S	19W	30.214A	PRAT	OFFUTT	5/59		413	4425			4425	Qal			I	OS	
	27S	19W	31.223	PRAT	UNKNOWN				4430	178	1/5/83	4252	Qal				SEOD	
	27S	19W	31.223	PRAT	ADAM				4450	178	1/5/83	4272	Qal	FL	W	S	GSSE	*
	27S	19W	32.200	PRAT	JOHNSON	12/76		300	4437	180	12/76	4257	Qal			D,S	OS	*
	27S	19W	34.113	PRAT	ADAMS	10/77		275	4475	215	10/77	4260	Qal			I	OS	*
	27S	19W	34.114	PRAT	ADAMS		DRLD	250	4487	215.57	1/5/81	4271.43	Qal				GSSE	*
	27S	20W	05.244	PRAT	WASHBU	1955			4290	71.2	1/12/55	4218.8	Qal	J	E	S	GWSI	
%	27S	20W	09.100	PRAT	PABUE	1/73		76.5	4312	75	11/13	4237	Qal				OS	*
	27S	20W	09.121	PRAT	WASHBURN				4300	71.2	8/1/49	4228.8	Qal	P			OS	
	27S	20W	10.433	PRAT	WASHBURN	10/32		150	4350	95.08	1/12/55	4254.92	Qtb	P			OS	*
	27S	20W	12.144	PRAT	KING	3/49		200	4350			4350	Qtb	T			OS	
	27S	20W	12.230	PRAT	PAYNE	5/74		350	4350	120	5/74	4230	Qal			I	OS	*
	27S	20W	12.244	PRAT	KING			170	4350	103	3/25/48	4247	Qal	T			OS	*
%	27S	20W	12.444	PRAT	MOORE	1951		255	4380	133.03	8/20/60	4246.97	Qal			I	GWSI	
%	27S	20W	12.444	PRAT	UNKNOWN				4370	157.8	1/5/83	4212.2	Qal				SEOD	
%	27S	20W	12.444	PRAT	CURRY	11/51	DRLD	255	4377	157.81	1/5/83	4219.19	Qal	T	G	A	GSSE	*
%	27S	20W	13.300	PRAT	UNKNOWN	5/51			4375			4375	QTb	P			OS	
	27S	20W	13.410	PRAT	HAMEL	3/61		198	4373	120	3/61	4253	QTb			S	OS	
	27S	20W	16.400	PRAT	EL PASO	7/65		433	4350	18	7/65	4332	QTb			C	OS	
	27S	20W	16.400	PRAT	PABUE			104	4350	98	11/13	4252	QTb				OS	*
	27S	20W	16.443	PRAT	WASHBURN	11/54		125	4350			4350	QTb				OS	*
	27S	20W	21.110	PRAT	HILL	5/59		405	4400	203	5/59	4197	QTb?			S	OS	
%	27S	20W	21.222	PRAT	HILL	11/54		240	4343	98.83	1/6/55	4244.17	QTb	T	G	I	GWSI	
	27S	20W	21.222	PRAT	UNKNOWN				4340	147.7	1/5/83	4192.3	QTb				SEOD	
	27S	20W	21.222	PRAT	HILL	11/54	DRLD	290	4375	147.68	1/3/83	4227.32	QTb	T	G	A	GSSE	*
	27S	20W	21.222	PRAT	HILL	1/55		240	4350	98.83	1/6/55	4251.17	QTb	T			OS	*
	27S	20W	21.300	PRAT	UNKNOWN			105	4437		11/13	4437	Qal?				OS	
	27S	20W	22.111	PRAT	HILL	1951		240	4350			4350	QTb	T			OS	
	27S	20W	22.312	PRAT	WASHBURN				4375	134.08	1/55	4240.92	QTb	P			OS	*
	27S	20W	26.300	PRAT	PABUE			132	4435			4423	Qal				OS	*
	27S	20W	26.310	PRAT	ELBROOK	10/70		320	4425	160	10/70	4265	Qal			I	OS	
	27S	20W	26.311	PRAT	MARTIN	3/53		245	4400	124.23	1/6/55	4275.73	Qal	P			OS	
	27S	20W	30.214	PRAT	NEAL	8/57		218	4416			4416	Qal	T	E	I	GWSI	
	27S	21W	04.232	PRAT	ROBB				4262	393.9	1/13/80	3868.1	Qal				GSSE	*
	27S	21W	06.143	PORT	PAITY				4020	93.29	1/14/80	3926.71	Qal				GSSE	*
L	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	WL	PS	USE	SRCE	P

C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL REF	WL DATE	WL ELE	AQUIFER	MI	PE	USE	SECE	P
	27S	21W	07.232	PORT	BAGWELL			200	4020	110.99	1/10/80	3909.01	Qal				GSSE	*
	27S	21W	17.124	PORT	BAGWELL			220	4020	120.93	1/10/80	3899.07	Qal				GSSE	*
	27S	21W	20.322	PORT	HOGGETT				4020	80	1/14/80	3940	Qal				GSSE	*
	27S	21W	22.122	PRAT	ROBB				4225	323.82	1/14/80	3901.18	Qal				GSSE	*
	27S	21W	29.433	PORT	BEITOGO				4040	72.8	1/17/78	3967.2	Qal				GSSE	*
*	27S	21W	30.413	PORT	SMITH			200	4100	130.56	1/24/80	3969.44	Qal				GSSE	*
	27S	21W	31.311	PORT	SMITH		DRLD		4145	168.43	1/10/79	3976.57	Qal				GSSE	*
	27S	21W	32.241	PORT	HOGGETT		DRLD	400	4040	76.55	1/10/79	3963.45	Qal				GSSE	*
	27S	21W	33.333	PRAT	HOGGETT				4162	74.64	1/24/80	4087.36	Qal				GSSE	*
	27S	22W	01.313	PORT	WEATHER			505	4063	149.53	1/10/80	3913.47	Qal				GSSE	*
	28S	14W	27.440	HACH	EXXON	1975		1000	5062	220	6/6/83	4842	Tv				SEOD	*
	28S	14W	33.330	HACH	UNKNOWN				4810	95	6/9/83	4715	Tv				PO	*
	28S	16W	33.213	HACH	SMITH			50	4873	38.97	1/25/83	4834.03	TKi			D.S	GSSE	*
	28S	17W	08.213	PLAY	VICTORIO				4290	1.96	1/24/83	4288.04	Qal			S	GSSE	*
	28S	17W	08.213	PLAY	UNKNOWN				4279	1.96	3/3/83	4277.04	Qal				SEOD	
	28S	17W	17.400	PLAY	UNKNOWN				4282	0		4282	Qal				OS	
	28S	17W	18.444	PLAY	PHELPS			318	4364	92	7/83	4272	Qal				PD	*
	28S	17W	19.444	PLAY	PHELPS			400	4355	80.5	7/83	4274	Qal				PD	*
	28S	17W	19.444	PLAY	GREAT			400	4363	74.41	1/25/78	4288.59	Qal				GSSE	*
	28S	17W	31.200	PLAY	VICTORIO				4412	0		4412	Qal				OS	
	28S	17W	33.400	PLAY	WHITMIRE			150	4287	8	1949	4279	Qal				UGC	*
	28S	18W	01.411	PLAY	ADAMS	1910		135	4394	112.07	3/14/55	4281.93	Qal	T	W	S	GWSI	
	28S	18W	01.411	PLAY	ADAM			135	4389	115.33	1/24/83	4273.67	Qal			S	GSSE	*
	28S	18W	01.411	PLAY	UNKNOWN				4389	103.76	3/1/73	4285.24	Qal			S	SEOD	*
	28S	18W	10.443	PLAY	UNKNOWN				4600	324.22	3/1/73	4276	Qtg			TES	SEOD	*
	28S	19W	03.110	PRAT	DARNELL	1/76		360	4450	190	1/76	4260	Qal			D,S	OS	*
	28S	19W	15.433	PRAT	JOHNSON		DUG	306	4545	232.71	1/8/74	4312.29	Qal				GSSE	*
	28S	19W	16.244	PRAT	VECK		DUG		4510	220.38	1/10/78	4289.62	Qal				GSSE	*
	28S	19W	16.442	PRAT	UNKNOWN				4513	230.29	1/5/83	4282.21	Qal			A	GSSE	*
	28S	19W	16.444	PRAT	GREEN	4/75		800	4525	225	4/75	4300	Qal			I	OS	*
	28S	19W	17.231	PRAT	TYLER		DUG	330	4487	180.6	1/10/78	4306.4	Qal				GSSE	*
*	28S	19W	20.244	PRAT	GOV'T	1955		270	4560	257.8	1/25/55	4302.2	Qal	P	N	S	GWSI	
*	28S	19W	20.244	PRAT	GOV'T		DRLD	270.4	4560	275.95	1/5/83	4284.05	Qal	PL	N	S,O	GSSE	*
	28S	19W	27.200	PRAT	CROOM	11/70		391	4575	310	11/70	4265	Qal			S	OS	
	28S	19W	27.314	PRAT	DUNAS	10/64		1000	4575	272	10/64	4303	Qal			I	OS	
	28S	19W	27.314	PRAT	DUNA			1000	4565	176.07	1/5/83	4388.93	Qal			A	GSSE	*
	28S	19W	34.133	PRAT	UNKNOWN				4600	23.93	1/5/83	4576.07	Qal			S	GSSE	*
	28S	19W	34.430	PRAT	JOHNSON	4/70		370	4599			4599	Qal			D.S	OS	
*	28S	20W	02.200	PRAT	DARNELL	6/68		300	4525	180	6/68	4345	QTb			D	OS	
*	28S	20W	12.210	PRAT	STRANGE	8/56		285	4550	250	8/56	4300	Qal				OS	*
*	28S	21W	05.413	PORT	RICHARD				4080	92.89	1/24/78	3987.11	Qal				GSSE	*
	28S	21W	09.433	PRAT	ALBALA				4162	178.59	1/24/80	3983.41	Qal				GSSE	*
	28S	21W	22.123	PRAT	SULTIE			530	4550	497.4	1/23/80	4052.6	Qal				GSSE	*
	28S	21W	29.142	PORT	WEINKLE				4200	143.98	1/15/80	4056.02	Qal				GSSE	*
	28S	21W	30.222	PORT	JOHNSON		DRLD	471	4130	124.1	6/1/83	4005.9	Qal				GSSE	*
	28S	21W	31.133	PORT	ALBALA		DRLD		4140	141.89	1/10/80	3998.11	Qal				GSSE	*
	28S	22W	12.134	PORT	UNKNOWN				4160	176.7	1/24/80	3983.3	Qal				GSSE	*

C	TWP	RGE	SECTION	QUAD	WELL NAME	D DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	WL	FS	USE	SRCE	P
	29S	22W	25.222	PORT	UNKNOWN				4110	56.74	1/14/80	4053.26	Qal				GSSE	*
	28S	22W	36.134	PORT	LYONS			300	4135	139.94	1/14/80	3995.06	Qal				GSSE	*
	29S	14W	23.142	HACH	UNKNOWN				4770	176	6/9/83	4594	Qal				FO	
	29S	15W	04.232	HACH	DIAMOND	1955		260	4392	196.46	12/55	4195.54	Qal			S	GWSI	
	29S	16W	13.313	HACH	UNKNOWN				4700			4700	Qal				FO	
	29S	16W	15.000	HACH	UNKNOWN				4750	704	6/9/83	4046	Qal				FO	
*	29S	16W	20.110	HACH	LAND	1927		195	4402	138.27	5/16/56	4263.73	Qal	T	W	S	GWSI	
	29S	16W	20.110	HACH	VICTORIO			195	4375	136.4	1/24/83	4238.6	Qal			S	GSSE	*
	29S	16W	22.220	HACH	SMITH	1955		50	4728	35.63	12/55	4692.37	Qal	T	W	S	GWSI	*
	29S	16W	30.400	PLAY	UNKNOWN				4312	41	9/30/13	4271	Qal				OS	*
	29S	16W	31.200	WALN	LANE				4300	30	9/30/13	4270	Qal				OS	*
*	29S	16W	32.300	BIG	LANE				4300	22	9/30/13	4278	Qal				OS	*
	29S	16W	32.311	BIG	YOUNG		DUG	38	4300	35.3	1/25/83	4264.7	Qal			D,S	GSSE	*
	29S	17W	01.220	PLAY	LAND	1932		244	4464	187.02	1/17/56	4276.98	Qal			S	GWSI	
	29S	17W	01.220	PLAY	VICTORIO			244	4450	189.99	3/8/82	4260.01	Qal				GSSE	*
	29S	17W	01.330	PLAY	LAND	1923		192	4363	58.27	12/55	4304.73	Qal	T	W	S	GWSI	
*	29S	17W	07.313	PLAY	VICTORIO			218	4488	194.82	1/24/83	4292.68	Qal			S	GSSE	*
	29S	17W	07.313	PLAY	UNKNOWN				4500	184.76	3/1/73	4315.24	Qal			S	SEOD	*
	29S	17W	11.300	PLAY	UNKNOWN				4290	21	1949	4269	Qal				UGC	*
	29S	17W	16.431	PLAY	PHELPS			450	4392	103	7/83	4289	Qal				FO	*
	29S	17W	16.440	PLAY	GREAT			450	4380	87.92	1/23/78	4292.08	Qal				GSSE	*
	29S	17W	21.242	PLAY	PHELPS			400	4385	94.5	7/83	4290	Qal				FO	*
	29S	17W	25.300	PLAY	ARTESIAN		DUG		4298	2	12/55	4296	Qal				UGC	*
	29S	17W	26.211	PLAY	DODGE			200	4330	22.6	1/24/83	4307.4	Qal			I	GSSE	*
	29S	17W	33.310	WALN	VICTORIO			220	4475	184.04	1/24/83	4290.96	Qal			S	GSSE	*
	29S	17W	33.310	WALN	UNKNOWN				4475	178.24	3/1/73	4296.76	Qal			S	SEOD	*
	29S	19W	03.100	PRAT	AUSTIN				4600	23	11/13	4577	Qal				OS	*
	29S	19W	03.300	PRAT	STRICK		DUG	20.5	4600	15.71	1/5/83	4584.29	Qal	C	G	O	GSSE	*
	29S	19W	04.233	PRAT	SANFORD		DUG		4625	18.69	1/5/83	4606.31	Qal			S	GSSE	*
*	29S	19W	04.400	PRAT	ISAACS				4612	16	11/13	4596	Qal				OS	*
	29S	19W	09.200	PRAT	UNKNOWN				4615	18	11/13	4597	Qal				OS	*
	29S	19W	09.432	PRAT	UNKNOWN	7/82		450	4627	330	6/6/83	4297	Qal				SEOD	*
	29S	19W	10.100	PRAT	UNKNOWN				4615	18	11/13	4597	Qal				OS	*
	29S	19W	17.200	PRAT	GALLMAN				4645	19	11/13	4626	Qal				OS	*
	29S	19W	17.223	PRAT	MIDDLE			30	4644	20	1913	4624	Qal		W		FO	
	29S	19W	20.106	PRAT	BURKLETT				4667	16.5	11/13	4650.5	Qal				OS	*
	29S	19W	20.220	PRAT	CROOM	4/64		60	4650	35	4/64	4615	Qal			S	OS	
	29S	19W	20.220	PRAT	CROOM	4/64		60	4650	35	4/64	4615	Qal				OS	*
	29S	19W	20.234	PRAT	GILLILA			435	4662		1913	4661.5	Qal		E		FO	
	29S	19W	29.300	PRAT	UNKNOWN				4700	18	11/13	4682	Qal				OS	*
	29S	19W	30.400	PRAT	YT HEAD				4700	20	11/13	4680	Qal				OS	*
	29S	19W	30.444	PRAT	OLD HOUSE			30	4713	15	1918	4697.5	Qal		O		FO	
	29S	19W	30.444	ANIM	BIG HOUSE			410	4713	380		4332.5	Qal	S			FO	
	29S	19W	30.444	PRAT	SMALL			30	4712	20	1973	4692	Qal			W	FO	*
	29S	19W	31.300	ANIM	DUNNIGAN				4725			4725	Qal				OS	*
	29S	19W	34.300	PRAT	COCKRE	10/71		140	4800	90	10/71	4710	Qal			C	OS	
	29S	19W	34.300	ANIM	COCKRELL	10/71		140	4800	90	10/71	4710	Qal				OS	*

	29S	19W	34.333	PRAT	DEEP			320	4713	460	1939	4.353	Qal		S		FD	
	29S	20W	02.410	PRAT	GODFREY	5/63		320	4800	478	5/63	4322	Qal			S	DS	
	29S	20W	02.410	PRAT	GODFREY	5/63		330	4800	478	5/63	4322	Qal				DS	*
	29S	20W	02.412	PRAT	BRYANT			360	4800		1973	4800	Qal			S	FD	*
	29S	21W	05.114	PORT	SANFORD				4180	183.5	1/13/80	3996.5	Qal				GSSE	*
	29S	21W	06.133	PORT	PRICHARD		DRLD		4150	156.12	1/10/80	3993.88	Qal				GSSE	*
	29S	22W	01.133	PORT	TURNER				4140	163.08	1/9/80	3976.92	Qal				GSSE	*
	29S	22W	11.241	PORT	RICHARD		DRLD	330	4180	159.62	1/10/80	4020.38	Qal				GSSE	*
	29S	22W	12.131	PORT	GRABE				4180	169.32	1/6/80	4010.68	Qal				GSSE	*
	29S	22W	12.133	PORT	ROARK		DRLD	663	4180	158.3	9/1/83	4021.7	Qal				GSSE	*
	30S	14W	29.141	BIG	BADGER			157.3	4251	106.8	12/8/55	4144.2	Qal	F		S	TH	*
	30S	14W	33.211A	BIG	RICHENS			116.1	4248	106.2	12/7/55	4141.8	Qal	F		S	TH	*
	30S	15W	19.134A	BIG	HEADQUART				4284	118.4	12/8/55	4165.6	Qal	T		D,S	TH	*
	30S	15W	16.313	BIG	WITCH			143.3	4387	106.9	12/5/55	4280.1	Qal	F		S	TH	*
	30S	16W	03.400	BIG	SMITH				4320	55.5	12/55	4264.5	Qal		W		UGC	*
	30S	16W	03.440	BIG	SMITH	1930		59	4320	55.3	12/55	4264.7	Qal	T	W	H,S	GWSI	
	30S	16W	05.433	BIG	VICTORIO			64	4313	31.39	1/25/83	4280.61	Qal			S	GSSE	*
	30S	16W	05.433	BIG	UNKNOWN				4312	31.9	1/25/83	4280.1	Qal				SEOD	
*	30S	16W	07.331	WALN	BLACK			318	4363	58.5	1/24/83	4304	Qal			A	GSSE	*
	30S	16W	07.333	WALN	KILLI		DRLD		4376	63.85	1/24/83	4312.15	Qal	T		A	GSSE	*
	30S	16W	11.331	BIG	MC CA		DRLD	118	4316	47	1/25/83	4269	Qal	T	G	A	GSSE	*
*	30S	16W	12.100	BIG	UNKNOWN				4310	44.3	12/55	4265.7	Qal		W		UGC	*
	30S	16W	12.314	BIG	SOUTH			78.6	4299	57.5	12/8/55	4241.5	Qal	P		S	TH	*
	30S	16W	14.211	BIG	UNKNOWN				4311	46.9	1/20/82	4264.1	Qal				SEOD	
	30S	16W	14.211	BIG	UNKNOWN				4311	46.97	1/20/83	4264.03	Qal				SEOD	*
	30S	16W	14.211	BIG	EVERHART		DRLD	120	4312	46.97	1/20/83	4265.03	Qal				GSSE	*
	30S	16W	16.244	BIG	UNKNOWN			80	4321	44.14	1/25/83	4276.86	Qal				SEOD	*
	30S	16W	18.133	WALN	HAMB			260	4388	74.67	1/24/83	4312.83	Qal			A	GSSE	*
	30S	16W	18.413	WALN	WRIGHT			152	4362	53.23	2/6/76	4308.77	Qal				GSSE	*
	30S	16W	18.433	WALN	UNKNOWN				4375	69.1	1/1/83	4305.9	Qal				SEOD	
	30S	16W	19.433	WALN	UNKNOWN			183	4363	69.05	1/24/83	4293.45	Qal			A	GSSE	*
	30S	16W	19.233	WALN	UNKNOWN				4388	77	1/25/83	4310.5	Qal				SEOD	
	30S	16W	19.233	WALN	BENNET				4388	77	1/25/83	4310.5	Qal			A	GSSE	*
	30S	16W	20.333	BIG	BENNET			420	4326	55.12	1/25/83	4270.88	Qal			A	GSSE	*
	30S	16W	20.433	BIG	UNKNOWN				4330	46.7	1/25/83	4303.3	Qal				SEOD	
	30S	16W	20.433	BIG	BENNET			250	4350	46.66	1/25/83	4303.34	Qal			A	GSSE	*
	30S	16W	21.412	BIGH	GILLESPIE	7/48		200	4332	97.8	12/55	4234.2	Qal	T	E	I	GWSI	
	30S	16W	21.412	BIG	UNKNOWN				4337	45.5	1/25/83	4291.5	Qal				SEOD	
	30S	16W	21.412	BIG	GILLES		DRLD	160	4335	45.52	1/25/83	4289.48	Qal	N		A	GSSE	*
	30S	16W	21.444	BIG	UNKNOWN				4337	49.2	1/25/83	4287.8	Qal				SEOD	
	30S	16W	21.444	BIG	GILLES			215	4335	49.22	1/25/83	4285.78	Qal			A	GSSE	*
*	30S	16W	28.334	BIGH	UNKNOWN	5/49		170	4350	60.49	8/20/65	4289.51	Qal	T	E	I	GWSI	
*	30S	16W	28.334	BIG	GROSS		DRLD		4336	53.63	1/23/83	4282.37	Qal	T	E	A	GSSE	*
	30S	16W	29.423	BIG	GROSS		DRLD	160	4336	54.81	1/25/83	[illegible]	Qal			A	GSSE	
	30S	16W	29.424	BIG	UNKNOWN				4350	54.81	1/25/83	4295.19	Qal				SEOD	*
*	30S	16W	34.300	BIG	UNKNOWN				4375	74.2	12/55	4300.8	Qal		W		UGC	*
	30S	17W	13.343	WALN	GREAT LA			400	4430	127.36	1/24/83	4302.64	Qal			A	GSSE	*
C	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	WL	PS	USE	SRCE	#

	30S	17W	14.333	WALN	GREAT LA			500	4510	192.07	1/15/79	4317.18	Qal				GSSE	*
*	30S	17W	15.131	WALN	VICTORIO			255	4320	205.48	3/3/82	4314.52	Qal				GSSE	*
	30S	17W	20.131	BIG	BENNETT			350	4362	40.97	1/17/74	4321.01	Qal				GSSE	*
	30S	17W	32.211	WALN	UNKNOWN				4737	59.33	3/1/73	4677.67	Qal			S	SEOD	*
	30S	17W	36.200	WALN	SAND BAR			200	4550			4550	Qal		W		UGC	*
	30S	18W	18.134	WALN	ADAMA			300	5230	50	1977	5170	Tv				FO	*
	30S	18W	18.432	WALN	UPSHAW			35	5250	15	1918	5235	Tv		W		FO	
	30S	18W	31.311	WALN	UNKNOWN			110	5425			5425	Tv	S			FO	
	30S	19W	06.100	ANIM	SPEAR				4737	20	11/13	4717	Qal				OS	*
	30S	19W	07.133	ANIM	CUNNINGHA			550	4795		1972	4795	Qal		W		FO	
	30S	19W	07.133	ANIM	DUNNIGAN			215	4795	28	1913	4767	Qal		W		FO	
	30S	19W	07.300	ANIM	DUNNAG				4775	28	11/13	4747	Qal				OS	*
	30S	20W	01.400	ANIM	UNKNOWN				4800	29	11/13	4771	Qal				OS	*
	30S	20W	11.100	ANIM	RITCHFIEL				4950			4930	Qal				OS	
	30S	20W	12.243	ANIM	UNKNOWN			530	4800		1972	4800	Qal	S			OS	
	30S	20W	20.200	ANIM	HATFIELD			55	5450			5450	Tv				OS	
	30S	20W	24.213	ANIM	HATFIELD			420	4828		1968	4828	Qal	S			FO	
	30S	20W	24.330	PRAT	RICHARD	7/74		600	4875	520	7/74	4335	Qal			S	OS	*
	30S	20W	24.330	ANIM	RICHARD	7/74		600	4875	520	7/74	4355	Qal				OS	*
	30S	20W	25.100	ANIM	VICTORIO				4913	22		4890.5	Qal				OS	*
*	30S	20W	25.142	ANIM	MIDDLE 1			125	4848		1918	4848	Qal		W		FO	
	30S	20W	25.142	ANIM	MIDDLE 2			125	4848		1918	4848	Qal		W		FO	
	30S	20W	35.400	ANIM	VICTORIO				4912	22		4890	Qal				OS	*
	31S	14W	01.333	BIG	TEST HOLE			460	4180	54.9	11/16/5	4125.1	Qal	N		T	TH	*
	31S	14W	02.222	BIG	DOUBLE WE			92.6	4185	68.5	12/7/55	4116.5	Qal	P		S	TH	*
	31S	14W	09.441	BIG	HIGH LONE			200	4326	186	12/7/55	4140	Qal	P		S	TH	*
	31S	14W	13.212	BIG	CABIN WEL			38.3	4148	25.8	12/7/55	4122.2	Qal	P		S	TH	*
	31S	14W	24.444	BIG	ARTESIAN			32.6	4150	4.5	12/6/55	4145.5	Qal	P		S	TH	*
	31S	14W	25.322	BIG	DEEP WELL			657.9	4760	555.4	12/8/55	4204.6	Qal	P		S	TH	*
	31S	14W	35.242	BIG	HATCHET N			135	4240	32.9	12/6/55	4207.1	Qal	P		S	TH	*
	31S	15W	02.221	BIG	TEST	6/56	DRLD	600	4600	456	8/31/56	4144	Qal	N		T	TH	*
	31S	15W	03.344	BIG	LOWER THO			297.5	5095	220.8	12/1/55	4874.2	Qal?	N		T	TH	*
	31S	15W	23.144	BIG	SHERIDAN			173.9	5045	54.8	12/6/55	4990.2	Qal	P		S	TH	*
	31S	16W	15.344	BIG	BENNET		DRLD	550	4385	63.95	1/25/83	4321.05	Qal	T	G	A	GSSE	*
*	31S	16W	17.100	BIG	LAS CIENE			100	4376	10.5	12/55	4365.5	Qal				UGC	*
*	31S	16W	17.140	BIG	HEARD	8/55		200	4404	70.42	9/22/85	4333.58	Qal				[illegible]	
	31S	16W	22.300	BIG	HEARD			185	4397	71.3	11/55	4325.7	Qal			A	UGC	*
	31S	16W	28.133	BIG	LEONARD			550	4395	45.08	1/25/83	4349.92	Qal			A	GSSE	*
*	31S	16W	28.333	BIG	U-BAR		DRLD	914	4400	45.05	1/25/83	4354.95	Qal	T		A	GSSE	*
	31S	16W	32.243	BIG	U-BAR			710	4412	46.97	3/4/82	4365.03	Qal				GSSE	*
	31S	16W	32.443	BIG	U-BAR			594	4413	34.5	1/25/83	4378	Qal			A	GSSE	*
	31S	16W	33.233	BIG	U-BAR		DRLD	404	4404	47.53	1/25/83	4356.47	Qal	T	G	A	GSSE	*
	31S	16W	33.343	BIG	U-BAR			990	4413	45.75	1/25/83	4366.71	Qal			A	GSSE	*
	31S	16W	34.400	BIG	ROBERTANN				4420	92.6	9/55	4327.4	Qal		W		UGC	*
	31S	17W	01.134	WALN	GREAT LA				4568	135.97	1/25/83	4412.03	Qal			A	GSSE	*
	31S	17W	05.233	WALN	YOUNG	1935		160	4728	125.25	12/55	4602.75	Qal	T	W	S	GWSI	
*	31S	17W	05.4[illegible]	WALN	UNKNOWN				4728	128.03	3/1/73	4599.97	Qal			S	SEOD	*
*	TWP	RG	SECTION	[illegible]	[illegible]	C DATE	[illegible]	TD	ELEV	WL DEP	WL DATE	WL ELEV	AQUIFER	[illegible]	[illegible]	USE	SOURCE	[illegible]

C	TWP	RGE	SECTION	[illegible]	WELL NAME	C DATE	TYPE	TD	GSE	WL DEP	WL DATE	WL ELE	AQUIFER	WL	ES	USE	SRCE	R
	31S	17W	11.124	WALN	GREAT L				4550	177.67	1/15/79	4372.33	Qal				GSSE	*
	31S	17W	15.232	WALN	UNKNOWN				4587	203.28	3/1/73	4383.72	Qal			S	SEOD	*
	31S	18W	03.432	WALN	CORNER			570	5400			5400	Qal		W		FO	
	31S	18W	15.114	WALN	NEW WELL			900	5600			5600	Qal		E		FO	
	31S	19W	03.223	ANIM	DOUBLE			15	5200	9	1918	5191	Qal		W		FO	*
	31S	19W	13.233	WALN	BOX CANYO			700	5600			5600	QTb		W		FO	
	31S	19W	14.222	WALN	UNKNOWN			20	5325	3	1970	5322	QTb				FO	*
	31S	19W	24.444	WALN	OK BAR			86	5500	70	1918	5430	Ts		W		FO	*
	31S	20W	03.114	ANIM	UNKNOWN			20	5050			5050	Qal		W		FO	
$	31S	20W	10.400	ANIM	VICTORIO				4900			4900	Qal				OS	*
	31S	20W	10.424	ANIM	HORSE C			156	4932			4932	Qal		W		FO	
	31S	20W	15.300	ANIM	MOREHOU				4950	28	11/13	4922	Qal				OS	*
	31S	20W	15.400	ANIM	TAYLOR			37	5000	26.5	9/17/13	4973.5	Qal				OS	*
$	31S	20W	22.100	ANIM	HOWE				4975	17	11/13	4958	Qal				OS	*
	31S	20W	22.132	ANIM	HOWE			60	4975	17	1913	4958	Qal		E		FO	
	31S	20W	22.132	ANIM	BIG HOWE			376	4975			4975	Qal		W		FO	
	31S	20W	22.132	ANIM	LITTLE HO			45	4975			4975	Qal		W		FO	
	31S	21W	25.124	ANIM	NORTH U			390	5250			5250	Qal		E		FO	
	31S	21W	25.433	ANIM	BUCK UP			15	5200	9	1918	5191	Qal		W		FO	$
	31S	21W	25.433	ANIM	BIG UP			579	5200			5200	Qal		W		FO	
	31S	21W	35.432	ANIM	LITTLE U			16	5200	10	1916	5190	Qal		W		FO	
	32S	14W	26.111	BIG	MENGUS TA			215.6	4370	211.6	12/6/55	4158.4	Qal	P		S	TH	*
*	32S	16W	03.200	BIG	NEW WELL			70	4407	61.7	11/55	4345.3	Qal		W		UGC	*
	32S	16W	04.133	BIG	U-BAR			700	4413	46.48	1/25/83	4366.02	Qal			A	GSSE	*
	32S	16W	04.343	BIG	U-BAR		DRLD	614	4424	49.17	1/25/83	4374.83	Qal	T	G	A	GSSE	$
	32S	16W	09.233	BIG	U-BAR			770	4433	62.5	1/25/83	4370	Qal			A	GSSE	*
	32S	16W	09.233	BIG	UNKNOWN				4437	62.5	1/25/83	4374.5	Qal				SEOD	$
	32S	16W	09.333	BIG	U-BAR		DRLD	780	4440	63.94	1/25/83	4376.06	Qal	T	G	A	GSSE	*
	32S	16W	09.343	BIG	U-BAR			769	4435	66.57	1/25/83	4368.43	Qal			A	GSSE	*
	32S	16W	16.113	BIG	U-BAR			915	4443	64.93	1/25/83	4378.07	Qal			A	GSSE	*
	32S	16W	16.113A	BIG	U-BAR			700	4443	67.46	1/25/83	4375.54	Qal			A	GSSE	
	32S	16W	16.143	BIG	U-BAR			815	4445	66.97	1/25/83	4378.03	Qal			A	GSSE	$
	32S	16W	16.313	BIG	U-BAR			660	4450	71.61	1/25/83	4378.4	Qal			A	GSSE	$
	32S	16W	16.333	BIG	U-BAR		DRLD	700	4456	71.23	1/25/83	4384.77	Qal	T	G	A	GSSE	*
	32S	16W	16.343	BIG	U-BAR			870	4453	67.2	1/25/83	4385.8	Qal			A	GSSE	*
	32S	16W	19.313	WALN	FREEM			251	4492	89.68	1/26/83	4392.32	Qal			A	GSSE	$
	32S	16W	19.333	WALN	FREEMAN		DRLD	192	4487	93.65	12/81	4393.35	Qal				GSSE	*
	32S	16W	20.313	BIG	U-BAR			300	4476	79.3	1/25/83	4396.7	Qal			A	GSSE	*
*	32S	16W	20.333	BIG	U-BAR		DRLD	450	4488	83.9	1/25/83	4403.6	Qal	T		A	GSSE	*
*	32S	16W	22.100	BIG	GILBERTS			80	4443	70.4	11/55	4372.6	Qal		W		UGC	*
	32S	16W	29.133	DOG	LEWIS			397	4488	90.55	1/26/83	4396.93	Qal			A	GSSE	*
	32S	16W	29.333	DOG	U-BAR		DRLD	501	4488	97.68	1/26/83	4389.82	Qal	T		A	GSSE	*
	32S	16W	30.134	ANIE	EDWARD		DRLD	170	4490	99.72	1/26/83	4390.28	Qal	T		A	GSSE	*
	32S	16W	31.333	ANIE	U-BAR			900	4520	112.4	1/26/83	4408.6	Qal			A	GSSE	*
	32S	16W	31.433	DOG	UNKNOWN				4512	116.1	1/26/83	4395.9	Qal				SEOD	
	32S	16W	31.433	ANIE	U-BAR			810	4513	115.1	1/26/83	4396.9	Qal			A	GSSE	*
	32S	16W	32.133	DOG	U-BAR			947	4513	113.17	1/26/83	4400.33	Qal			A	GSSE	*

	32S	16W	32.333	DOG	U-BAR		DRLD	1000	4515	110.22	1/26/83	4394.28	Qal	T	W	A	GSSE	*
	32S	17W	01.422	WALN	UNKNOWN				4437	55.2	3/2/73	4381.8	Qal			S	SEOD	*
	32S	17W	11.344	WALN	UNKNOWN				4537	146.8	3/2/73	4390.2	Qal			I	SEOD	*
	32S	17W	13.133	WALN	TIMBER			400	4495	103.27	1/26/73	4391.73	Qal				GSSE	*
*	32S	17W	13.543	WALN	LAND	1/13		61.5	4464	59.39	12/55	4404.61	Qal			S	AWSI	*
	32S	17W	14.133	WALN	UNKNOWN				4567	164	3/2/73	4403	Qal			S	SEOD	*
	32S	17W	23.224	WALN	UNKNOWN				4487	97.4	3/2/73	4389.6	Qal			S	SEOD	*
	32S	17W	27.200	ANTE	FRYE			134	4525			4525	Qal				UGC	*
*	32S	17W	27.222	WALN	UNKNOWN				4525	132	3/2/73	4393	Qal			S	SEOD	*
	32S	17W	36.133	ANTE	U-BAR		DRLD	515	4520	130.91	1/26/83	4389.09	Qal	T	G	A	GSSE	*
	32S	18W	18.321	WALN	UNKNOWN			240	5900			5900	Qal		W		FO	
	32S	18W	32.320	ANTE	DIVIDE			132	5400			5400	Qal		W		FO	
	32S	19W	24.223	WALN	SPUR			230	5700			5700	Qal		W		FO	
	32S	19W	24.323	WALN	UNKNOWN			130	5725			5725	Qal		W		FO	
	32S	20W	03.422	ANIM	LAST CHAN			500	5225			5225	Qal		W		FO	
	32S	20W	04.200	ANIM	BURCHAM			24	5050	23	11/13	5027	Qal				OS	*
	32S	20W	04.232	ANIM	TAYLOR			35	5050	23	1913	5027	Qal		W		FO	
	32S	20W	04.232	ANIM	TAYLOR			456	5050			5050	Qal		W		FO	
	32S	20W	16.100	ANIM	GRAY RA				5150	0	11/13	5150	Qal				OS	*
	32S	20W	16.422	ANIM	GRAY			24	5117			5117	Qal		E		FO	
*	32S	20W	16.444	ANIM	UPPER G			42	5125			5125	Qal		W		FO	
	32S	20W	17.200	ANIM	VICTORIO				5150	15	11/13	5135	Qal				OS	*
	32S	20W	22.300	ANIM	VICTORIO				5175	23	11/13	5152	Qal				OS	*
*	33S	14W	25.344	DOG	UNKNOWN				4775	350	12/93	4425	Qal				FO	
	33S	14W	31.314	DOGM	U-BAR	1956		30	4940	14.47	8/30/56	4925.53	Tv	T	W	S	GWSI	*
	33S	16W	04.200	DOG	BULL FAST			170	4572	152.5	11/55	4419.5	Gal		W		UGC	*
	33S	16W	05.222	DOG	U-BAR		DRLD	600	4543	145.87	1/26/83	4397.13	Qal	N		A	GSSE	*
	33S	16W	06.444	ANTE	U-BAR		DRLD	810	4538	145.5	1/26/83	4392	Qal	T	G	A	GSSE	*
	33S	16W	07.133	ANTE	U-BAR			520	4550	141	1/26/83	4409	Qal				GSSE	*
	33S	16W	07.144	ANTE	U-BAR			855	4550	152.36	1/26/83	4397.64	Qal			A	GSSE	*
*	33S	16W	07.244	ANTE	U-BAR	10/61		451	4560	161.04	1/9/63	4398.96	Qal	T	G	I	GWSI	
	33S	16W	07.244	ANTE	U-BAR	10/61		890	4560	161	1/9/63	4399	Qal	T	G	I	GWSI	
	33S	16W	07.244	ANTE	U-BAR		DRLD	890	4563	160.42	1/26/83	4402.02	Qal	T	G	A	GSSE	*
	33S	16W	13.100	DOG	ALAMO		DUG	20	4787	9.7	11/55	4777.3	Qal				UGC	*
	33S	16W	18.440	ANTE	LEONARD	1954		170	4580	161.2	11/55	4418.8	Qal	T	W	S	GWSI	
	33S	16W	19.100	ANTE	TEST HOLE			376	4607	176	12/55	4431	Qal			I	UGC	*
	33S	16W	20.743	DOG	U-BAR		DRLD	1045	4638	222.93	1/26/83	4415.07	Qal	N		A	GSSE	*
	33S	16W	32.310	DOG	LEONARD			265	4662	225.9	1/26/83	4436.1	Qal				GSSE	*
*	33S	16W	35.000	DOG	EAGLE MT			144	4785	101	11/55	4684	Qal		W		UGC	*
	33S	17W	01.133	ANTE	U-BAR			600	4338	145.15	1/26/83	4192.35	Qal			A	GSSE	*
	33S	17W	03.100	ANTE	LORDS			140	4562	134.1	11/55	4427.9	Qal		W		UGC	*
	33S	17W	08.100	ANTE	TIMBER				4600	148.7	12/55	4451.3	Ts		W		UGC	*
	33S	17W	12.131	ANTE	U-BAR			465	4568	162.35	1/26/83	4405.65	Qal			A	GSSE	*
	33S	17W	12.331	ANTE	U-BAR		DRLD	110	4580	168.22	1/26/83	4411.78	Qal	N		A	GSSE	*
	33S	17W	13.300	ANTE	TEST HOLE			998	4602	162.5	12/55	4438.5	Qal			T	UGC	*
*	33S	17W	22.300	ANTE	HIGH LON			375	4659		11/55	4659	Ts		W		UGC	
	33S	18W	05.312	ANTE	INDIAN			156	5350			5350	Qal		W		FO	
	TWP	RGE	SECTION	QUAD	WELL NAME	C DATE	TYPE	[illegible]	ELEV	WL DEPTH	WL DATE	WL ELEV	AQUIFER	[illegible]	[illegible]	USE	[illegible]	[illegible]

	33S	18W	08.243	ANTE	SPILLS			288	5175	49.6	1936	5125.4	Qal		W		FO	*
	33S	18W	17.444	ANTE	ROCK			60	5100			5100	Qal		W		FO	
	33S	18W	18.142	ANTE	LYNCH			210	5251			5251	Qal		W		FO	
	33S	18W	22.333	ANTE	JOYCE			331	5112	213	1956	4899	Qal		W		FO	*
	33S	18W	31.211	ANTE	AIKEN			170	5200			5200	Qal		W		FO	
	33S	19W	17.400	CIEN	JUNIPER				5300	0	11/13	5300	Qal				OS	*
	33S	19W	19.143	CIEN	JUNIPER			519	5188			5187.5	Qal		W		FO	
	33S	19W	25.224	ANTE	LITTLE L			720	5300			5300	Qal		W		FO	
	33S	19W	32.313	CIEN	PASS			626	5163			5162.5	Qal		W		FO	
	33S	20W	02.233	CIEN	FLAT			395	5188			5187.5	Qal		W		FO	
	33S	20W	22.323	CIEN	LITTLE F			15	5153	4	1913	5149	Qal		W		FO	
*	33S	20W	27.300	CIEN	FITZPAT				5153	4	11/13	5149	Qal				OS	*
	33S	20W	30.100	CIEN	UNKNOWN				5237	13	11/13	5224	Qal				OS	*
	33S	20W	32.100	CIEN	UNKNOWN				5200	10	11/13	5190	Qal				OS	*
	33S	20W	33.100	CIEN	CARRIER				5188			5187.5	Qal				OS	
	33S	20W	34.100	CIEN	WOLF				5150	4	11/13	5146	Qal				OS	*
	33S	20W	34.131	CIEN	WOLF			15	5150	4	1913	5146	Qal		W		FO	*
	33S	20W	34.322	CIEN	FITZPATRI			546	5150	540	1970	4610	Qal		W		FO	
	33S	21W	23.400	CIEN	VICTORIO				5300	0	11/13	5300	Tv				OS	*
*	34S	15W	13.312	DOG	UNKNOWN				4867		12/83	4867	Qal				FO	
*	34S	16W	18.100	ANTE	ANTELOPE			211	4662	201.3	11/55	4460.7	Qal		W		UGC	*
	34S	17W	04.110	ANTE	DIAMOND	1927		50	4752	21.3	12/55	4730.7	Qal?	T	W	S	GWSI	*
	34S	17W	05.240	ANTE	LAND	1953		83	4788	16.07	12/55	4771.93	Qal?	T	W	S	GWSI	
	34S	17W	05.240	ANTE	VICTORIO			83	4775	17.62	1/26/83	4757	Qal?			S	GSSE	*
	34S	17W	12.200	ANTE	TEST HOLE			245	4645	186.8	12/55	4458.2	Qal			T	UGC	*
	34S	17W	14.300	ANTE	ANTELOPE			285	4696	226.8	11/55	4469.2	Qal		W		UGC	*
	34S	17W	24.100	ANTE	DIP TANK				4660	183.3	11/55	4476.7	Qal		W		UGC	*
	34S	17W	24.113	ANTE	U-BAR		DRLD	211	4670	189.63	1/26/83	4480.37	Qal				GSSE	*
	34S	18W	01.111	ANTE	CULBERSON			180	4885			4632	Qal		W		FO	
	34S	18W	01.111	ANTE	CULBER			240	4888	225		4663	Qal		E		FO	*
	34S	18W	01.111	ANTE	CULBER			240	4889	225	1917	4663	Qal		W		FO	
	34S	19W	13.331	ANTE	MCKINN			600	5100			5100	Qal				FO	
	34S	19W	19.144	CIEN	LANB			24	5150			5150	Qal				FO	
*	34S	19W	19.200	CIEN	VICTORIO				5150	0	12/2/13	5150	Qal				OS	*
	34S	19W	19.224	CIEN	LITTLE LA			12	5189			5187.5	Qal		W		FO	
	34S	20W	04.100	CIEN	UNKNOWN				5150			5150	Qal				OS	*
	34S	20W	05.300	CIEN	AWTREY				5187	0	11/13	5187	Qal				OS	*
	34S	20W	06.200	CIEN	UNKNOWN				5212	0	11/13	5212	Qal				OS	*
	34S	20W	07.400	CIEN	UNKNOWN				5200	0	11/13	5200	Qal				OS	*
	34S	20W	15.142	CIEN	GARCIA			600	5150			5150	Qal				FO	
	34S	20W	22.111	CIEN	LITTLE G			20	5175	4		5171	Qal		W		FO	
	34S	20W	22.300	CIEN	GARCIA				5173	0	12/2/13	5173	Qal				OS	*
	34S	20W	23.300	CIEN	BRAMLETT				5150	0	12/2/13	5150	Qal				OS	*
	34S	20W	24.233	CIEN	LINE			400	5150			5150	Qal		W		FO	
	34S	20W	24.400	CIEN	GAYALANDO				5150	0	12/2/13	5150	Qal				OS	*
	34S	21W	01.200	CIEN	TURPIN				5230	13	11/13	5217	Qal				OS	*
	34S	24W	12.200	CIEN	CLARK				5223	11	11/13	5214	Tv				OS	*

Qal=ALLUVIUM
QTg=GILA CONGLOMERATE
QTb=BASALT FOLWS
Ts=TERTIARY SEDIMENTARY ROCKS
Tv=TERTIARY VOLCANIC ROCKS
Ti=TERTIARY INTRUSIVE ROCKS
TKi=TERTIARY/CRETACEOUS INTRUSIVE ROCKS

Table II

[illegible] COUNTY
CHEMICAL ANALYSIS

W	TWP	RGE	SECTION	DATE	CA	MG	NA K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	C	SRCE	F
W	198	20W	16.222		24	1[illegible]	1[illegible].2	300		18	16	[illegible]		23		340	8.14	Y	USGS	*
W	208	18W	29.132		29	1	22.8	109		20	9.5	0.3				220	8.14	Y	USGS	*
W	208	19W	15.312		11	1.3	103.2	238		58	18	2.7		21		530	7.92	Y	USGS	
W	208	20W	30.142		5.9	0.6	92	139		53	33	2.3		26		480	8.69	Y	USGS	*
W	218	20W	03.411		213.6	30.2	320.7					0		21.9		1300	6.9	Y	NURE	*
W	218	20W	17.324		30	4.9	172.6	106		170	160	1.4		26		1000	8.1	Y	FO	*
W	218	20W	34.323		76	17	304	64		650	190	0.5		22		1600	7.7	Y	FO	
W	218	20W	34.400		100	19		64		655	116	0			1413			Y	S	*
W	218	21W	35.243		6.9	0.44	321.5	205		300	130	9.1		20		1570	6.6	Y	FO	
W	218	21W	25.300		7.2	7.4	420	570		280	100	0			1340	1889		Y	USGS	*
W	218	21W	30.444		31	10	42.4	200		12	1[illegible]	0.3		30		460	7.9	Y	FO	*
	228	18W	09.444	8/19/81	17	2.7	54.8	140		26	14	0	1.4	25.3	225	361	8	Y	USGS	
	228	19W	05.312	8/16/81	4.5	0.55	68.8	71	20	28	16	0	0.8	24	113	342	8.2	Y	USGS	
W	228	19W	12.221		43.4	4.1	37.2					0		23		250	6	Y	NURE	*
	228	19W	29.334		17	3	85.4					0		8		350	6.5	Y		
W	228	20W	06.332		20	11	594.1	216		1077	36	0			1537	2800	7.2	Y	FO	*
W	228	20W	13.411	8/17/81	35	11	6323	490		800	340	0	0.1	24	2030	3500	7.8	Y	USGS	*
W	228	20W	18.423		50.5	29.2	2797.4					0		9		2700	6.8	Y	NURE	*
W	228	20W	23.142	8/17/81	41	17	442.9	276		720	300	0	0.3	24	1400	2410	7.8	Y	USGS	
W	228	20W	26.433		2.6	2.3	491.2	764		240	69	22		26		2300	8.9	Y	FO	*
W	228	21W	13.234		46	14	532.9	164		720	370	3.3		28		3020	7.9	Y	FO	*
W	238	17W	08.431		3	0.7	140.5					0		35		600	7.4	Y	NURE	*
W	238	17W	23.211		20.8	5.1	147.6					0		8		380	5	Y	NURE	*
	238	18W	13.431		7.6	1.4	149.1	234		53.7	27.6	3.7		25.3	564		8.09	Y	L	
W	238	19W	27.342		23.8	19.6	332					0				1200	6.6	Y	NURE	*
W	238	21W	13.441		1.3	0.6	3504.8	3980		2600	1000	90		23.5		****	9.3	Y	FO	*
W	238	21W	34.122		29.8	36.3	188					0		4		500	7.1	Y	NURE	
W	238	21W	35.444		3.4	0.3	300.5	518		140	17	13		17		1200	8.8	Y	USGS	*
	248	16W	08.342		28	2.3	247.8	315		270	40.5	4.5		13	81[illegible]		7.86	Y	L	
W	248	17W	11.233		111.3	20.6	68.7					0		7		800	7.1	Y	NURE	
W	248	17W	25.100		104	28		261		253	125	0			861			Y	S	*
W	248	17W	35.232		117.4	18.7	108.9	218		182	117	0			740		7.48	Y	L	*
W	248	17W	35.232		52.1	8	83	215	3.4	116	30.3	0	10		413	610	8.3	N	FO	*
W	248	17W	35.232		40.9	10	102.3	205	2.6	119	40.2	0	3.3		424	670	8.3	N	FO	*
W	248	19W	[illegible]		68	1[illegible].1	572.[illegible]	255		[illegible]	13[illegible]	1.[illegible]		28	1[illegible]		8.[illegible]	[illegible]	H	
W	248	19W	[illegible]		20.1	2.8	1[illegible]2.2	21[illegible]		75	24.[illegible]	0		14	366	630	8.2	[illegible]	H	[illegible]
W	248	19W	20.421		52.7	5.[illegible]	373.[illegible]					0		1[illegible]		600	7.3	Y	NURE	*
W	248	20W	01.422		64	17	567.[illegible]	157		451	2[illegible]4	0			1152	1650	7.9	Y	H	*
W	248	20W	01.422		370	94	639.8	76		3500	470	2.3		1[illegible]		4100	7.[illegible]	[illegible]	USGS	[illegible]
W	248	20W	01.422		120	29		100		610	240	2.3		14	1450	2150	7.4	Y	USGS	[illegible]
W	24[illegible]	20W	01.444					170			[illegible]	0		16		1[illegible]60	7.8	Y	USGS	[illegible]
W	24[illegible]	20W	[illegible]		[illegible]	4.4	[illegible]	2[illegible]		86	74	0			[illegible]	550		[illegible]	USGS	*
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

W	TWP	RGE	SECTION	DATE	CA	MG	NA K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	D	SRCE	F
W	248	20W	04.213		4.6	0.5	280.3					0		30.8		725	7.1	Y	NURE	$
	248	20W	11.341		38.3	[illegible]	103.6	298		259	14.7	3.9		[illegible]	[illegible]		7.9	Y	L	
W	248	20W	12.242		12	1.95	517	168		127	12	0		[illegible]	[illegible]	487	8.3	Y	H	
W	248	20W	17.122		35.7	25.3	367.4					0		[illegible]		130	7.6	Y	NURE	
W	248	20W	19.211		4.9	11	110	320		110	14	4.3		20	503	735	7.7	Y	USGS	$
W	248	20W	25.444		36.5	1.8	339.4	276		769	79.1	4.4			1348		7.92	Y	L	$
W	248	20W	26.211		22.3	2.9	50.6					0		17		420	7.4	Y	NURE	*
W	248	20W	33.444		39	3.6	20.3	163		94	14	0.7		19		600	7.4	Y	USGS	%
W	248	20W	34.444		38.3	5.3	102.3					0		9		500	7.4	Y	NURE	*
W	248	20W	34.414		40	3.7	67.6	153		96	16	0		18	381	430	6.90	Y	H	$
W	248	21W	12.222		13.2	3.8	349.6					0		16		900	7.9	Y	NURE	$
	258	15W	24.243		10	5	95.4	231		45	11	1.7				530	8.49	Y	USGS	
	258	17W	11.342	12/17/83	125	59.5	103.4	117		138	238	0	230			1400	8.2	N	FO	
W	258	17W	27.114		130	52	73.7	399		10	130	0.3				1420	7.34	Y		$
W	258	17W	27.114A	2/13/84	115.4	41	68.1	304		67.2	107	0	173		719	1110	8.1	N	FO	$
	258	17W	22.114B	2/13/84	91	29	56.7	315	10	27	56.2	0	100		525	810	8.7	N	FO	$
W	258	19W	07.133		61	6.6	376	210		540	150	6.4		33.5	1300	1960	8	Y	USGS	
W	258	19W	07.143		67.3	5.3	575.7	119		893	111	7.3		71	1608		7.84	Y	L	
W	258	19W	07.234		21.6	0.4	417.2					0		50		1800	7.7	Y	NURE	*
W	258	19W	07.234		67.3	5.3	425.8	119		893	111	13		71	1608		7.84	Y	L	$
W	258	19W	07.234		57	0.125	462	122		768	106	0		65	1452	2030	8.5	Y	H	$
	258	19W	07.241		23.3	0.8	339.7	104		450	27.6	17		21	1039		8.16	Y	L	
W	258	19W	07.424		34	6.05	103.6	168		175	12	0		24	418	499	7.6	Y	H	$
	258	19W	09.244		28	7.3	70.6	183		79.5	20.5	1.4		23	394		8.2	Y	L	
W	258	19W	10.311		29	11	60	187		56	19	3.6	8.8		308	481	7.3	Y		%
W	258	19W	11.112		31	23.5	77.9	162		197	42.5	0			675		8.35	Y	H	%
W	258	19W	24.314		120	32	73.1	327		120	61	0.7		18.5		1200	5.96	Y	USGS	%
W	258	20W	01.242		79.9	8.3	167.4	229		493	124	2.9		24	1372		7.94	Y	L	
W	258	20W	08.111		27	5.4	81.4	134		140	6.9	3				690	7.6	Y	USGS	*
W	258	20W	08.111		42	8	80.4	153		159	8	0		21.5	375	600	7.9	Y	H	$
W	258	20W	10.222		38.1	5.7	52.3	183		366	8.7	3.6		23	604		8.35	Y	L	$
	258	20W	11.111		22	2.1	[illegible]	148		51.6	2.1	0.9		18	384		8.44	Y	L	
W	258	20W	13.213		180	34	210	170		510	240	2.9		17	1340	2050	7.1	Y	USGS	$
W	258	20W	13.213		140	29	214.9	190		720	138	3.6		20.5	1330	1790	8	Y	USGS	%
W	258	20W	13.214		230	43	367	183		917	266	0		20	1984	2600	6.75	Y	H	
	258	20W	13.223		122	25.2	166.8	172		352	144	2.5		19	1164		7.82	Y	L	
	258	20W	13.241		159.3	34.9	240.7	207		956	182	3.6		21	1660		5.05	Y	L	
W	258	20W	13.444		45	7.4		200		140	63	3.3		13.5	350	546	7.8	Y	USGS	
W	258	20W	15.411		23.1	11.2	251.3					0		9		800	7.5	Y	NURE	$
	258	20W	15.413		22.8	2.7	57.4	141		21.6	3.5	1.1			272		7.52	Y	L	
W	258	20W	15.444		71	4	65.8	137		116	6	0			392	360	7.9	Y	H	
	258	20W	20.124		39.4	6.3	78	157		85.5	9.6	2.8		17	404		8.27	Y	L	
W	258	20W	22.313		34	2.9	61	170		64	7	0		19	255	434	[illegible]	Y	USGS	$
W	258	20W	[illegible]		73	7.1	91.5	134		150	[illegible]	[illegible]				1200	[illegible]	Y	USGS	
	258	20W	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	1023		[illegible]	Y	L	
	[illegible]	20W	[illegible]		[illegible]	[illegible]	[illegible]	130		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	Y	USGS	$

W	TWP	RGE	SECTION	DATE	CA	MG	NA K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	U	SRCE	P
W	258	20W	24.313		83.4	7.8	101.5	165		194	89	0		19.6	597	950	7.7	Y	H	*
	258	20W	25.224		66.5	5.7	158.6	[illegible]		167	66.1	2.5		20	629		7.82	Y	L	
W	258	20W	25.244		75	12.6	157.9	201		404	40.5	2.4		24	899		8.05	Y	L	*
W	258	20W	25.334		30	4.4	100	210		110	12	2.6				661		Y	USGS	*
W	258	20W	25.444		34	3.4	120	230		130	18	2.8		24	435	688	8.1	Y	USGS	*
W	258	20W	25.444		33	3.8	115	230		130	18	3		24	448	687	7.8	Y	USGS	*
W	258	20W	25.444					210			74	0		22		1020	7.6	Y	USGS	*
	258	20W	26.224		23.4	2.3	96.1	172		76.4	20.9	2.2		19	396		8.21	Y	L	
W	258	20W	26.344		47.2	3.6	163.9					0		22		650	7.8	Y	NURE	*
W	258	20W	33.474		43.2	4.1	99.3	192		305	21.0	2.3		23	632		8.02	Y	L	*
	258	20W	34.312		76.1	7.2	95.2	186		125	64.2	0.7		20	628		7.41	Y	L	
W	258	20W	34.333		152	9.6	123.2	153		337	72	0			773	1010	8.3	Y	H	*
W	258	20W	34.444		19.8	4.7	101.3	81.1		107	59.2	0.8		18	394		7.65	Y	L	*
	258	20W	35.213		31.3	3.2	70.3	157		38.8	27.3	1.7		21	332		8.43	Y	L	
	258	20W	35.333		30.7	5.7	136.2	267		113	29.4	4.0		22	524		8.17	Y	L	
	268	17W	10.111		11.3	0.99	134.5	276	9	91.6	29.2	1.0	2.5		440	670	8.7	N	FO	
	268	17W	10.111		10.2	1.8	160.8	301		104	33	2.7			593		7.94	Y	L	
	268	17W	28.400	10/06/13	439	66	1579	393		4072	167	0			6913			Y	D	
W	268	17W	32.421		4.2	0.2	163.7	283		61	32	0.9			415	620	8.8	Y	FO	*
	268	18W	34.432	9/19/81	24	5.4	69.3	190		30	21	0	3.8	24	295	449	8	Y	USGS	
	268	20W	02.423		18.2	2.5	51.6	139		38.4	6.5	0.6		24	240		7.93	Y	L	
	268	20W	03.333		49.3	4.4	114	193		317	38.6	1.2		23	600		7.9	Y	L	
	268	20W	05.242		34.5	3	80.6	166		74.8	8.5	2.5		21	384		7.73	Y	L	
W	268	20W	08.434		34	4.9	65	190		75	7	0		19	293	480		Y	USGS	*
	268	20W	09.334		29.8	8.5	115.7	157		117	32.9	0.8		18	524		7.92	Y	L	
	268	20W	09.412		30.7	3	92.6	174		66.9	19.8	1.6		20	384		8.34	Y	L	
W	268	20W	14.200		29	4.7	34	152		25	12	0			544	779		Y	USGS	*
	268	20W	15.121		35	1.6	107.3	168		84.1	27.3	3.0		22	420		8.26	Y	L	
	268	20W	17.122		81.8	9.1	114.9	202		199	38.3	2.9		19	688		7.68	Y	L	
W	268	20W	17.133		26	1.8	72.6	176		58.8	1.8	3.5		20	340		7.75	Y	L	
	268	20W	17.133		26	1.8	72.6	176		58.8	1.8	3.5			340		7.75	Y	L	
W	268	20W	24.333		24	4.25	52.4	151		57	14	0			287	340	6.92	Y	H	
W	268	20W	26.422		66.6	10.7	99.8					0		11		400	7.3	Y	NURE	*
W	268	20W	26.[illegible]		26.2	1.6	88.9					0		20		430	7.9	Y	NURE	*
W	268	20W	35.111		21	1.18	74.7	137		101	6	0		16	273	370	8.4	Y	H	*
W	268	21W	12.114		43	6.1	85.1	202		130	6.1	3.4				800	7.4	Y	USGS	*
	278	14W	05.334	6/07/56				300		275	43	1.5				1880	7.4	Y	D	
	278	14W	08.100	10/04/13	150	37	96	232		392	43	0			950			Y	D	
W	278	17W	07.422		21	1.4	187	265		116	79	4		22.2	594	980	7.4	Y	D	
	278	17W	08.1[illegible]		3.[illegible]	0.2	261.3	[illegible]	7.7	176	104	0	2.5		740	1110	8.5	N	FO	
W	278	17W	08.300	10/04/13	22	9.1	106	272		72	17	0			421			Y	D	
	275	17W	08.531		10.8	6.2	133.7	272	7.7	51.6	27	0	4.[illegible]		362	550	8.8	N	FO	
	278	17W	21.300	10/03/13	80	21	74	275		70	33	0			430			Y	D	
W	278	17W	26.240					235		125	40	1.4				799	7.6	Y	D	
W	278	17W	30.234		15.[illegible]	2.3	235.8	[illegible]		135	56.[illegible]	[illegible]			756		7.82	Y	L	*
W	[illegible]	17W	[illegible]		35	3.7	[illegible]	[illegible]		30	15	[illegible]		20		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

W	TWP	RGE	SECTION	DATE	CA	MG	NA+K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	Q	SRCE	P
W	27S	18W	12.220		9.2	0.7	124.9	260		41	10	4.3		26		600	5.2	Y	FO	$
	27S	18W	13.200	10/06/13	70	8.6	130	281		77	40	0			478			Y	D	
W	27S	19W	11.344		35	11	110.7					0		15		450	7.1	Y	NURE	$
W	27S	19W	19.121		32	5	63.2	97		55	43	0		12	287	500	7.6	Y	FO	$
	27S	19W	19.121	12/14/83	32	5	63.2	97		55	43		40		287	500	7.6	N	FO	
W	27S	19W	19.433		24	5.9	57	170		55	6	0.8		21	277	388	7.8	Y	USGS	$
	27S	19W	20.122		22	7.3	27.6	147		19.2	3.5	0.3			205		7.92	Y	L	
W	27S	19W	20.343		27.7	7.2	51.9					0		8.7		280	6.5	Y	NURE	$
	27S	19W	23.114	9/09/81	20	7.8	89.9	260		44	14	0	0.2	20	319	524	7.9	Y	USGS	
	27S	19W	27.212	12/16/83	17	12	60	150		30	11	0	4		239	270	7.6	N	FO	
W	27S	20W	09.100		36	3.7	64	170		84	12	0			370	536		Y	USGS	$
W	27S	20W	12.444		30	5.1	45	160		45	8.3	0.4		21	286	367	8	Y	USGS	$
W	27S	20W	12.444					180			7.5	0				413	7.7	Y	USGS	$
W	27S	20W	12.444		28	3.9	50	173		40	7	0			216	276		Y	R	$
W	27S	20W	13.300		28	3.5	72	190		65	7	1.6		20	276	464		Y	USGS	
W	27S	20W	21.222		31	8.8	66	180		22	7	4			331	478	7.5	Y	USGS	$
	27S	20W	27.422	12/17/83	31	3	63.4	135		77	22	0	4.1		268	500	7.3	N	FO	
	27S	20W	30.242	12/14/83	20	3	193.4	468		70	18	0	0.2		539	850	7.8	N	FO	
W	27S	21W	30.413		49.6	6.4	34.3					0		9		210	5.9	Y	NURE	$
	28S	17W	05.400	10/01/13	30	13	61	221		59	12	0			370			Y	D	
	28S	17W	33.244	6/07/36	5.3	2.1	80	126		35	6	1.8	1.5	83	268	391	8.2	Y	D	
	28S	17W	8.122A		8	0.45	107.2	215	2.6	45.5	19.0	0	3.2		296	448	8.5	N	FO	
	28S	17W	8.122B		9.6	0.91	191	409		26.3	49.7	0	3.8		422	780	7.8	N	FO	
	28S	17W	8.122B		3.4	0.2	111.7	226	2.6	41	17	0	1.1		392	420	8.4	N	FO	
	28S	19W	06.441		16.4	0.6	66.5	178		32.7	4.7	2.3			320		8.15	Y	L	
W	28S	19W	20.244		28	2.2	76	180		77	5	2		25.5	287	439		Y	USGS	$
W	28S	19W	20.244		13.9	0.8	35.6					0		10		235	6.5	Y	NURE	$
W	28S	20W	02.221		22.7	2.3	89.4					0		8		420	6.8	Y	NURE	$
W	28S	20W	12.212		28.4	2.8	83.9					0		7		370	6.8	Y	NURE	$
	28S	20W	34.122		26	2.2	22.3	110		4.3	2.8	1.3		21.2	184		7.57	Y	L	
W	28S	21W	05.413		109.8	8.2	204.6					0		21		330	6	Y	NURE	$
	29S	15W	10.440	12/16/83	60	22	74	194		118	40	0	30		484	650	8.1	N	FO	
W	29S	15W	20.112		9.2	5.2	234.5					0		20.5		540	8.2	Y	NURE	$
W	29S	16W	32.300		18	4.3	26	108		12	29	0			357			Y	D	$
W	29S	17W	07.313		19	3.6	62	180		33	15	1		23.3	266	403	7.6	Y	D	$
	29S	17W	13.300	12/17/13	20	7.1	59	193		32	13	0			308			Y	D	
	29S	17W	15.311	12/13/83	47	6	76.6	182		81	50	0	12		367	600	7.5	N	FO	
	29S	17W	36.400	7/30/13	[illegible]	13	40	152		34	12	0			[illegible]			Y	D	
W	29S	19W	04.443		40.7	4.9	17.2	155		4.3	2.5	0.2		21.4	208		7.82	Y	L	$
	29S	19W	31.121		31.3	0.7	14.4	95.2		1.3	0.1	0.2			156		8.06	Y	L	
	30S	14W	24.141	12/16/83	29	11	116.5	220		131	20	0	10		433	750	8.4	N	FO	
	30S	14W	33.311	12/15/83	30	17	116.5	243		57	26	0	7.4		434	700	6.4	N	FO	
	30S	15W	[illegible]	12/13/83	49	11	109.7	170		156	41	0	5.6		498	750	7.9	N	FO	
W	30S	16W	[illegible]		21	4.1	55	[illegible]		[illegible]	12	0			[illegible]			Y	D	$
W	30S	16W	[illegible]		[illegible]	[illegible]	121	315		127	53	2.3			547	900	8.5	Y	FO	$
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	0			[illegible]			[illegible]	[illegible]	

W	TWP	RGE	SECTION	DATE	CA	MG	NA K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	D	SRCE	F
	30S	16W	14.233	9/21/53	20	3.4	114	262		49	12	3.6	3.2		405	588		Y	D	
	30S	16W	21.4[illegible]	9/21/53	[illegible]	[illegible]	[illegible]	197		15	8	4.4	1.[illegible]		299	41[illegible]		Y	D	
	30S	17W	21.455	6/29/56				183			15	0		64		343		Y	D	
W	30S	16W	28.344					204			16	0		19.4		474	7.5	Y	USGS	*
W	30S	16W	28.334		26	3.6	80	190			16	3.9		20		486	8.5	Y	USGS	*
	30S	16W	30.200	6/29/56				126			6.5	0		45		279	7.9	Y	D	
W	30S	16W	34.243		71.1	4.8	294.6	0				0		15		523	6.8	Y	NURE	*
W	30S	17W	15.131					164		37	7	2.4		26.1		355	7.6	Y		*
W	30S	20W	23.142		21	3.2	10.7	65.9		33.6	0.7	0.1		18.7	176		7.35	Y	L	
	31S	14W	22.232	12/16/83	46	6	220.9	[illegible]		166	69	0	7.2		730	1000	8.6	N	FO	
	31S	14W	13.212	12/16/83	46	17	60.7	223		83	16	0	5.1		339	600	8.1	N	FO	
	31S	14W	35.241	12/16/83	37	18	72.5	252		92	16	0	3.3		365	500	8	N	FO	
W	31S	16W	17.100	12/11/53	13	7.1	44	133		29	12	0			243			Y	D	*
W	31S	16W	17.140					142		28	7	7.4				317		Y	D	
W	31S	16W	28.333					123			12	0		25		435	9.2	Y	D	*
W	31S	17W	05.411		27.6	8.3	147.6					0		14		550	6.4	Y	NURE	*
	31S	20W	08.311		29.4	1.7	13.8	117		5.7	0.1	0.2			164		7.94	Y	L	
W	31S	20W	10.400		16	2.6	10	490		16	12	0			136	209		Y	USGS	*
W	31S	20W	22.100		12	4.6	6	41		20	5.8	0			138	212		Y	USGS	*
	31S	20W	33.224		27.6	3.2	15.4	134		13.4	1	0.4			212		8.11	Y	L	
	32S	14W	26.111	12/16/83	30	18	54.3	220		33	18	0	10		276	380	8	N	FO	
	32S	15W	15.140	1/28/52			89	283		64	25	1.5		65		623		Y	D	
	32S	15W	22.244	12/15/83	21	12	144.3	357		80	29	0	4.1		469	750	7.6	N	FO	
	32S	16W	03.200	12/10/53	24	20	37	153		41	16	0			142			Y	D	
W	32S	16W	03.214	12/15/83	32	11	57.9	225		43	13	0	2.8		272	410	7.3	N	FO	*
W	32S	16W	20.333		41.3	3.3	176.2					0		11		220	7.3	Y	NURE	*
W	32S	16W	22.100		41	16	40	276		35	26	0			340			Y	NURE	*
	32S	16W	30.200	11/23/53	41	6.4	19	129		28	21	0.6	5.9		323	345		Y	D	
W	32S	17W	13.243		31	8.6	28	160		20	15	0			260			Y	D	*
W	32S	17W	27.222		29.8	3.2	14.5					0		16		190	7.1	Y	NURE	*
W	32S	20W	16.444		22.9	5.2	19.5					0		9		160	6.2	Y	NURE	
W	33S	14W	25.344		28	8	39.5	133		30	16	0		[illegible]	[illegible]	400	8.3	Y	FO	
W	33S	14W	23.344	12/16/83	26	8	[illegible]	[illegible]		30	16	0	5.8		[illegible]	400	8.3	N	FO	
W	33S	16W	07.244		26	2.4	22	180		35	6.5	2.1		12	[illegible]	398		Y	USGS	
W	33S	16W	35.433		69.7	30.1	135					0				700	7.3	Y	NURE	*
W	33S	17W	22.342		40.1	2.7	12.8					0		22		240	7.1	Y	NURE	
	33S	17W	33.400	12/06/53	26	5.1	5.5	101		4.1	7.2	0			144			Y	D	
	33S	20W	02.232		[illegible]	0.5	30.1	106		16.3	4.2	0.1			100		8.3	Y	L	
W	33S	20W	27.000		12	5	12	41		22	5	0			138	240		Y	USGS	*
	33S	20W	31.341		12.8	2.7	17.2	27.8		22.8	6.7	0.2		10	[illegible]		6.20	Y	L	
	34S	14W	09.344	12/17/83	8	1.3	136	214		106	24	0	0.7		398	700	9.5	N	FO	
	34S	14W	13.224	12/16/83	25	11	70.7	203		26	22	0	18		267	530	8.9	N	FO	
W	34S	[illegible]	13.312		38	6	35.8	187		5	11	0		13	188	310	7	Y	FO	
W	34S	15W	13.311	12/16/83	38	6	37.8	157		6	15	0	4.3		188	310	7	N	FO	
W	34S	16W	13.1[illegible]		35	4	33.[illegible]					0		12		[illegible]	[illegible]	Y	NURE	*
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]				[illegible]	

W	TWP	RGE	SECTION	DATE	CA	MG	NA K	HCO3	CO3	SO4	CL	F	NO3	TMP	TDS	SC	PH	O	SRCE	P
W	44S	19W	15 [illegible]		6.8	3		21		12	5.8	0			155			[illegible]	S	X
	34S	10W	[illegible] 12		8.2	1.7	17 [illegible]	[illegible]		[illegible]	1 [illegible]	0.1		17	1[illegible]		7	[illegible]	L	

EXPLANATION

W (WELL RECORD?): (W) INDICATES WELL RECORD AVAILABLE; SEE TABLE
TWP (TOWNSHIP)
RGE (RANGE)
SECTION-SECTION AND STATE ENGINEER'S SUBSECTION DESIGNATION
DATE: DATE SAMPLE COLLECTED
CA: CALCIUM (MG/L)
MG: MAGNESIUM (MG/L)
NA K: SODIUM PLUS POTASSIUM (MG/L)
HCO3: BICARBONATE (MG/L)
CO3: CARBONATE (MG/L)
SO4: SULFATE (MG/L)
CL: CHLORIDE (MG/L)
F: FLUORIDE (MG/L)
NO3: NITRATE (MG/L)
TMP (TEMPERATURE), DEGREES C
TDS (TOTAL DISSOLVED SOLIDS), MG/L
SC (SPECIFIC CONDUCTANCE), MICROMHOS/CM
PH (HYDROGEN ION ACTIVITY OF THE WATER)
O (OTHER CONSTITUENTS GIVEN IN SOURCE?): Y=YES N=NO
SRCE (SOURCE OF INFORMATION): D=DOTY (1960)
FO=FIELD OBSERVATION
H=HANKINS (1981)
L=LOOPOON (1981)
NURE=NATIONAL URANIUM RESOURCE EVALUATION DATA
S=SCHWENNSEN (1918)
USGS=U.S. GEOLOGICAL SURVEY CHEMICAL DATA
P (PLOTTED?): X INDICATES PLOTTED ON PLATE

C (* INDICATES CHEMICAL ANALYSIS AVAILABLE)
TWP (TOWNSHIP)
RGE (RANGE)
SECTION (SECTION AND STATE ENGINEER'S SUBSECTION DESIGNATION)
QUAD (TOPOGRAPHIC QUADRANGLE): ABBREVIATIONS LISTED SEPARATELY BELOW
WELL NAME: BASED ON OWNER OR TENANT
C.DATE (CONSTRUCTION DATE): YEAR CONSTRUCTED; A=AFTER B=BEFORE
TYPE (TYPE OF WELL): DUG=DUG WELL DRLD=DRILLED WELL
TD (TOTAL DEPTH): WELL DEPTH FROM SURFACE (FT)
GSE (GROUND SURFACE ELEVATION): ELEVATION OF LAND SURFACE AT WELL (FT)
WL.DEP (WATER LEVEL DEPTH): DEPTH BELOW LAND SURFACE (FT); M=MEASURED R=REPORTED
WL.DATE (WATER LEVEL DATE): DATE VALUE MEASURED OR REPORTED
WL.ELE (WATER LEVEL ELEVATION), GSE MINUS WL.DEP (FT)
AQUIFER: UNIT BELIEVED PRODUCING WATER IN WELL; ABBREVIATIONS LISTED SEPARATELY BELOW
ML (METHOD OF LIFT): C=CENTRIFUGAL PUMP
J=JET PUMP
N=NONE
P=PLUNGER OR CYLINDER PUMP
S=SUBMERSIBLE PUMP
T=TURBINE PUMP
PS (POWER SOURCE): B=BUTANE
D=DIESEL
E=ELECTRIC
G=GAS
L=
N=NOT USED
W=WIND
USE (USE OF WELL): A=AGRICULTURAL IRRIGATION
D=DOMESTIC
H=
I=INDUSTRY
H&M=
N=NOT USED
O=OBSERVATION
P=PUBLIC
S=STOCK
T=TEST
SRCE (SOURCE OF INFORMATION): FO=FIELD OBSERVATIONS
GSSE=U.S. GEOLOGICAL SURVEY/ STATE ENGINEER ANNUAL OBSERVATION WELL DATA
GWSI=U.S. GEOLOGICAL SURVEY COUNTY DATA BASE
OS=O'BRIEN AND STONE (1981 OR 1983)
PD=PHELPS DODGE MINING CORPORATION
SEOD=STATE ENGINEER OFFICE FILES, DEMING
TH=TRAUGER AND HERRICK (1962)
UGC=UNITED GEOPHYSICAL CORPORATION
P: * INDICATES PLOTTED ON PLATE

Plate 1

STABLE BASE
7-13-87 CAS

32 52 30
109 07 30

32 52 30
109 07 30

Plate 2

scale 1 to 168,960
(1 in = 2 mi)

Plate 3

Plate 4

Hidalgo Co
(stone)