TEXAS
WATER
DEVELOPMENT
BOARD

REPORT 50

GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

JUNE 1967

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By

Victor M. Shamburger, Jr.

Prepared by the Texas Water Development Board
in cooperation with
Mitchell and Nolan Counties

June 1967

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FOREWORD

On September 1, 1965 the Texas Water Commission (formerly, before February 1962, the State Board of Water Engineers) experienced a far-reaching realignment of functions and personnel, directed toward the increased emphasis needed for planning and developing Texas' water resources and for administering water rights.

Realigned and concentrated in the Texas Water Development Board were the investigative, planning, development, research, financing, and supporting functions, including the reports review and publication functions. The name Texas Water Commission was changed to Texas Water Rights Commission, and responsibility for functions relating to water-rights administration was vested therein.

For the reader's convenience, references in this report have been altered, where necessary, to reflect the current (post September 1, 1965) assignment of responsibility for the function mentioned. In other words credit for a function performed by the Texas Water Commission before the September 1, 1965 realignment generally will be given in this report either to the Water Development Board or to the Water Rights Commission, depending on which agency now has responsibility for that function.

TEXAS WATER DEVELOPMENT BOARD

John J. Vandertulip
Chief Engineer

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GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

ABSTRACT

Mitchell County and the western one-third of Nolan County embrace an area of about 1,150 square miles in the Callahan Divide subdivision of the Great Plains Province in central Texas. Most of the area is in the Colorado River drainage basin with the Colorado River flowing from northwest to southeast through Mitchell County. Colorado City, the largest city in the area and the county seat of Mitchell County, is about 75 miles west of Abilene and about 70 miles north-northwest of San Angelo. The area had a population of about 14,000 in 1960. The climate ranges from semiarid to subhumid, and the average annual precipitation is about 20 inches.

Irrigation is practiced in much of the area east of the Colorado River, where cotton and grain sorghums are the principal crops. A large part of the industrial development is associated with petroleum production and the mining of sand, gravel, and cement material.

Water-bearing rocks which contain usable quality water in Mitchell and western Nolan Counties include beds of Permian age, the Santa Rosa and Chinle Formations of Triassic age, the Trinity and Fredericksburg Groups of Cretaceous age, the Ogallala Formation, and Quaternary alluvium. The water-bearing unit of principal interest consists of basal gravel and sand of the Santa Rosa Formation, the upper Santa Rosa Formation, and the sand of the Trinity Group.

Recharge to the aquifer is primarily from precipitation on the outcrop. The amount and seasonal distribution of precipitation significantly effects the amount of water received by the aquifer. Locally the amount of replenishment varies according to the permeability of the outcropping rock or the nature of the soil mantle and vegetative cover. Movement of ground water east of the Colorado River is generally to the west, whereas west of the river the movement of ground water is to the east, toward the river. Water is discharged from the aquifer by seepage into the major drainageways, spring flow, evaporation, transpiration by plants, and by interformational leakage. Also, large quantities of water are discharged through irrigation wells in the Santa Rosa Formation.

Changes in water levels in the Santa Rosa Formation generally correlate with cumulative departures from the average annual precipitation. Observation well data indicate that water levels are in the process of recovery from an unusually large deficit of precipitation since 1946, and that water levels probably have not fully recovered from the effects of the drought. During the 1960-63 period of observation, water levels in wells in various areas responded differently to the combined effects of recharge and pumpage. Water-level changes during this period ranged from -9.0 to +13.3 feet.

Water of quality usable for municipal and most irrigation and industrial purposes occurs in the Santa Rosa Formation throughout the area east of Colorado City. Hardness, however, is very high and will require softening for many municipal and industrial uses. Fluoride is also marginally acceptable to excessive in many places. West of the Colorado River, water in the basal Santa Rosa sands is rather highly mineralized.

Principal irrigation development began in the early 1950's as a result of the drought. Since 1961, irrigation has accounted for more than 95 percent of the ground water pumped from the Santa Rosa Formation. In 1963 there were about 300 active irrigation wells in Mitchell and western Nolan Counties, 12 active municipal wells, and 7 industrial wells. In 1961, 10,035 acre-feet was pumped from the Santa Rosa Formation for municipal, industrial, and irrigation purposes; in 1962, 10,834 acre-feet was pumped; and in 1963, 15,069 acre-feet.

It is estimated that between 12,000 and 15,000 acre-feet of water per year can be developed from the Santa Rosa Formation, east of the Colorado River, on a perennial basis. In periods of drought, or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. Only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels until the economic limit of irrigation pumpage is reached.

In addition to the perennial yield, approximately 2,000,000 acre-feet of usable quality ground water is stored in the Santa Rosa Formation, of which about one-half could be recovered under the present economics of irrigation pumpage. Also, about 400,000 acre-feet of water is stored in the Trinity Group.

It is recommended that, where possible, new development should be restricted to areas having little or no water-level declines. In these areas the best prospects for development are those areas containing the maximum amount of saturated sand and gravel.

GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

INTRODUCTION

Purpose and Scope

The western one-third of Nolan County and the northeastern one-fourth of Mitchell County are underlain by strata containing fresh water, principally in the Santa Rosa Formation of Triassic age, which supplies water to many irrigation wells. Nearly all of these wells have been drilled since 1950 to supplement rainfall for cotton and feed-grain crops. Many of these wells were drilled during the severe 1951-56 drought.

Preliminary studies of water-bearing units in this area, accomplished as part of a statewide reconnaissance of ground-water resources, indicated that recharge to the water-bearing units in the area may equal or perhaps exceed amounts of water pumped for irrigation in periods of normal regional rainfall.

On the basis of the reconnaissance studies, recommendations were made by the Texas Water Commission for a more detailed ground-water study of the Santa Rosa Formation, with principal emphasis on recharge aspects. Also, considerable local interest developed in the area for a thorough study of water available for irrigation east of the Colorado River.

In early 1962 the Commissioners Court of Mitchell County requested assistance from the Texas Water Commission for a detailed study of the ground-water resources of the county, and that the study be directed principally toward determining the degree of permanence to be expected from existing irrigation development and the probable effects of future development. Other hopeful objectives would be to obtain guidance for future exploration for irrigation water in and near the present area, and possible disclosure of undiscovered areas favorable for developing large quantities of ground water.

The Texas Water Commission agreed to make a study which would be financed by the State and local cooperators, and urged that the program include also that part of the common Triassic aquifer which occurs in Nolan County. Subsequently, the Nolan County Commissioners Court contributed to the investigation. Additional contributions from well owners and business establishments in Mitchell and Nolan Counties supplied the balance of necessary funds.

A program was then outlined by the Texas Water Commission to accomplish the principal objectives within the framework of an overall study of ground water in Mitchell County and in the approximate western one-third of Nolan County. The program called for a study which would define: (1) ground-water conditions throughout the area; (2) changes in ground-water conditions caused by previous development; (3) the estimated amount of ground water available from the principal aquifer on a perennial basis, if possible; (4) the estimated amount of ground water available from storage within the principal aquifer; and (5) recommendations for a future program of data collection to detect changes in ground-water conditions and the causes.

The scope of the investigation included the compilation, review, and analysis of all previously collected hydrologic data, the subsequent correlation thereof with data collected during the period of fieldwork which was from August 1962 to September 1963, and the presentation of results of the investigation in a report illustrating ground-water conditions in the area.

This investigation was made and the report prepared under the general direction of John J. Vandertulip, Chief Engineer, L. G. McMillion, former director, Ground Water Division, and Richard C. Peckham, director, Ground Water Division. The fieldwork and report preparation were under the direct supervision of Bernard B. Baker, assistant director in charge of Availability Programs.

Location and Extent

The area considered in this report embraces approximately 1,150 square miles, and includes all of Mitchell County and approximately the western one-third of Nolan County. Colorado City, the largest city in Mitchell County and the county seat, is approximately 75 miles west of Abilene and about 70 miles north-northwest of San Angelo. The location of the area of study within the State is shown on Figure 1.

Methods of Investigation

In conducting the detailed study of ground-water occurrence and development in Mitchell and Nolan Counties the following items of work were accomplished:

(1) inventory of municpal, industrial, and irrigation wells and selected domestic and livestock wells;

(2) collection of water samples from wells and springs for chemical analysis, and collection of available chemical analyses;

(3) collection and examination of drill cuttings from selected wells;

(4) determination of approximate altitudes of wells and outcrops;

(5) periodic measurement of static water levels in selected wells;

(6) measurement of depths to water in and discharge from selected wells;

(7) conducting pumping tests on selected wells;

(8) measurement of application rates of many irrigation wells;

(9) determination of power-consumption rates of selected electric-powered irrigation pumps, and collection of power-consumption records from the utility company;

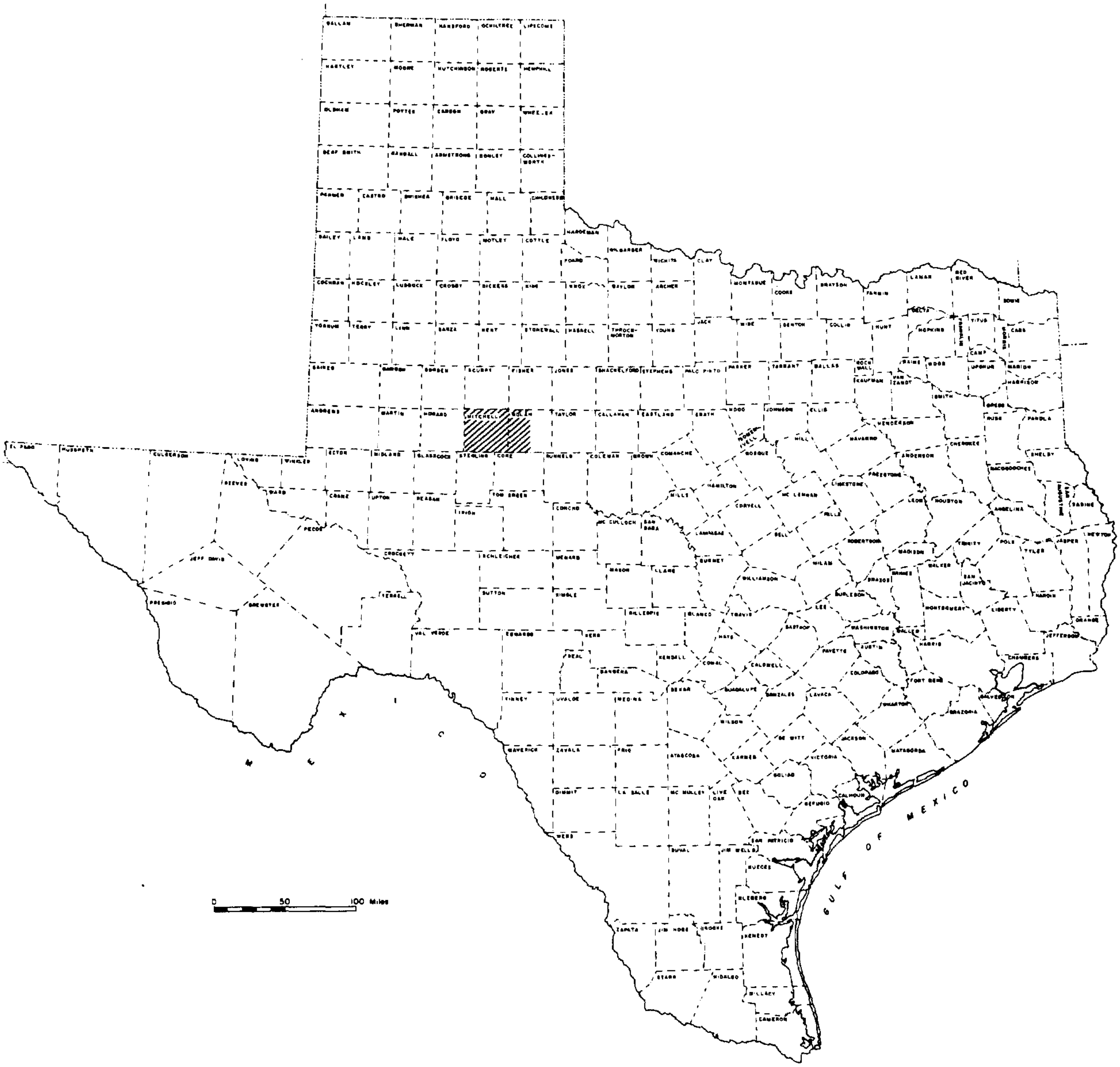

Figure I

Map of Texas Showing Location of Mitchell and Western Nolan Counties

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

(10) inventory of ground-water pumpage for municipal, industrial, and irrigation purposes;

(11) mapping of surface geology using topographic maps and aerial photographs;

(12) collection, compilation, and correlation of electrical logs and drillers' logs of oil tests and water wells;

(13) collection and analysis of streamflow, precipitation, temperature, and evaporation data pertinent to the study area; and

(14) compilation and analysis of data and preparation of illustrations showing geologic and hydrologic conditions.

Approximately 175 electrical logs were examined for information on thickness, depth, and attitude of subsurface strata. About 250 irrigation wells were inventoried for performance, completion, and construction data, and yields or application rates of approximately 130 wells were measured during the study. Static water-level measurements in about 475 wells were obtained during the period 1960-63, and comparative static water levels were measured annually in the winter months in approximately 75 irrigation wells during the same period.

One hundred and forty chemical analyses of ground water were evaluated. Power-rate tests were run on about 105 wells equipped with electric pumps, and about 200 altitude determinations of wells were made by hand-leveling. More than 175 drillers' logs of water wells were evaluated. Pumping tests were conducted on four wells to determine aquifer characteristics. Depths to water were measured in approximately 50 irrigation wells while pumping.

Previous Investigations

No previous detailed study of ground water in this area has been made. Broadhurst and Dale (1953) presented a memorandum report noting irrigation development in Mitchell County. Knowles (1947) compiled an inventory of wells in northwestern Nolan County.

Unpublished records of the U.S. Geological Survey which provided water-level and quality data during the course of this study included a water-quality survey in the vicinity of Cuthbert in 1948, the results of an investigation of ground-water conditions within a 4 to 5 mile radius of Colorado City in 1946 made in consideration of long-term water requirements, and a memorandum report on availability of additional ground water to the city of Sweetwater in 1950.

Well-Numbering System

The numbers assigned to wells and springs in this report are based on a grid system in which quadrangles formed by degrees of latitude and longitude are repeatedly subdivided into small quadrangles as shown on Figure 2.

The largest quadrangle, a 1-degree quadrangle, is divided into sixty-four $7\frac{1}{2}$-minute quadrangles, each of which is further divided into nine $2\frac{1}{2}$-minute quadrangles. Each 1-degree quadrangle in the State has been assigned a number

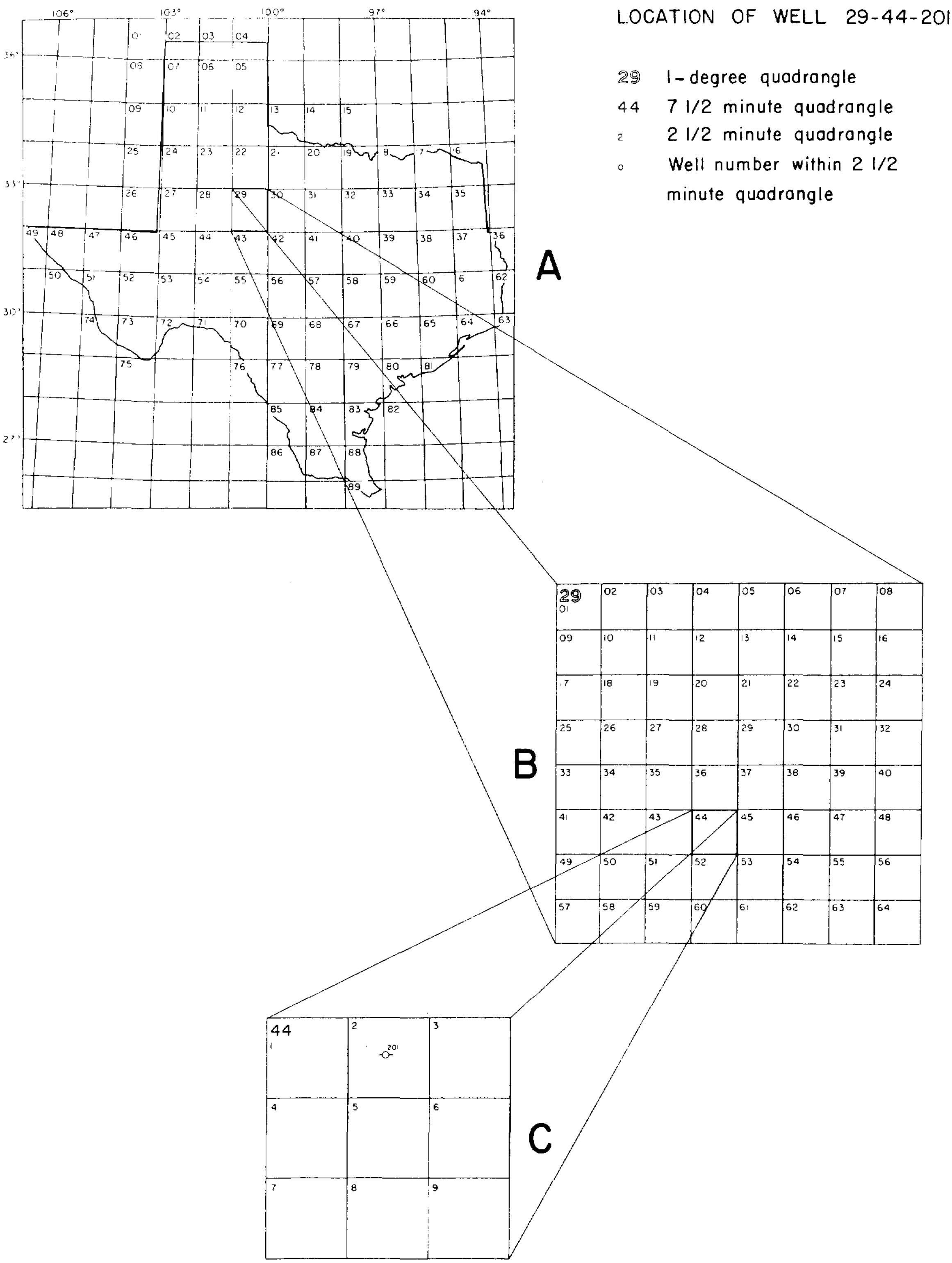

Figure 2

Well-Numbering System

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

for indentification. The $7\frac{1}{2}$-minute quadrangles are numbered consecutively from left to right, beginning in the upper left-hand corner of the 1-degree quanrangle, and the $2\frac{1}{2}$-minute quadrangles within each $7\frac{1}{2}$-minute quadrangle are similarly numbered. The first two digits of a well number identify the 1-degree quadrangle; the third and fourth digits identify the $7\frac{1}{2}$-minute quadrangle; the fifth digit identifies the $2\frac{1}{2}$-minute quadrangle; and the last two digits identify the well within the $2\frac{1}{2}$-minute quadrangle.

Acknowledgements

Appreciation is expressed to personnel of Shell, Humble, and Skelly oil companies for their assistance with problems involving regional geology.

The writer is grateful to the many individual well owners and city officials who provided access to their records, wells, and property so that needed data could be obtained.

The writer is particularly indebted to deceased drilling contractors N. C. and O. R. House and their widows, and to Hopkins Drilling Company for making available their complete log files and giving freely of their working knowledge of ground water in Mitchell and Nolan Counties. Appreciation is also expressed to Lone Wolf Electric Cooperative for supplying the electricity-consumption data which was used to compute irrigation pumpage.

Appreciation and commendation are extended to those residents who, under the leadership of the late Frank Kelley, procured the funds for this study; and to the Commissioners Courts of Mitchell and Nolan Counties for their excellent cooperation throughout the study.

GEOGRAPHY

Physical Features

The study area lies within the Callahan Divide subdivision of the Great Plains in central Texas. The topography of the area is generally rolling except for a rather flat part in Nolan County, which is a remnant of the Edwards Plateau and constitutes a segment of the Callahan Divide which separates drainage of the Colorado and Brazos Rivers. Marginal to the Colorado River are small, flat, alluvial terraces and occasionally deeply eroded, rugged topography.

The land surface in Mitchell County slopes regionally from northwest to southeast and locally toward the Colorado River which traverses the county diagonally from northwest to southeast. The topography is gently rolling to moderately rugged along major streams. Local relief averages 50 to 100 feet and ranges upward to 150 feet along the Colorado River in places. Altitudes within Mitchell County range from about 1,900 feet along the Colorado River in the southeast to about 2,400 feet in the southwest and northeast (Figure 5).

Soils in Mitchell County are generally reddish-brown and of quartzitic, upland type. They are mainly sandy, gravelly, and loose, but in some places are clayey, loamy, and dense.

The topography of western Nolan County varies from gently rolling and rugged west of the Callahan Divide to generally flat in the area surrounding Roscoe and in west-central areas along the divide. Altitudes are generally between 2,400 and 2,600 feet along the topographic divide, and about 2,100 feet in the southwest at the county line.

Soils of flat, upland areas of northwestern and southwestern Nolan County are dark, loamy, and calcareous and are derived from calcareous alluvial sediments or Cretaceous limestones. Soils along the lower western slope of the Callahan Divide are generally brownish-red, sandy, and occasionally loamy.

Roscoe is the principal town of the Nolan County part of the study area and is about 20 miles east of Colorado City.

The Colorado River and its tributaries drain all the area of this report except for about 100 square miles of northwestern Nolan County which is slightly dissected by tributaries of the Clear Fork of the Brazos River. The Callahan Divide which separates the Colorado and Brazos drainage basins trends southeastward from the northwest corner of Nolan County and passes through the community of Maryneal in the south-central part of the county.

Principal tributaries of the Colorado River draining Nolan and eastern Mitchell Counties are the south and north forks of Champion Creek and Big Silver Creek. All are intermittent streams. Largest tributaries of the Colorado River draining western Mitchell County are Morgan, Wildhorse, and Beals Creeks, which also flow intermittently.

Climate

The climate of the area embraced by this report ranges from semiarid in western Mitchell County to subhumid in Nolan County. It is characterized by long, hot summers, and generally moderate winters which exhibit a wide range of temperatures. The average temperature in January is 44°F and the average temperature in July and August is 81°F. The mean annual temperature at Colorado City is 64°F.

The average annual precipitation for the period 1939-63 at Colorado City is 19.66 inches and at Roscoe 20.72 inches, most of which occurs between April and October. The driest months are in the winter when northerly winds prevail. Precipitation is mostly rain, a large proportion of which falls in relatively few torrential storms. Highest recorded annual precipitation in the area was in excess of 35 inches at Roscoe in 1936 and Colorado City in 1957; the lowest recorded was 11.4 inches at Colorado City in 1910. The average annual gross lake surface evaporation rate in study area for the 18 years, 1940-57, was about 81 inches (Lowry, 1960).

Figure 3 shows graphically the annual precipitation, average annual precipitation, and cumulative departure from the average annual precipitation at Roscoe and Colorado City for the period 1939-63. The distribution of the annual precipitation is illustrated by the mean monthly precipitation at the two stations, presented on Figure 4.

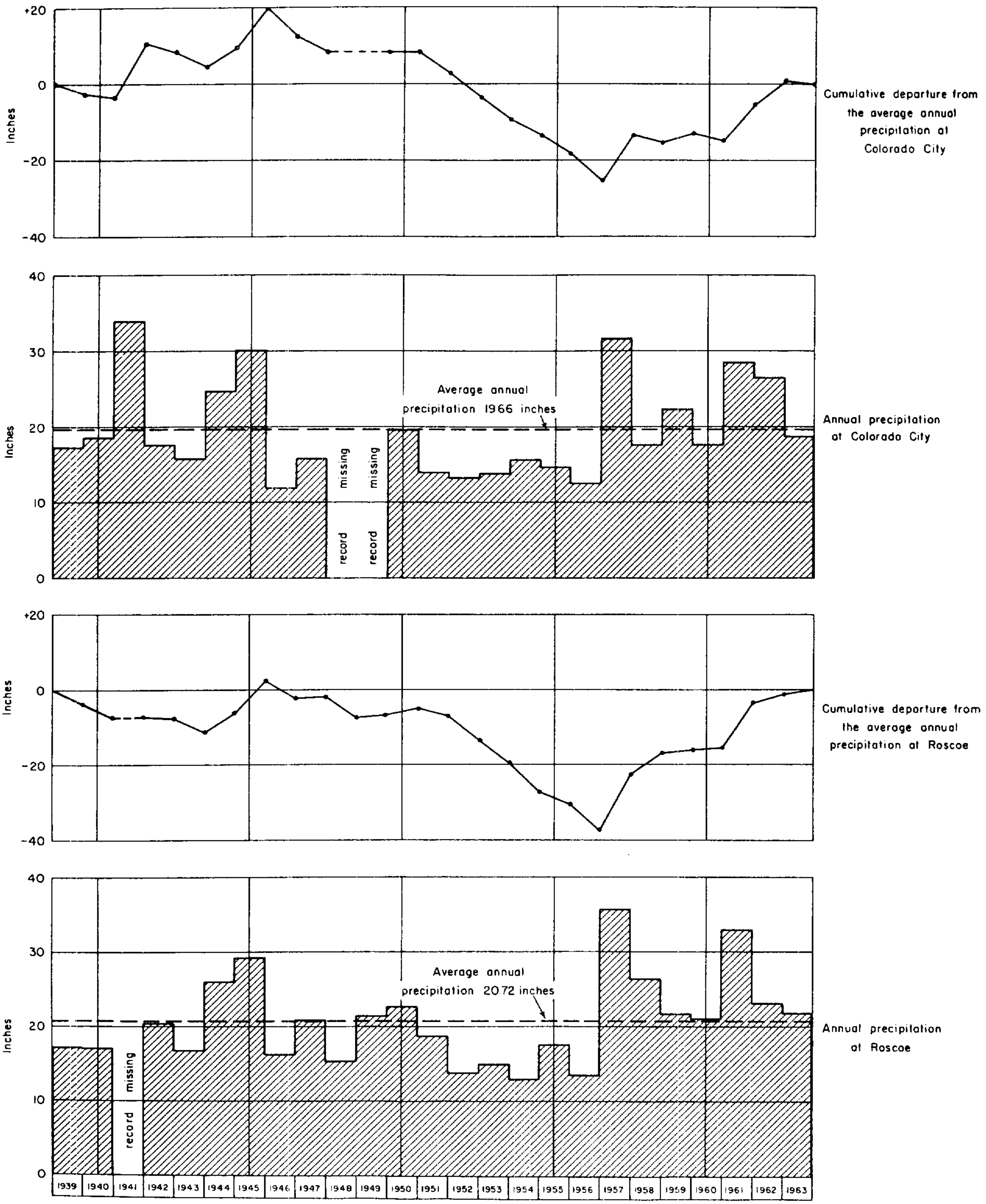

Figure 3

Annual Precipitation and Cumulative Departure from the Average Annual Precipitation at Colorado City and Roscoe, 1939-63

(Data from U. S. Weather Bureau)

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

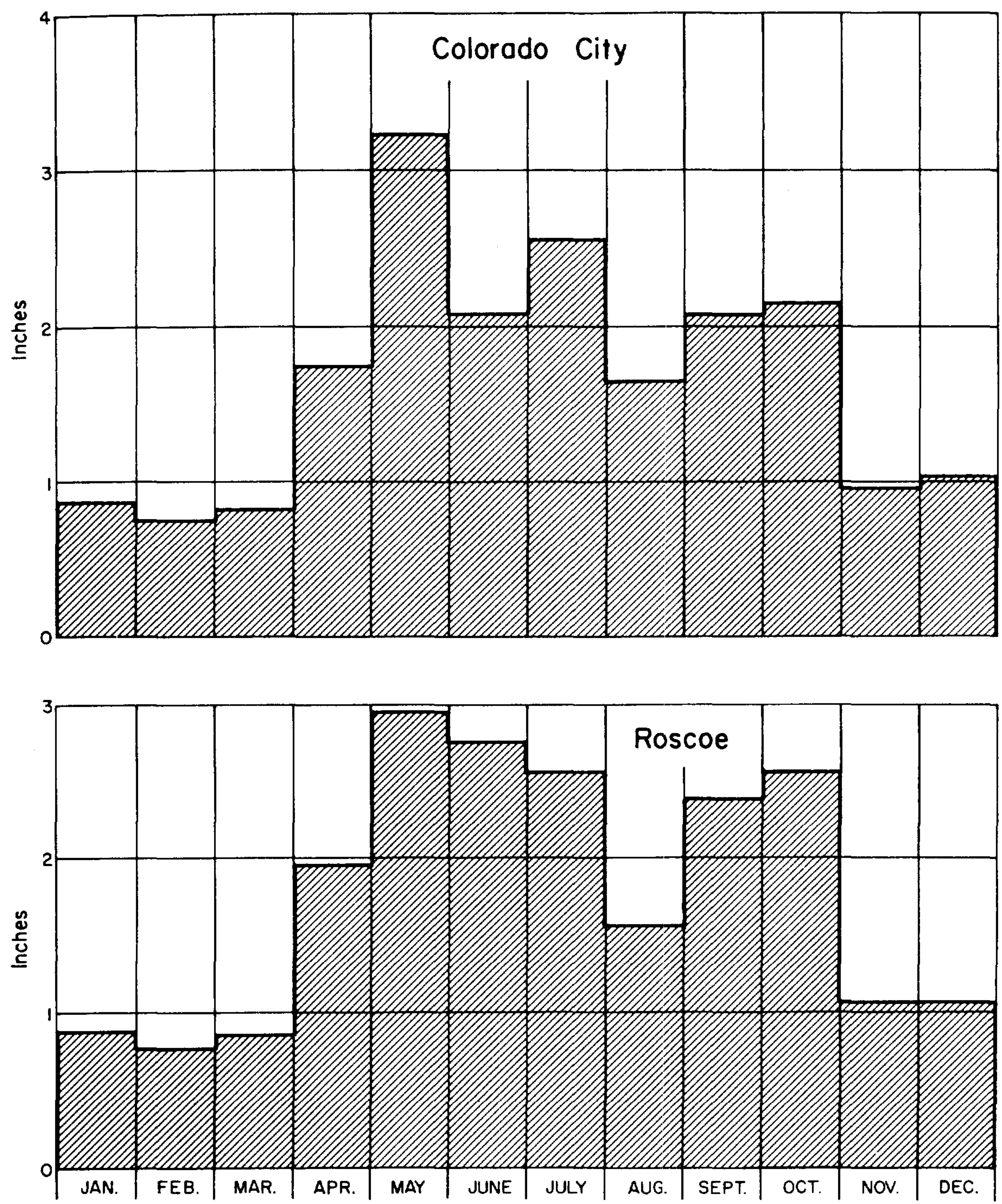

Figure 4

Mean Monthly Precipitation at Colorado City and Roscoe, 1939 - 63

(Data from U. S. Weather Bureau)

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

Population and Economy

The census of 1960 shows a population of 11,255 for Mitchell County and 19,700 for Nolan County; it is estimated that approximately 2,900 people live in the Nolan County area of this study, generally termed the Roscoe subdivision of the county. From 1950 to 1960 the population of Mitchell County declined by about 20 percent. It is estimated that the population of Nolan within the study area declined by less than 5 percent.

Population decreases are principally attributed to the national trend of declining farm population and to a general lessening of intensity and variety of oil production activity. The economy of the area is largely based upon agriculture and livestock production, which were valued respectively at $5.4 million and $1.8 million in 1959. Principal crops are cotton and grain sorghums.

Principal income from the study area is probably derived from production of electric power; manufacture of refined petroleum and cottonseed oil; and from mineral industries producing oil, gas, sand and gravel, and cement valued at more than $11 million in 1958.

Major sources of employment in 1960 were: agriculture with 884 workers; wholesale and retail trade, 942 workers; manufacturing, 503 workers; construction, 426 workers; education, 239 workers; and mineral production, 267 workers.

GEOLOGY

General Geology

Water-bearing rocks with which this report is concerned include beds of the Guadalupe and Ochoa Series of Permian age, the Santa Rosa and Chinle Formations of Triassic age, the Trinity and Fredericksburg Groups of Cretaceous age, the Ogallala Formation, and Quaternary alluvium. All of the units crop out within the study area. Figure 5 is a geologic map showing the areal distribution of the outcrops. Table 1 lists geologic units and summarizes lithology and water-bearing characteristics. Older rock units recognized in the subsurface but having no known fresh-water potential are, in ascending order: Precambrian, Cambrian, Ordovician, Mississippian, Pennsylvanian, and lower Permian strata. Pennsylvanian and lower Permian strata are notable for the occurrence of oil and gas in the general area of this report.

Of paramount importance to this study are the Santa Rosa Formation and the sands of the Trinity Group which constitute the principal source of ground water in the area. The Santa Rosa Formation is of terrestrial origin whereas the Trinity Group is generally considered to be of littoral, or near-shore, origin. Triassic rocks dip regionally west and northwest at a generally low angle, apparently thickening toward the axis of a synclinal basin, while the Cretaceous rocks dip regionally to the southeast at low angles.

The Trinity Group overlies and overlaps the Santa Rosa Formation in eastern Mitchell and western Nolan Counties where, in places, a common hydrologic unit is formed by a sand-on-sand formational contact. The contact between the two is unconformable, as is their contact with underlying Permian strata. Figure 6 shows formational relationships and generalized topography of the study area.

Table 1.--Geologic units and their water-bearing characteristics in Mitchell and western Nolan Counties

System	Series	Group	Formation	Approximate thickness (feet)	Lithology	Water-bearing characteristics
Quaternary	Pleistocene and Recent		Alluvium	0-100	Fine to coarse sand, and small to large gravel, with occasional clay and caliche beds.	Above the regional water table east of Colorado River, but yields up to 20 gpm of good quality water in southwestern Mitchell County.
Tertiary	Pliocene		Ogallala	0-100	Fine to coarse sand, gravel, caliche, and zones of clay.	Above the water table east of Colorado River, but yields up to 20 gpm of good quality water to wells in northwestern Mitchell County.
Cretaceous	Comanche	Fredericksburg		0-220	Predominantly limestone. 15 to 25 feet of sandy yellow marl at base overlain by chalk and shaly limestone. Very dense, massive, fossiliferous limestone in the upper part.	Upper limestones contain in places small to moderate supplies of potable but hard water in solutional openings developed along fracture systems; recharge to the openings occurs through numerous sinks.
		Trinity		0-100	White to purplish quartz sand, fine to medium grained, moderately to loosely consolidated, with occasional lenses of quartz gravel at the base.	Yields small to large quantities of potable but hard water, the amount depends on saturated thickness which ranges from 100 percent under interior limestone areas to a few feet in parts of the outcrop; yields of several hundred gallons per minute are reported.
Triassic		Dockum	Chinle	0-640	Predominantly red to maroon and purplish clay and shale, interbedded with thin, tight, cross-bedded, yellow-brown to reddish-white sandstone.	Sandstones contain generally small quantities of moderately to highly mineralized water; used principally for livestock.
			Santa Rosa	0-330	Basal conglomerate overlain by brown to gray, micaceous and carbonaceous, cross-bedded sand alternating with beds of red and gray clay.	Sands and gravels contain moderate to large quantities of fresh water east of the Colorado River, with yields up to 1,000 gpm reported; west of Colorado River capacity of sand is reportedly substantial but water is generally not potable.
Permain	Guadalupe and Ochoa				Fine-grained, red to brown sandstone; dense red silty shale with occasional gypsum or anhydrite beds.	Yield small quantities of moderately to highly mineralized water to livestock and domestic wells.

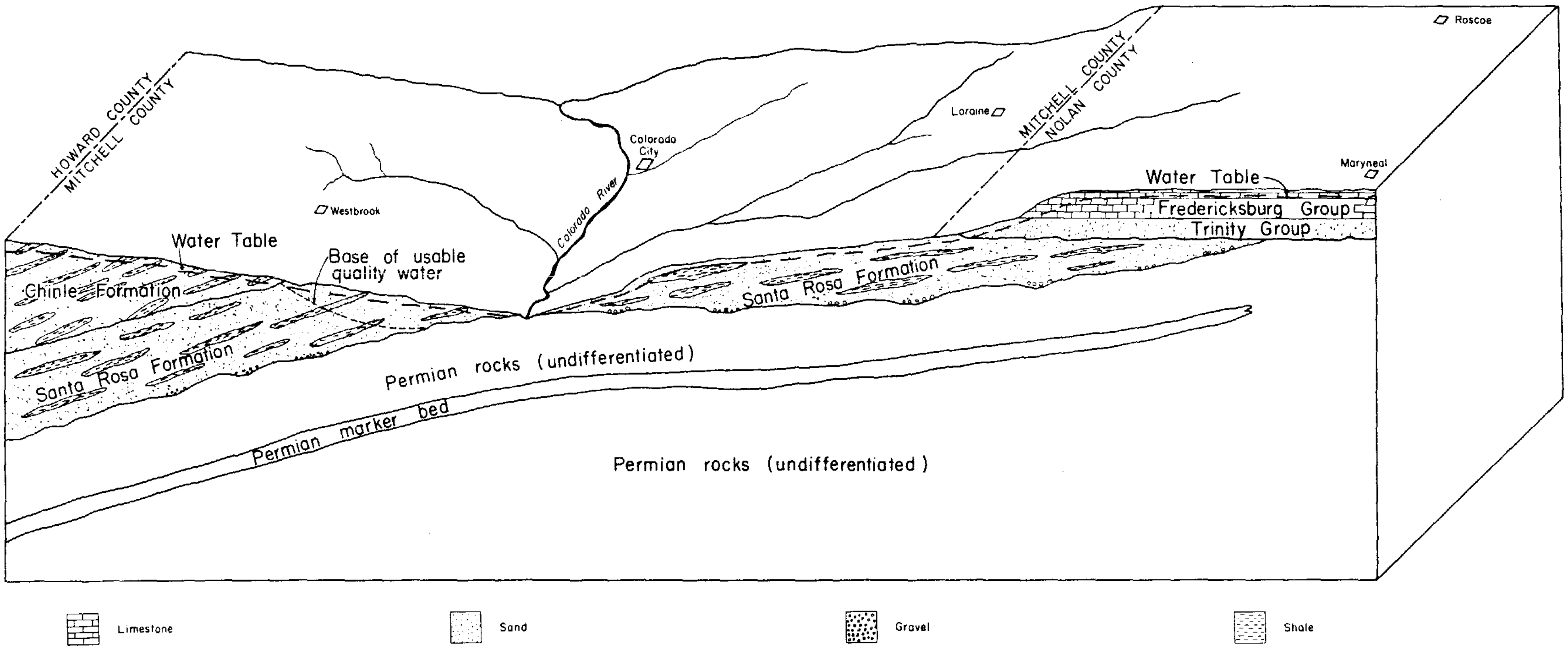

Figure 6

General Geologic Structure and Formation Relationships in Mitchell and Western Nolan Counties

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

The regional structural setting of the report area is the Eastern platform of the Permian basin of West Texas. The structure of the Permian basin is illustrated on Figure 7 which shows the Permian marker bed dipping westward at a rate of about 25 to 30 feet per mile. Locally, structural features in the Permian rocks have influenced the thickness of overlying Triassic and Cretaceous sands and, consequently, their water-bearing characteristics.

The geologic history of the area of this report is largely a consequence of structural movements controlling the Permian basin. In early Permian time the sea encroached upon an eroded Pennsylvanian surface from the southwest as a result of regional subsidence, depositing at first great sequences of limestone. Later, evaporite deposition of anhydrite and salt interbedded with red clay and silt occurred as the seas began intermittent retreat to the southwest, producing once more a terrestrial environment.

Extensive erosion of the elevated Permian surface occurred prior to deposition of the coarse terrestrial sediments of Triassic age, which were transported by fast-moving waters from highlands probably lying to the east and south. Regional subsidence of the Permian basin apparently continued throughout the period of Trassic deposition.

A period of uplift followed Trassic deposition, during which unknown thicknesses of Triassic material were stripped away before the last marine transgression of the area brought shallow Cretaceous seas from the southeast. During Cretaceous time littoral sediments were initally deposited, followed later by alternating marine and littoral sediments, then finally, marine deposits.

Since retreat of the Cretaceous seas, Cretaceous strata, which one covered nearly all of Texas, were removed from all of Mitchell County, except for a small area east of Loraine, by erosion. Stripping and redeposition of Cretaceous rocks largely characterized the emergent post-Cretaceous time. Tertiary deposition is represented in this area principally by a remnant of the Ogallala Formation surrounding Roscoe in Nolan County. Quaternary deposits are represented by widely scattered erosional remnants of flood-plain and stream-terrace deposits largely containing reworked Triassic and Cretaceous sediments.

Tertiary and Quaternary sediments are above the water table in all of the area except western Mitchell County, and occur as scattered thin mantles of caliche, sand, and gravel overlying Triassic or Cretaceous rocks in Nolan County and Permian or Triassic rocks in Mitchell County.

Geologic Units and Their Water-Bearing Properties

Permian System

Guadalupe and Ochoa Series

Permian rocks are exposed principally in the southeastern quarter of Mitchell County. They are largely insignificant as a source of usable water except for livestock, and no attempt was made in this study to differentiate the Periman rock units. Electrical logs indicate, however, that most exposures are stratigraphically above the Yates Formation and thus belong in part to the

Guadalupe Series and in part to the Ochoa Series, both of upper Permian age. The exposed Permian rocks may include strata of the Tansill, Salado, and Dewey Lake Formations. About 175 feet of Permian rock thickness is exposed along the Colorado River and its principal tributaries.

Permian exposures consist principally of "red beds," which are dense red silty shales with gray-green inclusions, interbedded with tight red-brown to yellow-orange, fine-grained, laminated sandstones and occasional gypsum or anhydrite beds.

Permian rocks of this area are overlain unconformably by Triassic conglomerate or sandstone or are thinly mantled by remnants of Quaternary alluvium. The Permian beds dip westward at an average rate of about 25 to 30 feet per mile, steepening considerably in extreme western Mitchell County near the margin of the Midland basin.

Water wells in the Permian rocks generally are less than 100 feet deep and yield small quantities of moderately to highly mineralized water.

Triassic System

Dockum Group

Rocks of Late Triassic age belonging to the Dockum Group occur at the surface or in the subsurface in about 80 percent of the study area. They have been completely removed in much of southeastern Mitchell County by erosion and are absent in the subsurface of a part of southwestern Nolan County because of either pre-Cretaceous erosion or nondeposition.

Dockum beds are of continental origin and were probably laid down as river-channel and flood-plain deposits. Subdivision of the Dockum group has been made by several investigators. In this report the subdivision of Adams (1929, p. 1045) into the Santa Rosa and Chinle Formations is employed. Adams has stated of the southern end of the Southern High Plains: "In the area south of the 33rd parallel the Dockum group consists of red and non-red conglomerate, sandstone, and shale beds of terrestrial origin. Examination of a series of well samples shows that it is composed of two formations. The names Santa Rosa and Chinle, as used for the Triassic of central New Mexico is extended to include the equivalent formations in the Texas section."

The contact between the Santa Rosa Formation and the overlying Chinle Formation is not readily apparent in the Mitchell-Nolan Counties area due to the presence of lenticular sands and thick red clay or shale zones in both formations. It is not defined on the geologic map of Texas (Darton and others, 1937) and it was considered beyond the scope of this study to attempt to map it. During the field investigation, it was observed that a section composed of a thick, brick-red to maroon and purple shale with green and gray mottling and thin beds of red-brown to gray, fine-grained, micaceous sandstone occurs generally west of a north-south line through Westbrook in western Mitchell County. This section is presumed to be a component of the Chinle Formation.

It also is not possible with certainty to define the subsurface contact of the Chinle and Santa Rosa Formations on gamma-ray logs, as logs generally indicate simply an alternating series of sand and shale from the top of the Permian section to the surface. Arenaceous materials that generally predominate in the lower part of the Triassic are considered to be the Santa Rosa Formation.

Santa Rosa Formation

The Santa Rosa Formation underlies the Chinle Formation in western Mitchell County. Although the western limit of the Santa Rosa Formation outcrop cannot be defined on Figure 5, all Triassic sediments in the study area eastward from the general vicinity of Westbrook are considered to belong to the Santa Rosa Formation. The geologic map on Figure 5 shows that the Santa Rosa is overlain in places by alluvium or the Ogallala Formation, as in the Roscoe area, and by the Trinity Group in areas south and southwest of Roscoe. The Santa Rosa crops out both on the east and west sides of the Brazos-Colorado river basin divide in Nolan County.

The Santa Rosa sediments east of the Colorado River generally consist of a few to 20 or 30 feet of hard, coarse-gravel conglomerate at the base, succeeded upward by alternating red and gray micaceous shale, clay, and sand or gravel. Sand and gravel generally predominate in the lower 100 feet of the formation. The conglomerate comprising the base of the Santa Rosa Formation marks the base of the fresh water section in the area for local well drillers. On the outcrop, the sands are generally buff-brown to red-brown or grayish, fine to medium grained, slightly to highly micaceous, with much carbonaceous material, very slightly to moderately consolidated, and cross-bedded. Sands in the subsurface are characteristically gray to gray-white, containing much dark colored minerals.

The sand and clay beds are highly lenticular, grading both laterally and vertically into one another within short distances as revealed by a study of many drillers' logs and outcrops. East of the river the sediments appear to gradually become finer-grained to the west, and fossil wood fragments and "coal" are reported in drill cuttings from wells.

Thickness of the Santa Rosa Formation in the outcrop ranges from a few feet in parts of southwestern Nolan County to over 300 feet north and northeast of Colorado City. The thickness of the formation encountered in irrigation wells is generally about 150 to 200 feet.

Local structures in the Triassic strata are difficult to detect because of the lack of persistent marker horizons in the lenticular beds and because of the unconformable surfaces at the base and top of the Triassic sediments. Figure 8 shows the varying slope of the Permian surface (and the base of the Triassic sediments in most of the area). In eastern Mitchell and western Nolan Counties the slope is about 20 to 25 feet per mile westerly, becoming northwesterly and steepening to 40 to 80 feet per mile west of the Colorado River.

The Santa Rosa Formation supplies water to nearly all the irrigation wells and to all the municipal wells in the area of study, which yield up to 1,000 gpm (gallons per minute) of fresh but generally hard water. The Santa Rosa Formation west of the Colorado River in several localities has reportedly yielded over 300 gpm to individual wells, but the water was excessively mineralized for irrigation.

Chinle Formation

The lower boundary of the Chinle Formation on the outcrop is not precisely defined. It occurs principally west of Westbrook. The Chinle Formation is predominantly red clay and shale with thin, lenticular, sandstone interbeds, and overlies the more arenaceous Santa Rosa Formation. The Chinle is generally unimportant as a source of water except for livestock. It yields only small quantities of moderately to highly mineralized water from fine-grained sandstones near the surface. Its thick red shales appear to constitute an effective aquiclude, which prevents local recharge to the sands of the Santa Rosa Formation below. The maximum thickness of the Chinle is probably as much as 640 feet in the westernmost part of Mitchell County.

Cretaceous System

Cretaceous rocks within the area of the study are of Lower Cretaceous age and belong to the Trinity and Fredericksburg Groups.

Trinity Group

The basal Cretaceous sand of the Southern High Plains of Texas has been considered to be the equivalent of the Paluxy Sand of the Fort Worth area (Hill, 1901, p. 132-140), and the name Paluxy has been used in West Texas by some investigators. In this report, the sands are referred to as the Trinity Group.

The sand of the Trinity Group was deposited in a near-shore, or littoral, environment of an advancing Cretaceous sea and is thus epicontinental in nature. The sand is present in western Nolan County, cropping out beneath Cretaceous limestone or Tertiary and Quaternary deposits. The Trinity Group principally overlies Triassic rocks, but in a sizeable part of southwestern Nolan County it rests upon Permian rocks.

In Nolan County the Trinity Group principally consists of white to purplish, loosely to moderately consolidated, fine- to coarse-grained quartz sand. The sand is mainly fine grained, and is sometimes referred to as "sugar sand" by well drillers. The coarser sand beds generally consist of highly varicolored quartz, and occasionally lenses of quartz gravel occur near the base.

The Trinity Group ranges in thickness from 60 to about 100 feet and averages about 80 feet throughout the area. In measured sections of exposures along the Mitchell-Nolan County line in southwestern Nolan County the Trinity was found to be 70 to 80 feet thick. The sand appears more yellowish and calcareous near the top, seemingly grading into sandy yellow limestone.

The regional dip of the Trinity Group is to the southeast at low angles. However, some variation in dip occurs due to local structural influence. The local elevation of the base of the sand, as interpreted from drill cuttings, electrical logs, and drillers' logs, is highly variable, probably due in part to structural influence and to the erosional character of the surface of the Triassic or Permian rocks below it.

Figures 9, 10, and 11 illustrate the relationship of the Trinity Group with the underlying Trassic and Permian sediments. The Trinity Group overlaps

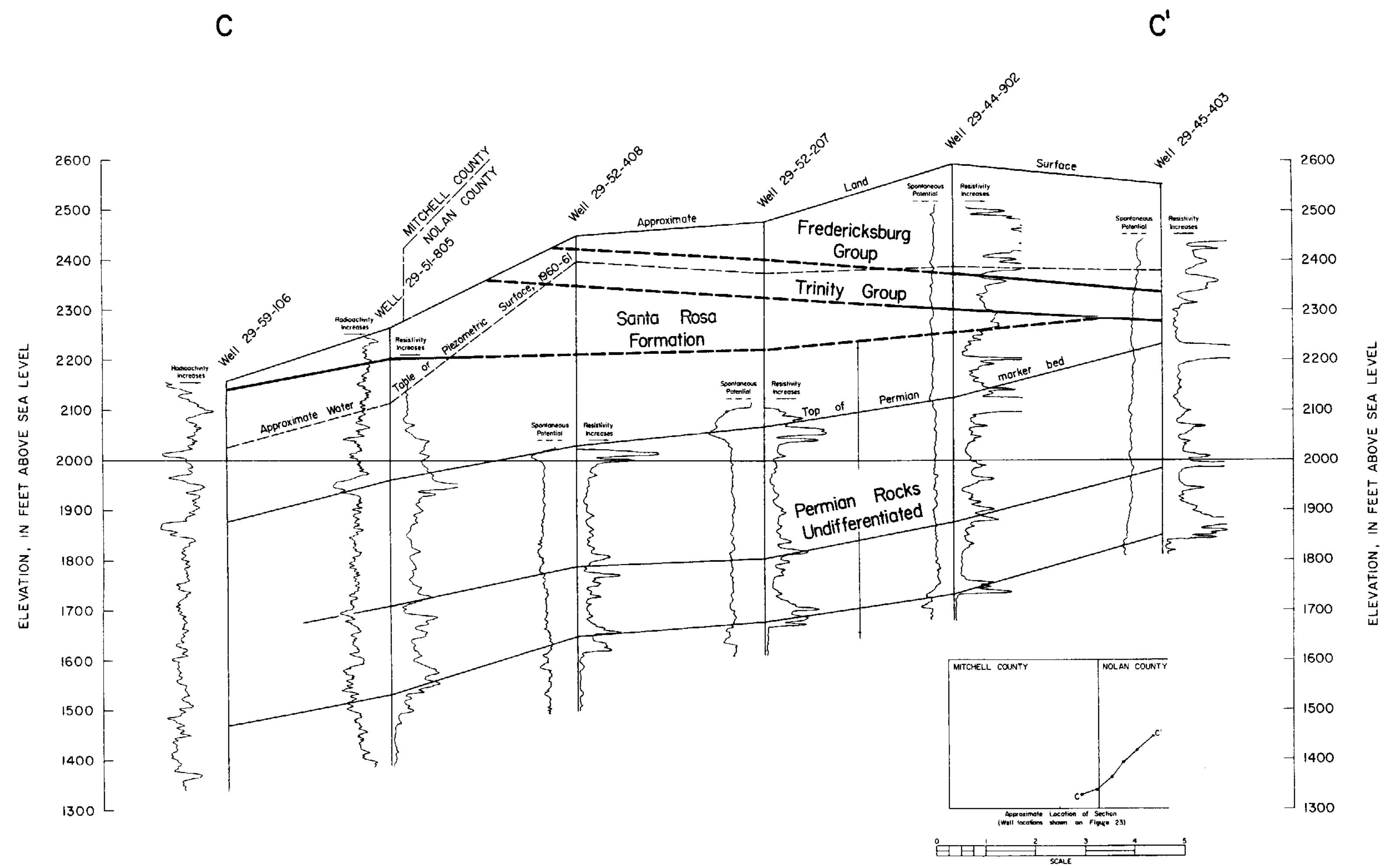

Figure 11

Geologic Section C-C'

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

the Santa Rosa Formation which pinches out on a high Permian surface trending southwestward from Maryneal (Figure 8).

The sand of the Trinity Group is the only important source of water in most of southwestern Nolan County; in some places it is fully saturated to the base of the overlying limestones (Figures 10 and 11). Although yields of 250 to 500 gpm have been reported from wells developed in the Trinity Group, yields are generally expected to be much less.

Fredericksburg Group

As much as 220 feet of calcareous sediments overlie the Trinity Group, seemingly grading upward from sandy marl to arenaceous limestone to chalky, fossiliferous limestone, and finally, to thin- and massive-bedded, gray-white, resistant, fossiliferous limestone. These beds are of little importance as water sources in the area, and therefore no attempt was made to distinguish individual formations of this group. However, available literature and field observations indicate that the Walnut Clay is probably represented within the basal 15 to 20 feet of the Fredericksburg Group, overlain by undetermined thicknesses of the Comanche Peak and Edwards Limestones.

Occasionally, solutional openings in the Edwards Limestone yield small to moderate supplies of water to domestic wells. The Edwards Limestone outcrop is characterized by many large, circular areas of interior drainage, or sinks, which are the result of collapse into solution-formed openings and provide a source of recharge to the underlying sands.

Tertiary System

Ogallala Formation

Rocks generally regarded as Tertiary in age crop out in the divide area which surrounds Roscoe. They are erosional remnants of the Ogallala Formation of the High Plains of Texas. In Nolan County, they consist of a maximum of 40 to 50 feet of caliche, and sand and gravel interbedded with light-colored clay. The sediments are entirely above the regional water table and are not a source of water; however, they appear to constitute an effective recharge conduit to saturated sand and gravel of the Santa Rosa Formation or Trinity Group below.

Thin remnants of the Ogallala are also present in west-central and northwestern Mitchell County. They consist of a maximum of 100 feet of unconsolidated buff-brown sand with a zone of coarse gravel at the base. They generally yield small quantities of usable water of variable quality to domestic and livestock wells.

Quaternary System

Alluvium

Alluvium that is probably Pleistocene in age occurs both east and west of the Colorado River in Mitchell County. The alluvium is not a source of water east of the river, because it occurs as very thin mantles of caliche, sand, and gravel overlying Triassic strata. In southwestern Mitchell County, in the general vicinity of the Hyman community, up to 100 feet of Quaternary alluvium overlies Triassic red beds and yields small to moderate quantities of fresh water to livestock and domestic wells. Limited saturated thickness precludes development of large supplies of water in this area.

Recent alluvium occurs as small flood-plain deposits along the Colorado River. Because they are generally above the water table, they are not a source of ground water. On the east side of the Colorado River scattered outcrops of wind-blown sand mantle Triassic or Permian rocks to a depth of 8 to 10 feet, giving rise to dune topography.

GROUND WATER

General Principles of Occurrence

Figure 12 illustrates the earth's circulatory system, showing that water is constantly evaporating from and returning to the sea by difference avenues of access. The part of the returning water which enters and moves through interstices of porous rocks of the earth's crust is ground water, and the source of all fresh ground water is precipitation although only a small percentage of precipitation becomes ground water.

Water moving downward through porous rocks first enters unsaturated voids which contain both air and water, and later enters a zone of saturation where all voids are full of water. The upper surface of the zone of saturation is called the water table, and water within it is ground water. If the water, in its downward movement, encounters impermeable strata above this level it forms a perched water table above the zone of saturation.

A geologic formation, group of formations, or part of a formation that yields water in usable quantities is termed an aquifer. A formation or part of a formation that is incapable of transmitting water in significant quantities is call an aquiclude.

Where the upper surface of the zone of saturation is under atmospheric pressure and unconfined, water-table conditions are said to exist. In areas where the water-bearing formation dips below impermeable beds in the subsurface, the water becomes confined under pressure and, if the formation is penetrated by a well, water will rise in the well above the base of the confining bed. Such water is said to be under artesian conditions.

The water table generally approximates the configuration of the regional topography, modified by local areas of recharge and discharge. Comparisons of elevations of the water table acquired in wells at selected points throughout

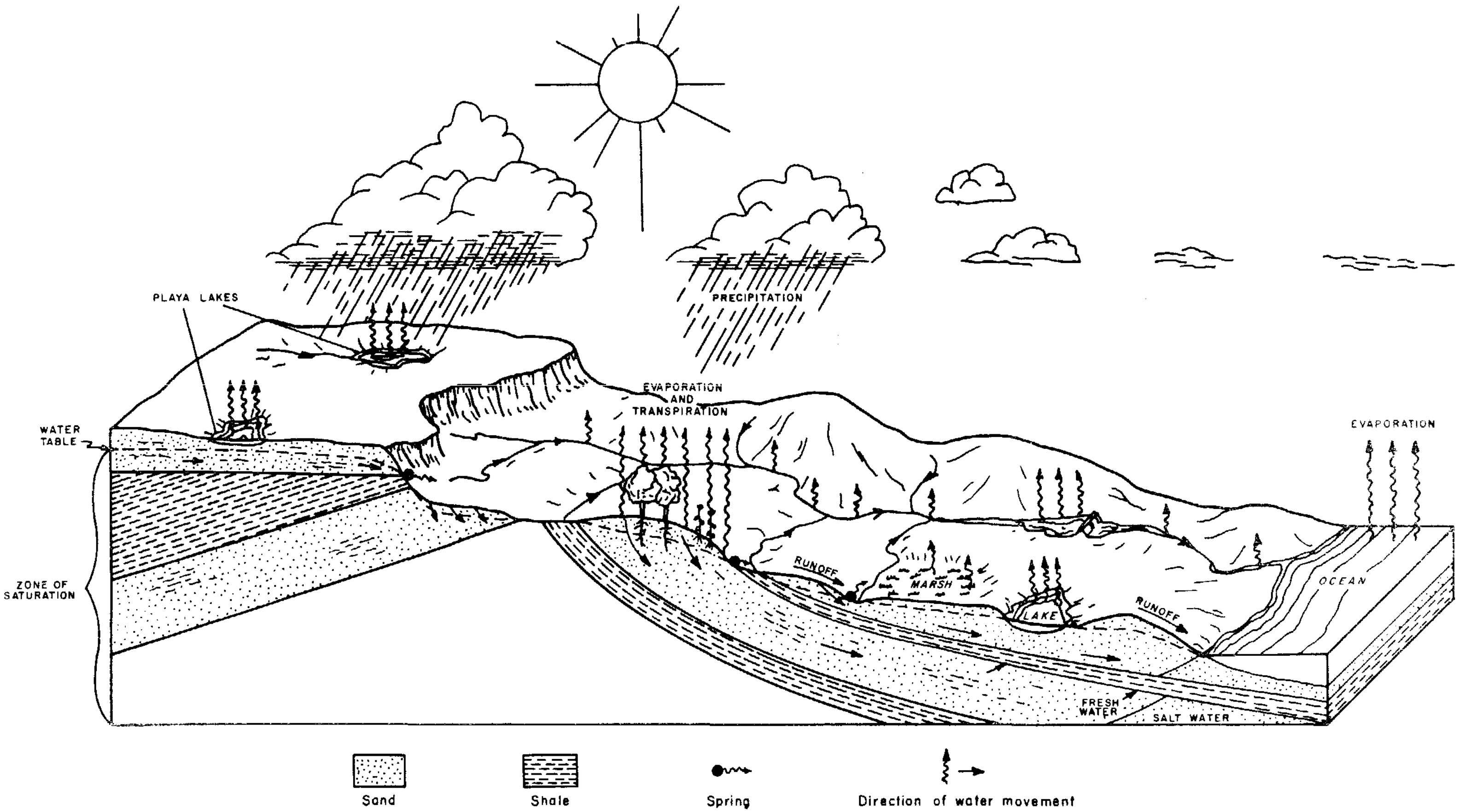

Figure 12

Earth's Hydrologic Cycle

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

the extent of an aquifer indicate the direction of movement and the hydraulic gradient, or slope, under which it moves.

The gradient and direction of movement can also be determined in artesian aquifers by mapping the pressure surface (piezometric surface) as reflected by elevations of water levels in wells. In contrast to the water table, this surface is imaginary, representing the elevation to which water would rise if penetrated, but mapping of it shows the direction and relative rate of movement of the confined water. Water will flow from wells in an artesian aquifer if the piezometric surface is higher than the land surface. An aretesian aquifer is essentially an inclined conduit through which water moves under pressure.

The storage capacity of the voids of an aquifer is important in calculating stored volumes of water, and in an artesian aquifer is expressed as the coefficient of storage, which is the volume of water per unit surface area that will be taken into or released from storage when the piezometric surface is raised or lowered by 1 foot. Under water-table conditions, the term specific yield is used, and is defined as the ratio of the volume of water yielded to the volume of aquifer unwatered. Artesian storage is dependent upon elastic properties of the aquifer, and coefficients of storage are very small in comparison to specific yields of water-table aquifers.

An aquifer's ability to transmit water is important in computing the amount of water available for development on a continuous basis. Its coefficient of transmissibility is a measure of this characteristic and is expressed as the amount of water in gallons per day which will flow through a vertical column of the aquifer 1 foot wide under a 45-degree slope, or unit gradient. With a known hydraulic gradient, the coefficient of transmissibility is used to calculate volumes of water passing through given segments of an aquifer.

The coefficients of transmissibility and storage can be determined by pumping tests of wells, with repeated measurements of water levels in the pumped well and/or nearby observation wells while pumping at a constant rate. The coefficients may be used to determine proper well spacing, to predict effects one well may have on another, and to predict drawdown of water levels at various distances from a well pumping at a given rate for a specified time.

The specific capacity of a well also affords an indication of the hydraulic characteristics of an aquifer. It is equal to the yield in gallons per minute per foot of drawdown of the water level in a well pumped at a constant rate. Specific capacities, however, vary with the rate and duration of pumping and thoroughness of well completion.

Recharge, Discharge, and Movement

Recharge, or replenishment of water to an aquifer, may be artificial or natural. Precipitation and the seepage from lakes or streams on the outcrop contribute natural recharge. Artificial recharge may be effected through wells or by spreading water over permeable outcrops. Over a long period of time, recharge must equal discharge or water in storage will be progressively depleted.

Conduciveness to recharge of an aquifer is dependent on the topography and vegetative cover of outcropping rocks and soils, and the ability of the rocks to transmit infiltrating water. The amount and frequency of precipitation is, of course, a controlling factor in recharge.

Discharge of water from an aquifer occurs artificially through wells or ditching. Natural discharge of water occurs as spring flow, effluent seepage, evaporation, transpiration by plants, and interformational leakage.

Water in an aquifer moves slowly from areas of recharge to discharge areas. Water under artesian conditions moves generally down the dip of the confined strata, and under water-table conditions generally follows the slope of the land surface, but discharging wells can materially change the direction of movement of water toward the wells. The rate of movement in most aquifers is no more than a few hundred feet per year.

Water Levels in Wells

Measurements of water levels in wells show locally the depths to the water table or piezometric surface. The measured level is termed static when no pumping influence is reflected. A pumping level reflects the position of the water table or piezometric surface in a pumping well. Changes in water levels are important in evaluation of aquifers, and may be due to local or regional influences. Changes in water levels are of significance over both long and short time intervals. The most significant changes result from imbalance of the recharge-discharge relationship.

Concentrated pumpage also can produce significant changes in water levels. The water table or piezometric surface near a pumped well is drawn down into the shape of an inverted cone with its apex at the pumped well. Development of this cone is dependent upon the hydraulic coefficients of the aquifer and the pumping rate. The cone of depression expands until it intercepts recharge which is equal to the demand, or it continues to expand as water is withdrawn from storage. In heavily developed irrigation areas the cone of each well is superimposed upon the cones of all adjacent wells, thus creating a regional cone of depression in the water table or piezometric surface.

Changes in atmospheric pressure, tidal forces, and earthquakes can effect changes in water levels, but the magnitude of fluctuations are usually very small.

Chemical Quality

All ground water contains minerals in solution generally dissolved from the rocks through which the water moves. The mineral composition of the rocks may vary considerably. Water in the form of precipitation is largely free of dissolved minerals but when it contacts rocks of the earth's crust, gradual solution commences. Concentrations of disolved solids generally increase with depth of the aquifer.

Ground water is sometimes subject to contamination by surface disposal of brine produced with oil or by leakage from producing or abandoned oil wells. Improper disposal of sewage in the ground also may lead to contamination.

Chemical Quality Criteria

The principal chemical constituents found in ground water are calcium, magnesium, sodium, potassium, iron, silica, bicarbonate, carbonate, sulfate, chloride, and minor amounts of manganese, nitrate, fluoride, and boron. Concentrations of these ions or chemical constituents are commonly reported by weight in parts per million (ppm). One ppm defines one part by weight of the ion to a million parts by weight of water.

Certain quality standards have been established or suggested for public, industrial, and irrigation supplies. Water used for public supplies should be colorless, odorless, palatable, and if possible within the mineral concentration limits set forth by the U.S. Public Health Service (1962) for drinking water used on interstate carriers. Some of these standards, in allowable parts per million, are as follows:

Substance	Concentration (ppm)
Chloride (Cl)	250
Fluoride (F)	(*)
Iron (Fe)	.3
Manganese (Mn)	.05
Nitrate (NO_3)	45
Sulfate (SO_4)	250
Total dissolved solids	500

*When fluoride is present naturally in drinking water, the concentration should not average more than the appropriate upper limit shown in the following table:

Annual average of maximum daily air temperatures (°F)	Recommended control limits of fluoride concentrations (ppm)		
	Lower	Optimum	Upper
50.0 - 53.7	0.9	1.2	1.7
53.8 - 58.3	.8	1.1	1.5
58.4 - 63.8	.8	1.0	1.3
63.9 - 70.6	.7	.9	1.2
70.7 - 79.2	.7	.8	1.0
79.3 - 90.5	.6	.7	.8

The use of drinking water having a fluoride content exceeding the upper recommended limits may cause mottling of the teeth of children (Dean, Dixon, and Cohen, 1935, p. 424-442). However, the use of drinking water that contains the optimum fluoride concentration appears to reduce the incidence of tooth decay (Dean, Arnold, and Elvove, 1942, p. 1155-1179).

In many areas of Texas, municipal water supplies complying with these standards cannot be obtained. However, supplies that fail to meet these standards have been used for long periods without apparent ill effects to the user. The Texas State Department of Health reports that some authorities recommend that drinking water should not contain in excess of 20 ppm of nitrate, as it may indicate organic pollution. Maxcy (1950, p. 271) states that water having a nitrate content exceeding 45 ppm should be regarded as unsafe for infant feeding.

Hardness of water is also important in consideration of water supplies. It is expressed in parts per million as calcium carbonate. A generalized classification for hardness, which is useful as an index to the analyses of water, is as follows: less than 60 ppm, soft; 61 to 120 ppm, moderately hard; 121 to 200 ppm, hard; and more than 200 ppm, very hard.

Standards for industrial supplies are varied depending upon the type of industry. A major concern to industries is the development of a water supply which does not contain corrosive or scale-forming constituents. Calcium and magnesium, which directly affect the hardness, are a limiting factor in the suitability of water for boiler use. Iron and silica in excessive amounts also cause scale deposits which clog lines and reduce the efficiency of other industrial processes. Each industry interested in developing a water supply will have its own quality requirements.

Whether water is suitable for irrigation depends not only on the quality of the water but also on the type of soil to which it is applied, adequacy of drainage, type of crops, and climatic conditions. The U.S. Salinity Laboratory Staff (1954) outlined the characteristics which are important in determining the suitability of water for irrigation. These characteristics are: (1) total concentration of soluble salts, (2) percentage of sodium in relation to the other cations, (3) residual sodium carbonate, and (4) concentrations of boron and other toxic elements.

Treatment of Water

Water that does not meet the requirements of a municipal or industrial user commonly can be treated by various methods so that it will become usable. Treatment methods include softening, aeration, filtration, cooling, dilution or blending of poor and good quality waters, and addition of chemicals. The limiting factor in treatment is economics. Each water may require different treatment practices and the treatment should be designed for that particular water. However, once a treatment is established it probably will not have to be changed as the chemical characteristics of uncontaminated ground water remain fairly constant.

Principal Aquifer

The water-bearing unit of principal interest in the study area consists of the basal gravel and sand of the Santa Rosa Formation, the upper Santa Rosa Formation, and the sand of the Trinity Group. In parts of western Nolan County the Trinity Group and Santa Rosa Formation are in direct contact with one another, but in places are separated by clay or shale.

In general, the base of fresh water east of the Colorado River is illustrated by Figure 8, which shows the altitude of the top of the Permian rocks.

Saturated thickness of the principal aquifer (in the Santa Rosa Formation and Trinity Group) in areas east of the Colorado River is shown on Figure 13. In much of the southwestern part of Nolan County, Trinity Group sand accounts for most of the saturated thickness values. In areas north and northeast of Colorado City, water-bearing parts of the upper Santa Rosa Formation are included in the saturated thickness values.

Santa Rosa Formation

Because this study is chiefly concerned with the availability of ground water in the Santa Rosa Formation under present and future conditions of irrigation development, and because the Santa Rosa contains no important quantities of fresh water west of the Colorado River, the formation is discussed separately in its occurrence east and west of the river.

Occurrence East of Colorado River

Most of the following information on the Santa Rosa Formation pertains to the basal gravel and sand of the Santa Rosa Formation; however, north and northeast of Colorado City the upper Santa Rosa sands are saturated and are also included in this discussion. The upper sands in this area have a different water level than the lower Santa Rosa and generally have inferior quality water to that contained in the lower unit, particularly in sulfate concentrations.

Recharge, Movement, and Discharge

The source of all water in storage in the Santa Rosa Formation and the source of recharge to it is precipitation on the formation outcrop and on the outcrops of overlying Cretaceous, Tertiary, and Quaternary rocks. Locally the amount of replenishment varies according to the permeability of the outcropping rock or the nature of the soil mantle and vegetative cover. Regionally, the amount varies with precipitation.

Recharge to the Santa Rosa appears to be substantial in flat, alluvial areas of northwestern Nolan County. Although the soils are comparatively tight, terraced surfaces retain considerable precipitation which infiltrates the soil and is transmitted downward through generally pervious caliche. In southwestern Nolan County recharge is from the Trinity Group where the two sands are, in places, in contact with one another. Sandy areas, highly conducive to recharge, are formed on outcrops of sand in the upper Santa Rosa and occur generally west of Loraine, particularly along Lone Wolf Creek. Recharge is undoubtedly substantial through the channels of tributaries of Champion Creek in sandy upper reaches above discharge areas. In the South Fork Champion Creek area in Nolan County, one well is reported to be capable of supplying 15 to 20 percent more sprinklers after sustained heavy runoff in the creek.

In general, the direction of movement of ground water is to the west, toward the Colorado River where much of it is discharged into the river or its principal tributaries, constituting a fairly constant increment of the flow or underflow of the streams. Before the advent of irrigation and the generally increased water demands, perennial flow reportedly occurred along South Fork Champion Creek almost as far east as the Nolan County lines, as a result of natural ground-water discharge, or spring flow. However, the water table is now generally below the base of that stream except in its lowermost reaches.

The contours on Figure 14 show the slope of the water table or piezometric surface in Permian, Triassic, and Cretaceous strata and also reflect the direction of ground-water movement. Contours becoming more closely spaced may indicate a greater rate of movement of water, but closely spaced contours may also indicate, as they do in southwestern Nolan County, a transitional zone of ground-water occurrence from an upper to a lower water-bearing unit.

Figure 14 principally reflects the elevation of a largely unconfined water surface (water table) in Nolan County and a piezometric surface representing artesian conditions of the lower Santa Rosa Formation in much of Mitchell County and parts of Nolan County. Throughout the irrigation area, the average gradient of the water table or piezometric surface as indicated by the contours is 20 to 25 feet per mile. A ground-water divide occurs along or slightly east of the Roscoe-Maryneal highway and continues north-westward into Scurry County and southwest into Coke County. Northeast of the divide, water in the Santa Rosa Formation and Trinity Group moves toward discharge areas in the Brazos River basin; southeast of the divide, water moves into Coke County toward the Colorado River; and west of the divide, water moves into Mitchell County toward the Colorado River.

Water is discharged from the aquifer through seepage into the major drainages, spring flow, evaporation, transpiration by plants, and by downward leakage into the Permian rocks. Also, large quantities of water are discharged through wells, primarily for irrigation purposes.

Water-Bearing Characteristics

The Santa Rosa Formation east of the Colorado River generally consists of a few feet to 30 feet of hard, porous, gravel conglomerate at the base, succeeded upward by alternating red and gray micaceous shale, clay and sand or gravel. Sand and gravel generally predominate in the lower 100 feet of the formation. The sands and clays are highly lenticular, grading both laterally and vertically into one another within short distances.

The thickness of the Santa Rosa Formation ranges from a few feet in parts of southwestern Nolan County to over 300 feet north and northeast of Colorado City. Figure 13 shows the total saturated thickness of the Santa Rosa Formation and Trinity Group, and the calculated thickness of saturated sand and gravel. The saturated thickness of the aquifer ranges from a few feet at its periphery to as much as 280 feet in northern Mitchell County. From an analysis of 87 drillers' logs of water wells, some of which are included in Table 6, the average percentage of sand and gravel in the total saturated thickness of the Santa Rosa sediments is about 65 percent, and the average thickness of sand and gravel is about 76 feet.

Water-bearing characteristics of the lower Santa Rosa Formation were determined at four localities by pumping tests of wells having small to medium yields (Table 2). Coefficients of transmissibility and storage calculated from the data obtained in these tests averaged 8,845 gpd (gallons per day) per foot and 0.00019, respectively. Some of the test indicated that under static conditions water may be artesian, but that with pumping, water levels may be lowered below the confining strata, thus producing water-table conditions. Because the wells tested included none with large yields, which are numerous and widely distributed over the area, the average coefficient of transmissibility determined is probably low.

Table 2.--Summary of results of pumping tests of wells in the Santa Rosa Formation, Mitchell County

Pumped well	Owner	Pumping rate (gpm)	Time pumped (hrs)	Distance to observation well (ft)	Coefficient of transmissibility (gpd per ft)	Coefficient of storage
29-34-714	Colorado City	70	11 & 45	730 & 795	* 5,955	*0.00008
29-35-106	H. E. Thomas	170	6	490	11,270	.00013
29-35-712	Price Hall	245	18	178	5,856	.00044
29-43-403	D. C. Stubblefield	70	17	274	12,300	.00012
				Average....	8,845	0.00019

*Average value from two tests.

No data are available on the hydrologic characteristics of the upper beds of the Santa Rosa, but it is not likely that they would sustain concentrated development in any one area. The sands are lenticular and comprise individual hydrologic units at distinctly different levels within the Santa Rose Formation. The sands are generally less than 100 feet deep.

Coefficients of transmissibility and storage obtained from reasonably homogeneous and confined aquifers can be used to predict future water-level declines and consequently amounts of water available for development in given areas. However, the practical value of these coefficients for an aquifer composed of lenticular sands such as the Santa Rosa beds appears questionable.

Well Construction and Performance

Construction of the irrigation wells in Mitchell and Nolan Counties presents few problems. Most recent irrigation, industrial, and municipal wells are completed with 6 to 12-inch casing which extends to the bottom of the well and is slotted below static water level. Muncipal wells are often gravel packed with a 2- or 3-inch layer of gravel. Consolidated rock has permitted successful open-hole development below the water level in many of the older wells, but caving red clay below the water level in some areas has led to the use of perforated liners on the bottom, extending upward through the clay. Only a few Santa Rosa wells pump sand, which would cause wear on pumps. Wells are commonly flushed with acid to remove chemical deposits from perforations, and many are "shot" with nitroglycerin in an attempt to increase the effective diameter of the well, reportedly with varying degrees of success.

Table 5 shows reported yields or measured application rates for the irrigation wells. Reported or measured yields range from 20 to 1,400 gpm, probably averaging about 175 to 200 gpm. However, for the wells with largest reported yields, the measured application rates were generally found to be less than the reported yields. Because closely spaced wells with comparable saturated thicknesses in the developed irrigation area may range in yield from 60 to over 1,000 gpm, permeabilities are believed to vary considerably in the lower sand. Channel gravel is suggested in accounting for the well yields greater than 1,000 gpm, as the sands generally are not capable of supporting such withdrawals of water.

Two wells produce water from the upper Santa Rosa Formation for irrigation purposes, and yield about 40 gpm. These are wells 29-34-414 and 29-26-803.

Table 3 shows the approximate specific capacities of wells in the irrigated area. The specific capacities range from 0.4 to 183 gpm per foot of drawdown.

About 65 to 70 percent of the pumps are powered electrically, and most of the remainder, usually the larger wells, are powered by butane gas. A few wells use natural gas.

Pumps on the large-capacity wells are usually the standard turbine type. Submersible pumps are used in many wells that have relatively small yields. Pumps are selected and set on the basis of pumping tests which determine the maximum possible drawdown of the water level and the maximum well yield.

In Nolan County where soils are comparatively tight, irrigators generally gravity-flood individual crop rows from open discharge. However, in Mitchell County, sprinkler systems are used in more than 95 percent of irrigation operations. The sprinkler system causes a considerable addition to the pumping head, and commonly results in a reduction of pumping rate.

Behavior of Irrigation Wells

The following is an analysis of the behavior of wells in the Santa Rosa Formation during the course of an irrigation season and the following period of inactivity.

In a given pumping well the maximum rate of transmission of water occurs under artesian conditions when the water level is drawn down to the top of the producing strata; further lowering of the water level causes unwatering of the saturated material, producing water-table conditions. This rate may be obtained by adjusting the pumping rate as necessary to approximately stabilize the water level at the top of the water-producing strata. If the induced recharge equals the rate of withdrawal, the well yield and water level will remain constant; if not, both will decline gradually.

If the pumping rate is not adjusted to stabilize the water level for artesian transmission, the water level will decline below the top of the water-producing strata. Subsequent unwatering of sands by gravity drainage results in the availability of additional water from storage, which has the temporary effect of reducing the rate of decline of the water level. As pumping continues, artesian conditions progressively change to water-table conditions farther and farther from the pumped well, as the water level declines below the

Table 3.--Approximate specific capacities of selected wells

Well	Yield (gpm)	Drawdown (feet)	Specific capacity (gpm per foot)
29-34-207	* 50	133	0.4
302	179	96	1.9
701	35	43	.8
706	73	58	1.3
709	95	49	1.9
714	75	28	2.7
35-307	130	61	2.1
401	*200	106	1.9
405	120	115	1.0
407	*185	131	1.4
414	142	113	1.2
501	*200	73	2.7
504	315	81	3.9
507	†500	†102	4.9
704	* 60	38	1.6
801	300	84	3.5
36-415	91	47	1.9
416	108	68	1.6
802	33	36	.9
811	58	34	1.4
820	82	60	1.4
906	123	24	4.9
42-301	*270	13	21.0
302	446	32	14.0
43-101	*340	49	7.0
202	640	58	11.0
302	*125	94	1.3
403	70	21	3.3
502	490	66	7.1
507	†925	5	183.0
44-101	*350	96	3.7
103	59	103	.6
104	220	69	3.2
112	154	118	1.3
118	*150	55	2.7
208	123	128	1.0
308	91	80	1.1
402	60	80	.8
414	*100	127	.8
505	130	113	1.2

* Yield reported by owner.
† Data from owner's records.

confining stratum. The water level will continue to decline in the well until it reaches the pump intake, at which point a marked decline in the well yield will occur.

If concentrated irrigation pumpage exceeds recharge in a given area it is expected that well yields should noticeably decline during the 2 to 3 months of seasonal pumpage as wells compete for both stored and transmitted water. Such performance is commonly reported in wells in the study area as some well yields decline 15 to 20 percent over the course of a pumping season. Interference between irrigation wells is frequently reported in nearly all areas of substantial development.

Irrigation wells are rarely pumped constantly over 60 days. They are generally not used at all from mid-September until late February. Upon cessation of seasonal irrigation pumpage a large inverted cone of depression exists in the water table or piezometric surface. It is caused by the extraction of ground water from storage in the aquifer and is replaced, at first, by water moving into it from all directions. Much of the recharge, however, comes to the irrigation area from the east as indicated by contours on Figure 14, the amount depending on the amount of regional precipitation received. Water levels subsequently rise in wells until pumping is resumed. If the recharge is adequate during the shut-down period, water levels will rise to about the same level they were before seasonal pumpage started, thus re-establishing the artesian conditions that prevailed under static conditions of the aquifer. If recharge is inadequate, the wells will show a decline in water level from one season to the next, which has been observed in areas of most concentrated development.

Water Levels in Wells

Water levels in wells in the lower Santa Rosa Formation range from 15 to 215 feet below land surface. The shallowest depths to water are along the streambeds of the North and South Forks of Champion Creek in Mitchell County, where the streambeds are at or below the water table. Greatest depths to water are in Nolan County. Table 5 shows depths to water in selected wells throughout the entire area studied. The average depth to water in the irrigated area of Nolan County is 140 to 150 feet, and 50 to 70 feet in the irrigated area of Mitchell County.

Because of the lenticular nature of sands in the Santa Rosa Formation, the hydrostatic head in the individual water-bearing zones may vary considerably at a particular locality. Saturated sands occur above the artesian water level of the lower Santa Rosa Formation in the Colorado City area and to the north and northeast. Generally, water levels are highest in wells penetrating the shallowest zones.

Figure 14 shows the altitude of water levels in wells, most of which were measured in 1960 and 1961. Observed changes in water levels over this 2-year period were generally less than 2 feet, which is insignificant in relation to the 20-foot contour interval employed on this map.

Changes in Water Levels

Since inception of this study it was recognized that changes in water levels are of singular importance in assessing the degree of permanence to be expected from wells of the developed irrigation area, the principal concern of this study. All available historical water-level data for this area were analyzed. Water-level data fall into four general categories:

(1) two-measurement points, consisting of the oldest available measurement and a recent measurement in the same well, not necessarily measured in winter months;

(2) annual measurements of winter static levels in observation wells from 1952 to 1963 (a part of the Texas Water Development Board's continuing Water-Level Observation Well Program);

(3) annual measurements of winter static levels in many active irrigation wells and others, from November 1960 to February 1964; and

(4) seasonal measurements, mainly in nonirrigation wells, to reveal the magnitude of drawdown in and near developed areas caused by irrigation pumpage.

Observed changes in each category were analyzed in relation to precipitation data in an attempt to predict the behavior of wells during periods of severe drought, normal rainfall, and greater than normal rainfall. The most significant conclusions of this report rest upon comparisons of winter static water-level measurements made in many irrigation wells from 1960 to 1964.

The water levels in irrigation wells generally fluctuate in seasonal cycles, being near the base of the aquifer during the pumping season and gradually rising toward a peak which is generally reached just prior to commencing pumpage the next year. This seasonal fluctutation of water levels is illustrated by hydrographs of Figure 15 which show effects of pumpage on water levels both near and away from active irrigation wells. Water levels in well 29-34-510, an unused well about 250 yards from active irrigation wells, declined 75 feet during the pumping season. Effects of regional irrigation pumpage are discernable in some wells up to a distance of 1.5 miles from the developed areas. The hydrographs on Figure 15 show the cyclic behavior of water levels in the irrigation area, and confirm the development of a regional cone of depression in the developed area during the irrigating season.

Comparative measurements made immediately prior to starting pumps each year for pre-watering should reveal whether the last season's pumpage has resulted in a net decline of water level in the well, assuming that static conditions prevail in the aquifer at the time of both measurements. Because of highly variable pumping practices and starting times, it is impossible to obtain measurements under static conditions in a large number of wells immediately prior to pumping--early pumpage in some wells destroys the static conditions of the aquifer. As an alternative to this procedure, it has been assumed that measurements made from November through February in a large number of wells should afford reasonably valid annual comparisons. Pumpage during this period is generally insignificant, and water levels should be at approximately the same stage of recovery each year.

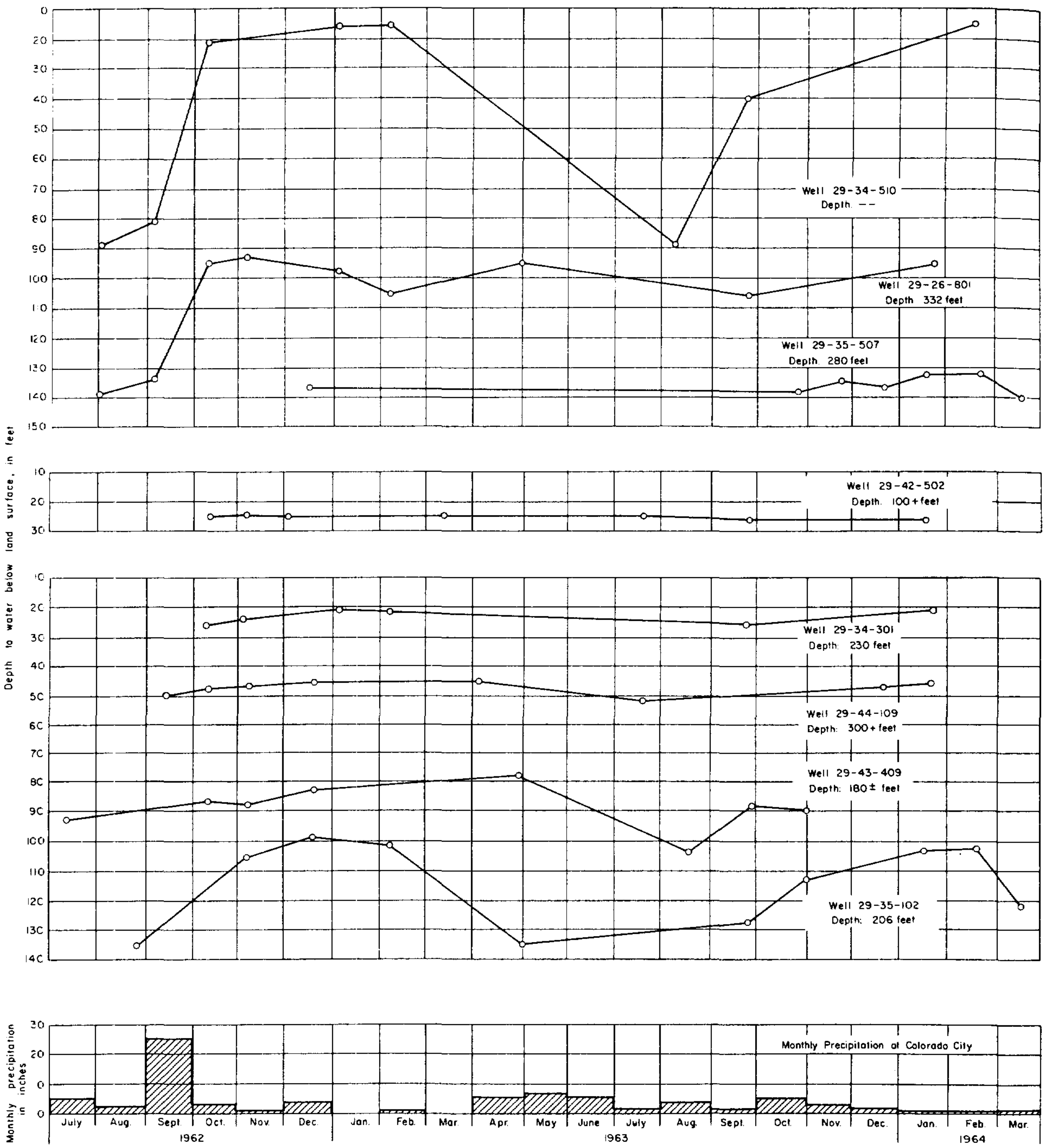

Figure 15

Seasonal Measurements of Depth to Water in Selected Wells in or Near the Irrigation Area, and Monthly Precipitation at Colorado City, July 1962—March 1964

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

References made in this report to winter static water levels of a particular year refer to December of that year, even though some of the measurements may have been made in January or February of the following year; for example, the 1963 winter measurements refer to measurements made in November and December of 1963 and January and February of 1964.

Oldest Available Comparisons of Water Levels.--During this study measurements were obtained in scattered wells where measurements dating back to 1946 were available. Comparisons of past and recent measurements are presented in Table 4. Most of the oldest water-level measurements are for wells in Nolan County, measured by the U.S. Geological Survey in 1946. In general, these data indicate that water levels have declined about 5 to 6 feet since 1946 in northwestern Nolan County. However, the 1946 water-level measurements were not acquired for comparative purposes as were the 1963 measurements, and may not reflect a static condition in all cases; the earlier data were obtained in summer months, the latter in winter months.

The data indicate that since 1946 water levels have declined about 7 feet at Roscoe and at the abandoned Sweetwater well field 4 miles south of Roscoe, and about 5 feet in the Champion area of Nolan County. In the Colorado City well field, water levels have risen 14 to 21 feet since 1946, reflecting cessation of pumping in the early 1950's. Historical water-level data are unavailable for Loraine municipal wells, and hence the effects of pumping on water levels there is unknown.

Water Levels in Observation Wells, 1952-63.--Unfortunately, no annual water-level data are available that are continuous from pre-drought years to the present. Earliest measurements in irrigation wells date back to 1952, a year well into the drought of 1951-56. Measurements in both active and abandoned irrigation wells, the Colorado City well field, and selected livestock wells were started by the U.S. Geological Survey in the period 1952-54 and have been made annually since then by Federal or State agencies during the months of December, January, or February. Figure 16 presents hydrographs of water levels in selected observation wells. The relationship of water levels to annual precipitation and cumulative departure from the average annual precipitation can be seen by comparing Figure 16 with Figure 3. Cumulative effects of the 1951-56 drought are reflected by the hydrographs, and also the effects of higher-than average precipitation during 1957-63. Despite an excess of precipitation accrued during the latter period, the area has not fully regained the volume of water pumped during the drought years.

The water-level hydrographs correlate generally with the precipitation cumulative departure graph of Figure 3, illustrating a close relationship between the trend of water levels and regional rainfall. A net gain of about 25 inches of rain above the average annual precipitation was received at Colorado City from 1957 to 1963. Therefore, this period should have been optimum for water-level recovery because of a combination of less pumpage and more recharge. This is reflected in the hydrographs, some of which show a rising trend over the period, others showing a much slower decline than the generally sharp declines of the last years of the drought.

The full magnitude of water-level declines from 1951 to 1956, the drought years, is not available for any one well. Declines of 10 to 15 feet were recorded in two wells during 1956, the last drought year. It seems reasonable,

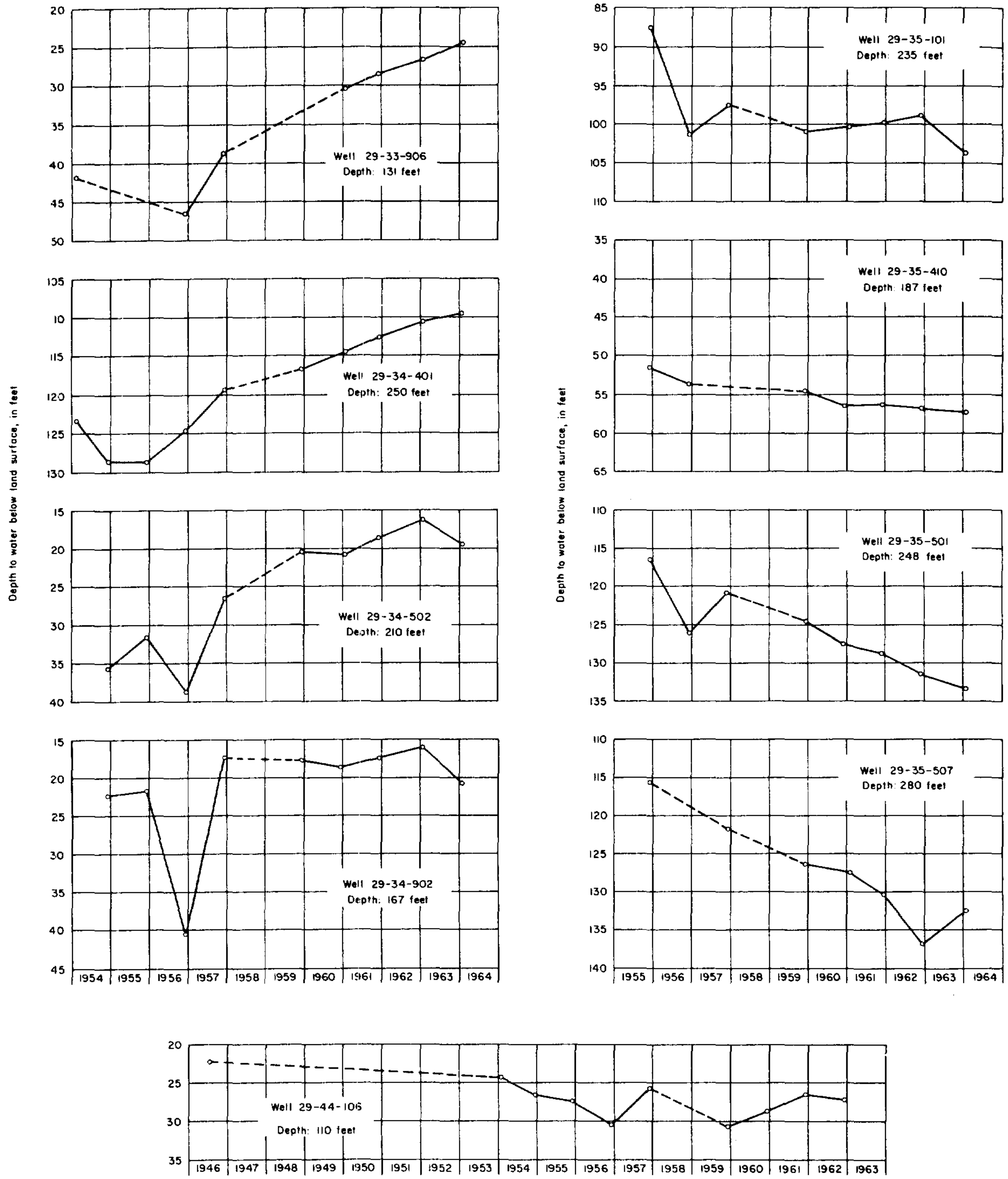

Figure 16

Annual Measurements of Depth to Water in Selected Wells in or Near the Irrigation Area, 1946-64

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

Table 4.--Historical water-level measurements compared to recent measurements

Well	Depth to water	Date	Depth to water	Date	Decline (feet)	Rise (feet)
29-33-202	92.5	May 1948	92.9	Mar. 1964	0.4	--
34-701	127.9	Mar. 1946	113.6	Mar. 1961	--	14.3*
714	135.4	do	113.8	Jan. 1963	--	21.6*
716	128.2	do	113.6	do	--	14.6*
35-308	177.8	July 1946	199.9	Feb. 1963	22.1	--
708	21.3	Jan. 1953	25.0	Jan. 1964	3.7	--
36-410	162.2	July 1946	168.2	Feb. 1963	6.0	--
507	126.9	Apr. 1950	136.4	Jan. 1964	9.0	--
603	88.0	June 1946	95.8	Nov. 1960	7.8	--
808	139.5	July 1946	143.9	Feb. 1963	4.4	--
815	120.4	do	127.9	do	7.5	--
905	100.9	1928	104.7	Jan. 1964	3.8	--
906	103.0	1928	109.9	do	6.9	--
919	97.4	Apr. 1950	104.4	Oct. 1963	7.0	--
42-205	87.8	May 1946	83.8	Mar. 1963	--	4.0
601	64.3	Jan. 1953	62.8	Jan. 1964	--	1.5
43-402	34.8	do	44.5	do	9.7	--
44-106	22.1	May 1946	27.2	Feb. 1962	5.1	--
108	47.7	July 1946	51.1	Jan. 1964	3.4	--

* Rise due to cessation of municipal pumpage, Colorado City well field.

therefore, to expect that declines of at least 30 to 40 feet were experienced in some wells over the period 1951-56 with an appreciable reduction of the aquifer's saturated thickness.

The hydrograph of well 29-44-106 (Figure 16), in Nolan County, shows that water-level declines which were established during the drought were essentially reversed after 1957 as a result of high rainfall.

The water level in well 29-34-401, in the abandoned Colorado City well field, has shown a uniformly consistent rise during 1956-63, probably resulting from a combination of additional recharge following the drought years and recovery from the drawdown caused by pumping in the last years of use in the early 1950's. Well 29-33-906, an occasionally used irrigation well, shows the same general pattern of recovery; its proximity to the Colorado City well field suggests that it may be subject to the same influences.

Notable on the hydrographs of Figure 16 are the rises of water levels in irrigation wells from the extremely dry year 1956 to the extremely wet year 1957. The water-level changes reflect responses to the effects of both decreases in recharge; the relative magnitude of either effect is unknown.

In some irrigation wells water-level trends appear to be anomolous to precipitation trends, probably as a result of variations in the amount and seasonal distribution of local precipitation.

The 1952-63 observation well data indicate that water levels are in the process of recovery from an unusually large deficit of precipitation since 1946, and that water levels are probably lower than usual. Of greatest significance to this study, however, is the trend of the water levels since 1957 in relation to precipitation. They indicate that higher-than-normal rainfall is in many areas capable of stabilizing or reversing downward trends of water levels caused by drought and pumpage such as occurred during 1951-56. However, the distribution of these observation wells, while covering a large area and many areas of pumpage, is insufficient for assessing adequacy of recharge in all areas. The foregoing analysis cannot be projected safely to undeveloped areas remote from these observation wells.

<u>Changes in Water Levels, 1960-63</u>.--An intensive program of winter water-level measurements in active irrigation wells was pursued in 1962 and 1963, using for comparison the measurements obtained during the reconnaissance investigation which began in 1960. The purpose of this program was to establish and analyze the behavior of water levels under the existing replenishment conditions in order to predict future water-level trends under similar, and less favorable, conditions of precipitation. Conditions for replenishment of water pumped from irrigation wells were generally favorable during 1960-63 owing to above-normal precipitation for the period.

Table 7 presents comparative winter water-level measurements used to construct Figures 17, 18, and 19, which show:

(1) net change of water levels in irrigation and other wells for approximately a 3-year period (1960-63), which consisted of three irigating seasons (1961, 1962, and 1963) and was characterized by higher-than-normal annual rainfall;

(2) net change of water levels during a 2-year period (1960-62), including the 1961 and 1962 pumping seasons which were characterized by higher-than-normal annual rainfall and lower-than-normal pumpage; and

(3) net change of water levels for a 1-year period (1962-63) which includes the 1963 irrigation season of intensive pumpage necessitated by unfavorable seasonal distribution of rainfall.

Water-level changes on Figure 17 are principally for irrigation wells which have been used to some extent in each irrigation season of the 1960-63 period. Changes for other wells are included for comparison with those for the active irrigation wells. Analysis of Figure 17 shows that water levels in inactive wells marginal to developed areas closely correlate with water-level changes in wells in the developed area.

It is apparent that water levels in wells in the various areas represented on Figure 17 responded differently to the combined effects of recharge and pumpage during the 3-year period of observation. In grids 29-34 and 29-42 the water-level changes indicate that recharge generally exceeded discharge in the area. The water-level changes in these two grids ranged from -1.5 to +13.3 feet, with all but four wells showing rises.

In grids 29-36 and 29-44 recharge appears to have been approximately equal to the discharge. The areas of decline and rise of water levels were approximately equal, and both the declines and rises were generally slight. The water-level changes ranged from -3.1 to +3.4 feet.

Water levels declined in most of the wells in grids 29-35 and 29-43, indicating that the discharge in this area exceeded the recharge for the 3-year period. The water-level changes in these grids ranged from -9.0 to +4.4 feet, with most wells showing declines. In grid 29-35 the declines average about 4.5 feet. Thus the recharge in this area, which includes the Loraine municipal wells, was inadequate to sustain the pumpage for the 3-year period. In grid 29-43 the declines averaged about 2.5 feet.

Changes in Water Levels, 1960-62.--A study of water-level changes in irrigation wells during a two-season period (1961 and 1962) characterized by much higher than average rainfall and less than average pumpage is presented on Figure 18.

The water-level changes on Figure 18 indicate that recharge exceeded the discharge in grids 29-34, 29-36, and 29-42. In grids 29-34 and 29-42 the water-level changes ranged from -0.9 to +11.8 feet, with all but two wells showing rises. Grid 29-36 reflects the favorable effects of rainfall on the plateau area of northwestern Nolan County, where very slight declines were recorded in only 4 of the 17 wells studied. The changes in water levels ranged from -1.0 to +2.7 feet.

Figure 18 indicates that recharge was approximately equal to the discharge in grids 29-43 and 29-44 during the 1960-62 period. The water-level changes ranged from -4.6 to +4.0 feet, with more wells indicating rises than declines. Water levels in grid 29-43 generally rose during the 1960-62 period, except in the southern third of the grid, as compared with general declines for the period 1960-63 which includes the effects of unfavorable distribution of rainfall in 1963.

Only in grid 29-35 does it appear that discharge exceeded the recharge of the area. Despite highly favorable conditions of precipitation, water levels measured in central part of the grid generally declined from 1 to 4 feet. The declines were of a smaller magnitude than those for 1960-63. Parts of the grid, outside the central decline area, had substantial rises, thus indicating that some of the decline in the central area of the grid during 1960-62 was due in part to excessive concentration of pumpage.

Changes in Water Levels, 1962-63.--Figure 19 shows the changes in water levels in wells between the winters of 1962 and 1963, including a year of normal rainfall but unfavorable seasonal distribution that resulted in above-normal pumpage. Comparison of Figures 19 and 18 shows a marked contrast in the trends of water levels between the two periods.

Figure 19 shows no grids in which recharge exceeded discharge. Only in grids 29-34 and 29-42 did recharge equal discharge, where a sharp rising trend of the previous period was either sharply curtailed or reversed.

In grid 29-35, where the previous period had also shown discharge exceeding recharge, water levels continued downward at even a sharper rate than before and the area of decline expanded to include all but a very small area in the northeast corner of the grid. The range of water-level changes in the grid was from -8.4 to +1.5 feet.

Water-level measurements in grids 29-36, 29-43, and 29-44 also indicate that discharge exceeded recharge in 1963. The changes ranged from -4.0 to +3.2 feet, with only nine wells reflecting rises in water levels in contrast to the majority of rises reflected during 1960-62.

Chemical Quality

Criteria for judging the suitability of a particular water for municipal, industrial, and irrigation use were discussed under the general section on "Chemical Quality" (page 35). Selected chemical analyses of samples of ground water collected in the study area are presented in Table 8. Figure 20 shows locations of wells in the Santa Rosa Formation from which samples were collected, and selected chemical constituents analyzed. Inspection of Figure 20 reveals that the quality of water in the basal part of the Santa Rosa is considerably more mineralized in the west. Analyses of water from wells 29-34-414 and 29-35-108, which produce from the upper Santa Rosa Formation, show that the quality of water from these wells is inferior to the quality of water in the deeper sands of the area.

Water of a quality usable for municipal and most irrigation and industrial purposes occurs throughout the area east of Colorado City. Hardness, however, is always very high and will require softening for many municipal and industrial uses. For industrial purposes the silica content is generally acceptable, but bicarbonate and hardness, because of scale-forming properties, would cause water to be unsuitable for boiler use unless a treatment process is applied. Fluoride content is also marginally acceptable to excessive in many places. The amount of fluoride varies considerably from place to place, and ranges from 0.1 ppm to as much as 4.8 ppm. Water containing more than 1.5 ppm fluoride is not recommended for continuous comsumption by children according to standards of the U.S. Public Health Service. All other standards for public supply are satisfied by water from the Santa Rosa Formation.

Ground water in and east of grids 29-35, 29-43, and 29-51 generally is less mineralized than to the west, having a fairly uniform quality which is generally represented by the following typical analysis:

Substance	Concentration (ppm)
Dissolved solids	500-600
Hardness as calcium carbonate	270
Sulfate	70
Chloride	35
Bicarbonate	285
Boron	0.30
Silica	20
Fluoride	1.5

West from Loraine the quality of water becomes progressively more mineralized, particularly in sulfate concentrations. Water marginally acceptable for municipal use was formerly produced by wells at Colorado City. Ground water in that area shows a wide variation in quality, the concentration of dissolved solids generally increasing westward toward the Colorado River. The upper sands of the Santa Rosa were reportedly cased off in the municipal wells at Colorado City because of the poor quality water contained in them.

The quality of ground water east of the river has, in all but a few wells, been found by experience to be acceptable for irrigation of cotton. Water from wells 29-42-307, 29-43-123, and 29-35-905 seems anomalous in quality to water from other wells in the same areas and is believed to reflect some unknown contaminating source.

Water from well 29-34-207 is reported to have caused soil or crop damage over the past several years. According to Figure 21, a diagram for classification of irrigation waters, the water produced from this well has a medium sodium hazard but a very high salinity hazard. Bulletin 876 of the Texas Agricultural Experiment Station states: "Very high salinity water (C4) is not suitable for irrigation under ordinary conditions but may be used occasionally under special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and highly salt-tolerant crops should be selected." Soils on this farm appear to be quite sandy, but clay lenses are reported in the subsoil which may impede soil drainage. Irrigation was by sprinkling, and cotton was grown at the time of the reported damage. The chloride concentration of this water may have been the principal offender; the concentration was 670 ppm, which is about six to ten times higher than in any other nearby well. The source of this chloride is unknown.

Though generally regarded through experience as acceptable for irrigation of cotton and grain sorghums in Mitchell and Nolan Counties, Figure 21 shows the ground water in a large part of the irrigated area to be considerably high in salinity. The average salinity classification of ground water in Mitchell County is C3, and in Nolan County, C2 and C3. Bulletin 876 states further concerning class C3 salinity: "High salinity water cannot be used on soils with restricted drainage. Even with adequate drainage special management for salinity control may be required and plants with good salt tolerance should be selected."

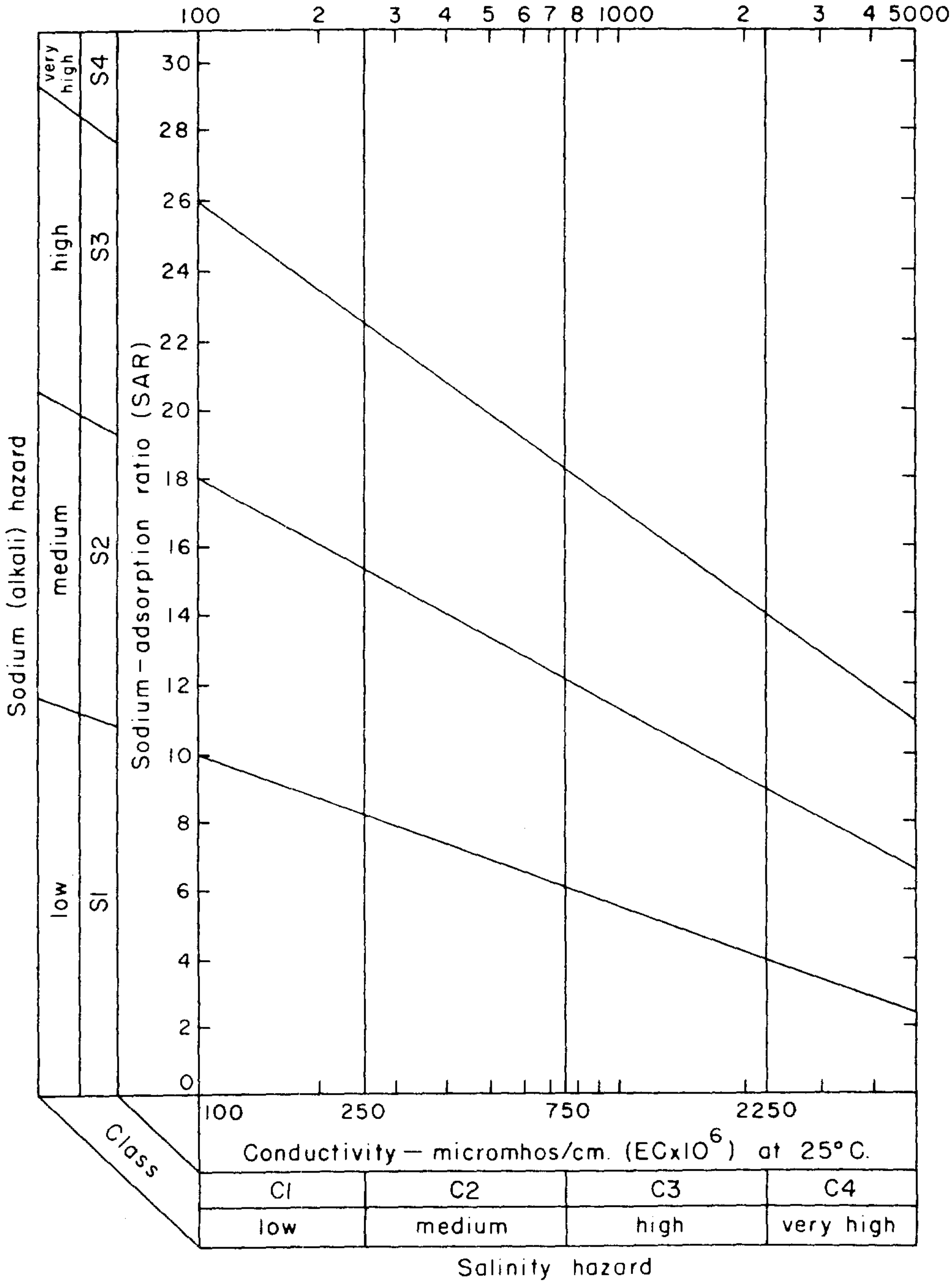

Figure 21

Diagram for the Classification of Irrigation Waters

(After United States Salinity Laboratory Staff, 1954, p.80)

Texas Water Development Board in cooperation with Mitchell and Nolan Counties

The conditions specified for use of C3 water are met over a large part of Mitchell County, the soils generally being sandy with good drainage. Some areas of Mitchell County apparently having a dense red clay subsoil have employed C3 water for many years with apparently no detrimental effect on agriculture. With the exception of well 29-34-207, no report of plant or soil damage was received in Mitchell County, but in well 29-33-910, which is near the fresh-saline water interface, salt water was induced into the well by pumpage in 1962.

In Nolan County where the salinity hazard of ground water is generally somewhat less, soils are much more dense and drainage is probably not as adequate as in Mitchell County. Views based on previous experience conflict as to the mertis of using Santa Rosa water on the gray-black dense soils of northwestern Nolan County. Although irrigation is generally regarded by well owners as economically advantageous, the belief has been expressed to the writer frequently in the course of well inventory that continuous seasonal irrigation of the same land with Santa Rosa water may impair soil fertility. Particularly has this been reported in connection with small gardens which are said to decline in productivity after the first year or two of irrigation. According to the classification shown of Figure 21, it appears that the use of Santa Rosa water on relatively tight soils of northwestern Nolan County may be capable of producing soil damage, since ground water ranges there in classification from C2 to C3.

Although a low sodium level (SAR) prevails generally in Santa Rosa water, a potential sodium hazard appears to exist due to generally high bicarbonate concentrations. Water containing large amounts of bicarbonate tend to precipitate calcium and magnesium carbonates when the soil becomes drier, increasing the sodium percentage in the soil moisture.

Where comparisons of an old and recent analyses are available for the same irrigation well it appears that changes in water quality have generally been favorable. However, studies of the quality of water in the Colorado City well field by the U.S. Geological Survey in 1946 tend to indicate that an increase in mineralization occurred with prolonged pumpage, particularly with respect to sulfate.

Contamination of Santa Rosa water by brine associated with oil drilling and producing operations has not been reported or detected during this study. However, in wells 29-33-202, 29-33-207, and 29-33-910 the water samples contained more chloride than sulfate, which differs from the usual pattern for ground water east of the Colorado River.

Utilization and Present Development

Figure 22 shows locations of all municipal, industrial, and irrigation wells, selected springs, and selected livestock and domestic wells. Data obtained for these are shown in Table 5.

Domestic and livestock wells commonly tap Santa Rosa sands over a large area. The volume of water produced from them was not determined but is believed small in comparison to amounts produced from the larger municipal, industrial, and irrigation wells.

There are 12 active municipal wells producing water from the Santa Rosa Formation east of the Colorado River. One well, 29-34-702, supplies water for a swimming pool in Colorado City. Four of the wells, in grid 29-35-7, supply water to Loraine, and 7 wells, in grids 29-36-5 and 29-36-6, supply the city of Roscoe. Five of the 7 active industrial wells are in grids 29-44-2 and 29-44-3 and are used by the Skelly Oil Company for water flooding of oil reservoirs. The other industrial wells are 29-34-405, used by the Standard Oil Company of Texas for oil production operations, and 29-34-718, used to supply a minnow pond.

In 1963 there were about 300 active irrigation wells in Mitchell and Nolan Counties--about 210 in Mitchell County and about 90 in Nolan County. Two of the wells in Mitchell County, 29-26-803 and 29-34-414, produce water from the upper Santa Rosa sand. Ground-water irrigation in the area began as early as 1936 with the operation of well 29-36-507 in Nolan County. There were probably less than 30 active irrigation wells in the study area prior to 1950. Thus, approximately 270 wells were developed during the past 13 years with principal development occurring from 1950 to 1956. Since 1956, due to more adequate rainfall, the average rate of development has probably been only 12 to 15 wells per year. A recent trend toward irrigation of row crops and pastures in both summer and winter is causing increased irrigation pumpage.

The following table shows approximate amounts of water pumped for municipal, industrial, and irrigation purposes during 1961, 1962, and 1963.

Principal pumpage from the Santa Rosa Formation, in acre-feet

Year	Municipal	Industrial	Irrigation	Total
1961	270	40	9,725	10,035
1962	272	126	10,436	10,834
1963	280	513	14,276	15,069

Of principal significance were irrigation withdrawals, which averaged about 11,500 acre-feet annually over the 3-year period, with a maximum of approximately 14,000 acre-feet in 1963.

Future Availability in Relation to Effects of Present Development

Water available to present and future wells in the Santa Rosa Formation is from two types of occurrence, which will be evaluated separately: recharge and storage. Future availability is predictable only from consideration of effects of present and past development on water levels, which were included in the preceeding discussions.

Recharge.--Developed areas of the Santa Rosa Formation derive recharge both locally from the land surface and from undeveloped areas, including the Cretaceous sediments in Nolan County, which contribute water to the areas of development. The amount of recharge any one area might receive depends on a number of factors such as soil and rock type, topography, extent of cultivation, and the intensity and distribution of rainfall.

The best indicator of the adequacy of recharge is the behavior of water levels in wells. The behavior of water levels, together with the amount of water pumped, can be used to estimate of the amount of water available on a continuing basis.

Based on Figure 18, which shows the changes in winter water-level measurements from 1960 to 1962, covering the pumping seasons of 1961 and 1962, recharge generally exceeded the discharge. During this period the average pumpage was about 10,400 acre-feet each year and they were years of above-normal rainfall. But even during years of favorable recharge, the area in the vicinity of and north of Loraine continued to show a decline of water levels, primarily due to the concentrated pumpage in this area.

Figure 19 represents the changes in winter water-level measurments from 1962 to 1963, which includes the pumping season of 1963. This was a year of normal rainfall, but the seasonal distribution was poor. During 1963, approximately 15,000 acre-feet of water was pumped. In most places the discharge exceeded the recharge, partly due to the poor distribution of rainfall which caused greater than normal pumpage. Thus, it would seem that not more than 15,000 acre-feet of pumpage annually could be depended upon on a perennial basis.

Figure 17 covers the entire period from the winter of 1960 to the winter of 1963 and includes the pumping seasons of 1961, 1962, and 1963. Rainfall was above normal during this period, and the average pumpage was approximately 12,000 acre-feet per year. Figure 17 indicates that recharge exceeded discharge in about one-third of the area, was equal to discharge in about one-third, and was less than discharge in the other one-third. Thus, about 12,000 acre-feet is available annually from the Santa Rosa Formation east of the Colorado River, under these conditions. To this amount could be added an increment of water now being lost by natural discharge into the Colorado River and its tributaries. The exact amount of natural discharge which could be intercepted by pumping is not known. The flow of the Colorado River averaged 3.2 cubic feet per second (a rate of about 2,300 acre-feet per year) over the dry period November 6, 1958 to May 31, 1959 at Colorado City. Not all of this amount would have been contributed from the area which is being considered in this report, nor would all of the area being considered have contributed to this flow.

It is estimated that between 12,000 and 15,000 acre-feet of water can be developed from the Santa Rosa Formation on a perennial basis, throughout its extent east of the Colorado River. In periods of drought or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. In consideration of future development, therefore, it should be realized that during a drought such as occurred from 1951 to 1956, yields of wells are likely to decline seriously in areas having large concentrations of irrigation wells. Further development in these areas would accentuate the decline of yields in a particular developed area. It appears that only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels until the economic limit of irrigation pumpage is reached.

Storage.--Most water pumped during the irrigation season is obtained from storage in the aquifer which is then, if the pumpage does not exceed recharge, replenished during the non-pumping season. If pumpage continually exceeds the recharge to the aquifer, then water is permanently removed from storage and water levels decline as the aquifer gradually is depleted. Under the latter condition, the availability of water must be related to the number of years that water in storage will sustain pumpage.

From an analysis of 87 drillers' logs of water wells, some of which are included in Table 6, the average percentage of sand and gravel in that total saturated thickness of the Santa Rosa Formation is about 65 percent, and the average thickness of sand and gravel is about 76 feet. During an irrigation season, most of the water pumped is from storage under water-table conditions. A specific yield of 0.15 was used to estimate the amount of water available from storage. Using this specific yield for the average thickness of sand and gravel, the total volume of water stored in the approximately 250,000 square miles of developed and potential irrigation area is about 2,000,000 acre-feet. Not all of this water can be recovered, as well yields will decline as the water levels decline. It is significant that when saturated thickness in a well decreases by 25 percent, the well's yield decreases by about 50 percent. Probably not more than one-half, or 1,000,000 acre-feet, could be recovered from storage under the present economics of irrigation pumpage.

In areas characterized by declining water levels the value of existing wells and future wells must be related to the amount of water in storage and the number of years that this water can sustain pumpage. Water levels in wells north of Loraine declined an average of about 4.5 feet over the 1961-63 irrigation seasons. The average saturated thickness of the aquifer in this area is about 140 feet. Projecting the 4.5-foot decline rate, which is probably low since it occurred under higher-than-average rainfall rates, in 15 years the saturated thickness will have decreased to about 70 feet with accompanying reduction in well yields. In no other area of the investigation have declines been so persistently great and irreversible, even during the wet years.

Even if the average annual recharge to the aquifer does not exceed 12,000 acre-feet per year, and the average annual pumpage was doubled (24,000 acre-feet per year), there is sufficient water in storage to allow this quantity of water to be pumped for approximately 80 years. But as pointed out before, as the saturated thickness decreases, so will the well yields, thus requiring more wells to produce the same amount of water.

Recommendations for Future Development

1. Wherever possible, new development should be restricted to areas outside of the areas having more than 1 foot of decline as shown on Figure 19. In areas of little or no decline the best prospects for development are those areas containing the maximum amount of saturated sand and gravel as shown on Figure 13.

2. Before developing new wells, historical water-level data should be examined to determine if water levels are already on a declining basis. If so, the economic value of the proposed well must be related to the number of years ground water in storage will sustain pumpage requirements.

3. New wells should be located beyond the radius of influence of existing wells.

4. Irrigation wells should largely be used only for per-watering except during droughts.

5. The trend toward pumpage of water the year-round for row crops or grass will greatly accelerate the decline of water levels. It is therefore suggested that irrigation be applied only to the use yielding the highest return.

6. Wherever possible, efforts should be made to retain all possible precipitation on permeable outcrops by tanks and dams, and to generally retard runoff by terracing.

Occurrence West of Colorado River

Discussion of the Santa Rosa Formation west of the Colorado River includes both lower and upper beds because of the relative importance of upper beds in this area. Water-quality data and reports by residents and well drillers indicate that no significant quantities of fresh water are available west of the river, hence the area was not studied in great detail. A representative well inventory was made of the area to provide information on the occurrence of water in the Santa Rosa and other formations west of the river.

Lithology and Structure

The Santa Rosa Formation west of the river appears to contain a much greater percentage of red clay or shale than east of the river. About 50 to 75 feet of sand and gravel is usually present at the base of the formation where it is exposed along the Colorado River and Beals Creek. The contact between the Santa Rosa Formation and the overlying Chinle Formation is not readily apparent in Mitchell County due to the presence of lenticular sands and thick red clay or shale zones in both formations. It appears, however, that a thick maroon shale and clay section which generally constitutes the land surface at higher elevations from Westbrook to the Howard County line is a part of the Chinle Formation and it is so considered in this study.

It also is not possible with certainty to define the subsurface contact of the Chinle and Santa Rosa Formations on gamma-ray logs. The structural position of the Santa Rosa Formation in relationship to the overlying Chinle and the underlying Permian rocks is shown on Figure 9. The thickness of the Santa Rosa Formation is approximately 250 to 300 feet, with the base of the Santa Rosa near the Howard County line being as deep as 900 feet below the land surface. The base of the Santa Rosa Formation as shown on Figure 8 generally dips westward and northwestward. A local high in the northwest corner of Mitchell County causes a reversal in the regional dip. The base of the Santa Rosa Formation along the west line of Mitchell County ranges from 300 to 550 feet below the level of the Colorado River.

Although the western limit of the Santa Rosa Formation outcrop is not delineated on Figure 5, the geologic map, all Triassic sediments in the study area eastward from the general vicinty of Westbrook are considered in this report to belong to the Santa Rosa Formation.

Hydrology

Water occurs in both the upper and lower sands of the Santa Rosa Formation west of the Colorado River. In the outcrop of the Santa Rosa Formation, water in the aquifer is recharged by rainfall and moves toward the river, as shown on Figure 14. The Colorado River has incised to and through the base of the aquifer in the lower half of Mitchell County and to considerable depths into the aquifer in the northern half of the county. The elevation of the bedrock channel of the river controls regional movement of the water, just as it does east of the river. The only usable quality water is contained in the shallow sands of the Santa Rosa Formation outcrop, east of the line on Figure 20 which marks the approximate western extent of water containing less than 3,000 ppm dissolved solids. Quality data reveal that no fresh water is produced from deep Santa Rosa wells any appreciable distance west of the river.

The shallow sand beds that yield fresh water derive their recharge locally through sandy outcrops. The water generally moves to the east, under water-table conditions, some of it discharging to small springs near the river. Perched water tables occur in the shallower beds of both the Santa Rosa and Chinle Formations.

The hydrology of the Santa Rosa sands in the deeper subsurface is more complex. The water in the Santa Rosa Formation in the downdip area, west of Westbrook, is under artesian head and moves to the east, opposite to the westward dip of the formation (Figures 6, 9, and 14). Water-level data on Figure 14 are from wells completed in the Santa Rosa and Chinle Formations. Wells 28-40-601 and 28-48-401 are completed in the Santa Rosa downdip from the outcrop area, and their water levels reflect a high artesian head. Because the artesian head decreases toward the Colorado River, recharge is from the west, although the area of recharge has not been determined. The gradient, although comparatively flat west of the river, causes an unknown amount of water to move continuously through the sands to discharge areas along the river and Beals Creek. It is probable that some water transmitted to the river from the west is moderately to highly mineralized.

Chemical Quality

Figure 20 shows selected chemical analyses of ground water, some of which were acquired during this study and some during a ground-water study conducted by the U.S. Geological Survey in 1948.

The analyses largely represent the quality of water in upper Santa Rosa beds, because development of water is principally from them. The quality of water at depths of 250 or more feet is shown to be moderately to highly mineralized by analyses of water from wells 28-32-704, 28-40-601, and 28-40-806. Several irrigation test wells drilled to the basal Santa Rosa sands reportedly encountered strong supplies of water at depths of 250 to 300 feet, but the water was too saline for agricultural use and became progressively more saline during pumping.

The quality of water in shallow Santa Rosa wells is highly variable, within short distances ranging from potable to highly mineralized. Sulfate exceeds desirable concentrations in nearly all wells. In the area west of the line marking the western extent of water containing less than 3,000 ppm dissolved solids on Figure 20, water in the Santa Rosa is unfit for cooking or drinking and very few wells are used except for livestock watering. Potable water in this area is seldom found below depths of 100 feet.

Analyses of water from wells of varying depths in the outcrop areas show a wide range of chemical quality which bears no consistent relationship to depth; some wells may yield acceptable water for domestic use while others short distances away may contain highly mineralized water. Such quality occurs in areas where it is unlikely that contamination by oil-field operations is responsible for the variation. Since the quality varies so widely it would be difficult to detect possible contamination by oil-field brines; however, no complaints of such contamination were received during this study.

Present Development and Availability

This study revealed no major development of Santa Rosa water west of the Colorado River except for livestock watering. It thus appears that potential development of the aquifer would principally be for waterflooding of oil reservoirs.

Water suitable for most beneficial uses occurs only in upper sands, which are lenticular in character and reportedly are incapable of significant sustained withdrawals. Data are insufficient to estimate the quantity of water which is available. Reported yields of existing domestic and livestock wells range up to as much as 20 gpm.

Available electrical logs indicate that a significant quantity of highly mineralized water may be stored in basal Santa Rosa sands of western Mitchell County, but the logs are inadequate for accurate quantitative computations of storage. Nevertheless, they indicate an average thickness of potential water-bearing sand of about 150 feet over a 140-square-mile area of western Mitchell County west of Westbrook. Assuming a specific yield of 0.15, about 2,000,000 acre-feet of highly mineralized water is stored in the aquifer in this area. The amount of water available from recharge is unknown, but is probably small.

Trinity Group

The Trinity Group, which is the basal unit of Cretaceous rocks in this area, occurs throughout much of western Nolan County (Figure 5) and has significant potential as a source of water in much of this area. In northwestern Nolan County, it occurs beneath the Ogallala Formation or thin beds of limestone. In places the Trinity Group constitutes a common hydrologic unit with the underlying Santa Rosa Formation, and thus both are considered to comprise the principal aquifer in Mitchell and western Nolan Counties.

There is little development of water from the Trinity Group by large-capacity wells, and comparatively few hydrologic data are available to define the water-bearing characteristics of the sand.

Recharge, Movement, and Discharge

All water in the sand of the Trinity Group is derived from precipitation on its outcrop or from overlying Cretaceous limestones which serve as recharge conduits in areas where stress-type fracture systems and solutional openings extend down to the sand. Large surface depressions frequently seen in the area are indications of favorable recharge areas.

Cretaceous rocks in Nolan County essentially constitute a large isolated erosional remnant, or outlier, of the Edwards Plateau. The Trinity Group outcrop is exposed along the margins of the outlier. Movement of water in the Trinity Group is outward from central areas of the outlier, where the water table is highest, toward the outcrop areas along the periphery of the outlier, which is at lower elevations. (See Figures 5 and 14.)

In most areas, outcrop data and logs indicate that water in the Trinity sand moves along the top of impervious shale or clay of the underlying Santa Rosa Formation. But where sands of the two units are in contact, water from the Trinity Group moves directly into the Santa Rosa Formation.

Water discharged from the Trinity Group and which does not enter the Santa Rosa Formation is, for the most part, lost to evapotranspiration or spring flow along the periphery of the Trinity outcrop. The amount of recharge moving into the Santa Rosa Formation from the Trinity sand cannot be computed.

Water-Bearing Characteristics

The Trinity Group ranges in thickness from 60 to about 100 feet and averages about 80 feet throughout the area. Figure 13 shows the saturated thickness of the Santa Rosa Formation and Trinity Group. South of the Panhandle and Santa Fe Railroad, southwestern Nolan County, the contours on Figure 13 represent almost exclusively the Trinity Group, whereas north of the railroad it represents a combination of both the Trinity Group and Santa Rosa Formation.

Water-level and log data indicate that water in the Trinity Group is entirely under water-table conditions. No pumping tests were made on the Trinity Group sand in this investigation, but in other Edwards Plateau areas having a similar saturated thickness of Trinity Group sand, coefficients of transmissibility of 3,000 to 5,000 gpd per foot have been determined. The specific yield was not determined but is estimated to be about 0.15.

The average reported yield of the Trinity Group, where tested for irrigation or oil-rig supply, is about 100 gpm or less. In areas marginal to the Trinity Group outcrop, saturated thickness and well yields are very small, but they increase toward interior areas of the Cretaceous outlier. Reported yields of existing irrigation wells in areas of maximum saturated thickness range from 70 to 500 gpm. However, from available data the large yield seems to be quite exceptional for the Trinity Group sand. The source of water in these large wells is reported to be sand and small gravel of the Trinity Group. Test wells drilled south of large-capacity (500 gpm) well 29-52-307 yielded only 70 and 170 gpm indicating highly local occurrence of such large yields.

Water Levels

Historical water-level data are not available for wells completed in the Trinity Group in western Nolan County. Comparative measurements of the water level in well 29-53-205 during this study indicate that the water level has risen somewhat since 1960 in the Maryneal area.

Depths to water in the Trinity Group sand range from a few feet in outcrop areas to 215 feet in the high plateau area. Water levels generally are below the base of the limestone of the Fredericksburg Group or only slightly above it (Figures 9, 10, and 11).

Chemical Quality

Concentrations of chemical constituents in water from the Trinity Group sand are shown in Table 8 for selected wells. The water is invariably high in hardness and bicarbonate, making it desirable to soften the water before using it for municipal supply and for boiler-feed water. The dissolved solids do not exceed 400 ppm, and sulfate and chloride concentrations are generally very low. Fluoride concentrations range from 0.2 to 1.1 ppm, which is within the limits of the U.S. Public Health Service standards. Boron concentrations, which are particularly important in irrigation of stone-fruit trees, range from 0.25 to 0.42 ppm, which is acceptable.

No reports of contamination of water by oil-field brines were received during the well inventory of this area and none is indicated by analyses of water sampled during this study. It is possible that brine may still be detectable in northern areas of the Nena Lucia oil field where in 1959 brine was found entering the sands of the Trinity Group from the bottom of unlined earthen disposal pits. Since then, the use of such pits has ceased and brine is now disposed into the deep subsurface.

Utilization and Present Development

Only four irrigation wells (29-44-901, 29-44-903, 29-52-307, and 29-53-208) obtained water exclusively from the Trinity Group. The estimated pumpage from these wells, based on a reported 60-day pumping season, is about 230 to 240 acre-feet per year. All four of the wells were drilled since 1958.

Many livestock and domestic wells obtain water from the Trinity Group sand over a large area, and an undetermined number of oil-rig supply wells frequently pump 10 to 20 gpm over extended periods.

Ground Water Available for Development

As overall recharge is probably limited, and that which moves into the Santa Rosa Formation has been considered with the availability discussed previously for the Santa Rosa Formation east of the Colorado River, the amount of water in storage is the important aspect of availability in the Trinity Group. The type and distribution of log control for Cretaceous sediments does not permit an accurate estimate of water in storage; however, selected data indicate that an average of about 60 feet of Trinity Group sand is saturated under the undissected interior area of the plateau, an area of about 70 square miles. Using a specific yield of 0.15 and an average saturated thickness of 60 feet, about 400,000 acre-feet of water is stored under the area.

The amount of water available to a well on a sustained basis at a given location will depend upon the local transmission capacity of the Trinity Group and the adequacy of recharge, and should be determined by long-term pumping tests. Recharge is undoubtedly inadequate to sustain concentrated irrigation pumpage in any locality, and the duration of such development would be related to the rate of water-level decline and saturated thickness.

Minor Aquifers

All other ground water in Mitchell and western Nolan Counties is in the Chinle Formation, Fredericksburg Group, Quaternary alluvium, Ogallala Formation, or Permian rocks and is of comparatively minor importance, although each water-bearing unit is locally important for domestic or livestock-watering purposes. Table 1 briefly summarizes the water-bearing properties of these units, and chemical analyses of water from these aquifers are shown in Table 8. Locations of these aquifers are shown on the geologic map (Figure 5), except for the Chinle Formation.

Permian rocks are exposed principally in the southeastern quarter of Mitchell County. Wells generally penetrate less than 100 feet of Permian rocks, and yield small quantities of moderately to highly mineralized water.

The lower boundary of the Chinle Formation on the outcrop is not precisely defined, but generally occurs in the vicinity of Westbrook and to the west. The Chinle generally yields only small quantities of moderately to highly mineralized water from fine-grained sandstones near the surface.

The Fredericksburg Group consists of as much as 200 feet of calcareous sediments overlying the Trinity Group in western Nolan County. In places, solution openings in the Edwards Formation yield small to moderate supplies of good quality water to domestic wells. The Edwards Formation outcrop is characterized by many large, circular areas of interior drainage, or sinks, which are the result of collapse into solution-formed openings and provide a source of recharge to the underlying sands.

The Ogallala Formation occurs in the northwest part of Nolan County in the vicinity of Roscoe and as small remnants in western Mitchell County. In Nolan County, the Ogallala consists of a maximum of 40 to 50 feet of caliche, and sand and gravel interbedded with light-colored clay. The Ogallala in Nolan County is entirely above the regional water table and is not a source of water, but does constitute an effective recharge conduit to the saturated sand and gravel of the Santa Rosa Formation and Trinity Group below. In western Mitchell County, the Ogallala consists of a maximum of 100 feet of unconsolidated sand with a zone of coarse gravel at the base. The Ogallala generally yields small quantities of usable quality water to domestic and livestock wells.

Quaternary alluvium occurs both east and west of the Colorado River in Mitchell County, but east of the river the deposits are not a source of water because they occur as very thin mantles of caliche, sand, and gravel overlying Triassic strata. In southwestern Mitchell County, the alluvium ranges up to

100 feet in thickness, yielding small to moderate quantities of fresh water to livestock and domestic wells.

In recent years brine disposed into unlined earthen pits contaminated ground water in the alluvium overlying Triassic beds in the Turner-Gregory oil field (grid 29-40-7), and may have also entered the Triassic beds. The Texas Railroad Commission has since issued a "no pit" order in this field. Although no reports of contamination came to the writer, it was noted that in the Westbrook oil field, which embraces a large area trending from southwest of Westbrook to Cuthbert in northwestern Mitchell County, produced brine is reportedly discharged directly to surface drainage or into pits, usually dug on red clay or shale outcrops. It is evident from the condition of the surface at many places in the field that such disposal practices have been employed for many years. In much of this area, however, shallow ground water is naturally highly mineralized and seldom used. Surface-disposed brine in this area which does not fine its way into the shallow Santa Rosa or Chinle beds ultimately must be carried by runoff into Lake Colorado City.

SUMMARY AND CONCLUSIONS

Since about 1950, an irrigation area of about 200 square miles with about 300 wells has been developed in northeastern Mitchell and northwestern Nolan Counties. Most of the wells were drilled during the drought years, 1951 to 1956, to supplement rainfall on cotton, grain sorghum, or pastures. Since 1956, development has continued at a steady, but comparatively slower rate due to higher-than-average regional rainfall. Most wells are completed in the Santa Rosa Formation of Triassic age.

Recognizing that there are now appreciably more wells than in the worst years of the drought and that declining yields were suspected in some wells, the Commissioners Courts of Mitchell and Nolan Counties entered into a cooperative agreement with the Texas Water Commission to make a study of the water resources of Mitchell and western Nolan Counties with principal emphasis to be placed on hydrologic effects of past irrigation development and projection of those effects to future periods of drought and normal rainfall.

A study of available historical water-level data with principal emphasis on the periods 1952-63 and 1960-63 in relation to pumpage determined for 1961, 1962, and 1963 indicated that water levels and, consequently, yields of all irrigation wells are solely dependent upon regional rainfall for replenishment of water removed by pumping. Only in wet periods, like the 1961 and 1962 seasons, will recharge be adequate to sustain water levels in most of the existing wells. Even under such favorable conditions, water levels and yields of some wells in heavily developed areas continue to decline.

Under drought conditions as in 1951-56, assuming pumpage at the 1963 level of 15,000 acre-feet per year, water levels in all developed areas are expected to decline significantly, up to as much as 35 to 50 feet, accompanied by substantial reduction of well yields.

Despite near-normal rainfall in 1963, approximately 80 percent of the wells measured showed declines in water levels. Pumpage in 1963 was approximately 15,000 acre-feet as compared with pumpage of about 10,000 and 11,000 acre-feet in 1961 and 1962, respectively. A recent trend toward irrigation of row crops and pastures in both summer and winter will cause a gradual increase in pumpage, with some variations in response to variations in rainfall.

It is estimated that between 12,000 and 15,000 acre-feet of water can be developed from the Santa Rosa Formation on a perennial basis, throughout its extent east of the Colorado River. In periods of drought, or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. Only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels.

The amount of water stored in the Santa Rosa sands and gravels within the developed and potential irrigation area is on the order of 2,000,000 acre-feet, but development of not more than one-half of this amount can be expected under present economics of irrigation pumpage. The large amount of water available from storage allows full development of the aquifer with a pumping rate equal to the average recharge of the aquifer during years of normal rainfall. By utilizing the water in storage, which can be replenished during years of above-normal rainfall, larger quantities of water can be pumped during drought years. It would be possible by depleting the aquifer to use both the recharge and available water in storage. About 24,000 acre-feet of water per year could be pumped for approximately 80 years, but as the saturated thickness decreases so will the well yields, thus requiring more wells to produce the same amount of water. The useful life of wells in areas showing persistent annual declines of water levels is dependent entirely upon the total saturated thickness and projected annual decline rates.

The quality of water in the basal Santa Rosa sands east of the Colorado River has been proven generally acceptable for irrigation of cotton despite excessive salinity classifications in some instances. It appears possible that without proper rotation of crops, irrigation with Santa Rosa water could eventually cause excessive salinity in soils of northwestern Nolan County.

Study of the Santa Rosa Formation west of the Colorado River revealed no significant supplies of normally usable water. Water acceptable for domestic use occurs only in sands at depths generally 100 feet or less, in some places there is no fresh ground water available. The quality of water in lower beds of the Santa Rosa Formation west of the river is sparsely documented by chemical analyses, but available information indicates it is too highly mineralized everywhere for most purposes except perhaps for flooding of oil reservoirs.

It is estimated that the sand of the Trinity Group of southwestern Nolan County contains about 400,000 acre-feet of water in storage. Recharge to the sand is believed to be inadequate to sustain concentrated pumpage in any one area without significant reduction of saturated thickness. At the present time only four irrigation wells are completed exclusively in the Trinity Group. Because anticipated well yields in the most favorable areas are not over 100 to 150 gallons per minute, with pumping lifts of 250 to 280 feet, it is unlikely that irrigation will become widespread.

The sand of the Trinity Group contains excellent quality water which has dissolved solids of less than 400 parts per million, and very low sulfate and chloride concentrations. The water is invariably high in hardness and bicarbonate, making it desirable to soften the water before using it for municipal supply and for boiler-feed water.

No significant new source of water of good quality was revealed by this study of Mitchell and western Nolan Counties. All water of generally acceptable quality in the subsurface is in strata above Permian rocks.

It is a principal conclusion of this study that additional irrigation withdrawals in substantially developed parts of the irrigation area will be almost entirely from aquifer storage, leading to progressively declining water levels and well yields until the economic limit of irrigation pumpage is reached.

An expanded network of annual water-level observation wells should be instituted utilizing some of the wells for which measurements were made in the winters of 1960-63. Available data indicate there is no present need for monitoring the quality of water in irrigation wells.

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Table 5.--Records of selected water wells, springs, and test wells

Water-bearing unit : Ca, Quaternary alluvium or Ogallala Formation; Kf, Fredericksburg Group; Kt, Trinity Group; P, Permian rocks, undifferentiated; Trc, Chinle Formation; Trs, Santa Rosa Formation; Trd, Dockum Group, undifferentiated.

Method of lift and type of power: C, cylinder; E, electric; G, gasoline, butane, diesel, or natural gas; J, jet; N, none; S, submersible, T, turbine; W, windmill.

Use of water and type of well : D, domestic; Ind, industrial; Irr, irrigation; P, public supply; S, livestock; A, abandoned; T, drilled for test purposes.

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
28-31-901	A. L. Dunn	H. M. House	1947	172	6	172	Trd	--	7.9	May 1948	C	S	--	--	Casing perforated 152-172 ft. Water highly mineralized.
902	E. E. Dunn	-- House	1949	70	6	70	Trc	2,242	32.4	July 1963	C	S	--	--	
32-701	W. W. Hester	--	1921	35	--	--	Ca	2,238	16.4	May 1948	C	D,S	--	--	Rock-walled well.
702	F. Carpenter	--	--	20	--	--	Ca	--	11.9	do	C	--	--	--	Rock-walled well. Reported strong supply.
703	Mary Gatlin	--	--	21	36	21	Ca	2,258	12.5	July 1963	C	S	--	2	Concrete-pipe casing.
* 704	R. L. Soloman	--	1946	288	4½	240	Trs	2,180	55.1	July 1948	C	S	--	--	Well in sand at 288 ft.
* 705	W. W. Hester	--	--	32	48	--	Ca	2,245	10.4	July 1963	J	D	--	--	Reported strong supply.
* 801	O. B. Strain	--	1946	93	6	--	Trd	2,240	57.6	May 1948	C	S	--	--	
802	Albert Erwin	--	--	22	--	--	Ca	--	16.5	do	C	D,S	--	--	Reported strong supply of poor quality water.
803	W. A. Alexander	--	1951	24	24	24	Ca	2,245	7.1	July 1963	J	D	21	1½	Base of water-bearing unit at 14 ft. Reported yield, 2-3 gpm.
804	W. W. Hester	-- Longbottom	1953	80	6	80	Ca	2,241	7.4	do	T,E	A,Irr	30	4	Drilled to 700 feet, plugged back to 80 feet; encountered salty water. Reported yield, 40 gpm.
* 805	J. B. Autry	--	1916	7	48	7	Ca	2,210	2.0	do	--	D	--	--	Reported yield, 5 gpm.
806	Cecil Erwin	--	--	14	40	--	Ca	2,241	22.0	do	C	D	--	1½	Reported yield, 3-4 gpm of soft, potable water.
* 901	Coleman Estate	--	--	115	6	20	Trd	2,238	65.1	May 1948	C	S	--	--	Reported strong supply.
902	R. E. Byrd	--	1946	108	6	--	Trd	--	34.6	Mar. 1961	J	D	--	--	Reported strong supply of potable water.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
28-32-903	Charles Rogers	--	1948	48	6	--	Ca	2,221	18.1	July 1963	S	D	--	--	Water not potable.
* 39-801	Tom Jackson	Cliff Myrick	1939	203	6	--	Trd	2,251	89.4	do	C	D	--	1½	Reported strong supply, no water encountered above 200 ft.
* 901	Ben Van Tuyle	--	1918	12	52	12	Ca	2,217	6.4	do	J	D,S	--	1½	Supplied several families during drought in 1918. Reported yield, 10-12 gpm.
902	Pond & Merritt	--	--	14	48	--	Ca	--	5.9	Mar. 1963	J	S	--	1½	
* 40-101	R. L. Solomon	-- Webb	1939	243	4½	219	Trs	--	154.1	July 1948	C	S	--	2	Bottom of well in sand.
102	G. M. Solomon	--	1945	320	4½	280	Trs	2,230	71.1	July 1963	C	S	--	2	Water reported salty; sand 280-320 ft.
103	--	--	--	13	54	13	Trc	--	11.7	July 1960	N	--	--	--	
104	G. M. Solomon	--	--	284	4½	239	Trs	2,236	64.8	July 1963	C,W	--	--	--	
201	Dutch Daws	--	1957	200+	--	--	Trd	2,118	41.3	Mar. 1961	--	D	--	--	Test well for water supply during recent drought.
203	J. C. Womack	--	--	15	--	--	Trc	2,180	9.3	July 1963	S	D,S	--	--	Water reported to have petroleum taste.
301	Ada Edwards	--	--	139	--	--	Trd	2,250±	113.0	May 1963	C,W	D,S	--	--	
302	C. Berry	--	--	72	6	--	Trd	2,217	24.4	July 1963	C,W	D,S	--	1½	
309	Lee Strain	--	--	67±	6	--	Trd	2,234	70.0	do	C,W	S	--	1½	
310	T. G. Davenport	--	--	--	4	--	Trd	--	--	--	C,E	D	--	1	Water soft but not potable.
311	Muriel Thurman	--	1951	33	5	5	Trd	2,203	10.2	July 1963	J	D	--	1	Reported strong supply of good quality water.
312	Cicero Martin	--	--	100	6	20	Trd	2,257	88.6	do	C,E	D	--	1½	Reported yield, 4-5 gpm of poor quality water.
* 401	Robert Brennand	--	--	122	5½	20	Trd	2,179	56.6	do	C,W	S	--	2	Reported yield 1-2 gpm.
402	do	--	1935	240	6	230	Trd	2,195	44.8	do	C,W	A,S	--	--	Reported strong supply of salty water; artesian water-bearing sand at 195-250 ft; not used since 1940.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
28-40-501	R. S. Brennand, Jr.	--	--	18	36	18	Ca	--	4.4	July 1948	C,W	D,S	--	--	Water reported soft, good quality.
* 601	O. R. Foster	--	--	300	8	--	Trs	2,165	36.4	do	C	S	--	--	Water not potable; reported strong supply.
602	Minor Bros.	--	1920	65	5½	--	Trd	2,150	33.8	July 1963	C,W	D	60	1½	Reported weak supply.
603	Ed Strain	--	--	83	7	--	Trs	2,181	47.1	July 1948	--	--	--	--	
606	E. T. Strain	--	1953	270	--	--	Trs	2,151	--	--	N	A,Irr	--	--	Test well for irrigation; reported water level 30 feet below land surface when drilled; reported yield, 250± gpm.
607	do	--	--	55	6	--	Trs	2,148	23.4	July 1963	C,W	S	--	1½	Reported produces better quality water than neighboring wells.
* 608	do	--	1960	129	5	--	Trs	2,171	60.4	do	J	D	--	1½	Reported water-bearing sand at 100-129 ft.
* 711	T. E. Grant	--	--	25	36	25	Ca	2,190	12.9	do	C,W	D	25	1½	Water level measured while pumping; reported yield, 1-2 gpm.
712	Bill Gregory	--	--	20	52	20	Ca	2,200	7.1	do	J	D	--	1½	Brick curbing.
* 713	D. J. Henderson	--	--	263	5	263	Trd	--	--	--	C,E	Ind	--	2½	Too salty for irrigation use; reported yield, 10-12 gpm.
714	T. A. Rees	--	--	--	--	--	Ca	--	--	--	C,E	S	--	--	
715	B. F. Ellette	--	--	20	6	--	Ca	2,176	11.7	July 1963	C,E	D	--	1½	
* 716	D. J. Henderson	--	--	45	36	45	Ca	2,212	25.4	do	J	D	--	1½	Reported yield, 4-5 gpm.
717	F. E. York	--	--	70	6	--	Trd	2,197	64.6	do	C,W	A,S	--	1½	
* 803	T. R. Jackson	--	--	137	6	--	Trd	2,175	56.3	do	C,E	D	--	1½	Reported strong supply of salty water.
804	Tom Morrison	--	--	14	6	--	Trd	2,144	--	--	C,W	D	--	1½	Reported strong supply of potable water.
* 806	do	--	--	300±	10	--	Trs	2,120	--	--	N	A,D	--	--	Flows 3-5 gpm of salty water.
901	Burton Hines	--	--	21	30	21	Trd	2,150	11.1	July 1963	J	D	--	1½	Reported yield, 25-30 gpm.
902	J. W. Lewis	--	--	41	5½	41	Trd	2,121	20±	do	C,W	D	--	1½	Reported weak supply of hard, potable water.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level 1/: Below land surface (ft)	Water level 1/: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
28-40-903	H. H. Callan	--	1920	72	5½	15	Trd	2,131	29.2	July 1963	C,E	D	--	1½	Reported yield 4-5 gpm of potable water.
* 47-604	Foster Ranch	--	--	106	4½	--	Trc	2,375	102.6	do	C,W	S	--	2	
901	T. L. McKenny	--	--	61	48	--	Ca	2,310	42.9	do	N	A,S	--	--	
48-301	Westbrook Gin	--	--	171	5	--	Trs	2,155	30.3	June 1963	N	A,Ind	--	--	Water salty; formerly used to cool engines.
* 302	H. M. Rice	--	--	65	5½	--	Trd	2,168	44.9	do	C,W	D	--	1½	Water potable, but mineralized.
303	Jose Reyes	--	--	61	5	--	Trd	2,189	30.2	July 1963	C,W	D,S	--	1½	Water potable.
304	G. C. Strange	-- Bell	1935	90	12	20	Trs	2,120	25.7	do	J	A,D	--	--	Reported weak supply of mineralized water.
1/ 401	Etta Holt Brown	I. O. Fannin	1953	615	7	503	Trs	2,254	117.3	June 1963	N	A,Ind	--	--	Used as supply for oil tests; reported yield, 13 gpm.2/
* 501	B. B. Hill	--	--	65	6	--	Trd	2,161	8.8	Apr. 1963	C,W	D,S	--	1½	
502	Mary Hayton	--	--	80	8	--	Trd	2,160	33.6	June 1963	C,W	S	--	1½	
* 601	Warren Costin	T. P. House	1962	212	5½	215	Trs	2,258	112.7	do	C,E	S	--	1½	
* 602	Mrs. J. M. Byrd	--	--	27	36	27	Trd	2,185	12.3	do	J	D	20	1	Reported strong supply.
603	D. J. Barber	--	--	63	6	--	Trd	2,178	39.9	do	N	A,S	--	--	Good quality water reported.
604	Bedford Dulin	--	--	72	6½	--	Trd	2,230	47.0	do	C,W	A,S	--	1½	
605	Dalton Conaway	-- Blakely	1960	42	8	5	Trd	2,171	15.9	July 1963	J	D	--	1½	Unused; water-bearing zone reported at 32 ft; water potable but hard.
606	Jolette Rogers	--	--	86	5½	--	Trd	2,212	34.5	do	C,W	S	--	1½	
* 702	Maude Farmer	Huron Gist	1948	100	--	--	Ca	2,318	31.0	do	C,W	D	--	--	Reported yield, 1-2 gpm.
* 901	W. E. Smith, Jr.	--	1962	65	5½	--	Trs	2,117	26.6	do	C,W	S	--	--	Do.
902	J. D. Beal	--	--	53	5	--	Trd	2,255	38.0	do	C,W	S	--	--	
55-902	J. B. Henderson	--	1953	80	5½	--	Ca	2,349	78.3	May 1963	C,E	S	80	2	Furnishes water for about 100 head of cattle; reported yield, 5-10 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
28-55-903	F. L. Andrews	--	--	91	$5\frac{1}{2}$	--	Ca	2,368	90.6	Aug. 1963	C,W	D	--	$1\frac{1}{2}$	Water reported mineralized; reported yield, 1-2 gpm.
904	H. L. Harkrider	--	--	--	$5\frac{1}{2}$	--	Ca	2,314	58.9	May 1963	C,E	D,S	--	2	Water potable; reported yield, 1 gpm.
905	do	--	--	80	$5\frac{1}{2}$	--	Ca	2,323	51.2	do	C,W	S	--	--	
* 56-201	E. L. Powell	--	--	20	5	20	Ca	2,250	7.6	do	C,E	D,S	--	--	Reported weak supply.
202	J. D. Sheffield	--	--	57	6	--	Ca	2,288	43.8	July 1963	C,W	A,S	--	--	
401	F. L. Terry	Bill Justice	--	51	$5\frac{1}{2}$	--	Ca	--	24.1	Aug. 1963	C,W	S	--	$1\frac{1}{2}$	Reported yield, 1 gpm.
402	do	do	1962	52	6	52	Ca	2,287	31.6	do	C,W	D,S	--	2	Water potable; reported yield, 6 gpm.
601	H. H. Allard	--	--	36	$5\frac{1}{2}$	--	Trs	2,115	24.1	do	C,W	S	--	2	Reported yield, 25 gpm.
602	R. R. Hargrove	--	--	28	--	--	P	2,084	21.8	Apr. 1963	C,E	D,S	26	2	
* 701	W. T. Scott	O. R. House	1953	62	5	--	Ca	2,304	44.5	Aug. 1963	C,E	D,S	--	2	Furnishes water for about 100 head of cattle; reported yield, 15 gpm.
901	Spade Ranch	--	--	--	6	--	Ca	--	11.5	July 1961	C,W	S	--	--	Reported weak supply.
902	do	--	1929	101	$5\frac{1}{2}$	--	Ca	2,262	61.3	Nov. 1962	C,W	S	--	--	Reported yield, 12 gpm.
903	do	--	--	50	6	50	Ca	--	29.4	Apr. 1963	C,W	S	--	--	Reported strong supply.
* 63-201	W. E. Stockton	--	--	100	$5\frac{1}{2}$	--	Ca	2,419	83.8	Aug. 1963	C,W	S	--	$1\frac{1}{2}$	
302	Spade Ranch	--	1951	80	6	80	Ca	2,310	77.4	Apr. 1963	C,W	S	--	2	
* 64-301	do	--	--	93	6	93	Ca	--	59.9	Dec. 1960	C,W	S	90	$2\frac{1}{2}$	Yielded 8 to 10 gpm when drilled; current reported yield, 2 gpm.
[1] 302	do	James House	1963	90	--	--	--	--	--	--	C,W	S	--	--	[2]
* 303	do	--	--	Spring	--	--	Ca	--	(+)	--	Flows	D,S	--	--	
29-25-701	-- Fuller	--	--	151	$5\frac{1}{2}$	--	Trs	--	43.5	May 1948	N	A,S	--	--	Abondoned due to caving.
* 702	R. E. Byrd	--	--	Spring	--	--	Trs	--	(+)	--	Flows	--	--	--	
703	Robert McPhaul	--	--	70	$5\frac{1}{2}$	--	Trs	2,225	24.5	June 1963	J	D	--	$1\frac{1}{2}$	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-25-705	J. D. Fuller	--	--	150	4½	--	Trs	2,242	99.0	June 1963	N	A,D	--	--	
* 706	Robert McPhaul	--	--	68	--	--	Trs	2,228	34.4	do	C,E	S	--	1½	
* 801	Longstring	--	--	143	--	--	Trs	2,210	88.2	May	C,W	D,S	--	--	
901	J. J. Ford Est.	--	--	100±	5	--	Trs	2,225	81.1	Mar. 1963	C,W	D,S	--	--	
902	-- Alvarez	--	--	101	5½	--	Trs	2,190	52.5	do	C,W	D,S	--	--	
* 903	Otis Chalk Ranch	--	--	100+	6	--	Trs	2,182	79.9	Dec. 1963	C,E	D	--	--	
* 26-702	-- Feaster Estate	--	--	115	5½	--	Trs	2,293	60.2	July 1963	C,E	D	--	2	Water level measured 5 minutes after pumping ceased.
* 801	F. W. Merket	O. R. House	1961	332	10	332	Trs	2,359	95.1	Jan. 1964	T,E	Irr	300	5	Reported yield, 140 gpm.[2]
802	Henry Hoyle	Hopkins Drlg. Co.	1961	300+	--	--	Trs	2,314	40.4	Mar. 1961	N	A,T	--	--	Test well, weak supply.
803	F. W. Merket	--	1952	90	6	90	Trs	2,355	39.4	Nov. 1962	S	Irr	85	3	Completed in upper part of Santa Rosa Formation; reported yeild, 50 gpm.
901	Lane Compton	--	--	35	--	--	Trs	2,318	22.1	June 1963	N	A,T	--	--	Yield inadequate.
902	W. R. Dunn	--	1910	180	5	20	Trs	2,305	108.2	do	C,W	D	--	1½	
* 903	C. W. Valentine	--	--	91	5	--	Trs	2,331	43.3	do	C,W	D	--	2	
904	Ernest Haggerton	Hopkins Drlg. Co.	1960	195	--	--	--	--	--	--	N	A,T	--	--	
27-701	--	--	--	101	5	--	Trs	2,406	76.4	Jan. 1961	S	D	--	--	
801	D. S. Riggs	--	--	65	--	--	Trs	--	57.8	Apr. 1963	N	A,D	--	--	
802	John Henson	--	--	65	5	--	Trs	--	50.3	do	C,W	D	--	1½	
902	Veltic Turner	--	--	50	5½	--	Trs	--	33.6	do	J	D	--	1 1/4	Water potable, but hard; some caving reported.
28-701	J. W. Young, Jr.	--	--	160	5½	--	P	2,385	133.0	Nov. 1960	N	A,S	--	1½	Destroyed in 1961.
702	Louise Ferree	--	--	170	5½	--	P	2,388	97.8	Mar. 1963	C,W	D	--	1½	
901	Harvey Staton	--	1916	180±	5½	--	P	2,383	165.4	Oct. 1960	C	D,S	--	1½	Reported strong supply of potable water.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing		Water-bearing unit	Altitude of land surface (ft)	Water level[1]		Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
					Diameter (in.)	Depth (ft)			Below land surface (ft)	Date of measurement					
*29-33-101	Jim Boget	--	--	117	5½	--	Trs	--	46.5	May 1948	C,W	D,S	--	1½	Reported strong supply of fair quality water.
102	C. C. Berry	--	--	124	--	--	Trs	--	51.2	do	C,W	D,S	--	1½	Do.
* 103	C. G. Crawford	--	1924	101	--	--	Trs	2,266	49.1	Mar. 1961	C,W	D	--	1½	
104	J. L. Strain	--	1905	100	5½	20	Trs	2,233	34.0	do	C,E	D	98	1½	Reported strong supply.
105	S. S. Erwin	--	--	90	--	--	Trs	2,212	34.2	May 1948	C,W	D,S	--	--	
107	R. E. McMillan	--	--	52	--	--	Trs	2,202	12.5	June 1963	C,W	D,S	--	3½	Reported strong supply; reported hardness, 300-350 ppm.
* 108	-- Pace Estate	--	--	80	5½	--	Trs	2,181	28.4	July 1963	C,E	D	80	1½	Reported yield, 1-3 gpm.
109	Ed Strain	--	--	250+	--	--	Trs	--	--	--	N	A,Irr	--	--	Irrigation test well; water saline; reported yield, 350+ gpm.
* 201	L. Womack	--	--	121	5	--	Trs	2,220	51.6	Mar. 1961	C,W	D,S	--	--	
* 202	Mitchell County	--	--	160	6	--	Trs	2,203	92.9	Jan. 1964	N	A,S	--	--	
203	Ross Strain	--	--	52	6	--	Trs	2,120	25.3	Mar. 1961	C,W	D,S	--	1½	Water unsuitable for drinking.
* 206	Del Barber	--	--	96	6	--	Trs	2,159	87.7	June 1963	C,W	S	--	2	
* 207	J. L. Strain	O. R. House	1945	180	6	--	Trs	--	86.2	July 1963	C,W	S	--	1½	Reported yield, 1-2 gpm.
208	do	O. L. Williams	1963	54	5½	55	Trs	2,162	40.0	do	S	S	45	2	Reported yield, 10 gpm.
302	M. L. Feaster	--	--	180±	4	--	Trs	2,232	103.0	Mar. 1961	C,W	D,S	180	--	Reported poor quality; reported yield, 2-3 gpm.
303	A. Hammon	O. R. House	1963	192	5	145	Trs	2,260	126.7	May 1963	S	D	--	1½	Yielded 10 gpm on bailer test.
304	Bernice Duringen	--	--	60	5	--	Trs	2,155	21.4	June 1963	C,E	D,S	--	2	
305	do	--	--	73	5	--	Trs	2,182	63.8	do	C,E	S	--	1½	
* 306	Del Barber	--	--	187	6	--	Trs	2,250	102.7	July 1963	C,W	S	--	2	Reported yield, 1-2 gpm.
* 401	B. W. Stump	--	1945	57	--	--	Trs	2,205	40.7	May 1948	C,W	D,S	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-33-402	J. V. Stewart	--	--	83	6	--	Trs	2,250	69.7	May 1948	C,W	D,S	--	--	
* 403	J. H. Humphreys	--	1920	49	6	--	Trs	--	41.6	July 1948	N	A,D	--	2	Water reported soft, good quality; well destroyed.
404	D. M. Smith	--	--	70	8	--	Trs	--	33.7	do	C,W	D,S	--	--	
405	Gewin Feaster	--	--	65	8	--	Trs	2,230	41.2	May 1948	C,W	D,S	--	--	
408	Pruitt Keel	--	--	--	--	--	Trs	2,178	12.2	July 1963	S	S	--	--	
409	A. B. Carlisle	--	1962	220	4	20	Trs	2,223	29.1	do	N	A,S	--	--	Drilled for seismic exploration; water-bearing zone at 80 ft.
410	do	--	--	90	6	20	Trs	2,218	51.3	do	C,W	D,S	--	1½	Reported yield, 1 gpm, but dependable supply of soft water.
411	Ed Strain	--	1961	78	6	--	Trs	2,240	59.4	do	C,W	D	--	1½	Reported yield, 2-4 gpm of soft water.
* 501	J. H. Humphreys	--	--	48	6	--	Trs	2,125	37.9	July 1948	C,W	A,S	--	--	Destroyed in 1961.
502	Geiger	--	--	75	4	--	Trs	2,131	29.1	Mar. 1961	C,E	D,S	--	1½	Water reported very soft.
505	Gewin Feaster	Bill Justice	1962	65	--	--	Trs	2,166	39.7	July 1963	C,E	D,S	--	1½	Water not potable, very hard.
506	Pruitt Keel	O. R. House	--	62±	6½	--	Trs	2,136	50.3	do	C	Irr	--	1½	Discharge to earth tank; reported yield, 3-5 gpm.
507	C. A. Gross	--	--	--	5½	--	Trs	2,120	31.4	June 1963	C,W	S	--	1½	
* 601	Dr. H. G. Logsdon	E. W. Martin	1952	170	10	--	Trs	2,088	28.8	Jan. 1963	S	Irr	--	4	Discharge to earth tank; reported yield, 350 gpm.
602	Mary Smith	--	--	118±	5½	--	Trs	2,168	104.4	Mar. 1961	C,W	S	--	5½	Reported yield, 2 gpm.
603	Del Barber	--	--	90	5	--	Trs	2,133	83.2	do	C,W	S	--	1½	Reported yield, ½ gpm.
604	do	E. W. Martin	1953	160	7	160	Trs	2,130	52.8	Aug. 1963	--	Irr	150	--	Unused for several years; reported yield, 170 gpm.
701	Clara Shoemaker	--	1948	61	6	--	Trs	2,205	31.4	July 1963	J	D	--	--	Good quality water reported; pumping 1½ gpm during water-level measurement; reported yield, 3 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-33-702	J. T. Christon	N. C. House	1960	70	6	--	Trs	2,091	21.4	July 1963	N	D	--	--	Reported yield, 3 gpm of poor quality water; dug to 38 ft.
703	Roy Warren	--	--	86	--	--	Trs	2,112	32.8	do	C,W	D,S	--	2	Water not potable.
* 801	C. J. Robertson	--	--	125	--	--	Trs	2,115	79.5	May 1946	C,W	A,S	--	--	Destroyed in 1961.
802	H. T. Berman	-- Dawcy	1946	100	--	--	Trs	2,178	46.0	do	C,W	A,S	--	--	Destroyed in 1961.
803	Mrs. J. C. Costin	O. L. Williams	1962	40	5	40	Trs	2,156	20.6	July 1963	S	D	--	1½	Good quality water reported; used for irrigating lawn.
804	Don Pritchett	--	1963	57	--	--	Trs	2,150	25.2	do	N	Ind	--	--	
805	H. H. Howell	Bill Justice	1955	90	8	--	Trs	2,157	51.2	do	N	A,S	--	--	Used for lawn and livestock.
* 806	Clay Smith	--	--	72	5½	--	Trs	2,148	52.2	do	C,W	D	--	2	
901	Harold Letcher	--	--	137	--	--	Trs	--	107.6	May 1946	C,W	D,S	--	--	
* 902	Ted Enderly	--	--	100	6	--	Trs	--	--	--	C,W	D,S	--	--	
903	L. E. Jordan	--	--	59	--	--	Trs	2,075	48.2	Jan. 1964	C,W	D,S	--	--	
904	Katie Buchanan	--	--	74	--	--	Trs	--	--	--	C,W	D,S	--	--	
905	Col-Tex Refinery	-- House	1934	155	8	--	Trs	--	--	--	N	A,Ind	--	--	Supplied refinery; reported yield, 37 gpm.
* 906	R. H. Ratliff	E. W. Martin	1952	131	6	10	Trs	2,073	24.5	Jan. 1964	T,E	Irr	120	2½	Application rate measured for open discharge, 63 gpm.
907	do	Justice House	1959	158	9	158	Trs	2,071	25.6	do	T,G	Irr	155	--	Application rate measured for open discharge, 55 gpm (Aug. 1963).
* 908	Woodrow Crabtree	O. R. House	1960	200	8	160	Trs	2,159	85.7	Apr. 1961	S	D	180	3	Reported yield, 20 gpm.
* 909	Col-Tex Refinery	--	1934	135	--	--	Trs	--	--	--	T,E	A,Ind	--	4	Supplied refinery; reported yield, 66 gpm.
* 910	R. H. Ratliff	Bill Justice	1956	160	8	160	Trs	2,072	--	--	T,G	Irr	148	--	Quality reported to have begun deteriorating in 1961; reported yield, 170 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-33-912	Col-Tex Refinery	--	1945	142	10	--	Trs	2,045	44.4	Mar. 1946	T,E	A,Ind	--	--	Standby well; reported yield, 30 gpm.[2]
913	do	--	1934	155	--	--	Trs	2,063	23.3	Mar. 1963	T,E	A,Ind	--	--	Standby well; reported yield, 37 gpm.
* 914	George Callan	O. R. House	1949	50	5	8	Trs	2,164	33.7	May 1963	C,W	D	--	2	
* 915	Victoria Enderly	do	1942	142	5½	--	Trs	2,167	105.3	July 1963	C,E	S	--	2	Reported strong supply.
34-101	R. Y. Hammond	do	1955	250	8	200	Trs	2,192	37.5	Jan. 1964	T,E	Irr	153	4	Application rate measured for open discharge into earth tank, 69 gpm (Mar. 1963). Reported yield, 150 gpm.
102	Mary Johnson	--	1923	220	5	--	Trs	2,205	79.0	Mar. 1961	S	D,S	--	1½	Water not potable; reported yield, 10 gpm.
104	J. Blackard	O. R. House	1962	155	5	155	Trs	2,264	104.8	May 1963	S	D	--	1½	Water hard, but potable.
105	R. Y. Hammond	do	1954	155	10	--	Trs	--	17.9	Jan. 1964	T,E	Irr	150	4	Application rate measured for open discharge into earth tank, 65 gpm (Mar. 1963). Reported yield, 120 gpm.
* 106	Lyndon Solomon	do	1963	200	8	202	Trs	2,160	17.6	June 1963	T,E	Irr	198	4	Discharge to 22 5-gpm sprinklers.[2]
107	Ernest Brown	--	--	90	6	--	Trs	2,270	76.3	July 1963	C,W	D,S	--	--	
201	H. G. Kruse	John Weir	1960	230	6½	100	Trs	2,188	15.2	Jan. 1964	S	Irr	178	3	Application rate measured for discharge to sprinkler system, 37 gpm (Mar. 1963); "red beds" encountered at 190 ft. Reported yield, 69 gpm.
202	Glenn Hamilton	--	--	--	--	--	Trs	--	--	--	N	A,Irr	--	--	Irrigation test well.
204	do	O. R. House	1961	183	6	130	Trs	2,208	21.7	Feb. 1964	S	Irr	165	3	Application rate measured for open discharge; 20 gpm (Mar. 1963); "red beds" encountered at 183 ft.[2]
205	--	--	--	150±	5½	--	Trs	--	60.5	do	N	A,Irr	--	--	
206	Grady Ezell	O. R. House	1949	205	10	205	Trs	--	--	--	T,G	Irr	178	4	Discharge to sprinkler system; reported yield, 50 gpm.
* 207	do	do	1956	178	8	120	Trs	2,176	13.9	Jan. 1964	T,G	Irr	175	4	Discharge to sprinkler system; pumping level, 146 ft; reported yield, 50 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-34-208	H. G. Kruse	John Weir	--	188	6	--	Trs	--	--	--	S	Irr	180	3	Application rate measured for discharge to sprinkler system, 37 gpm (Mar. 1963); reported yield, 65 gpm.
* 209	Glenn Hamilton	O. R. House	1961	205	6	115	Trs	2,194	13.7	Mar. 1963	S	Irr	135	3	Application measured for open discharge, 20 gpm (Mar. 1963).
210	H. G. Kruse	do	1962	160	5	92	Trs	2,197	--	--	S	D	--	2	Yielded over 35 gpm on bailer test when drilled.
212	Grady Ezell	do	1956	248	--	--	Trs	2,220±	--	--	N	A,Irr	--	--	Reported small yield; well destroyed.
213	Leslie Hamilton	--	--	64	6	--	Trs	2,232	42.4	June 1963	C,W	D	--	--	
* 301	C. L. LeFerre	U. Compton	1952	230	8	160	Trs	2,213	20.1	Jan. 1964	T,E	Irr	165	5	Application rate measured for discharge to sprinkler system, 158 gpm (Mar. 1963); reported yield, 250 gpm.
* 302	Mrs. C. G. Smith	Sam Smith	1956	290	14	290	Trs	--	97.6	do	T,G	Irr	275	5	Application rate measured for discharge to sprinkler system, 179 gpm (Aug. 1963); reported yield, 220 gpm.
303	R. H. McDaniel	--	1933	100	5	30	Trs	--	--	--	C,E	D	--	--	Reported yield, 4-5 gpm.
304	D. D. Myers	--	--	121	10	--	Trs	2,299	99.1	Oct. 1963	C,W	S	--	1½	
307	R. H. McDaniel	--	--	31	5½	--	Trs	2,232	8.0	June 1963	N	A,Ind	--	--	Reported strong supply; formerly supplied cotton gin.
* 401	Colorado City	--	1947	250	8	250	Trs	2,169	109.5	Jan. 1964	T,E	A,P	175±	4	Standby well; formerly supplied city; reported yield, 50 gpm.
402	Huron Gist	--	1939	150	4	--	Trs	--	71.4	May 1946	C,E	D	--	--	
403	E. L. Dorn	--	1942	220	6	166	Trs	--	--	--	C,E	D	--	--	
404	Earl Hunter	--	1945	220	4	196	Trs	--	33.5	May 1946	C,W	D,S	--	--	
405	Standard Oil of Texas	--	1930	210	10	210	Trs	2,191	98.5	Jan. 1963	S	Ind	--	5	Supplies oil-field camp; reported yield, 70 gpm.
406	Richardson	Kelly Well Co.	1929	239	--	--	Trs	2,206	--	--	N	A,T	--	--	Test well for Colorado City.
407	Huron Gist	do	1929	233	8½	--	Trs	2,190	--	--	N	A,T	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-34-408	Richardson	Kelly Well Co.	1929	177	--	--	Trs	2,117	--	--	N	A,T	--	--	Test well for Colorado city.
* 413	J. Bourland	Huron Gist	1950	203	7	145	Trs	--	--	--	T,G	Irr	--	4	Irrigation of grass from sprinkler system; reported yield, 100 gpm.
* 414	Irvin Grant	E. W. Martin	1952	215	8	30	Trs	2,178	7.1	Jan. 1964	S	Irr	40±	--	Completed in upper Santa Rosa Formation; reported yield, 40 gpm.
416	Colorado City	O. R. House	1947	257	10	186	Trs	2,209	141.8	Dec. 1963	T,E	A,T	180±	--	Standby well; formerly supplied city; reported yield, 40 gpm.
418	do	do	1947	245	10	182	Trs	2,148	83.7	July 1963	T,E	A,T	--	4	Do.
419	Homer Bodine	do	1960	205	6	--	Trs	2,151	73.8	Mar. 1961	S	D	--	2½	
420	E. P. Hines	--	--	190	6	190	Trs	--	71.4	July 1963	T,E	D	--	--	Formerly used for irrigation; reported yield, 70± gpm.
421	Jack Bourland	Huron Gist	--	200±	10	--	Trs	2,169	52.7	Dec. 1963	N	A,Irr	--	--	Reported yield, 130 gpm.
422	E. H. Wilson	--	--	110	6	--	Trs	2,127	36.9	Mar. 1961	C,W	S	--	1½	
423	Jack Bourland	Huron Gist	--	218	8	--	Trs	--	--	--	T,E	Irr	--	--	Irrigation of grass from sprinkler system; reported yield, 100+ gpm.
424	Irvin Grant	O. R. House	1961	245	10	180	Trs	2,206	37.0	Jan. 1964	S	Irr	225	1½	Application rate measured for discharge to sprinkler system, 124 gpm (Mar. 1963). Reported yield, 450 gpm.
425	C. B. Hines	--	1961	--	8	--	Trs	2,135	58.7	July 1963	T,E	Irr	--	--	Discharge to sprinkler system; operation began in 1963; reported yield, 70 gpm.
* 426	Irvin Grant	O. R. House	1961	220	8	160	Trs	2,178	59.2	Jan. 1964	S	Irr	210	4	Application rate measured for open discharge to earth tank, 60 gpm (Mar. 1963); reported yield, 200 gpm.
427	Jasper Wood	Kenneth House	1963	232	7	--	Trs	--	48.2	May 1963	S	Irr	--	3	Discharge to sprinkler system; reported yield, 120 gpm.
* 501	C. H. Dorn	--	--	51	5	--	Trs	--	13.0	May 1946	--	D,S	--	1½	
502	Doyle Gray	E. W. Martin	1952	210	10	210	Trs	2,185	19.4	Jan. 1964	S	Irr	175	4	Discharge to sprinkler system; reported yield, 20-25 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing		Water bearing unit	Altitude of land surface (ft)	Water level[1]		Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
					Diameter (in.)	Depth (ft)			Below land surface (ft)	Date of measurement					
29-34-503	O. B. Trulock	--	1953	190±	8	--	Trs	2,150	15.9	Jan. 1964	T	Irr	180±	--	Discharge to sprinkler system.
* 505	A. K. McCarley, Jr.	Huron Gist	1952	160	8	120	Trs	2,178	15.5	do	T,E	Irr	158	4	Sand reported at 120-160 ft; discharge to sprinkler system; reported yield, 190 gpm.
506	James Cox	Cox & Yost	1956	160	10	100	Trs	2,154	21.2	Feb. 1964	T,E	Irr	155	4	Reported yield, 90 gpm.
507	Doyle Gray	E. W. Martin	1952	155	8	155	Trs	2,167	31.0	Jan. 1964	T,G	Irr	150	4	Discharge to earth tank; reported yield, 60 gpm.
508	do	do	1952	171	6	107	Trs	2,152	24.0	do	T,G	Irr	145	4	Discharge to earth tank; reported yield, 75 gpm.
* 509	J. C. Pritchett	Gale & Thompson	1956	176	4	150	Trs	2,134	20.7	do	T,E	Irr	150	4	Discharge to sprinkler system; reported yield, 150 gpm.
510	Bill Gale	O. R. House	--	--	6	--	Trs	--	14.0	Feb. 1964	N	A,Irr	--	--	Abandoned due to caving.
511	Raymond Wadlington	do	1961	190	8	190	Trs	2,220	78.4	Jan. 1964	S	Irr	189	4	Discharge to sprinkler system; reported yield, 185 gpm.
512	J. C. Pritchett	Gale & Thompson	1954	157	8	56	Trs	--	--	--	T,E	Irr	157	4	Discharge to sprinkler system; reported yield, 125 gpm.
513	James Cox	Bill Gale	1957	190	10	100	Trs	--	33.3	Mar. 1963	T,E	Irr	185	4	Application rate measured for discharge to sprinkler system, 55 gpm (Mar. 1963); reported yield, 75 gpm.
514	do	O. R. House	1961	160	8	90	Trs	2,150	19.7	do	S	Irr	155	3	Discharge to earth tank; reported yield, 80 gpm.
* 515	L. C. Webb	Preston House	1953	248	10	248	Trs	--	--	--	T,E	Irr	230	4	Application rate measured for discharge to sprinkler system, 75 gpm (Mar. 1963); reported yield, 150 gpm.
516	James Cox	O. R. House	1962	170	5½	145	Trs	--	130±	Jan. 1964	C,E	D	--	2	Water level reported by driller.
517	J. C. Pritchett	Flores	1961	160	8	--	Trs	2,137	15.9	do	T,E	Irr	150	4	Discharge to sprinkler system; reported yield, 150 gpm.
518	do	Hopkins Drlg. Co.	1961	200	--	--	Trs	--	--	do	N	A,T	--	--	Test well for irrigation; reported yield, 175 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-34-520	Doyle Gray	E. W. Martin	1952	150±	8	150	Trs	--	--	--	T,G	Irr	145	4	Reported bottom of well in "red bed"; discharge to sprinkler system; reported yield, 60 gpm.
521	J. D. Cox	O. R. House	1963	167	7	85	Trs	--	--	--	S	Irr	146	4	Yields only 50 gpm continuously; reported yield, 170 gpm.
601	Mrs. A. C. Pratt	--	1953	265	8	260	Trs	--	52.6	Feb. 1963	T,G	Irr	158	4	Water reported from tight sand and gravel; discharge to sprinkler system; reported yield, 135 gpm.
602	do	Sam Smith	1960	252	10	252	Trs	2,272	55.2	Jan. 1964	T,G	Irr	252	5	Reported yield, 220 gpm.
603	-- Hoover	O. R. House	1961	--	8	--	Trs	2,260	92.3	do	S	Irr	--	4	Discharge to sprinkler system; seldom used in 1962 and 1963; reported yield, 110 gpm.
605	Roy Reynolds	--	--	115±	-5½	--	Trs	--	96.6	Nov. 1963	C,W	S	--	2	
606	Dwayne Williams	O. R. House	1955	218	--	--	Trs	--	--	--	N	A,T	--	9	Drilled for irrigation; never used; reported yield, 95 gpm.
607	Mrs. A. C Pratt	do	1960	247	--	--	Trs	2,255	--	--	N	A,T	--	--	Never used; reported yield, 140 gpm.[2/]
608	do	N. C. House	1960	265	--	--	Trs	2,269	--	--	N	A,T	--	--	Never used; reported yield, 110 gpm.
* 701	Colorado City	O. R. House	1944	238	10	238	Trs	2,167	113.6	Mar. 1961	T,E	A,P	--	4	Standby well.
* 702	do	--	1942	165	10	--	Trs	2,104	46.0	May 1946	T,E	P	--	4	Supplies swimming pool.
* 703	do	--	1922	256	8	--	Trs	2,158	83.2	do	N	A,P	--	4	Reported yield, 21 gpm.
705	E. Bohanon	--	--	100	--	--	Trs	2,125	41.2	Dec. 1963	C,W	D	--	1½	
* 706	Jim Kelley	E. W. Martin	1957	105	6	20	Trs	2,070	30.7	do	T,E	Irr	95	4	Application rate measured for open discharge, 75 gpm (Aug. 1963); reported yield, 105 gpm.
708	Colorado City	--	1930	240±	15	--	Trs	2,153	122.0	Mar. 1946	T,E	A,P	--	--	Standby well.
709	do	O. R. House	1944	255	10	--	Trs	2,189	144.0	Dec. 1956	T,E	A,P	199	4	Reported yield, 75-100 gpm.
712	J. E. Cox	E. W. Martin	1957	179	8	100	Trs	2,131	59.1	Jan. 1964	T,G	Irr	158	3	Discharge to sprinkler system; irrigates 15 acres of cotton; reported yield, [illegible] gpm.

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-34-713	Colorado City	O. R. House	1921	--	8	--	Trs	2,149	91.6	Mar. 1961	T,E	A,P	--	--	Standby well.
* 714	do	do	1921	233	8	--	Trs	2,172	113.7	Jan. 1963	T,E	A,P	--	4	Standby well; measured yield 70 gpm (Mar. 1963); reported yield, 90 gpm.
715	Mrs. Drew Cook	--	--	105±	5	--	Trs	2,168	79.0	Jan. 1964	S	D	100±	2	
716	Colorado City	O. R. House	1944	249	10	--	Trs	2,173	128.2	1946	T,E	A,P	--	4	
718	-- Bassinger	do	1960	112	6	--	Trs	2,060	27.2	Mar. 1963	S	Ind	--	2	Supplies water for minnow pond; reported yield, 35 gpm.
719	-- Mitchell	do	1960	185	5	115	Trs	--	--	--	--	D	--	--	
720	R. B. Golden	-- Mundell	1961	150	10	10	Trs	2,115	23.6	Apr. 1963	T,G	Irr	145	4	Drilled for road construction supply; used for irrigation in 1963; reported yield, 80 gpm.
* 801	do	--	--	117	4	70	Trs	--	22.6	May 1946	C,W	D	--	1½	
* 802	O. B. Trulock	--	--	28	--	--	Trs	--	7.0	do	C,W	S	--	1½	
* 803	Noble Walker	E. W. Martin	1952	188	15½	--	Trs	--	47.6	Jan. 1964	T,G	Irr	185	6	Reported yield 400 gpm when drilled; current reported yield, 230 gpm.
* 804	do	do	1952	170	7	91	Trs	--	53.6	Jan. 1953	S	Irr	--	3	Reported yield more than 300 gpm when drilled; current reported yield, 60 gpm.
805	Buena Wulfjen	--	--	190±	6	--	Trs	2,197	69.5	Jan. 1964	T,G	Irr	--	4	Reported yield, 150 gpm.
806	R. B. Golden	-- Mundell	1961	150	8	150	Trs	2,132	32.8	do	T,G	Irr	140	3	Discharge to 11-sprinkler system; reported yield, 80 gpm.
807	Noble Walker	E. W. Martin	1952	184	10	90	Trs	2,208	52.8	do	T,E	Irr	--	5	Discharge to sprinkler system; reported yield, 200 gpm.
808	do	--	1959	206	12	--	Trs	--	34.5	Jan. 1961	T,E	A,Irr	--	--	Do.
809	do	--	1954	180±	10	--	Trs	--	39.7	do	T,E	Irr	--	5	Discharge to sprinkler system; 20-hp motor; reported yield, 250 gpm.
810	do	E. W. Martin	--	190	10	22	Trs	2,217	59.5	Jan. 1964	N	A,Irr	--	--	Reported yield, 250 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-34-811	R. B. Golden	Bill Gale	1953	150	10	10	Trs	2,136	--	--	T,G	Irr	145	4	Top of "red bed" reported at 150 ft; discharge to 18-sprinkler system; reported yield, 140 gpm.
812	Warren Anderson	O. R. House	1962	180	5	120	Trs	2,166	31.0	Feb. 1963	S	D	--	1½	2/
814	Hudson & Sparks	Hopkins Drlg. Co.	1962	240	5	--	Trs	2,258	--	--	N	A,T	--	--	Test well for irrigation; air-drilled; reported yield, 80 gpm.
815	do	do	1962	232	--	--	Trs	2,232	101.2	May 1962	N	A,T	--	--	Test well for irrigation; reported yield, 135 gpm.
817	R. B. Golden	-- Mundell	1953	150	6	10	Trs	2,132	--	--	S	Irr	140	3	Discharge to 13-sprinkler system; reported yield, 80 gpm.
901	C. L. Root Est.	M. R. House	1952	163	10	150	Trs	2,190	24.4	Jan. 1964	T,E	Irr	160	6	Application rate measured for discharge to sprinkler system, 134 gpm (Aug. 1963); reported yield, 300 gpm.
902	C. C. Thompson	do	1952	167	12	140	Trs	2,184	20.9	do	N	A,Irr	--	--	Caved in after several years of use; reported yield, 160 gpm.
903	-- Carlock	--	--	--	6	--	Trs	2,208	54.7	do	C,W	S	--	1½	
* 905	C. L. Root	Huron Gist	1952	232	10	232	Trs	2,236	73.0	do	T,G	Irr	225	5	Irrigated 60 acres in 1953; reported yield, 250 gpm.
906	Jim Kelley	E. W. Martin	1953	160	6	30	Trs	2,185	20.0	do	T,E	Irr	140	5	Irrigates cotton and grassland; reported yield, 200 gpm.
907	C. C. Thompson	M. R. House	1953	178	10	10	Trs	2,206	35.6	do	T,E	Irr	165	4	Yielded 400 gpm when drilled; current reported yield, 225 gpm.
* 908	do	Bill Justice	1952	150	8	100	Trs	2,177	27.0	do	S	Irr	145	3	Discharge to sprinkler system; 7½- hp motor; reported yield, 80 gpm.
909	do	M. R. House	1952	152	8	141	Trs	--	--	--	T,E	Irr	145	4	Application rate measured for discharge to sprinkler system, 97 gpm (Mar. 1963); reported yield, 160 gpm, 10-hp motor.
910	Atwood Sheffield	O. R. House	1959	203	10	203	Trs	2,203	38.9	Jan. 1964	T,G	Irr	160	5	Application rate measured for discharge to sprinkler system, 125 gpm (Mar. 1963); reported yield, 150± gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-302	Ernest Parrott	O. R. House	1959	308	12	308	Trs	2,397	182.2	Jan. 1964	T,E	Irr	290	6	Casing perforated at 190-290 ft; 30-hp motor; reported yield, 420 gpm.[2/]
303	do	do	1959	300	12	300	Trs	--	--	--	T,E	Irr	290	6	Motor, 40 hp; reported yield, 315 gpm.
304	J. C. Bruce	do	1945	250	--	--	Trs	2,425	207±	Nov. 1960	T,G	Irr	250±	4	Application rate measured for open discharge, 76 gpm (Aug. 1962); reported yield, 125 gpm.
305	C. S. Riggs	Crosshans Bros.	1958	240	10	250	Trs	2,386	166.0	Dec. 1961	T,E	Irr	240	5	Application rate measured for open discharge, 83 gpm (Aug. 1962); reported yield, 250 gpm.
306	Ernest Ater	--	--	300	12	--	Trs	--	--	--	T,E	Irr	--	5	Motor, 40 hp; reported yield, 150 gpm.
307	W. Jocob	O. R. House	1957	315	8	315	Trs	2,431	200.4	Jan. 1964	T,E	Irr	315	5	Application rate measured for open discharge, 130 gpm (Aug. 1962); 30-hp motor; upper water-bearing sand at 290 ft; reported yield, 180 gpm.
308	E. W. Wyman	do	1945	220	6	--	Trs	--	199.9	Feb. 1963	C,W	D	--	2½	
309	C. S. Riggs	Grosshans Bros.	1957	240	8	--	Trs	--	67.1	Jan. 1964	T,E	Irr	230	5	Application rate measured for open discharge, 83 gpm (Aug. 1962); reported yield, 110 gpm.
310	-- Wilson	--	1957	300±	8	--	Trs	--	186.5	Nov. 1960	S	Irr	--	4	Application rate measured for open discharge, 119 gpm (Aug. 1962); reported yield, 100± gpm.
311	Ernest Ater	--	--	295±	8	--	Trs	2,392	170.6	Jan. 1964	N	A,Irr	--	--	Not used for several years; reported yield, 125± gpm.
312	Emil Shoettel	--	--	163±	6½	--	Trs	2,372	153.2	do	C,W	S	--	2	Reported yield, 2-3 gpm.
* 313	Ernest Wyman	O. R. House	1957	335	10	--	Trs	2,415	198.3	do	T,E	Irr	320	6	Yield of well improved by fracturing method; application rate measured for open discharge, 202 gpm (Aug. 1962); reported yield, 300 gpm.
314	do	--	1957	320	10	--	Trs	--	--	--	T,E	Irr	300	6	Measured yield, 99 gpm (Aug. 1962); reported yield, 200 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-315	Ernest Wyman	O. R. House	1958	300	10	--	Trs	--	--	--	T,E	Irr	290	5	Measured yield, 112 gpm (Aug. 1962); reported yield, 250 gpm.
316	do	--	1958	310	10	--	Trs	--	--	--	T,E	Irr	300	5	Measured yield, 81 gpm (Aug. 1962); reported yield, 150 gpm.
* 401	Royce Mahon	Eulis Compton	1952	196	16	196	Trs	--	59.2	Jan. 1964	T,G	Irr	190	5	Bottom of well in "red beds"; reported yield, 210 gpm.
402	Ralph Langford	O. R. House	1956	283	6	283	Trs	--	--	--	C,E	D	--	2	Reported yield, 3-5 gpm; water-bearing sand at 170-283 ft.
403	do	Eulis Compton	1955	283	12	272	Trs	2,322	117.0	Jan. 1964	T,G	Irr	273	6	Formerly yielded 255 gpm; current reported yield, 200 gpm.
404	D. Mahon	O. R. House	1960	265	--	--	Trs	2,314	107.2	Feb. 1961	N	A,T	--	--	Test well for irrigation; reported yield, 165 gpm.
405	Jim Kelley	E. W. Martin	1954	220	14	120	Trs	2,258	59.2	Jan. 1964	T,E	Irr	210	6	Yield influenced by pumping from nearby well; application rate measured for open discharge, 120 gpm (Aug. 1962); reported yield, 350 gpm.
* 406	do	do	1955	262	12	122	Trs	2,269	--	--	T,G	Irr	260	6	Reported yield, 650 gpm.
407	do	do	1955	238	10	155	Trs	2,268	75.0	Jan. 1964	T,G	Irr	220	6	Reported yield, 350 gpm.
408	May S. Martin	C. L. Cleaver	1957	237	10	237	Trs	2,255	67.5	do	T,G	Irr	237	6	Reported yield, 800 gpm.
409	Bill Voss	--	1955	190	8	190	Trs	--	48.2	do	T,E	Irr	185	4	Application rate measured for discharge to sprinkler system, 105 gpm (Aug. 1963); "red beds" reported at 190 ft; reported yield, 70 gpm.
410	A. D. Palmer	--	1953	187	8	187	Trs	2,263	57.1	do	N	A,Irr	--	4	Used in 1961 and 1962; abandoned in 1963; reported yield, 150 gpm.
412	Royce Mahon	O. R. House	1960	180	8	180	Trs	2,258	58.5	do	S	Irr	170	4	First used in 1961; reported yield, 80 gpm.
414	K. L. Taylor	O. Cleaver	1958	257	12	257	Trs	--	82.9	do	T,G	Irr	255	6	Application rate measured for discharge to sprinkler system, 142 gpm (Aug. 1963); yields 400 gpm when nearby wells not operating.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-415	J. B. Mahon	Eulis Compton	1954	165	10	100	Trs	--	58.3	Jan. 1964	T,E	Irr	155	5	Application rate measured for discharge to sprinkler system, 163 gpm (Mar. 1963); reported yield, 180 gpm.
* 416	do	O. R. House	1954	200	12	200	Trs	--	78.4	do	T,E	Irr	195	6	Measured yield, 250 gpm (Mar. 1963); reported yield, 190 gpm.
417	W. Pratt	O. Cleaver	1955	250	14	250	Trs	2,257	70.1	do	T,G	Irr	245	6	Yields 500 gpm at start of irrigating season; reported yield, 324 gpm.[2]
418	do	O. R. House	1959	140	12	140	Trs	2,252	55.7	Feb. 1963	T,G	Irr	140	5	Discharge to sprinkler system; reported yield, 160 gpm.
419	Bill Voss	do	1955	200	8	200	Trs	--	--	--	T,E	Irr	185	4	Reported yield, 200 gpm.
420	do	do	1955	200	8	200	Trs	--	--	--	T,E	Irr	185	4	Do.
421	Abraham Castro	--	1957	206±	10	206	Trs	--	--	--	T,E	Irr	180	4	Discharge to sprinkler system; used to irrigate grass and cotton; reported yield, 150 gpm.
422	do	O. L. Williams	1954	206	10	206	Trs	--	--	--	T,G	Irr	180	6	Application rate measured for discharge to sprinkler system, 168 gpm (Aug. 1963); formerly yielded 350 gpm.
423	Bill Voss	Gale & Thompson	1952	180	10	180	Trs	--	188.5	Feb. 1963	T,E	Irr	175	5	Application rate measured for discharge to sprinkler system, 105 gpm (Aug. 1963); yielded 500 gpm when drilled; water level measured while pumping.
424	Jim Kelley	C. W. Martin	1956	230	10	120	Trs	--	--	--	T,G	Irr	220	5	Application rate measured for open discharge, 108 gpm (Aug. 1962); reported yield, 300 gpm.
425	Abraham Castro	N. C. House	1962	207	6	207	Trs	2,238	46.6	Jan. 1964	S	Irr	174	3	Discharge to sprinkler system; reported yield, 105 gpm.
426	Jim Kelley	Ernest Martin	1955	228	12	65	Trs	--	62.4	do	T,G	Irr	220	5	Reported yield, 250 gpm.
427	do	C. W. Martin	1955	228	12	228	Trs	--	--	--	T,G	Irr	210	6	Reported yield, 500 gpm.
428	D. Mahon	N. C. House	1962	190	12	190	Trs	2,272	70.2	Jan. 1964	S	Irr	180	4	Application rate measured for discharge to sprinkler system, 175 gpm (Mar. 1963); reported yield, 330 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing		Water-bearing unit	Altitude of land surface (ft)	Water level[1]		Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
					Diameter (in.)	Depth (ft)			Below land surface (ft)	Date of measurement					
29-35-429	H. Hallmark	N. C. House	1961	205	10	194	Trs	2,247	53.6	Jan. 1964	S	Irr	--	4	Discharge to sprinkler system; reported yield, 160 gpm.
430	D. Mahon	do	1960	180	10	180	Trs	--	64.2	do	S	Irr	180	4	Application rate measured for discharge to sprinkler system, 82 gpm (Mar. 1963); reported yield, 150 gpm.
431	do	do	1961	185	10	185	Trs	--	--	--	S	Irr	75	4	Discharge to sprinkler system; reported discharge, 180 gpm.
432	J. L. Pratt	--	--	70±	5	--	Trs	2,243	45.9	Jan. 1964	C,W	S	--	2	
433	J. B. Mahon	N. C. House	1962	206	--	--	Trs	--	--	--	N	A,T	--	--	Never used; reported yield, 150 gpm.
434	T. L. Holman	do	1962	165	--	--	Trs	--	38.4	Aug. 1963	N	A,T	--	--	Never used; reported yield, 110 gpm.
435	Jim Kelley	O. R. House	1963	205	12	202	Trs	--	63.4	Jan. 1964	N	A,T	--	--	Used for about 2 months; abandoned; reported yield, 100± gpm.
436	D. Mahon	Hopkins Drlg. Co.	1960	200	--	--	Trs	2,258	--	--	N	A,T	--	--	Never used; reported yield, 140 gpm.
501	H. L. Johnson	Pioneer Irrigation	1954	248	10	248	Trs	2,336	133.1	Jan. 1964	T,G	Irr	235	5	Reported yield, 230 gpm.
502	Robinson Green	O. R. House	1959	242	10	--	Trs	2,342	136.5	Feb. 1963	T,G	Irr	--	6	Application rate measured for discharge to sprinkler system, 276 gpm (Mar. 1963); reported yield, 430 gpm.
503	Lloyd Brame	Eulis Compton	1959	228	10	228	Trs	--	--	--	T,G	Irr	210	6	Reported yield, 400 gpm.
* 504	do	O. Cleaver	1956	250	12	250	Trs	2,334	129.0	Jan. 1964	T,G	Irr	250	6	Measured yield, 315 gpm (Mar. 1963); reported yield, 700 gpm.
505	Kelly Treadway	do	1956	250	12	250	Trs	2,319	109.1	do	T,G	Irr	--	6	Reported yield, 750 gpm.
506	H. C. Taylor	O. R. House	1957	257	10	257	Trs	2,319	116.5	do	T,G	Irr	240	6	Bottom of casing on hard conglomerate; reported yield, 400 gpm.
* 507	W. A. Taylor	O. Cleaver	1954	280	12	270	Trs	2,338	132.6	do	T,G	Irr	258	6	Application rate measured for discharge to sprinkler system, 295 gpm (Mar. 1963); reported yield, 600 gpm.
508	C. D. Taylor	O. R. House	1956	207	10	12	Trs	2,268	77.0	do	T,G	Irr	185	5	"Red beds" reported at 201 ft; reported yield, 200 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-509	W. Jacks	O. R. House	1960	230	12	225	Trs	2,345	146.8	Jan. 1964	T,E	Irr	--	5	Used in 1960 and 1961; unused in 1962 and 1963; reported yield, 150+ gpm.
510	H. C. Taylor	do	1960	275	--	--	Trs	--	--	-- --	N	A,T	--	--	Never used; reported yield, 195 gpm.
511	Ira Hall	Eulis Compton	1957	210	10	210	Trs	2,307	104.2	Jan. 1964	T,G	Irr	210	4	Discharge to sprinkler system, reported yield, 200 gpm.
512	H. C. Taylor	--	1958	260±	12	--	Trs	2,329	119.2	do	N	A,Irr	--	--	Reported yield, 200± gpm.
513	W. Jacks	N. C. House	1961	274	12	274	Trs	2,357	145.7	do	T,G	Irr	--	6	Reported yield, 600+ gpm.[2/]
516	D. F. Hester	do	1959	--	--	--	Trs	--	--	--	N	A,T	--	--	Test well for irrigation.
* 601	Alvin Hackfeld	Sam Smith	1957	333	14-10	333	Trs	2,434	195±	Jan. 1964	T,G	Irr	325	8	Application rate measured for open discharge, 357 gpm (Aug. 1962); maximum yield undetermined; reported yield, 500+ gpm.
602	Mrs. Emma Hackfeld	O. R. House	--	290	6	290	Trs	--	--	--	S	Irr	--	4	Reported yield, 90 gpm.
* 603	A. J. Robinson	do	1957	330	8	330	Trs	2,434	199.6	Jan. 1964	T,E	Irr	290	5	Application rate measured for open discharge, 167 gpm (Aug. 1962); reported yield, 220 gpm.
604	Robert Hackfeld	do	1961	320	10	100	Trs	--	92.0	Feb. 1961	S	Irr	240	4	Measured yield, 73 gpm (Aug 1962); reported yield, 110 gpm.
605	William Hackfeld	do	--	200	8	--	Trs	--	--	--	T,G	Irr	120	4	Discharge to sprinkler system; reported yield, 120 gpm.
607	John Zetzman	Eulis Compton	1958	312	8	312	Trs	2,423	191.4	Jan. 1964	T,E	Irr	300	4	Open discharge; casing perforated at 190-312 ft; reported yield, 150 gpm.
608	Robert Hackfeld	O. R. House	1961	327	8	327	Trs	2,421	193.2	do	T,G	Irr	--	4	Application rate measured for open discharge, 138 gpm (Aug. 1962); reported yield, 160 gpm.
609	A. J. Marth	do	1957	298	8	298	Trs	2,406	144.7	do	T,E	Irr	280	5	Measured yield, 266 gpm.
610	Robert Hackfeld	do	1961	315	7	285	Trs	2,420	186.5	Feb. 1963	T,G	Irr	--	4	
611	Alvin Hackfeld	--	--	110±	5½	--	Kt	2,429	106.1	Jan. 1964	N	A,D	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-612	Arthur Lehman	O. R. House	1962	135	5	135	Kt	--	90.8	Jan. 1963	C	D	--	1½	
613	A. J. Marth	--	--	255±	5½	--	Trs	2,408	174.7	Dec. 1963	C,W	D	--	1½	
701	City of Loraine	--	--	250	8	250	Trs	--	--	--	T,E	P	235	4	Reported yield, 100 gpm.
* 702	do	-- House	--	250	12	250	Trs	--	--	--	N	A,P	--	--	Pump inoperative; reported yield, 60 gpm.
703	do	--	--	250	8	250	Trs	--	--	--	T,E	P	245	4	Reported yield, 220 gpm.
* 704	do	Fannin Drlg. Co.	1952	268	18	268	Trs	--	147.1	Mar. 1961	T,E	P	250±	5	Casing perforated 198-268 ft; seldom used; reported yield, 60 gpm.
706	Price Hall	N. C. House	1957	170	8	175	Trs	--	--	--	T,E	Irr	143	5	Discharge to 10 20-gpm sprinklers; reported yield, 170 gpm.
707	A. D. Palmer	--	1952	174	10	174	Trs	2,237	37.5	Jan. 1964	T,G	Irr	165	4	Unused in 1961 and 1962; reported yield, 150 gpm.
* 708	George Mahon	J. O. Fannin	1952	220	16	150	Trs	2,217	25.0	do	S	Irr	135	4	Application rate measured for discharge to sprinkler system, 105 gpm (Mar. 1963); reported yield, 250 gpm.
709	T. D. Rider	--	--	178	8	--	Trs	2,337	146.0	do	C,W	S	--	1½	
710	Travis Branch	O. L. Williams	1955	195	12	195	Trs	--	--	--	T,G	Irr	175	8	Application rate measured for discharge to 60 15-gpm sprinklers, 425 gpm (Aug. 1963); maximum yield unknown.
711	J. Furlow	O. R. House	1960	200	10	195	Trs	2,264	74.2	Feb. 1961	T,G	Irr	195	4	Application rate measured for discharge to sprinkler system, 93 gpm (Mar. 1963); reported yield, 200 gpm.[2/]
* 712	Price Hall	Eulis Compton	1959	185	10	185	Trs	2,223	40.7	Jan. 1964	T,G	Irr	170±	5	Measured yield, 135 gpm (Mar. 1963); reported yield, 250 gpm.
713	do	N. C. House	1959	--	--	--	Trs	--	--	--	N	A,T	--	--	Test well for irrigation; reported yield, 250 gpm.
714	Frank Crownover	Hopkins Drlg. Co.	1960	200	--	--	Trs	2,267	--	--	N	A,T	--	--	Reported yield, 180 gpm.
716	J. W. Voss	O. R. House	1963	270	7	270	Trs	--	172.3	June 1963	T,E	Irr	250	4	Discharge to sprinkler system; water-bearing sands at 240-270 ft; reported yield, 162 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-717	City of Loraine	--	1962	268	10 3/4	268	Trs	--	--	--	T,E	P	--	--	Reported yield, 250 gpm.
718	George Mahon	Hopkins Drlg. Co.	--	177	--	--	Trs	2,219	--	--	N	A,T	--	--	
719	T. P. Fowler	O. R. House	1962	207	12	210	Trs	2,276	77.3	Jan. 1964	T,E	Irr	200	5	Discharge to sprinkler system; irrigates grain and grass; reported yield, 295 gpm.
* 801	C. C. Thompson	I. O. Fannin	1952	315	10	315	Trs	2,375	157.8	do	T,E	Irr	270	6	Application rate measured for discharge to 38-sprinkler system, 300 gpm (Mar. 1963); pumping level 241 ft; reported yield, 512 gpm.
* 802	E. C. Hallmark	Sam Smith	1956	250	14	250	Trs	2,343	142.0	do	T,G	Irr	240	8	Application rate measured for discharge to sprinkler system, 426 gpm (Mar. 1963); casing perforated at 150-250 ft; reported yield, 650+ gpm.
803	W. H. Narrell	Eulis Compton	1954	274	10	274	Trs	--	--	--	T,G	Irr	270	6	Application rate measured for discharge to sprinkler system, 379 gpm (Mar. 1963); maximum yield 600 gpm.
804	do	do	1957	274	10	274	Trs	--	147.3	Nov. 1962	T,G	Irr	270	5	Discharge to sprinkler system; reported yield, 285 gpm.
805	J. A. Merket	Ernest Martin	1954	40±	8	40	Trs	2,336	26.4	do	T,G	Irr	40	4	Reported yield, 100+ gpm.
807	A. H. Miles	O. R. House	1962	264	8	264	Trs	--	--	--	T,E	Irr	245	4	Discharge to sprinkler system; irrigates grassland; reported yield, 80 gpm.
808	Kenneth Merket	Sam Smith	1963	215	8	--	Trs	2,330	122.7	Apr. 1963	T,G	Irr	197	5	Reported yield, 200 gpm.
809	Roy Price	Kenneth House	1963	244	6½	--	Trs	2,334	14.6	July 1963	--	Irr	--	--	Reported yield, 160 gpm.
901	A. A. Gaebler	-- Moseley	1947	350	16½	350	Trs	2,420	118.4	Apr. 1949	T,E	Irr	350	6	Seldom used in 1962 and 1963; reported yield, 350 gpm.
902	do	O. R. House	1956	320	12	320	Trs	--	--	--	T,E	Irr	284	5	Drilled to "red bed"; reported yield, 260 gpm.
903	R. H. Wharton	Grosshans Bros.	1959	346	10	340	Trs	2,435	209.7	Jan. 1964	T,E	Irr	334	6	Application rate measured for open discharge, 160 gpm (Aug. 1962); casing slotted at 110-340 ft.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-35-904	Laura Althof	Bill Wilkerson	1935	253	5	253	Trs	--	156.22	July 1946	C,W	D,S	--	--	
* 905	R. H. Marth	O. R. House	1960	310	10	310	Trs	2,402	174.1	Jan. 1964	T,E	Irr	310	5	Application rate measured for open discharge, 211 gpm (Aug. 1962); casing perforated at 238-310 ft.
* 907	R. H. Wharton	Grosshans Bros.	1959	340	10	340	Trs	2,425	205.4	do	T,E	Irr	337	6	Application rate measured for open discharge, 307 gpm (Aug. 1962); casing slotted at 105-325 ft.
909	-- Wallace Estate	O. R. House	1962	182	4	--	Kt	2,343	20.6	Feb. 1963	C,W	S	--	1½	
913	G. R. Baumann	--	--	117±	5½	--	Kt	2,441	99.7	Apr. 1963	C,W	S	--	2	
915	Holiday Hayley	Kenneth House	1963	303	7	227	Trs	2,436	107.9	July 1963	N	A,T	--	--	Caved at 255 ft.
36-101	D. S. Riggs	--	--	280	6	--	Trs	2,370	114.6	Nov. 1960	S	A,Irr	--	4	Water reportedly causes soil damage; reported yield, 60-80 gpm.
102	W. Jacob	O. R. House	1960	170	6	140	Trs	2,376	116.9	Jan. 1964	N	A,T	--	--	Test well for irrigation; reported yield, 53 gpm.
103	Raymond Althof	do	1956	310	8	176	Trs	2,396	153.7	do	T,E	Irr	275	4	Application rate measured for open discharge, 40 gpm (Aug. 1962); reported yield, 150 gpm.[2/]
106	D. S. Riggs	--	--	280±	6	--	Trs	--	67.4	Mar. 1963	S	A,Irr	--	3	Unused for several years; reported yield, 60-80 gpm.
201	Mrs. L. S. Howard	--	--	145	4	--	Trs	2,386	98.7	Jan. 1964	C,W	S	--	1½	
202	B. O. Wilkins	--	--	131	6	--	Trs	2,383	115.9	Mar. 1963	C,W	A,D	--	1½	
203	Joe Hendricks	--	--	139	--	--	Trs	2,378	113.9	Oct. 1962	C,W	D,S	--	1½	
204	D. S. Riggs	O. R. House	1962	100	5½	--	Trs	--	--	--	S	D	--	--	Reported yield, 3 gpm.
* 301	P. A. Smith	--	--	152	6	--	Trs	2,383	118.2	Feb. 1963	C,W	D	150	--	
303	Jesse Faust	O. R. House	1961	190	5	190	Trs	2,382	89.0	do	S	D,S	--	--	Reported yield, 20 gpm.
304	H. L. Hunter	--	--	200	2	--	Trs	2,384	126.6	Apr. 1963	N	A,S	--	--	Measured depth 177 ft.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-401	R. E. Althof	O. R. House	1952	248	8	248	Trs	--	--	--	T,E	Irr	245	5	Application rate measured for open discharge, 105 gpm (Aug. 1962); reported yield, 190 gpm.
402	do	do	1953	244	8	244	Trs	--	--	--	T,E	Irr	242	5	Reported 60 gpm increase in yield after shooting with nitroglycerine; reported yield, 220 gpm.
403	do	Sam Smith	1954	242	8	242	Trs	2,402	162.2	Jan. 1964	T,E	Irr	--	5	Reported yield of 280 gpm has never decreased.
404	do	O. R. House	1958	270	8	270	Trs	--	--	--	T,E	Irr	248	6	Drilled to 340 ft; "red bed" at 270 ft; reported yield, 190 gpm.
405	do	do	1959	244	8	244	Trs	--	--	--	S	Irr	240	3	Reported yield, 130 gpm.
406	George Rannefeld	Grosshans Bros.	1959	220	8	220	Trs	2,385	134.3	Jan. 1964	T,E	Irr	210	4	Application rate measured for open discharge, 75 gpm (Aug. 1962); reported yield, 150 gpm.
407	E. J. Woodward	E. W. Martin	1957	240	12½	6	Trs	--	--	--	T,G	Irr	235	5	Measured yield, 260 gpm (Aug. 1962).[2/]
408	do	do	1957	234	12	7	Trs	--	68.5	Nov. 1960	T,G	Irr	230	5	Reported yield, 200 gpm.
409	do	Grosshans Bros.	1958	222	12	6	Trs	--	137.9	Dec. 1962	T,G	Irr	220	5	Measured yield, 70 gpm (Aug. 1962); reported yield, 150 gpm.
410	R. E. Sauer	--	--	200	6	--	Trs	--	168.2	Feb. 1963	C,W	D,S	--	--	
411	Mrs. Annie Jobe	--	--	170	--	--	Trs	2,389	140.5	July 1963	C,W	D,S	--	--	
412	E. J. Woodward	--	--	165	5½	--	Trs	2,393	138.4	Jan. 1964	C,W	D	--	1½	
413	Ernest Freyer	Sam Smith	1956	283	10	283	Trs	2,418	170.9	do	T,G	Irr	280	4	Application rate measured for open discharge, 95 gpm (Aug. 1962); casing perforated at 0-282 ft; reported yield, 158 gpm.
* 414	Roy Rannefeld	Grosshans Bros.	1958	335	10	335	Trs	2,412	162.3	do	T,E	Irr	330	6	Application rate measured for open discharge, 295 gpm (Aug. 1962); casing perforated at 240-235 ft; acid treatment in 1961 increased yield by 50-100 gpm. Reported yield, 450 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-415	E. F. Duncan	Grosshans Bros.	1957	230	10	230	Trs	2,386	131.7	Jan. 1964	T,E	Irr	220	4	Application rate measured for open discharge, 91 gpm (July 1963); casing perforated at 130-230 ft; pumping level 177.8 ft, (Aug. 1962); reported yield, 135 gpm.
* 416	do	do	1957	230	10	135	Trs	--	135.1	do	T,E	Irr	220	4	Application rate measured for open discharge, 110 gpm (July 1963); 10-hp motor; reported yield, 135 gpm.
418	do	Hopkins Drlg. Co.	1961	215	--	--	Trs	--	--	--	N	A,T	--	--	Reported yield, 100 gpm.
* 501	City of Roscoe	O. R. House	1950	208	8	136	Trs	--	--	--	T,E	P	165	5	Yielded 250 gpm when drilled; current reported yield, 80± gpm.
502	do	do	1950	196	7	196	Trs	--	--	--	T,E	P	185	5	Do.
503	do	do	1954	218	8	218	Trs	2,385	--	--	T,E	P	178	5	Do.
504	do	do	1955	160	8	160	Trs	--	--	--	T,E	P	--	--	
505	do	do	--	154	7	128	Trs	---	--	--	T,E	P	150	--	
506	Roscoe FFA	Grosshans Bros.	1960	200±	8	--	Trs	2,385	112.4	Jan. 1964	S	Irr	180	3	Reported yield, 55 gpm.
507	Roy Rasco	Grady Hudson	1936	530	8-12	275	Trs	2,390	136.4	do	T,E	Irr	200	4	Application rate measured for open discharge, 63 gpm (Aug. 1962); water-bearing sands above 200 ft; casing perforated at 30-200 ft; reported yield, 75 gpm.
510	Jess Smith	E. W. Martin	1956	250	7	185	Trs	2,376	118.3	do	S	Irr	175	2	Reported yield, 40 gpm.
511	Wilson Hrbacek	O. R. House	1957	182	8	180	Trs	--	118.8	Nov. 1960	S	Irr	175	3	Application rate measured for open discharge, 27 gpm (Aug. 1962).
512	Marion Duncan	Grosshans Bros.	1957	200	8	200	Trs	--	140.2	Jan. 1964	T,E	Irr	185	4	Measured yield, 45 gpm (Aug. 1962); reported yield, 65 gpm.
513	do	do	1960	200	8	200	Trs	--	--	--	S	Irr	185	3	Measured yield, 48 gpm (Aug. 1962); reported yield, 82 gpm.
514	Wilson Hrbacek	O. R. House	1957	182	8	180	Trs	--	--	--	S	Irr	--	4	Application rate measured for open discharge, 42 gpm (Aug. 1962); 7½-hp motor.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-515	E. L. Duncan	Grosshans Bros.	1957	182	8	182	Trs	--	--	--	T,E	Irr	175	3	Application rate measured for open discharge, 55 gpm (Aug. 1962).
516	do	do	1957	174	8	174	Trs	--	--	--	T,E	Irr	170	3	Measured yield, 78 gpm (Aug. 1962); reported yield, 104 gpm.
518	Roy Rasco	O. R. House	1961	207	7	195	Trs	--	--	--	S	Irr	195	3	Measured yield, 62 gpm (Aug. 1962); reported yield, 75 gpm.
519	Jess Smith	Grosshans Bros.	1959	185	5½	185	Trs	--	--	--	T,E	Irr	175	2½	Casing perforated at 160-180 ft; reported yield, 75+ gpm.
520	E. L. Duncan	--	--	150±	6	--	Trs	2,407	127.5	Feb. 1963	N	A,T	--	--	Supplied oil-test rig.
521	Arlon Orman	Hopkins Drlg. Co.	1961	220	--	--	Trs	2,419	--	--	N	A,T	--	--	Test well for irrigation; reported yield, 60 gpm.
* 601	City of Roscoe	O. R. House	1954	165	8	165	Trs	--	--	--	T,E	P	160	5	Reported yield, 80± gpm.
* 602	do	do	1947	165	8	165	Trs	--	--	--	T,E	P	--	--	
603	do	do	1946	180	8	180	Trs	2,382	95.8	Nov. 1960	N	A,P	--	--	Plugged and abandoned; reported yield, 100 gpm.
604	Mrs. L. S. Howard	do	1956	200	8	200	Trs	2,392	98.1	Jan. 1964	T,E	Irr	195	4	Reported yield, 75 gpm.
606	W. C. Cleckler	do	1961	170	7	103	Trs	2,414	112.6	do	N	A,T	--	3	Reported yield, 50 gpm.[2/]
607	E. C. Miles	Ken House	1963	202	--	--	Trs	--	--	--	N	A,T	--	--	Reported yield, 10 gpm.
608	E. G. Long	--	1961	172	6	172	Trs	2,389	110.0	Jan. 1964	S	Irr	169	3	Occassionally used for irrigation of grass; reported yield, 35 gpm.
609	E. C. Miles	Hopkins Drlg. Co.	1963	155	8	150	Trs	2,378	86.6	do	T,G	Irr	150	3	Application rate measured for open discharge, 270 gpm (Aug. 1962); reported yield, 50 gpm.
701	Max Wright	O. R. House	1956	360	6	200±	Trs	--	195.4	do	S	Irr	300	5	Application rate measured for open discharge, 88 gpm (Aug. 1962); reported "red bed" encountered at 320-360 ft; reported yield, 100 gpm.[2/]
* 702	do	Max Wright	1955	300	16-12	220	Trs	2,446	188.6	do	T,G	Irr	297	6	Application rate measured for open discharge, 98 gpm (Aug. 1962); yielded 300 gpm on test.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-704	S. H. Garrett	--	--	100	5	--	Trs	2,434	62.4	Feb. 1963	C,E	D,S	--	½	Reported yield, 3 gpm.
705	Frank Crownover	O. R. House	1957	300	8	300	Trs	2,431	190.7	Jan. 1964	T,E	Irr	280	5	Application rate measured for open discharge, 150 gpm (Aug. 1962); reported yield, 225 gpm.
707	Robert Wright	Hopkins Drlg. Co.	1963	217	--	--	Trs	2,400	95±	May 1963	N	A,T	--	--	Test well for irrigation; reported yield, 68 gpm.
801	D. L. Pearce	O. R. House	1956	200	8	185	Trs	--	--	--	T,E	Irr	--	3-4	Reported yield, 45 gpm.
802	do	Eulis Compton	1957	190	8	190	Trs	2,426	121.3	Feb. 1963	T,E	Irr	--	4	Application rate measured for open discharge, 33 gpm (Aug. 1962); casing perforated at 120-140 and 160-190 ft; reported yield, 90 gpm.
803	do	Grosshans Bros.	1958	185	5½	185	Trs	--	--	--	S	Irr	--	3	Casing perforated at 110-130 and 150-185 ft; pumping level 145.6 ft; reported yield, 45 gpm.
804	do	do	1958	200	5½	185	Trs	--	--	--	S	Irr	--	3	Application rate measured for open discharge, 26 gpm (Aug. 1962); casing perforated at 120-140 and 150-185 ft.
805	do	O. R. House	1956	200	5½	185	Trs	--	--	--	S	A,Irr	--	3	Casing perforated at 40-60 and 140-185 ft; reported yield, 45 gpm.
806	Gulf Pipeline Co.	--	1927	254	8	215	Trs	2,421	144.8	Jan. 1964	T,E	A,Ind	--	4	Reported yield, 15 gpm.
808	O. J. Blocker	-- Tyler	1909	160	6	--	Trs	--	144.0	Feb. 1963	C,W	S	--	--	
809	Frank Pretsche	Grosshans Bros.	1960	174	6	174	Trs	2,436	148.9	Jan. 1964	S	Irr	174	2	Application rate measured for open discharge, 24 gpm (Aug. 1962); reported yield, 33 gpm.
810	J. B. Cooper	O. R. House	--	185	6	--	Trs	--	108.0	Nov. 1960	S	Irr	--	3	Measured yield, 27 gpm (Aug. 1962); reported yield, 55 gpm.
811	Arlon Orman	Hopkins Drlg. Co.	1961	240	8	--	Trs	--	157.4	Jan. 1964	S	Irr	200	4	Measured yield, 58 gpm.
812	E. A. Ater	--	--	138	5½	--	Trs	2,415	117.3	do	C,W	D	--	1½	
813	D. L. Pearce	Grosshans Bros.	1960	185	--	--	Trs	2,417	--	--	--	Irr	--	--	Measured yield, 24 gpm (Aug. 1962); reported yield, 30 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-814	L. S. Howard	O. R. House	1956	185	8	185	Trs	2,432	125.7	Jan. 1964	T,E	Irr	180	4	Motor, 10 hp; reported yield, 150 gpm.
815	Maurine Horton	--	1941	145	6	--	Trs	2,431	127.9	Feb. 1963	C,W	D,S	--	1½	
816	D. L. Pearce	Grosshans Bros.	1960	185	--	--	Trs	2,417	121.8	Jan. 1960	N	A,T	--	--	Water-bearing zone at 140 ft; reported yield, 20 gpm.
818	F. H. Pretsche	--	1955	175	6	175	Trs	--	--	--	S	Irr	175	2½	Application rate measured for open discharge, 24 gpm (Aug. 1962); formerly supplied oil-test rig; reported yield, 55 gpm.
819	Leroy Pretsche	T. P. House	1957	220	6½	180	Trs	--	--	--	T,E	Irr	175	3	"Red beds" reported at 180 ft; reported yield, 80 gpm.
* 820	J. B. Cooper	O. R. House	1960	200	8	--	Trs	2,426	137.9	Jan. 1964	T,E	Irr	185	4	Pumping level 138.7 ft.
822	L. S. Howard	N. C. House	1956	185	8	185	Trs	--	--	--	T,E	Irr	175	4	Reported yield, 90 gpm.
901	Mertie Watt	--	1928	315	8	315	Trs	--	101.4	1928	N	A,P	--	--	Formerly supplied city of Sweetwater; reported yield, 100 gpm.
902	do	--	1928	400	7	400	Trs	--	104.3	1928	N	A,P	--	5	Do.
* 905	do	--	1928	180	10	180	Trs	2,420	104.7	Jan. 1964	T,E	Irr	160	5	Formerly supplied city of Sweetwater; reported yield, 125 gpm.[2]
906	do	--	1928	185	8	--	Trs	--	109.9	do	T,E	Irr	--	4	Application rate measured for open discharge, 122 gpm (Aug. 1962); formerly supplied city of Sweetwater.
908	do	--	1928	180	8	--	Trs	2,422	102.1	Dec. 1962	N	A,P	--	4	
910	W. W. Shields	Grosshans Bros.	1961	334	8	160	Trs	--	--	--	T,G	Irr	--	4	Application rate measured for open discharge, 64 gpm (Aug. 1962); "red beds" reported at 160 ft.
911	R. E. Althof	--	1928	205	10	--	Trs	2,422	108.2	Jan. 1964	T,G	Irr	195	4	Reported yield, 250 gpm.
915	Arlon Orman	Grosshans Bros.	1957	220	8	205	Trs	--	98.8	do	T,E	Irr	200	4	Application rate measured for open discharge, 103 gpm (Aug. 1962).[2]
916	do	do	1958	200±	8	165	Trs	--	103.8	Dec. 1960	T,E	Irr	190	4	Measured yield, 58 gpm (Aug. 1962).

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-36-917	Gulf Refining Co.	--	1927	170±	8	--	Trs	--	106.6	Dec. 1963	N	A,Ind	--	4	Formerly supplied refinery; reported yield, 50 gpm.
918	Woodrow Smith	--	1960	180	6	--	Trs	--	90.3	Feb. 1961	N	A,Ind	--	--	Well destroyed; formerly supplied oil-test rig.
919	Gulf Refining Co.	--	--	170±	8	--	Trs	--	104.4	Oct. 1963	T,E	A,Ind	--	4	
921	L. S. Howard	N. C. House	1957	185	6	--	Trs	--	--	--	S	Irr	--	2	Reported yield, 60 gpm.
922	Christo Richburg	O. R. House	1948	170	6½	110	Trs	--	115.1	Jan. 1964	T,E	Irr	160	4	Reported yield, 50 gpm.
924	Garland Price	Joe Whitworth	1963	204	8	204	Trs	--	128.8	Aug. 1963	S	Irr	195	3	Application rate measured for discharge to sprinkler system, 50 gpm; pumping level 167.8 ft.
925	Arlon Orman	Hopkins Drlg. Co.	1961	240	--	--	Trs	--	--	--	N	A,T	--	--	Test well for irrigation; reported yield, 80 gpm.
37-401	R. E. Gracey	--	1962	88	5	--	Trs	2,385	79.5	Oct. 1960	--	--	--	--	
404	Eula Cook	--	1962	--	5½	--	Trs	2,399	95.1	July 1962	J	D	--	2	
407	Texaco Service Station	O. R. House	1961	150	6	150	Trs	--	--	--	--	--	--	2	
703	E. W. Hopkins	--	--	38	--	--	P	2,235	32.2	Oct. 1960	--	--	--	1½	Water reported mineralized, but potable.
704	E. C. Miles	--	--	135±	5	--	Trs	2,399	96.9	Mar. 1963	--	D	--	1½	
41-101	Pete Hines	O. R. House	1962	300±	5	150	Trs	2,163	57.2	June 1963	C,W	S	--	1½	Reported strong supply; plugged back to 130 ft.
102	M. A. Webb	--	--	130	4	10	Trs	2,213	28.1	do	N	A,T	--	--	Yielded 40 gpm on test.
103	F. A. Fuller	--	--	38±	--	--	Trs	2,130	35.9	do	N	A,D	--	--	
* 104	E. A. Clark	--	1961	81	5½	--	Trs	2,091	32.8	do	C,E	D	--	1½	Reported weak supply.
105	L. R. Iglehart	--	--	130	5	--	Trs	2,174	99.2	July 1963	C,E	D,S	120	1½	Do.
106	J. B. Harris	Roscoe Higgins	--	100+	5	80	Trs	2,121	19.4	do	C,W	A,S	--	1½	Reported strong supply.
201	E. L. Henderson	--	--	80	5	--	Trs	2,159	32.1	May 1963	C,W	D,S	--	1½	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-41-202	F. W. Martin	--	--	34	5½	--	Trs	2,082	14.8	May 1963	C,W	A,D	--	1½	Reported poor quality water.
203	W. H. Dowlen	--	--	42	5	--	Trs	2,089	30.6	July 1963	C,W	A,S	--	1	Do.
204	Mrs. John Shackelford	--	--	25	5	--	Trs	2,090	19.9	do	C,E	A,D	--	1½	Reported strong supply of poor quality water.
205	Curtis Shurtleff	O. R. House	--	215	--	--	Trs	--	--	--	N	A,T	--	--	Reported water-bearing unit at 170 ft. Contains water of 3,000 ppm dissolved solids; water more highly mineralized in zone at 215 ft.
301	C. C. Thompson	--	--	52	--	--	Trs	--	37.0	May 1946	C,W	A,D	--	--	Well destroyed.
* 302	--	--	--	78	--	--	Trs	--	72.5	do	C,W	A,S	--	--	Reportedly caved in.
* 304	John Loveless	--	--	160	5	--	Trs	2,180	22.0	May 1963	S	D	40	1½	Water not potable; reported yield, 10 gpm.
305	B. R. Jackson	--	--	100	8	--	Trs	2,122	75.4	do	S	D,S	--	1 1/4	Water not potable; reported yield, 3-5 gpm.
306	Plainview Baptist Church	--	1959	54±	5½	--	Trs	2,170	24.0	do	S	D	--	1 1/4	Weak supply of hard but potable water.
307	Mrs. R. N. Keithley	--	--	66	5	--	Trs	2,140	19.2	do	C,W	S	--	--	Water hard, not potable.
401	Lee Dorn	--	--	25	5	20	Trs	2,142	10.1	June 1963	C,W	D,S	--	1	Water highly mineralized; reported yield, 1½ gpm.
402	R. B. Morris	--	--	90	5	--	Trs	2,210	20.3	do	N	A,S	--	--	Water highly mineralized.
403	B. M. Rich	--	--	131	8	--	Trs	2,199	76.3	do	C,W	A,D	--	1½	Do.
404	Warren Costin	--	--	166+	5½	--	Trs	2,271	166.0	July 1963	C,W	D	--	2	Strong supply of highly mineralized water.
405	Buck Costin	--	--	50	8	--	Trs	2,200	20.6	June 1963	N	A,S	--	--	Reported yield, 18 gpm.
* 501	G. W. Plaster	--	--	62	6	--	Trs	2,090	45.9	do	C,E	D,S	---	1½	Water mineralized but potable.
502	do	--	1952	40	5½	--	Trs	2,043	20.0	do	C,W	A,S	--	1½	Reported yield, 1 gpm.
503	Texas Electric Co.	--	--	99	4	--	Trs	2,110	69.9	do	C,W	S	--	1½	

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-41-601	C. C. Thompson	--	1913	100+	5½	--	Trs	2,082	74.4	Oct. 1962	C,E	D	--	1½	Water not potable.
602	W. R. Powell	--	--	108	--	--	P	2,080	64.1	do	C,E	D	--	1½	Water hard, but potable.
603	C. C. Thompson	--	1943	43±	5	--	Trs	2,070	26.2	June 1963	C,W	D,S	43	1½	Water reportedly of good chemical quality; reported yield, 2-3 gpm.
* 701	J. E. Cox	--	1963	131	5½	--	Trs	2,137	52.5	July 1963	C,E	S	--	1½	Reported weak supply.
* 702	J. C. Robinson	--	1963	120	5	--	Trs	2,113	66.3	do	C,W	S	--	3	Reported yield, 5 gpm.
703	Robert Bowlen	--	1962	42	5½	--	Trs	2,117	11.6	Aug. 1963	S	D	--	--	
704	J. C. Robinson	Hopkins Drlg. Co.	1963	160	--	--	Trs	2,117	--	--	N	A,T	--	--	Reported yield, 3 gpm.[2]
* 802	W. R. Powell	--	--	120	5½	--	P	2,072	73.1	Oct. 1962	C,E	D	--	2	Reported yield, 2-3 gpm.
803	G. L. Powell	--	--	112+	5½	--	Trs	2,118	111.0	do	C,W	S	--	2½	Water potable; reported yield, 1-2 gpm.
* 42-101	S. B. Hale	--	--	132	--	--	Trs	--	61.0	May 1946	C,W	D,S	--	1½	
* 102	James Payne	O. R. House	1962	120	5½	90	Trs	--	--	--	S	S	--	2	Reported yield, 30 gpm.
103	Eldon Mahon	do	1956	185	--	--	Trs	--	--	--	N	A,Irr	--	--	Reported yield, 150 gpm.
104	Brooks Stewart	O. R. House	1956	148	6	140	Trs	2,084	28.2	Mar. 1963	T,G	Irr	110	--	Water leaves visible white residue on soil; reported yield, 150 gpm.[2]
201	Looney School	--	--	109	--	--	Trs	--	91.6	May 1946	C,W	P	--	--	
* 203	Lewis Vowell	--	1943	110	--	--	Trs	--	70±	do	C,W	D,S	--	--	Well destroyed.
204	J. C. Cook	--	--	107	--	--	Trs	--	67.7	do	C,W	D,S	--	--	
* 205	J. A. Martin	-- Morrison	1941	139	4½	--	Trs	--	88.8	do	--	D,S	--	--	
206	O. A. Ruffin	O. R. House	1960	175	8	175	Trs	--	--	--	T,E	Irr	172	4	Discharge to sprinkler system; reported yield, 77 gpm.
* 207	J. C. Cook	--	1958	180	8	100	Trs	2,189	78.7	Jan. 1964	T,G	Irr	175	4	Discharge to sprinkler system; reported yield, 117 gpm.
208	W. P. Jarman	--	--	95±	8	--	Trs	2,173	71.4	do	N	A,D	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-42-209	James Wulfjen	O. R. House	1963	120	5½	120	Trs	2,158	66.7	Mar. 1963	S	D,S	--	2	
* 301	J. B. Mahon	I. O. Fannin	1952	160	16	150	Trs	2,200	86.5	Jan. 1964	T,G	Irr	155	8	Application rate measured for discharge to sprinkler system, 580 gpm (Mar. 1963); reported yield, 1,400 gpm.
* 302	D. Barber	E. W. Martin	1952	176	12	160	Trs	2,215	97.4	do	T,E	Irr	150	6	Application rate measured for discharge to 64-sprinkler system, 446 (Mar. 1963); "red bed" reported at 160 ft; reported yield, 850 gpm.
303	do	--	1952	150	6	6	Trs	--	19.7	Dec. 1961	N	A,Irr	--	--	Reported yield, 200 gpm.
* 304	Travis Turner	O. R. House	1953	170	8	80	Trs	2,165	45.2	Jan. 1964	T,E	Irr	150	4	Discharge to earth tank; reported yield, 100 gpm.[2]
305	W. W. Roland	E. W. Martin	1953	154	8	--	Trs	--	65.1	Mar. 1963	T,G	Irr	150	5	Discharge to sprinkler system; reported yield, 235 gpm.
306	Paris Yarbrough	do	1953	134	5	32	Trs	--	--	--	T,E	Irr	130	5	Discharge to sprinkler system; reported yield, 165 gpm.
* 307	do	do	1953	261	5	8	Trs	--	--	--	T,E	Irr	--	5	Discharge to sprinkler system; reported yield, 300 gpm.
308	L. G. Flowers	O. R. House	1954	172	7	172	Trs	2,186	62.5	Feb. 1961	S	D	--	2½	Reported yield, 125 gpm.
310	E. R. Padgett	--	1957	--	7½	--	Trs	2,170	31.0	Jan. 1964	T,E	Irr	--	4	Caving reported; reported yield, 100+ gpm.
311	D. Barber	--	--	115	8½	--	Trs	2,130	16.4	do	N	A,Irr	--	--	
312	W. Roland	--	--	145±	8	--	Trs	2,190	72.7	do	N	A,Irr	--	5	
313	Paris Yarbrough	C. W. Martin	1952	134	6	30	Trs	2,200	86.5	Mar. 1961	N	A,Irr	--	--	Reported yield, 200 gpm.
314	Travis Turner	do	--	160	6	155	Trs	--	--	--	T,E	Irr	155	3½	Discharge to earth tank; reported yield, 60 gpm.
315	D. Barber	--	1953	150	10	110	Trs	--	--	--	T,E	Irr	145	4	Reported yield, 165 gpm.
317	do	C. W. Martin	1952	120	8	120	Trs	--	--	--	T,E	A,Irr	115	3	Recently treated with acid to improve yield; seldom used in 1960; reported yield, 130 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-42-318	D. Barber	C. W. Martin	1952	140	8	140	Trs	--	--	--	T,E	A,Irr	135	4	Unused 1960-63; reported yield, 165 gpm.
322	Herman Miles	O. R. House	1962	135	5	119	Trs	2,177	22.5	May 1953	T,E	Irr	--	3	Used for irrigation of grass; water produces visible residue; reported yield, 72 gpm.
323	Travis Turner	do	--	160	6	155	Trs	--	--	--	S	Ind	155	3	Discharge to earth tank; reported yield, 80 gpm.
324	B. B. Lee	--	1962	160±	10	--	Trs	--	--	--	T,G	Irr	--	5	Reported yield, 350± gpm.
401	Bill Ross	O. R. House	1962	145	5	145	Trs	2,132	--	--	N	A,T	--	--	
402	do	--	--	--	5	--	Trs	2,152	67.4	--	--	S	--	1½	
501	Elon Harrell	E. W. Martin	1953	137	10	30	Trs	2,123	55.9	Jan. 1964	T,G	Irr	--	4	Seldom used in 1962 and 1963; reported yield, 300 gpm.[2]
502	D. C. Stubblefield	--	--	100±	8	--	Trs	2,105	26.3	do	N	A,Irr	--	--	Not used since 1960; reported yield, 50-74 gpm.
* 601	L. S. Girvin	O. R. House	1952	120	10	20	Trs	2,168	62.8	do	T,G	Irr	108	6	Reported yield, 490 gpm.[2]
602	W. H. Redwine	O. L. Williams	1954	200	8	200	Trs	2,230	127.0	May 1963	T,E	Irr	180	4	"Red bed" reported at 198 ft; reported yield, 115 gpm.
603	A. J. Barron	O. R. House	1959	187	10	187	Trs	2,224	93.4	Jan. 1964	T,G	Irr	187	5	Discharge to sprinkler system; "red bed" at 197 ft; reported yield, 240 gpm.
605	A. L. White	Eulis Compton	1948	240	10	224	Trs	2,197	102.9	July 1963	N	A,Irr	--	--	Reported yield, 450 gpm.
606	R. C. Small	--	--	104	5½	--	Trs	2,215	102.9	Jan. 1963	C,W	S	--	1½	
702	J. Wulfjen	--	--	70	55	--	Trs	2,133	30.0	Apr. 1961	C,E	D,S	--	1½	Reported yield, 3-5 gpm.
702	do	--	--	70	5	--	Trs	2,133	30.6	do	C,E	D,S	--	1½	
801	D. C. Stubblefield	Eulis Compton	1953	126	8	30	Trs	--	62.9	Jan. 1963	N	A,Irr	--	--	
* 802	do	do	--	125±	8	--	Trs	2,200	66.8	Feb. 1961	N	A,Irr	--	--	Reported yield, 100 gpm.
803	-- Fortenberry	--	--	90±	8	--	Trs	2,151	17.5	Mar. 1963	T,E	A,Irr	--	3	Not used since 1962; reported yield, 50 gpm.
804	D. C. Stubblefield	--	--	120±	10	---	Trs	2,200	63.5	Jan. 1964	N	A,Irr	--	--	

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level [1]: Below land surface (ft)	Water level [1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-42-806	Ed Roach	--	--	30	5	--	Trs	2,100	7.5	Apr. 1961	C,W	S	--	1½	
807	Mary Wulfjen	--	--	51	5½	--	Trs	2,147	31.9	Oct. 1962	S	S	--	--	
809	Ed Roach	O. R. House	1962	100	8	--	Trs	2,153	33.2	Mar. 1963	S	S	--	2	Reported yield, 6 gpm.
901	D. C. Stubblefield	--	--	131±	6	--	Trs	2,237	106.8	Apr. 1964	C,W	A,S	--	--	
* 902	Forrest Porter	--	1938	100±	6	--	Trs	2,231	72.5	Apr. 1961	C,E	D	--	2	Reported yield, 5 gpm.
903	C. H. Crawford	O. R. House	196	140	5½	--	Trs	--	70	Aug. 1963	--	D	--	1½	Reported yield, 4 gpm.
904	M. L. Adrian	--	--	163±	5½	--	Trs	2,250	78.2	.do	C,W	S	--	1½	Reported yield, 2 gpm.
43-101	C. R. Green	O. R. House	1959	150	12	147	Trs	2,231	58.3	Jan. 1964	T,E	Irr	100	5	Discharge to sprinkler system; reported yield, 340 gpm.
* 102	do	do	1959	160	12	160	Trs	--	--	--	T,E	Irr	130	5	Discharge to sprinkler system; reported yield, 190 gpm.
* 103	Roscoe Hudgins	E. W. Martin	--	130	12	--	Trs	2,210	--	--	N	A,Irr	--	--	Reported yield, 180 gpm. [2]
104	J. D. Givens	-- Nordyke	1958	155	10	--	Trs	--	47.8	Jan. 1964	T,E	Irr	150	4	"Red bed" reported at 155 ft; reported yield, 300 gpm.
105	do	Eulis Compton	1955	150	10	--	Trs	--	--	--	T,E	Irr	145	6	Drilled to 235 ft; "red bed" reported at 150 ft; reported yield, 500 gpm.
106	J. B. Mahon	-- Moseley	1955	156	12	156	Trs	--	--	--	T,G	Irr	--	6	Discharge to 65-sprinkler system; reported yield, 800+ gpm.
107	G. M. Lee	Gay & Thompson	1954	153	12	153	Trs	2,201	59.8	Jan. 1964	T,G	Irr	135	6	Application rate measured for discharge to sprinkler system, 393 gpm (Mar. 1963); reported yield, 670 gpm.
108	B. B. Lee	do	1955	150±	10	150	Trs	--	89.8	do	T,E	Irr	145	5	Discharge to sprinkler system; reported yield, 400 gpm.
109	T. T. Boatler	Tex Clevinger	1956	198	12	198	Trs	2,259	101.5	do	T,G	Irr	160	6	Yielded 700 gpm on 4-hour test.
* 110	Roscoe Hudgins	E. W. Martin	1955	260	8	10	Trs	2,212	55.7	do	T,E	Irr	--	4	Application rate measured for discharge to sprinkler system, 187 gpm (Mar. 1963); reported yield, 250 gpm.
111	Hugh Narrell	--	--	250±	10	--	Trs	2,258	83.6	do	N	A,Irr	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-43-112	J. A. Thompson	E. W. Martin	1953	166	10	--	Trs	2,215	91.2	Dec. 1961	T,G	Irr	--	--	Measured yield, 359 gpm (Mar. 1963); reported yield, 500 gpm.
113	do	--	--	Spring	--	--	--	--	(+)	--	Flows	--	--	--	Reported yield, 5 gpm.
114	Roscoe Hudgins	--	1954	130	6	130	Trs	2,196	46.6	Feb. 1961	T,E	Irr	128	6	Yields 400 gpm at beginning of irrigation season.
115	Mrs. S. E. Meadows	N. C. House	1962	150	8	190	Trs	2,237	55.0	Jan. 1964	S	Irr	190	4	Application rate measured for discharge to sprinkler system.
116	J. D. Givens	O. R. House	1958	150±	10	200+	Trs	2,219	40.7	Mar. 1963	T,E	Irr	150	4	Water not found below 160 ft; reported yield, 300 gpm.
117	D. M. Smith	--	1955	180	10	180	Trs	2,238	70.0	Jan. 1964	T,E	Irr	180	5	Application rate measured for discharge to sprinkler system, 147 gpm (Mar. 1963); yields 330 gpm at beginning of irrigation season.
118	do	Ken House	1955	164	8	164	Trs	--	--	--	T,E	Irr	--	4	Application rate measured for discharge to sprinkler system, 147 gpm (Mar. 1963).
120	A. D. Givens	Bissy Drlg. Co.	1961	218	12	218	Trs	2,206	36.2	Mar. 1963	T,G	Irr	180	8	Reported yield, 800 gpm.
121	J. C. Freeman	Gale & Thompson	1954	130	10	130	Trs	--	--	--	T,E	Irr	125	5	Discharge to 28-sprinkler system; reported yield, 200 gpm.
122	T. T. Boatler	O. R. House	1963	213	7	173	Trs	2,267	108.5	Mar. 1963	S	Irr	170	4	Discharge to sprinkler system; reported yield, 100 gpm.
* 123	A. D. Givens	Bissy Drlg. Co.	1962	115	14	115	Trs	2,193	31.9	Jan. 1963	S	D	--	3	Proposed future irrigation use; reported yield, 600+ gpm.
124	C. R. Green	O. R. House	1959	222	--	--	Trs	--	--	--	N	A,T	--	--	Test well for irrigation; reported yield, 130 gpm.
126	H. Miles	--	1963	225	--	--	Trs	--	33.3	Mar. 1963	--	Irr	--	4	Reported yield, 150+ gpm.
201	K. L. Taylor	D. V. Markham	1959	160	12	160	Trs	2,264	64.0	Jan. 1964	T,G	Irr	--	6	Application rate measured for discharge to sprinkler system, 363 gpm (Mar. 1963); yielded 550 gpm when drilled.

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Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-43-202	Frank Stewart	O. R. House	1955	283	14	250	Trs	2,298	90.7	Jan. 1964	T,G	Irr	180	6	Discharge to 64-sprinkler system; casing perforated at 100-183 ft; reported yield, 750+ gpm.
203	Edgar Baumann	-- Cleaver	1953	230	12	230	Trs	2,265	72.0	do	T,G	Irr	200	6	Reported yield, 450 gpm.
204	Melvin Baumann	--	1958	135	8	135	Trs	2,266	72.5	do	T,G	Irr	--	6	Reported yield, 250 gpm.
205	do	Sam Smith	1958	225	12	220	Trs	2,278	79.9	do	T,E	Irr	--	5½	Application rate measured for discharge to sprinkler system, 593 gpm (Mar. 1963).
206	do	N. C. House	1960	210	10	--	Trs	--	77.1	Nov. 1960	N	A,T	--	--	Test well for irrigation; reported yield, 300 gpm.
207	Edward Baumann	Sam Smith	1955	140	10	140	Trs	2,246	46.9	Jan. 1964	T,G	Irr	135	4	Reported yield, 145 gpm.
208	Armando Baumann	Hopkins Drlg. Co.	1961	132	10	130	Trs	--	--	--	T,G	Irr	120	4	Discharge to sprinkler system; reported yield, 180 gpm.
* 209	Edward Baumann	do	1961	138	10	138	Trs	--	--	--	T,G	Irr	130	5	Application rate measured for discharge to sprinkler system, 184 gpm (Mar. 1963); water-bearing zone at 133-138 ft; reported yield, 220 gpm.
210	K. L. Taylor	-- Cleaver	1955	140	10	140	Trs	2,223	47.7	Jan. 1964	T,E	Irr	140	5	Application rate measured for discharge to sprinkler system, 117 gpm (Mar. 1963); reported yield, 150 gpm.
212	Elsie Baumann	Ken House	1963	135	10	--	Trs	--	--	--	C,E	D	--	--	Reported yield, 135 gpm.
301	E. O. Mahon	Max Wright	1955	168	10	168	Trs	2,262	54.9	Jan. 1964	T,E	Irr	168	4	Application rate measured for open discharge, 79 gpm; water-bearing zone at 130-168 ft; reported yield, 100 gpm.
302	B. H. Johnson	Sam Smith	1954	180	8	180	Trs	2,327	85.2	do	T,G	Irr	175	4	Discharge to sprinkler system; reported yield, 170 gpm.
303	do	Eulis Compton	1953	150	12	100	Trs	2,260	26.8	do	T,E	Irr	110	6	Do.
304	J. B. Mahon	-- Cleaver	1956	150	12	150	Trs	2,265	56.7	do	T,G	Irr	160	5	Yield has increased since well was drilled; reported yield, 300 gpm.
305	--	--	--	92	4	--	Trs	--	72.8	Nov. 1960	C,W	N	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-43-307	J. B. Mahon	N. C. House	1962	155	5	115	Trs	2,260	50.2	Mar. 1963	C,E	D	--	1½	Plugged back to 115 ft; reported yield, 20+ gpm.
309	M. A. Dunahoo	O. R. House	1948	130	6	130	Trs	2,317	96.6	May 1963	C,E	D,S	120	1½	Reported strong supply.
310	G. B. Tartt	--	--	233	5½	233	Trs	2,369	132.9	do	N	A,Ind	--	--	Supplied oil-test rig.
311	B. H. Johnson	N. C. House	1961	195	--	--	Trs	2,315	43.7	do	N	A,T	--	--	Irrigation test well; reported yield, 75 gpm.[2]
312	E. O. Mahon	Hopkins Drlg. Co.	1963	180	6	180	Trs	2,299	71.3	do	S	Irr	170±	4	Gravel packed at water-bearing intervals; reported yield, 130 gpm.
401	D. C. Stubblefield	--	1956	210±	6	--	Trs	--	92.3	Nov. 1960	--	Irr	--	4	Application rate measured for open discharge to earth tank, 90 gpm (Aug. 1963).
* 402	R. Fee	E. W. Martin	1953	115	14	115	Trs	2,161	44.5	Jan. 1964	T,G	Irr	110	6	Yielded over 1,100 gpm on test; reported yield, 500+ gpm.
403	D. C. Stubblefield	--	1956	200±	6	--	Trs	--	--	--	T,E	Irr	--	4	Application rate measured for open discharge, 70 gpm (Mar. 1963).
* 404	do	Judge Campbell	1957	230	14	230	Trs	2,247	102.5	Jan. 1964	T,G	Irr	220	8	Application rate measured for discharge to sprinkler system, 820 gpm (Mar. 1963); reported yield, 1,000 gpm.
405	do	do	1956	200±	6	--	Trs	--	--	--	S	Irr	--	4	Application rate measured for open discharge to earth tank, 50 gpm (Mar. 1963).
406	J. C. Freeman	E. W. Martin	1955	115	12	105	Trs	--	--	--	T,G	Irr	95	8	Discharge to 60 7½-gpm sprinklers; reported yield, 1,100+ gpm.
408	Georgia Institute of Technology	--	--	153±	5	--	Trs	--	128.8	May 1963	C,W	S	--	2	Water-level measurement obtained while pumping.
409	D. C. Stubblefield	--	--	180±	6	--	Trs	2,236	86.5	Oct. 1962	C,W	S	--	2	
411	do	--	1956	160±	6	--	Trs	--	--	--	S	Irr	--	4	Open discharge to earth tank; reported yield, 100± gpm.
412	do	--	1956	170±	6	--	Trs	--	--	--	S	Irr	--	4	Application rate measured for open discharge to earth tank, 110 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-43-413	D. C. Stubblefield	--	1956	180±	6	--	Trs	--	--	--	S	Irr	--	4	Measured yield, 115 gpm.
415	do	--	--	75±	5½	--	Trs	--	38.0	Jan. 1963	C,W	D,S	--	1¼	
416	do	--	1956	150+	6	--	Trs	--	--	--	S	Irr	--	4	Application rate measured for open discharge, 80 gpm (Mar. 1963).
501	Perry Bowles	Eulis Compton	1957	130	12	130	Trs	--	44.0	1946	T,G	Irr	125	8	Reported yield, 44 gpm.
* 502	R. J. Hackfeld	do	1956	200	10	200	Trs	2,256	75.8	1962	T,G	Irr	180	6	Reported "red beds" at 180-200 ft; reported yield, 350 gpm.
503	A. K. Sheffield	O. R. House	1955	180	8	180	Trs	2,248	80.1	Jan. 1964	T,E	Irr	178	5	Application rate measured for discharge to sprinkler system, 126 gpm (Mar. 1963); reported yield, 200 gpm.
504	do	do	1960	152	10	156	Trs	--	74.6	do	T,E	Irr	--	4	Measured yield, 126 gpm.
505	Charles Finley	O. L. Williams	1954	223	10	190	Trs	--	50.8	do	T,G	Irr	125	5	Yielded 285 gpm on test; no water obtained below 125 ft.
506	Alfred Hackfeld	Eulis Compton	1960	230	12	134	Trs	2,230	59.8	do	T,G	Irr	144	8	Application rate measured for discharge to sprinkler system, 113 gpm (Aug. 1963); reported yield, 200 gpm.[2/]
* 507	Mrs. Grace Jackson	E. D. Cleaver	1956?	117	12	117	Trs	2,226	48.8	Mar. 1964	T,G	Irr	100	6	Application rate measured for discharge to sprinkler system, 630 gpm (Mar. 1963); reported 5-ft drawdown at 925 gpm.
508	Robert Looney	do	1956	83	8	83	Trs	--	26.0	Mar. 1963	T,G	Irr	50	3	Reported yield, 75 gpm.
509	B. H. Johnson	Bill Gale	1957	168	10	168	Trs	--	--	--	T,G	Irr	100	8	Reported 12-ft drawdown at 600 gpm.
* 510	Charles Finley	O. R. House	1961	113	10	113	Trs	--	--	--	T,G	Irr	108	5	Application rate measured for discharge to sprinkler system, 247 gpm (Mar. 1963); "red bed" reported at 113-118 ft; reported yield, 300 gpm.
511	do	--	1956	115	8	--	Trs	2,225	47.6	Jan. 1964	T,E	Irr	108	4	Reported yield, 100± gpm.
512	do	--	--	110	8	--	Trs	--	--	--	T,E	Irr	--	4	Do.
513	Alfred Hackfeld	Eulis Compton	1961	160	8	160	Trs	--	69.9	Jan. 1964	T,E	Irr	150	4	Casing slotted at 70-160 ft; reported yield, 200 gpm.

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-43-514	Alfred Hackfeld	--	1956	140	8	140	Trs	2,256	73.5	Jan. 1964	T,E	Irr	140	4	Discharge to sprinkler system; casing perforated at 70-140 ft; reported yield, 125 gpm.
515	C. L. Maynard	O. R. House	1962	143	5	143	Trs	--		--	--	D,S	--	--	Reported yield, 12 gpm.
516	Perry Bowles	N. C. House	1962	114	6	--	Trs	2,237	54.1	Mar. 1963	S	D,S	--	--	Yielded 35 gpm on bailer test.
517	A. K. Sheffield	Ken House	1962	143	--	--	Trs	2,237	67.5	Jan. 1964	N	A,T	--	--	Test well for irrigation; reported yield, 140 gpm.
518	B. H. Johnson	N. C. House	1962	152	10	152	Trs	2,247	57.0	do	T,G	Irr	145	5	Application rate measured for discharge to sprinkler system, 180 gpm (Aug. 1963); casing slotted at 82-152 ft; reported yield, 230 gpm.
519	C. L. Maynard	--	--	100±	5½	--	Trs	2,280	92.8	Apr. 1963	C,W	S	--	--	
520	Charles Finley	Hopkins Drlg. Co.	1961	122	--	--	Trs	--	--	--	N	A,T	--	--	Reported yield, 100+ gpm.
601	B. H. Johnson	Sam Smith	1960	150	8	150	--	2,297	49.1	Jan. 1964	S	Irr	150	4	Application rate measured for discharge to sprinkler system, 88 gpm (Aug. 1962); reported yield, 115 gpm.
* 602	Herman Aucutt	O. R. House	1956	220	8	60	Trs	2,363	94.8	do	T,G	Irr	218	4	Application rate measured for open discharge, 51 gpm (Aug. 1962); "red bed" at 210 ft; reported yield, 90 gpm.[2]
603	Georgia Institute of Technology	--	--	133	5½	--	Trs	2,337	97.1	Dec. 1961	C,W	D	--	1½	
604	Lester Finley	Hopkins Drlg. Co.	1960	180	8	--	Trs	2,303	94.1	Nov. 1960	N	A,T	--	--	Test well for irrigation; reported yield, 80 gpm.
605	Fred Sauer	--	--	120	5½	--	Trs	2,356	97.0	Jan. 1964	C,W	D,S	--	--	
606	Herman Aucutt	O. R. House	1962	210	6	220	Trs	--	--	--	S	Irr	200	--	
607	do	do	1962	218	--	--	Trs	--	--	--	N	A,T	--	--	Yielded 35 gpm on bailer test.
* 701	Willis Cornutt	O. L. Williams	1958	210±	8	210	Trs	2,295	122.0	Jan. 1964	T,E	Irr	210±	--	Application rate measured for discharge to sprinkler system, 115 gpm (Mar. 1963); reported yield, 175+ gpm.
702	L. R. Cornutt	--	--	124	6	--	Trs	2,267	100.0	do	S	D,S	--	--	Reported yield, 2-3 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-43-703	Willis Cornutt	O. R. House	1962	175	5½	--	Trs	2,280	--	--	S	D	--	--	
801	W. R. Cornutt	O. L. Williams	1958	220	10	--	Trs	2,300	129.0	Jan. 1964	T,E	Irr	210	4	Discharge to sprinkler system; reported yield, 200 gpm.
802	Dr. F. M. Gray	Hopkins Drlg. Co.	1960	106	8	103	Trs	2,216	12.5	July 1963	N	A,T	--	--	Gravel packed at 66-106 ft; reported yield, 90 gpm.[2/]
803	W. R. Cornutt	O. R. House	--	215±	8	--	Trs	--	--	--	T,E	Irr	210	4	Discharge to sprinkler system; reported yield, 150± gpm.
* 804	S. A. Hutchins	Hopkins Drlg. Co.	1960	90	5½	90	Trs	--	27.0	June 1963	S	D	80	2	
901	W. S. Wimberly	--	--	84	5	--	Trs	2,267	71.9	Oct. 1960	C,W	S	--	1¼	
* 902	Roy Spires	O. R. House	1958	135	5½	135	Trs	2,301	69.1	May 1963	S	D	--	2	
903	R. L. Spires	Austin Ramsey	--	40±	6	--	Trs	2,281	31.2	do	C,W	D	--	2	Water has objectionable taste; reported yield, 2-3 gpm.
44-101	J. E. Collier	Grosshans Bros.	1959	220	12	200	Trs	2,368	94.7	Jan. 1964	T,E	Irr	--	6	Yielded 450 gpm on test; yield declined after caving; reported yield, 350 gpm.
* 102	E. O. Mahon	N. C. House	1960	215	7	--	Trs	--	52.3	do	S	Irr	--	4	Application rate measured for open discharge, 59 gpm (Aug. 1962); reported yield, 99 gpm.
103	do	O. R. House	1960	205	8	140	Trs	2,336	64.6	do	S	Irr	--	4	Measured yield, 61 gpm (Aug. 1962); reported yield, 80 gpm.
* 104	W. H. Cooper	do	1953	150	10	80	Trs	2,307	27.7	do	T,E	Irr	145	5	Application rate measured for open discharge, 220 gpm (Mar. 1963); water-bearing zone at 90-150 ft.[2/]
105	Ed Gaebler	--	1954	152	10	60	Trs	--	--	--	T,E	Irr	145	4	Discharge to 22 10-gpm sprinklers; reported yield, 230 gpm.
106	E. A. Costephens	--	--	110	8	--	Trs	--	27.2	Feb. 1962	C,W	D	--	--	
108	J. R. Hawkins	--	1944	114	5	--	Trs	--	47.7	July 1946	C,W	D	--	--	Water-bearing zones at 19 and 90 ft.
109	E. A. Costephens	--	--	300+	8½	--	Trs	2,262	45.6	Jan. 1964	N	A,Irr	--	--	Oil test; plugged back to about 300 ft.
110	O. L. Hawkins	O. R. House	1956	179	8	92	Trs	2,340	51.1	do	T,E	Irr	160	4	Application rate measured for open discharge, 156 gpm (Mar. 1963).

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-44-111	Homer Ussery	Ed Gaebler	1953	150	10	60	Trs	--	28.7	Jan. 1964	T,E	Irr	145	4	Measured yield, 108 gpm (Mar. 1963); reported yield, 170 gpm.
112	C. J. Walker	O. R. House	1956	153	10	30	Trs	2,312	26.4	do	T,E	Irr	145	5	Measured yield, 154 gpm (Mar. 1963); reported yield, 200 gpm.
113	O. A. Rannefeld	do	1957	160	7	--	Trs	--	41.7	do	S	Irr	145	3	Discharge to earth tank; reported yield, 110 gpm.
114	R. L. Bankhead	do	1956	155	8	70	Trs	2,299	29.4	do	T,G	Irr	140	5	Discharge to sprinkler system; reported yield, 180 gpm.
115	Edsel Bankhead	do	1958	155	8	150	Trs	2,318	43.1	do	T,G	Irr	--	5	Application rate measured for discharge to sprinkler system, 70 gpm (Mar. 1963); reported yield, 100 gpm.
* 116	C. H. Hackfeld	do	1952	232	10	120	Trs	--	--	--	T,G	Irr	140	5	"Red bed" reported at 145 ft; measured yield, 145 gpm (Mar. 1963); reported yield, 225 gpm.
117	Edsel Bankhead	do	1953	150±	8	150	Trs	--	--	--	T,G	Irr	--	4	Application rate measured for discharge to sprinkler system, 70 gpm (Mar. 1963); reported yield, 100 gpm.
118	O. A. Rannefeld	do	1959	200	10	65	Trs	--	35.7	Jan. 1964	T,E	Irr	90	4	Reported yield, 170 gpm.
119	do	do	1960	155	6½	50	Trs	--	--	--	S	Irr	150	3	Discharge to earth tank; reported yield, 65 gpm.
120	do	do	1956	165	8	55	Trs	--	--	--	T,E	Irr	155	4	Discharge to earth tank; drilled to 220 ft; reported yield, 170 gpm.
121	Morgan Wright	do	1961	162	7	103	Trs	2,315	37.3	Jan. 1964	S	Irr	138	4	Discharge to earth tank; reported yield, 85 gpm.
122	C. H. Hackfeld	do	1961	150	7	60	Trs	2,302	39.6	Mar. 1963	S	Irr	125	4	Reported yield, 85 gpm.
201	Harlan Reed	Max Wright	1957	156	6	100	Trs	2,341	40.1	Jan. 1964	S	Irr	150	4	Seldom used since 1961; reported yield, 50 gpm.
203	W. J. Alexander	--	--	60±	8	--	Trs	2,419	85.5	Nov. 1960	N	A,Ind	--	--	Formerly supplied oil-test rig.
205	J. H. Woodard	--	--	64	5½	--	Trs	2,368	19.1	Jan. 1964	N	A,S	--	--	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-44-208	Skelly Oil Co.	O. R. House	1962	205	8½	205	Trs	2,417	72.5	July 1962	T,G	Ind	--	4	Used for water-flood operation; reported yield, 123 gpm.
210	Morgan Wright	Hopkins Drlg. Co.	--	--	5½	--	Trs	2,390	74.5	Mar. 1963	C,W	D	108	2	[2]
304	M. D. Jones	O. R. House	1957	204	8	90	Trs	2,426	51.2	Jan. 1964	S	Irr	190	4	Reported yield, 110 gpm.
305	do	do	1951	200	8	200	Trs	--	--	--	T,E	Irr	190	4	Reported yield, 120 gpm.[2]
306	J. T. Wilkes	--	--	143	5	--	Trs	2,516	131.9	Dec. 1963	N	A,S	--	--	Reported yield, 1-2 gpm.
* 308	L. R. Wright	Hopkins Drlg. Co.	1963	205	8	200	Trs	2,452	112.0	May 1963	S	Irr	200	3	Application rate measured for discharge to sprinkler system, 62 gpm (Aug. 1963).
402	C. H. Hackfeld	O. R. House	--	145	6	145	Trs	2,308	35.4	Jan. 1964	S	Irr	140	4	Application rate measured for open discharge, 60 gpm (Aug. 1962).
403	R. L. Haney	do	1956	215	10	212	Trs	--	--	--	T,G	Irr	190	5	Gravel-pack envelope, 12-14 inches; reported yield, 170 gpm.
404	do	do	1957	220	12	218	Trs	2,399	70.3	Jan. 1964	T,G	A,Irr	200	5	Gravel-pack envelope, 12-14 inches; reported yield, 225 gpm.
405	-- Brown	Eulis Compton	1953	187	8	187	Trs	--	--	--	T,G	Irr	187	4	Discharge to sprinkler system; reported yield, 120 gpm.
406	Skelly Oil Co.	O. R. House	1955	225	7	225	Trs	--	--	--	T,G	Irr	215	4	Water-bearing zones at 150-200 ft; "red bed" reported at 200 ft; reported yield, 90 gpm.
407	O. F. Lindsey	Huron Gist	1956	203	7	203	Trs	2,399	41.2	Mar. 1963	N	A,Irr	--	--	Yielded 160 gpm when drilled; reported yield, 40 gpm.
409	A. A. Gaebler	--	--	220±	6	--	Trs	2,401	113.2	Jan. 1964	S	A,Irr	--	3	Reported yield, 50 gpm.
410	R. L. Haney	O. R. House	1959	190	8	115	Trs	2,383	53.4	do	N	A,Irr	--	4	Caving reported; reported yield, 150+ gpm.
411	Virgil Walker	-- Johnson	1954	196	10	146	Trs	2,390	67.3	Mar. 1963	T,E	Irr	195	5	Seldom used since 1961; reported yield, 130 gpm.
412	O. F. Lindsey	O. R. House	1963	160	6	--	Trs	2,347	66.4	Feb. 1963	S	D	--	2	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-44-413	O. C. Gaebler	O. C. Gaebler	1958	160	6	160	Trs	--	--	--	S	D	155	2	Used to irrigate garden, lawn, and orchard; reported yield, 30-40 gpm.
414	R. L. Haney	Hopkins Drlg. Co.	1963	210	10	--	Trs	--	--	--	T,E	Irr	200	5	Reported yield, 100+ gpm.
*501	Skelly Oil Co.	O. R. House	1957	215	12	215	Trs	2,405	72.2	Mar. 1963	T,G	Ind	205	5	Used for water-flood operation; reported yield, 150 gpm.
503	do	do	1962	225	10	225	Trs	--	--	--	T,G	Ind	200	5	Used for water-flood operation; pumping level 185 ft; reported yield, 285 gpm.
504	do	--	--	135±	5	--	Trs	2,477	112.0	Oct. 1962	C,W	S	--	1½	
505	do	O. R. House	1962	266	8½	266	Trs	2,482	118.0	Aug. 1963	T,G	Ind	250	5	Pumping level 230 ft; reported yield, 130 gpm.[2]
506	do	do	1962	280	10 3/4	280	Trs	--	--	--	T,G	Ind	250	8	Reported yield, 200 gpm.
510	do	--	--	130±	5½	--	Trs	--	104.9	Dec. 1963	C,W	S	--	2	
601	R. L. Sims	O. R. House	1961	202	6	202	Kt	2,545	164.1	Mar. 1963	C,W	S	--	2	Yielded 30 gpm on bailer test; slight drawdown reported.
602	Ross Daniels	--	--	139	6	--	Kt	2,507	121.8	July 1963	C,W	S	--	1½	Reported yield, 2 gpm.
*603	do	--	1936	100±	5½	--	Kt	2,456	70.5	do	C,W	D,S	100	1½	Water hard, but potable; reported yield, 2 gpm.
701	Virgil Walker	--	--	170±	5½	--	Trs	2,375	83.3	Apr. 1963	C,W	D	--	1½	Water quality reported good.
702	Anna Judd	--	--	65	--	6	Kt	2,395	27.6	May 1963	C,W	D	--	2	
802	Evelyn Daniels Ranch	--	--	70±	4½	--	Kt	2,399	33.7	do	C,W	S	--	2	Reported yield, 1-2 gpm.
803	Beatrice K. Stone	--	--	110±	4½	--	Kt	2,472	88.3	July 1963	C,W	S	100±	2½	Do.
*901	Gus Farrar	O. R. House	1958	290	12	10	Kt	2,577	196.8	Dec. 1963	T,E	Irr	280	5	Formerly supplied oil-test rig; deepened and reamed to larger diameter; reported yield, 220 gpm.[2]
903	do	do	1958	290	12	290	Kt	--	--	--	T,E	Irr	280	5	Irrigates cotton and alfalfa; reported yield, 250 gpm.

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-44-905	Beatrice K. Stone	--	--	175±	6½	--	Kt	2,528	155.7	July 1963	C,W	S	--	2	Reported strong supply of good quality water.
* 45-101	R. E. Althof	Jack Stuart	1950	206	10	--	Trs	2,487	113.6	Apr. 1963	C,W	S	--	--	Yielded 50 gpm with 27-ft drawdown on bailer test; reported yield, 110 gpm.
103	do	--	--	160	6	--	Kt	2,490	118.8	Oct. 1960	C,W	S	--	2	Water quality reported good; reported yield, 2 gpm.
104	W. H. McBurnett	--	--	48±	5½	--	Kt	2,398	36.2	do	C,W	S	--	2	Do.
105	Dr. T. D. Young	--	--	70	6	--	Trs	2,372	29.3	do	N	A,Ind	--	--	Formerly supplied oil-test rig; reported yield, 70 gpm.
202	Shell Oil Co.	--	--	200	6	--	P	2,294	95.2	Mar. 1961	C,W	D	--	2	Water hard, but potable; reported yield, 20 gpm.
402	Mary S. Cook	--	--	200±	6½	--	Kt	2,568	183.2	Oct. 1960	C,W	S	--	2½	Water quality reported good.
501	El Paso Natural Gas Co.	Sam Smith	1956	185	10	185	Kt	2,477	107.1	do	T,E	A,Ind	--	4	Reported yield, 20+ gpm.
502	Bob Campbell Est.	--	--	80	5½	--	P	2,339	55.6	Mar. 1961	C,W	S	--	2	Water potable, but hard.
701	Lone Star Cement Co.	Layne Texas Co.	1951	257	9	257	Kt	2,561	--	--	S	A,Ind	--	4	Casing slotted at 197-257 ft; reported yield, 40 gpm.[2/]
* 703	do	do	1951	262	8½	262	Kt	2,561	--	--	T,E	A,Ind	--	3	Motor, 5 hp; reported yield, 17 gpm.
704	Beatrice K. Stone	--	--	200±	4	--	Kt	2,554	162.1	May 1963	C,W	S	--	2	
706	Mrs. Gus Farrar	--	--	165±	5	--	Kt	--	132.5	June 1963	C,W	S	--	--	Reported yield, 3 gpm.
707	Beatrice K. Stone	--	--	170±	6	--	Kt	2,526	142.5	July 1963	C,W	S	--	2	Water potable, but hard; reported yield, 2 gpm.
708	do	--	--	195±	5½	--	Kt	2,538	145.4	do	C,W	S	--	2½	Reported yield, 3 gpm.
49-101	E. Barber	O. R. House	1961	85	5	85	P	2,064	29.2	Aug. 1963	C,W	S	--	1½	
102	Harry Dockery	--	--	62±	4	--	Trs	2,099	26.2	July 1963	N	A,S	--	--	
* 201	R. A. Hood	--	--	56±	5	--	Trs	2,113	37.8	Aug. 1963	C,W	D,S	--	1½	Reported yield, 2 gpm.

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-49-301	U. D. Wulfjen	--	--	97±	6½	--	Trs	2,075	68.4	Aug. 1963	C,W	S	--	2	
601	C. E. Welch	--	--	54±	5	--	P	1,992	30.3	do	N	A,S	--	2	
701	Spade Ranch	--	--	55±	5	--	Trs	2,212	33.8	Nov. 1962	N	A,D	--	--	Water quality reported good.
* 702	do	--	--	Spring	--	--	Ca	2,177	(+)	--	Flows	D,S	--	--	Flow estimated 10 gpm (Nov. 1963).
* 703	do	--	1931	105	--	--	Ca	2,214	41.5	Nov. 1962	C,W	S	75	2	Water potable, but hard.
707	do	O. R. House	1962	37	6	37	Ca	2,185	23.7	Apr. 1963	C,E	D,S	--	2	
* 801	do	do	1944	26	6	--	Ca	2,170	19.4	May 1963	C,W	D,S	--	2½	Reported yield, 12 gpm.
50-201	B. L. Wulfjen	--	--	90±	6	--	P	2,112	40.2	Apr. 1911	C,W	A,D	--	--	
401	-- Holcombe	--	--	80±	5	--	P	2,019	60.3	Apr. 1961	C,W	A,S	--	1½	Water not potable.
* 402	-- Collins	--	1961	300	--	--	P	--	--	--	N	A,T	--	--	
* 501	Spade Ranch	--	--	70	6	--	P	2,034	47.1	Nov. 1962	C,W	S	--	2½	Called "Northwest 8-Section Pasture Well"; reported yield, 2 gpm.
502	do	--	1943	41	5½	--	P	1,979	34.3	Aug. 1963	C,W	S	--	3½	Called "Red Bank Well"; reported yield, 15 gpm.
601	do	--	--	70	6	--	P	2,063	49.3	Apr. 1961	C,W	D	--	2½	Water not potable.
602	do	--	--	70	6	--	P	2,070	46.6	do	C,W	S	--	2½	Weak supply of mineralized water.
* 603	do	--	--	83	5½	--	P	2,083	51.2	Nov. 1962	C,W	S	--	2	Called "Carpenter Well"; reported yield, 18 gpm.
901	do	--	1935	34	6	34	P	--	--	--	C,W	S	--	2½	Called "Silver Well"; reported yield, 12 gpm.
51-102	B. B. Byrne, Jr.	--	1948	150±	6	--	Trs	2,197	63.7	Apr. 1961	C,E	S	--	2	Reported yield, 30 gpm.
103	do	--	--	200	5½	--	P	2,179	114.7	do	C,W	S	--	1½	Weak supply of poor quality water.
* 106	do	N. C. House	1962	119	5	80-119	Trs	2,210	55.5	May 1963	S	D	--	1½	Casing slotted 80-119 ft; reported yield, 8 gpm.[2/]
201	do	--	--	83	5	--	Trs	2,264	60.2	Apr. 1963	C,W	S	--	--	

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Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1/]: Below land surface (ft)	Water level[1/]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-51-202	B. B. Byrne, Jr.	--	--	100	5½	--	Trs	2,210	61.2	Apr. 1963	C,W	S	--	1½	Irrigates garden.
301	R. L. Spires	--	--	150±	--	--	Trs	2,325	11.8	Oct. 1960	N	A,Ind	--	--	Formerly supplied oil-test rig.
401	V. P. Maddox	--	--	125	6	--	Trs	2,230	113.2	Apr. 1961	C,W	D,S	--	--	
601	M. L. Compton	--	--	103±	6½	--	Trs	2,322	97.9	do	C,W	S	--	2½	Supplies swimming pool and livestock.
602	do	--	--	70±	5	--	Trs	2,249	46.6	Oct. 1962	C,W	S	--	2	
603	R. L. Spires	--	--	171±	6	--	Kt	2,506	134.5	Aug. 1963	N	S	--	--	
701	V. T. McCabe	--	--	115±	5½	--	P	2,152	95.4	Apr. 1961	C,W	S	--	2	
* 801	Jahew Jameson	--	--	100±	5½	--	P	2,160	96.2	Nov. 1962	C,W	S	--	2	
803	J. H. Nail Est.	--	--	101±	5½	--	P	2,221	48.5	do	C,W	S	--	2	
* 903	M. L. Compton	--	1960	145	8½	--	Trs	2,338	76.5	Nov. 1960	C,G	Ind	--	4	Formerly supplied oil-test rig; reported yield, 15 gpm.
904	A. G. Compton et al.	--	--	300+	5½	--	P	2,323	151.2	Oct. 1962	C,W	S	--	2½	
905	M. L. Compton	--	--	101±	5½	--	Trs	2,351	89.7	do	C,W	S	--	2½	
907	V. T. McCabe	--	--	220±	5½	--	P	2,325	210.3	Apr. 1961	C,W	S	--	2	Water highly mineralized.
908	R. G. Compton	--	--	165±	6	--	Trs	2,378	91.0	Nov. 1962	N	A,Ind	--	--	Formerly supplied oil-test rig.
52-101	R. L. Spires	--	--	45±	4	--	Trs	2,416	38.9	Oct. 1960	C,W	S	--	2	
103	do	--	--	140±	4	--	Trs	2,451	85.4	do	C,W	S	--	2½	
* 104	do	--	--	155±	6½	--	Kt	2,484	124.6	July 1963	C,W	S	--	2½	Reported yield, 2 gpm.
208	Lance Sears	--	--	124±	5	--	Kt	2,477	83.8	do	N	A,Ind	--	4½	Formerly supplied oil-test rig.
209	do	--	--	172±	6	172	Kt	2,546	165.5	do	N	A,Ind	--	--	Do.
307	P. L. Wilkes	O. R. House	1961	275	12	--	Kt	2,579	200.1	do	T,G	Irr	243	6	Yielded 525 gpm on test with pump set at 243 ft; little water obtained below 243 ft.
308	do	--	1957	260±	7	--	Kt	2,561	178.8	do	N	A,Ind	--	--	Formerly supplied oil-test rig; reported yield, 100+ gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-52-312	Helen Alexander	--	--	156±	6	--	Kt	2,477	92.1	Nov. 1962	C,W	S	--	2	
313	P. L. Wilkes	O. R. House	1962	290	--	--	Kt	2,572	--	--	N	A,T	--	--	Test well for water-flood operation by Sun Oil Co.; reported yield, 60 gpm.
314	do	do	1962	225	--	--	Kt	2,545	--	--	N	A,T	--	--	Yielded 160 gpm on test with pump set at 170 ft.[2]
315	Lance Sears	Joe Whitworth	1963	300	--	--	Kt	2,588	203	July 1963	N	A,T	--	--	Yielded 195 gpm on test with pump set at 266 ft; yielded 149 gpm with pump set at 246 ft.
317	P. L. Wilkes	--	--	183	5½	--	Kt	2,551	167.6	do	C,W	S	--	1½	Reported yield, 2 gpm.
404	R. L. Spires	--	--	215±	6	--	Kt	2,525	127.1	Oct. 1960	C,W	S	--	2	
405	do	--	--	93	6	--	Kt	--	73.3	do	C,W	S	--	2	
412	M. L. Compton	--	--	207±	6½	207	Kt	2,579	190.4	July 1963	N	A,Ind	--	--	Reported strong supply; formerly supplied oil-test rig.
413	R. L. Spires	--	--	225±	6	220	Kt	2,590	200.9	do	S	Ind	--	3	Formerly supplied oil-test rig.
415	M. L. Compton	--	--	60±	6	--	Kt	2,415	20.0	Aug. 1963	C,W	S	--	2	
501	J. M. McLaughlin	--	--	191±	6	--	Kt	2,577	182.9	Oct. 1960	C,W	S	--	2½	Water quality reported good.
504	Helen Alexander	--	--	60	5½	--	Kt	2,450	40.5	Nov. 1962	C,W	S	--	2	
505	Parks Thomas	--	--	150	6	--	Kt	2,501	122.7	Aug. 1963	C,W	D,S	145	1½	Water potable, but hard; reported yield, 3 gpm.
601	Baker Ranch	--	--	185	6	--	Kt	2,565	174.6	Nov. 1960	C,W	S	--	2	Water potable, but hard.
* 602	J. M. McLaughlin	--	--	150	--	--	Kt	2,513	137.3	Aug. 1963	C,W	S	--	2	Water potable, but hard; reported yield, 2 gpm.
703	M. L. Compton	--	--	175	6	--	Kt	2,577	174.6	do	C,W	S	--	1½	Do.
704	J. M. McLaughlin	--	--	190	5½	10	Kt	2,535	156.7	do	C,W	S	180	1½	Water potable, but hard; reported yield, 3 gpm.
803	Eunice Parramore	--	--	190	6	--	Kt	2,562	186.0	Nov. 1960	C,W	S	--	2	

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
*29-52-807	J. M. McLaughlin	O. R. House	1959	280	--	--	Kt	2,580	199.3	Aug. 1963	C,W	S	--	2	Reported yield, 2-3 gpm.[2]
902	J. P. Maddox	--	--	100	5	--	Kt	2,444	68.7	Nov. 1960	C,W	S	--	2	
903	J. M. McLaughlin	--	--	213	6	10	Kt	2,577	189.9	Aug. 1963	C,W	S	183	2	Reported yield, 2 gpm of potable water.
904	Mrs. Z. P. Arledge	--	--	199	6	--	Kt	2,538	176.3	do	C,W	S	192	2	Reported yield, 2 gpm.
53-101	Lone Star Cement Co.	Layne Texas Co.	1951	292	8½	292	Kt	2,576	185.0	July 1951	T,E	A,Ind	--	4	Drilled to supply plant-construction operations; reported yield, 30 gpm.
103	Maryneal Cemetery	--	--	204	5½	--	Kt	2,554	96.5	Nov. 1962	C,W	D	--	2	
104	Mrs. B. K. Stone	--	--	205	5	--	Kt	2,525	47.7	July 1963	C,W	S	--	2	
105	Lance Sears	--	--	195	6	--	Kt	2,578	144.9	do	C,W	S	180	2	Reported yield, 3 gpm.
*106	Mrs. Gus Farrar	--	--	145	6	--	Kt	2,554	112.0	do	S	D,S	140	1½	Reported yield, 5 gpm.
107	Lewis Elliot	--	--	240	5½	--	Kt	--	--	--	S	D	--	2	Furnished 100 gpm to oil-test rig; reported yield, 25 gpm.
201	Lone Star Cement Co.	Layne Texas Co.	1951	252	8½	181	Kt	2,558	176.0	July 1951	T,E	A,Ind	--	3	Casing slotted at 182-242 ft; reported yield, 19 gpm.
202	do	do	1951	224	--	--	Kt	2,527	128.0	do	N	A,Ind	--	--	Drainage well for limestone quarry; reported yield, 19 gpm.
204	Santa Fe Railroad	--	--	665	8	--	Kt	2,567	168.0	1950	N	A,Ind	--	--	Reported yield, 47 gpm.
205	Maryneal Baptist Church	--	--	230	5½	--	Kt	2,567	179.4	Dec. 1963	C,W	D	--	2	Reported strong supply.
208	W. R. Adams	Jack Stuart	1960	265	12	6	Kt	2,558	185.5	do	T,G	Irr	263	4	Irrigates grass land; "red bed" reported at 265 ft; reported yield, 70 gpm.
401	Mrs. Iris Thomas	--	--	76	6	--	Kt	2,428	48.8	Aug. 1963	C,W	S	72	2	Reported yield, 2 gpm.
502	David Bridgeford	--	1962	180	--	--	Kt	--	51.7	do	N	A,Irr	--	--	Reported yield, 7 gpm.
*702	J. R. Maddox	--	--	45±	5	45	Kt	2,349	29.5	May 1963	C,W	D	--	--	
703	Mrs. Iris Thomas	--	--	116	5	--	Kt	2,408	99.0	Aug. 1963	C,W	S	--	1½	Reported yield, 2 gpm.

See footnotes at end of table.

Table 5.--Records of selected water wells, springs, and test wells--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Casing: Diameter (in.)	Casing: Depth (ft)	Water-bearing unit	Altitude of land surface (ft)	Water level[1]: Below land surface (ft)	Water level[1]: Date of measurement	Method of lift	Use of water	Pump setting below land surface (ft)	Pump column size (in.)	Remarks
29-53-801	Mrs. A. P. Arledge	--	--	110	--	--	Kt	2,316	40.0	Nov. 1960	C,W	S	--	2	
* 58-101	Spade Ranch	O. R. House	1934	178	6	178	P	2,185	172.6	Apr. 1961	C,W	S	--	2½	Reported yield, 8 gpm.[2]
201	do	--	--	98	5	--	P	2,057	45.9	do	C,W	D,S	90	2	Water level measured while pumping; reported yield, 4 gpm.
59-101	--	--	--	136	6	--	P	2,105	85.4	do	C,W	S	--	2	Presently unused.
102	Spade Ranch	--	--	55	5	--	P	2,040	38.1	do	C,W	S	--	2	Water mineralized.
* 104	do	O. R. House	1962	70	6	70	P	2,027	25.2	Nov. 1962	C,W	S	--	3	Reported yield, 70 gpm.
105	do	--	1957	235	--	--	P	--	--	--	C,W	S	--	--	Formerly supplied oil-test rig.
201	Donevan & Wight	--	--	76	6	--	P	2,098	48.1	Apr. 1961	C,W	S	--	2	
202	V. T. McCabe	--	--	69	--	--	Kt	2,145	64.0	Oct. 1962	C,W	S	--	1½	
301	do	--	--	117	5	--	Kt	2,299	88.3	Apr. 1961	C,W	S	--	1½	
302	do	--	--	110	5	--	P	2,230	107.0	do	C,W	S	--	1½	Reported yield, 2 gpm.
* 303	J. S. Walker	--	--	50	5½	--	P	2,188	132.7	Nov. 1962	C,W	S	--	2	Do.
* 304	Jahew Jameson	--	--	117	5½	117	Trs	2,350	102.1	May 1963	C,E	D,S	--	1½	Reported yield, 4 gpm.
* 60-202	Mrs. Z. P. Arledge	-- Mundell	--	162	5	--	Kt,Trs	--	46.6	do	C,W	S	--	1½	Yielded 90 gpm on bailer test, with 20-ft drawdown.
203	J. M. McLaughlin	--	--	230	5½	--	Kt	2,593	215.6	Aug. 1963	C,W	D	215	2	Reported yield, 1-2 gpm of potable water.
* 301	Mrs. Z. P. Arledge	--	--	83	5	--	Kt	2,420	55.0	May 1963	C,W	S	--	2	Reported strong supply.
61-101	Arledge Ranch	Sam Smith	1960	235	6½	235	Kt	2,426	92.6	Nov. 1960	N	A,Irr	--	--	Yielded 30 gpm on bailer test.[2]
103	C. L. Bast	--	1963	200±	--	--	Kt	2,452	130.3	Dec. 1963	N	A,Irr	--	--	Reported yield, 25 gpm.
104	Arledge Ranch	--	1963	180±	5½	--	Kt	2,444	95.8	Aug. 1963	N	A,Irr	--	--	Formerly supplied oil-test rig.
201	Mrs. W. F. Blair	--	--	40	5½	--	Kt	2,312	32.7	Oct. 1962	C,W	S	--	1½	
202	White Hat Ranch	--	--	89	5½	--	Kt	2,361	55.3	Aug. 1963	C,W	D,S	--	1½	Caving reported; reported yield, 2 gpm.
203	do	--	--	141	6	--	P	2,262	60.6	do	C,W	S	130	2	

* See Table 8 for chemical analyses.
1/ See Table 7 for additional water-level measurements.
2/ See Table 6 for drillers' logs.

Table 6.--Drillers' logs of selected water wells and oil tests

Well 28-40-505

Standard Oil of Texas, Adams No. 2.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Cellar and soil-------	8	8	Gray sand; hole full of salt water------	10	235
Red shale-------------	27	35	Blue shale-----------	15	250
Blue shale------------	3	38	Gray sand------------	5	255
Gray sand, 80 bbls salt water in 24 hrs-----	7	45	Gray lime------------	10	265
Gray sandy shale------	3	48	Blue shale-----------	90	355
Gray sand-------------	17	65	Red shale------------	5	360
Gray sand; 137 bbls water in 24 hrs-----	10	75	Blue shale-----------	40	400
Gray sand-------------	25	100	Gray sand------------	55	455
Red shale-------------	95	195	Red shale and anhydrite----------	5	460
Blue shale------------	30	225	Red shale------------	85	545
			Anhydrite------------	25	570

Well 28-48-201

Standard of Texas, Z. F. Morrison No. 1.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface formation-----	7	7	Red shale------------	248	438
Red shale-------------	93	100	Gray sand, hole full of salt water------	7	445
Blue shale------------	10	110	Gray water sand------	8	453
Red shale-------------	10	120	Red shale------------	12	465
Blue shale------------	10	130	Gray water sand------	10	475
Gray sand, 514 bbls salt water in 24 hrs	50	180	Red shale------------	2	477
Gray sand, hole full of salt water-------	10	190	Gray sand; hole full of salt water------	8	485

(Continued on next page)

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 28-48-201--Continued

Gray water sand--------	5	490	Red shale, 55 bbls water in 24 hrs-----	10	580
Blue shale-------------	15	505	Red shale-------------	10	590
Gray water sand--------	6	511	Anhydrite-------------	10	600
Red shale--------------	59	570	Red shale and anhydrite-----------	110	710

Well 28-48-401

Owner: Etta Holt Brown. Driller: J. O. Fannin.

Soil-------------------	3	3	Lime, Brown-----------	10	500
Caliche----------------	12	15	Shale, gray-----------	65	565
Red shale--------------	165	180	Sand rock, gray-------	10	575
Brown shale------------	80	260	Shale and shells------	20	595
Sand rock, gray--------	65	325	Water sand, white-----	15	610
Shale, red-------------	165	490	Shale, red------------	5	615

Well 28-64-302

Owner: Spade Ranch. Driller: James House.

Topsoil----------------	2	2	Gypsum----------------	20	60
Caliche----------------	6	8	Lime------------------	18	78
Red clay---------------	19	27	Sand rock, water------	12	90
Lime-------------------	13	40			

Table 6.--Drillers' logs of selected water wells and oil tests--Continued

Well 29-26-801

Owner: F. W. Merket. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	8	8	Blue clay	38	253
Sand rock, water	47	55	Sand, hard	72	325
Sand rock	53	108	Hard gravel rock	5	330
Red clay	107	215	Red bed	2	332

Well 29-33-912

Owner: Col-Tex Refinery. Driller: --

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gravel	30	30	Blue clay	2	112
Clay	30	60	Rock	10	122
Rock (water)	40	100	Red beds	28	150
Gravel	10	110			

Well 29-34-106

Owner: Lyndon Solomon. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	4	4	Blue clay	24	97
Sand rock, water	21	25	Red clay	21	118
Hard rock	10	35	Blue clay	7	125
Blue clay	2	37	Red clay	23	148
Sand rock	8	45	Sand rock	62	210
Hard rock	2	47	Hard rock	12	222
Red clay	26	73	Red bed		222

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-34-204

Owner: Glenn Hamilton. Driller: O. R. House.

Sand	8	8	Blue clay	7	117
Sand rock	11	19	Sand rock	38	155
Red clay	26	45	Gravel	5	160
Blue clay	5	50	Sand	5	165
Brown clay	15	65	Gravel	13	178
Sand rock, water	25	90	Hard rock	2	180
Hard rock (water at 95 ft)	20	110	Red bed	3	183

Well 29-34-607

Owner: Mrs. A. C. Pratt. Driller: O. R. House.

Sand and clay	8	8	Sand	10	170
Sand, rock, water	12	20	Sand and gravel	47	217
Sand rock	35	55	Blue clay	5	222
Tight clay, blue	32	87	Sand rock	15	237
Sand rock	25	112	Hard rock	6	243
Red and blue clay	48	160	Red	4	247

Well 29-34-812

Owner: Warren Anderson. Driller: O. R. House.

Topsoil	2	2	Brown clay	5	20
Brown clay	10	12	Sand rock (water 5 gpm)	30	50
Sand rock	3	15	Blue clay	5	55

(Continued on next page)

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-34-812--Continued

Gray sand, water-------	25	80	Hard gravel-----------	15	165
Brown clay-------------	25	105	Sand and gravel, water	5	170
Blue clay--------------	10	115	Conglomerate----------	5	175
Sand rock--------------	35	150	Red clay--------------	5	180

Well 29-34-912

Owner: Charles Root. Driller: O. R. House.

Top clay---------------	15	15	Sand------------------	16	108
Tight clay-------------	20	35	Blue clay-------------	2	110
Sand rock, water-------	10	45	Sand------------------	85	195
Sand rock--------------	43	88	Blue clay-------------	3	198
Blue clay--------------	4	92	Red clay, bottom------	2	200

Well 29-35-302

Owner: Ernest Parrott. Driller: O. R. House.

Caliche----------------	8	8	Sand------------------	5	157
Lime-------------------	18	25	Red-------------------	18	175
Sand-------------------	35	60	Sand------------------	15	190
Red clay---------------	15	75	Water sand------------	90	280
Sand rock--------------	6	81	Blue shale------------	4	284
Dark clay--------------	9	90	Sand and gravel-------	11	295
Sand rock--------------	20	110	Hard rock-------------	13	308
Blue clay--------------	42	152			

Table 6.--Drillers' logs of selected [illegible]--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-35-417

Owner: Woodrow Pratt. Driller: N. C. House.

Soil------------------	6	6	Shale, blue-----------	3	115
Caliche---------------	8	14	Sand and gravel (water)	25	140
Clay, yellow, sandy----	26	40	Gravel rock-----------	25	165
Sand and gravel (water)	15	65	Shale, blue-----------	10	175
Shale blue-------------	20	85	Rocks-----------------	12	187
Soft sand, rock, and gravel---------------	27	112	Red bed---------------	61	248

Well 29-35-513

Owner: Bill Jacks. Driller: N. C. House.

Soil------------------	4	4	Sandy yellow clay (dry)	15	125
Yellow sandy clay------	46	50	Gray sand rock--------	18	143
Yellow sand rock-------	10	60	Yellow shale----------	7	150
Yellow boulders--------	5	65	Gravel----------------	6	156
Yellow clay, soft------	5	70	Blue shale------------	22	178
Hard rock, gray--------	5	75	Gray sand and gravel--	82	260
Sandy yellow clay------	25	100	Hard gravel rock------	5	265
Sand rock, brown, water	10	110	Blue shale------------	5	270
			Red bed---------------	4	274

Well 29-35-711

Owner: J. Furlow. Driller: O. R. House.

Caliche and clay-------	12	12	Sand rock, water------	20	105
Sand rock--------------	43	55	Blue clay-------------	9	114
Brown and blue clay----	30	85	Sand rock-------------	4	118

(Continued on next page)

Table 6.--Drillers' logs of selected water wells and oil tests--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-35-711--Continued

Gravel	4	122	Gravel	20	195
Sand	18	140	Hard rock	3	198
Gravel	15	155	Red clay	2	200
Sand	20	175			

Well 29-36-103

Owner: Raymond Althof. Driller: O. R. House.

Clay and caliche	30	30	Blue sand	10	270
Sandy	37	67	Gravel	10	280
Red clay	43	110	Hard gravel rock	10	290
Sand rock	5	115	Gravel	5	295
Brown clay	25	140	Blue clay	12	307
Sand rock, water	10	150	Sand	5	312
Hard rock	15	165	Blue clay	8	320
Red clay	15	180	Sand and gravel	12	332
Sand, yellow	20	200	Blue clay	8	340
Hard gravel	20	220	Red clay	5	345
Sand	40	260			

Well 29-36-407

Owner: E. J. Woodward. Driller: E. W. Martin.

Soil	3	3	Red shale	19	71
Caliche	19	22	Light brown, shale	41	112
Light shale	30	52	Sandy shale	11	123

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	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-36-407--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sandstone	19	142	Gray sand	13	225
Yellow sand (water sand)	30	172	Broken sand and shale	15	240
Lime	3	175	Hard lime	4	244
Yellow sand	37	212	Red bed	2	246

Well 29-36-606

Owner: W. C. Cleckler. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Blue clay	20	98
Caliche	22	25	Sand, rock, water	27	125
Dry sand	7	32	Hard sand rock	25	150
Brown clay	30	62	Yellow sand	5	155
Yellow sand	5	67	Hard gravel rock	13	168
Yellow clay	11	78	Red clay	2	170

Well 29-36-701

Owner: Max Wright. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Caliche	12	12	Red clay	32	212
Lime rock	29	41	Blue clay	8	220
Soft rock	2	43	Sand rock	15	235
Hard lime	2	45	Blue clay	5	240
Brown sand	67	112	Sand rock	22	262
Blue clay	3	115	Hard rock	6	268
Red clay	21	136	Sand and gravel	12	280
Hard rock	16	152	Yellow sand	25	305
Red clay	7	159	Hard rock	15	320
Sand rock	21	180	Red clay	40	360

Table 6.--Drillers' logs of selected water wells and oil tests--Continued

Well 29-36-905

Owner: M. Watt. Driller: --

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Hard sand rock	1	121
Clay	31	35	Gravel and sand	14	135
Conglomerate, gravel	3	38	Hard and soft rock	3	138
Yellow clay	19	57	Yellow sand	7	145
Red sandy clay	5	62	Hard sand	13	158
Yellow sand rock	32	94	Soft and hard rock	7	165
Hard sand and gravel	4	98	Hard rock	9	174
Fine sand rock	22	120	Red clay	6	180

Well 29-36-915

Owner: O. Orman. Driller: Grosshans Bros.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	4	4	Rock	14	105
Caliche	36	40	Rock and yellow clay	14	119
Rock	10	50	Water sand, yellow	3	122
Yellow sand (dry)	15	65	Rock and breaks	28	150
Red clay	10	75	Sand and gravel	55	205
Tight brown sand	10	85	Rock	10	215
Red clay	6	91	Red bed	5	220

Well 29-41-704

Owner: R. Robinson. Driller: Hopkins Drilling Company.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	1	1	Blue sandy shale	12	26
Sand	13	14	Sand, hard, seep	5	31

(Continued on next page)

	Thickness (feet)	Depth (feet)

Well 29-41-704--Continued

	Thickness (feet)	Depth (feet)
Blue shale and lime ledges	4	35
Hard sand and sand rock	4	39
Green shale	2	41
Red shale and sand streaks	32	73
Limestone, limey shale (sandy)	6	79
Sandy red shale and lime ledges	31	110
Brown sandy shale and lime	12	122
Damp sand	3	125
Sandy shale	5	130
Damp blue shale (salt water)	4	134
Sandstone	2	136
Shale, red	24	160

Well 29-42-104

Owner: Brooks Stewart. Driller: O. R. House.

	Thickness (feet)	Depth (feet)
Gravel	30	30
Water	15	45
Hard rock	5	50
Blue clay	15	65
Sand water	60	125
Hard rock	20	145
Red	3	148

Well 29-42-304

Owner: Travis Turner. Driller: O. R. House.

	Thickness (feet)	Depth (feet)
Topsoil	5	5
Rock sand	40	45
Sand, water	5	50
Red beds	30	80
Sand, water	40	120
Shale	2	122
Sand, water	35	165
Red beds	5	170

Table 5.--Drillers' logs of selected water wells and oil tests--Continued

Well 29-42-501

Owner: Elon Harrell. Driller: E. W. Martin.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	3	3	Sand	12	127
Sand rock	23	26	Limestone sandy	4	131
Red beds	18	44	Shale, sandy and gravel	16	147
Shale, blue	33	77	Red beds	53	200
Sand, water	23	100			
Gravel	15	115			

Well 29-42-601

Owner: L. S. Girvin. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gravel	8	8	Water gravel	5	85
Clay	17	25	Hard rock	10	95
Sand rock (water)	42	67	Sand	25	120
Sand rock	13	80	Red	5	125

Well 29-43-103

Owner: Roscoe Hudgins. Driller: E. W. Martin.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	3	3	Gravel, fine	7	89
Caliche	27	30	Shale, blue	13	102
Gravel	21	51	Gravel	24	126
Sand rock	11	62	Red beds	4	130
Sand water	20	82			

Well 29-43-311

Owner: Dr. Bruce Johnson. Driller: N. C. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	4	4	Gray sand (hard)	20	120
Brown sand rock	11	15	Hard sand and gravel	30	150
Yellow sand rock	30	45	Gravel	25	175
Brown sand and gravel	10	55	Conglomerate rock, hard	15	190
Brown shale	45	100	Red bed	5	195

Well 29-43-506

Owner: Alfred Hackfeld. Driller: Eulis Compton.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil	2	2	Sand rock	17	62
Red clay	8	10	Water sand and gravel	70	132
Sand and gravel	2	12	Hard rock	2	134
Caliche	16	28	Red bed	96	230
Gray sandy shale	17	45			

Well 29-43-602

Owner: Herman Aucutt. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay and caliche	20	20	Hard	5	150
Sand, water	37	57	Sand	8	158
Red clay	14	71	Blue clay	5	163
Sand	44	115	Sand and gravel	52	215
Hard rock	10	125	Hard rock	2	217
Sand	20	145	Red clay	3	220

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-43-802

Owner: Dr. F. N. Gray. Driller: Hopkins Drilling Company.

Soil------------------	2	2	Blue clay and shale---	5	68
Sandy clay------------	6	8	Sand and gravel-------	4	72
Hard sand, sandstone ledges--------------	8	16	Conglomerated gravel--	4	76
			Sandy clay-----------	6	82
Yellow sand and clay streaks-------------	14	30	Hard sand and gravel streaks------------	17	99
Blue clay and sand streaks-------------	10	40	Conglomerate rock-----	3	102
Hard sand and soft sandstone-----------	19	59	Red shale and lime ledges-------------	4	106
Hard sandstone--------	4	63			

Well 29-44-104

Owner: W. H. Cooper. Driller: O. R. House.

Clay, tight-----------	11	11	Rock-----------------	55	140
Sand rock-------------	19	30	Rock, soft-----------	5	145
Red mud---------------	48	78	Hard-----------------	5	150
Rock, water, yellow----	7	85	Red, bottom----------	5	155

Well 29-44-210

Owner: Morgan Wright. Driller: Hopkins Drilling Company.

Surface sand----------	4	4	Damp sandy shale------	6	64
Sandy clay------------	4	8	Shale, ledges, and sandstone----------	4	68
Red clay and shale ledges--------------	50	58	Hard sand and sandstone----------	30	98

(Continued on next page)

Table 6.--Drillers' lo [illegible]

Well 29-44-210--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Coal and gravel--------	1	99	Sand and gravel, tight---------------	10	150
Hard sand and sandy ledges---------	6	105	Sand and gravel (best water)--------	18	168
Blue shale and ledges--	3	108	Conglomerate rock-----	5	173
Hard sand and sandstone-------------	30	138	Red shale-------------	2	175
Blue and red shale------	2	140			

Well 29-44-305

Owner: M. D. Jones. Driller: O. R. House.

Topsoil---------------	5	5	Gravel and sand-------	4	118
Tight clay------------	7	12	Brown sand------------	2	120
Rock, water-----------	19	31	Hard rock-------------	4	124
Gravel----------------	17	48	Yellow sand-----------	30	154
Hard rock-------------	29	77	Hard rock-------------	6	160
Red sand--------------	23	100	Yellow sand and gravel	4	164
Hard rock-------------	14	114	Hard rock-------------	18	182

Well 49-44-505

Owner: Skelly Oil Company. Driller: O. R. House.

Yellow lime------------	15	15	Yellow clay-----------	18	130
Gray lime--------------	50	65	Yellow sand rock------	5	135
Yellow sand rock-------	35	100	White sand (water)----	5	140
Yellow clay------------	8	108	Yellow clay-----------	5	145
Pink clay--------------	4	112	White sand (water)----	3	148

(Continued on next page)

Table 6.--Drillers' logs of selected water wells and oil tests--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 49-44-505--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Red and brown clay-----	7	155	Gravel rock-----------	29	229
Blue clay--------------	25	180	Conglomerate rock-----	31	260
Red--------------------	5	185	Red bed---------------	6	266
Red sand rock----------	15	200			

Well 29-44-901

Owner: Mrs. Gus Farrar. Driller: O. R. House.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay-------------------	12	12	Lime------------------	85	155
Lime-------------------	8	20	Blue clay-------------	13	168
Yellow clay------------	12	32	Lime------------------	7	175
Lime-------------------	28	60	Sand------------------	110	285
Blue clay--------------	10	70			

Well 29-45-701

Owner: Lone Star Cement. Driller: Layne Texas Company.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil-------------------	1	1	Sand and gravel-------	15	202
Broken lime------------	8	9	Sand and shale--------	8	210
Lime-------------------	41	50	Gray shale------------	8	218
Very hard lime---------	30	80	Coarse water sand-----	9	227
Blue-gray, hard lime---	33	113	Sand, gravel----------	8	235
Hard lime--------------	42	155	Gravel and sand-------	10	245
Lime, streaks of shale-	15	170	Gray shale------------	5	250
Yellow sandy lime------	10	180	Red bed---------------	7	257
Water sand-------------	7	187			

Table 6.--Dr[illegible]

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well 29-[illegible]

Owner: B. B. Byrne. Driller: N. C. House.

Soil------------------	4	4	Red and blue clay------	20	80
Yellow clay------------	11	15	Gray sand rock--------	10	90
Yellow sand rock--------	5	20	Yellow sand and gravel	27	117
Blue shale-------------	35	55	Red bed---------------	2	119
Sand and gravel, gray----------------	5	60			

Well 29-52-314

Owner: P. L. Wilkes. Driller: O. R. House.

Caliche---------------	8	8	Yellow sand-----------	65	215
Lime------------------	17	25	Blue shale------------	5	220
White lime------------	25	50	Red shale-------------	5	225
Blue lime-------------	100	150			

Well 29-52-807

Owner: J. M. McGlaughlin. Driller: O. R. House.

Lime------------------	175	175	Sand and clay---------	38	280
Sand------------------	65	240	Red, bottom-----------		280
Clay------------------	2	242			

Well 29-58-101

Owner: Spade Ranch. Driller: --

Caliche---------------	50	50	Black sand------------	28	128
Red clay--------------	50	100	Red bed---------------	50	178

Table 6.--Drillers' logs of selected water wells and oil tests--Continued

Well 29-61-101

Owner: Arledge Ranch. Driller: Sam Smith.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
White lime-------------	28	28	Clay and sandstone----	40	143
Yellow lime------------	35	63	Sand------------------	27	170
Blue and yellow lime---	17	80	Shale-----------------	65	235
Yellow lime------------	23	103			

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-26-803	--	--	--	--	39.4	Nov. 1962	39.6	Jan. 1964
33-202	92.4	Mar. 1961	--	--	92.8	Jan. 1963	92.9	do
601	33.8	Jan. 1961	31.7	Dec. 1961	28.8	do	--	--
906	30.2	do	28.4	do	26.9	do	24.5	Jan. 1964
907	27.2	do	29.0	do	27.3	do	25.6	do
34-101	29.0	Mar. 1961	35.1	do	35.7	do	37.5	do
105	20.7	do	15.2	do	16.0	do	17.9	do
201	21.3	Nov. 1960	--	--	16.4	Mar. 1963	15.2	do
204	30.6	Mar. 1961	--	--	21.6	do	21.7	Feb. 1964
207	--	--	--	--	12.8	do	13.9	Jan. 1964
301	32.4	Nov. 1960	25.2	Dec. 1961	20.6	Jan. 1963	20.1	do
302	96.2	Apr. 1961	96.6	do	96.5	Dec. 1962	97.6	do
401	114.5	Jan. 1961	112.6	do	110.7	Jan. 1963	109.5	do
405	101.3	Mar. 1961	101.0	do	98.5	do	--	--
414	9.3	do	7.2	do	5.0	do	7.1	Jan. 1964
416	146.0	do	144.6	do	140.6	do	141.8	Dec. 1963

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-34-421	64.3	Mar. 1961	--	--	--	--	52.7	Dec. 1963
424	49.0	do	--	--	21.0	Mar. 1963	37.0	Jan. 1964
426	64.1	do	--	--	59.8	Jan. 1963	59.2	do
502	20.9	Jan. 1961	18.7	Dec. 1961	16.1	do	19.4	do
503	23.5	do	19.6	do	12.1	do	15.9	do
505	25.2	Nov. 1960	20.7	do	15.7	do	15.5	do
506	--	--	--	--	23.4	Mar. 1963	21.2	Feb. 1964
507	38.6	Jan. 1961	34.6	Dec. 1961	30.6	Jan. 1963	31.0	Jan. 1964
508	27.6	Mar. 1961	--	--	23.7	Mar. 1963	24.0	do
509	25.9	do	--	--	21.2	do	20.7	do
511	85.0	do	83.9	Dec. 1961	79.5	Jan. 1963	78.4	do
517	--	--	--	--	15.3	Mar. 1963	15.9	do
602	68.5	Feb. 1961	64.8	Dec. 1961	58.4	Dec. 1962	55.2	do
603	94.0	do	94.2	Jan. 1962	92.6	Jan. 1963	92.3	do
605	97.6	Apr. 1961	97.3	Dec. 1961	--	--	96.6	Nov. 1963
705	44.1	Mar. 1961	42.8	do	41.1	Jan. 1963	41.2	Dec. 1963

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-34-706	--	--	--	--	31.0	Oct. 1963	30.7	Dec. 1963
712	60.6	Mar. 1961	--	--	58.5	Mar. 1963	59.1	Jan. 1964
715	78.7	Apr. 1961	--	--	--	--	79.0	do
803	47.2	Jan. 1961	38.9	Dec. 1961	43.7	Jan. 1963	47.6	do
805	70.9	Feb. 1961	--	--	67.4	Mar. 1963	69.5	do
807	56.7	Jan. 1961	54.9	Dec. 1961	53.4	Jan. 1963	52.8	do
810	--	--	--	--	60.8	Feb. 1963	59.5	do
901	25.7	Dec. 1960	25.5	Dec. 1961	22.8	Jan. 1963	24.4	do
902	18.7	do	17.2	do	16.0	do	20.9	do
903	56.1	do	56.8	do	55.1	do	54.7	do
905	--	--	--	--	72.5	Feb. 1963	73.0	do
906	--	--	--	--	16.1	do	20.0	do
907	--	--	--	--	33.0	do	35.6	do
908	28.0	Dec. 1960	--	--	25.2	Jan. 1963	27.0	do
910	42.1	Feb. 1961	--	--	38.5	Mar. 1963	38.9	do
911	--	--	--	--	36.7	Feb. 1963	40.9	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-34-912	38.0	Feb. 1961	--	--	32.5	Feb. 1963	34.8	Jan. 1964
913	--	--	--	--	24.6	Mar. 1963	26.3	do
914	92.0	Mar. 1961	--	--	91.2	Feb. 1963	90.3	do
921	--	--	--	--	21.5	Mar. 1963	22.7	do
35-101	100.1	Jan. 1961	99.8	Dec. 1961	98.8	Dec. 1962	103.7	do
102	100.0	do	98.6	do	99.7	do	103.3	do
106	--	--	--	--	87.7	Nov. 1962	90.8	do
201	113.9	Feb. 1961	114.8	Dec. 1961	116.4	Dec. 1962	118.1	do
202	99.3	Mar. 1961	--	--	102.9	Feb. 1963	105.7	do
301	190.8	Nov. 1960	--	--	189.5	do	184.6	do
302	--	--	186.6	Dec. 1961	183.8	do	182.2	do
307	203.6	Nov. 1960	202.4	do	201.9	Jan. 1963	200.4	do
311	182.5	do	--	--	--	--	170.6	do
312	156.8	do	154.0	Dec. 1961	151.0	Dec. 1962	153.2	do
313	201.3	Mar. 1961	--	--	201.8	Feb. 1963	198.3	do
401	54.8	Feb. 1961	--	--	57.2	do	59.2	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-35-403	115.7	Feb. 1961	--	--	115.0	Feb. 1963	117.0	Jan. 1964
405	53.6	do	--	--	57.7	do	59.2	do
407	68.9	do	--	--	70.9	do	75.0	do
408	62.0	do	63.5	Dec. 1961	64.9	Dec. 1962	67.5	do
409	44.5	do	45.1	do	48.5	do	48.2	do
410	56.4	Dec. 1960	56.1	do	56.9	do	57.1	do
412	57.0	Feb. 1961	--	--	57.5	Feb. 1963	58.5	do
415	--	--	--	--	65.6	Mar. 1963	58.3	do
416	--	--	--	--	76.9	Jan. 1963	78.4	do
417	--	--	--	--	67.2	Feb. 1963	70.1	do
425	--	--	--	--	45.8	do	46.6	do
428	--	--	--	--	68.3	do	70.2	do
429	--	--	--	--	53.6	do	53.6	do
430	--	--	--	--	67.2	do	64.2	do
435	--	--	--	--	60.6	Mar. 1963	63.4	do
501	127.8	Dec. 1960	128.6	Dec. 1961	131.4	Dec. 1962	133.1	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-35-502	140.3	Nov. 1960	--	--	136.5	Feb. 1963	--	--
504	--	--	--	--	126.8	do	129.0	Jan. 1964
505	106.0	Nov. 1960	--	--	106.6	do	109.1	do
506	113.9	do	114.0	Dec. 1961	115.3	Dec. 1962	116.5	do
507	127.4	Feb. 1961	130.1	do	136.9	do	132.6	do
508	73.9	Nov. 1960	72.6	do	76.2	Feb. 1963	77.0	do
509	138.1	Feb. 1961	--	--	141.5	do	146.8	do
511	97.1	do	--	--	100.6	do	104.2	do
513	--	--	--	--	148.2	do	145.7	do
603	200.8	Nov. 1960	199.3	Dec. 1961	200.0	Dec. 1962	199.6	do
607	189.9	do	189.7	do	191.9	do	191.4	do
608	189.0	Mar. 1961	--	--	192.2	Feb. 1963	193.2	do
609	--	--	--	--	154.9	Dec. 1962	144.7	do
707	39.0	Dec. 1960	39.3	Dec. 1961	36.5	do	37.5	do
708	26.8	Feb. 1961	--	--	24.3	Feb. 1963	25.0	do
709	142.2	Dec. 1960	139.3	Dec. 1961	142.8	Dec. 1962	146.0	do

TTable 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-35-712	50.5	Mar. 1961	37.9	Dec. 1961	32.3	Nov. 1962	40.7	Jan. 1964
719	--	--	--	--	76.2	Mar. 1963	77.3	do
801	--	--	156.7	Dec. 1961	155.9	Feb. 1963	157.8	do
802	135.6	Nov. 1960	135.9	do	136.8	Dec. 1962	142.0	do
903	212.9	do	--	--	212.0	Jan. 1963	209.7	do
905	175.8	do	--	--	172.9	Feb. 1963	174.1	do
907	206.5	June 1960	--	--	204.7	do	205.4	do
36-102	117.0	Nov. 1960	117.4	Dec. 1961	117.1	Dec. 1962	116.9	do
103	152.5	do	--	--	153.5	Feb. 1963	153.7	do
201	101.6	Oct. 1960	100.1	Dec. 1961	99.4	Dec. 1962	98.7	do
403	162.9	Nov. 1960	--	--	160.2	Feb. 1963	162.2	do
406	136.4	do	--	--	133.7	Mar. 1963	134.3	do
412	139.2	do	139.3	Dec. 1961	138.7	Dec. 1962	138.4	do
413	170.2	do	--	--	167.8	do	170.9	do
414	--	--	--	--	161.0	Feb. 1963	162.3	do
415	--	--	--	--	130.7	do	131.7	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-36-416	--	--	--	--	134.1	Feb. 1963	135.1	Jan. 1964
506	111.8	May 1960	--	--	112.3	Dec. 1962	112.4	do
507	139.8	Dec. 1960	137.2	Dec. 1961	137.1	do	136.4	do
510	118.9	Nov. 1960	--	--	117.7	Feb. 1963	118.3	do
512	138.8	do	--	--	--	--	140.2	do
604	--	--	--	--	98.4	Feb. 1963	98.1	do
606	--	--	--	--	113.1	Mar. 1963	112.6	do
702	--	--	--	--	188.2	do	188.6	do
705	189.4	Nov. 1960	189.0	Dec. 1961	189.5	Dec. 1962	190.7	do
802	123.3	do	--	--	121.3	Feb. 1963	--	--
806	114.4	do	143.6	Dec. 1961	143.7	Dec. 1962	144.8	Jan. 1964
809	148.5	do	--	--	148.4	Feb. 1963	148.9	do
811	--	--	--	--	153.4	Jan. 1963	157.4	do
812	117.8	Nov. 1960	117.9	Dec. 1961	117.2	Dec. 1962	117.3	do
814	--	--	--	--	123.2	Feb. 1963	125.7	do
905	--	--	--	--	102.9	Mar. 1963	104.7	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-36-906	111.6	Oct. 1960	--	--	--	--	109.9	Jan. 1964
911	109.0	do	108.3	Dec. 1961	107.3	Dec. 1962	108.2	do
915	100.5	Nov. 1960	99.3	do	98.5	do	98.8	do
917	109.7	do	104.9	do	--	--	106.6	Dec. 1963
42-207	80.2	Feb. 1961	80.3	do	79.5	Jan. 1963	78.7	Jan. 1964
208	79.9	Apr. 1961	75.5	do	73.1	do	71.4	do
301	93.9	Nov. 1960	--	--	81.9	Mar. 1963	86.5	do
302	98.7	do	--	--	97.5	do	97.4	do
304	52.0	Feb. 1961	--	--	44.8	do	45.2	do
310	36.4	do	--	--	30.7	do	31.0	do
311	21.2	Dec. 1960	18.2	Dec. 1961	15.3	Jan. 1963	16.4	do
312	73.4	Mar. 1961	--	--	69.6	Mar. 1963	72.7	do
501	59.0	Feb. 1961	58.2	Dec. 1961	56.8	Jan. 1963	55.9	do
502	27.3	do	--	--	--	--	26.3	do
601	61.5	do	62.7	Dec. 1961	62.4	Jan. 1963	62.8	do
603	--	--	--	--	91.6	Apr. 1963	93.4	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-42-804	66.7	Feb. 1961	66.5	Dec. 1961	65.1	Jan. 1963	63.5	Jan. 1964
901	105.3	Apr. 1961	--	--	--	--	106.8	do
43-101	57.4	Dec. 1960	--	--	56.6	Mar. 1963	58.3	do
104	41.9	Nov. 1960	--	--	--	--	47.8	do
107	--	--	--	--	59.9	Mar. 1963	59.8	do
108	90.8	Nov. 1960	--	--	--	--	89.8	do
109	98.5	Feb. 1961	98.0	Dec. 1961	99.5	Dec. 1962	101.5	do
110	53.6	do	--	--	--	--	55.7	do
111	83.2	Apr. 1961	--	--	83.2	Mar. 1963	83.6	do
115	--	--	--	--	52.9	Nov. 1962	55.0	do
201	64.6	Nov. 1960	63.5	Dec. 1961	63.6	Dec. 1962	64.0	do
202	90.1	do	--	--	89.3	Mar. 1963	90.7	do
203	--	--	--	--	70.7	do	72.0	do
205	78.3	Nov. 1960	78.0	Dec. 1961	78.1	Dec. 1962	79.9	do
210	--	--	--	--	45.9	Mar. 1963	47.7	do
301	--	--	--	--	53.7	do	54.9	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-43-302	83.9	Nov. 1960	83.6	Dec. 1961	83.1	Dec. 1962	85.2	Jan. 1964
303	--	--	--	--	26.3	do	26.8	do
304	58.4	Nov. 1960	56.0	Dec. 1961	55.9	do	56.7	do
402	42.7	Feb. 1961	--	--	--	--	44.5	do
404	106.3	Nov. 1960	107.8	Dec. 1961	104.8	Jan. 1963	102.5	do
502	76.3	do	74.5	Nov. 1961	75.8	Dec. 1962	--	--
503	77.7	do	--	--	78.5	Mar. 1963	80.1	Jan. 1964
505	51.0	do	--	--	--	--	50.8	do
506	59.0	do	--	--	58.6	Mar. 1963	59.8	do
507	53.2	do	48.6	Dec. 1961	49.2	Jan. 1963	48.8	Mar. 1964
511	--	--	--	--	46.3	Mar. 1963	47.6	Jan. 1964
514	--	--	--	--	73.5	do	73.5	do
517	--	--	--	--	65.6	do	67.5	do
518	--	--	--	--	56.4	do	57.0	do
601	47.0	Nov. 1960	48.1	Dec. 1961	47.9	Dec. 1962	49.1	do
602	85.8	Oct. 1960	93.1	do	98.0	do	94.8	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-43-605	97.2	Nov. 1960	--	--	--	--	97.0	Jan. 1964
701	119.7	do	119.7	Dec. 1961	121.5	Dec. 1962	122.0	do
801	126.0	do	126.1	do	127.9	do	129.0	do
44-101	92.8	do	94.9	do	95.0	do	94.7	do
103	65.0	do	--	--	63.2	do	64.6	do
104	28.8	do	27.7	Dec. 1961	25.6	do	27.7	do
109	46.8	Dec. 1960	46.4	do	--	--	45.6	do
110	52.8	Nov. 1960	--	--	--	--	51.1	do
111	32.0	do	--	--	--	--	28.7	do
112	27.3	do	--	--	25.3	Mar. 1963	26.4	do
113	41.4	do	--	--	38.6	do	41.7	do
114	27.2	do	--	--	28.0	do	29.4	do
115	41.6	do	--	--	41.5	do	43.1	do
118	--	--	--	--	31.9	do	35.7	do
121	--	--	--	--	42.5	do	37.3	do
205	19.9	Jan. 1961	19.4	Dec. 1961	17.7	Dec. 1962	19.1	do

Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

Well	1960-61		1961-62		1962-63		1963-64	
	Depth to water	Date	Depth to water	Date	Depth to water	Date	Depth to water	Date
29-44-304	51.3	Nov. 1960	--	--	51.6	Mar. 1963	51.2	Jan. 1964
306	132.7	Dec. 1960	130.5	Dec. 1961	--	--	131.9	Dec. 1963
402	33.3	Nov. 1960	32.1	do	33.5	Dec. 1962	35.4	Jan. 1964
404	67.2	do	67.4	do	66.5	do	70.3	do
501	67.6	do	--	--	72.2	Mar. 1963	--	--
901	195.7	Oct. 1960	--	--	--	--	196.8	Dec. 1963
53-205	183.2	do	--	--	182.2	Sept. 1962	179.4	do

Table 8.--Chemical analyses of water from selected wells and springs

(Analyses are in parts per million except percent sodium, specific conductance, pH, and sodium adsorption ratio.)

Water-bearing unit: Ca, Quaternary alluvium or Ogallala Formation; Kf, Fredericksburg Group; Kt, Trinity Group; P, Permian rocks, undifferentiated; Trc, Chinle Formation; Trs, Santa Rosa Formation; Trd, Dockum Group, undifferentiated.

Laboratory : CL, Commercial laboratory; TSDH, Texas State Department of Health; USGS, United States Geological Survey.

Well	Depth of well (ft)	Water bearing unit	Date of collection	Laboratory	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorption ratio
28-32-704	288	Trs	July --, 1948	USGS	6	129	70	2,350	382	1,420	2,780	--	--	--	6,960	610	--	10,600	--	--
705	32	Ca	July 2, 1963	TSDH	25	49	88	336	510	439	173	6.5	137	--	1,500	484	--	2,150	7.7	--
801	93	Trd	May --, 1948	USGS	19	66	38	89	140	201	122	--	9.8	--	651	320	--	1,190	--	--
805	7	Ca	July 10, 1963	TSDH	32	52	18	210	357	127	115	4.7	72	--	808	204	--	1,260	8.0	--
901	115	Trd	May --, 1948	USGS	23	259	192	311	232	1,670	130	--	1.2	--	3,000	1,440	--	3,350	--	--
39-801	203	Trd	July 9, 1963	TSDH	11	79	46	1,560	423	1,160	1,630	1.0	.4	--	4,694	382	--	7,100	8.1	--
901	12	Ca	July 10, 1963	do	60	42	14	114	372	46	22	2.3	30	--	510	164	--	764	7.6	--
40-101	243	Trs	July --, 1948	USGS	5	169	88	2,820	291	1,650	3,510	--	--	--	--	734	--	12,500	--	--
401	122	Trd	July 9, 1963	TSDH	11	105	26	1,520	448	1,990	890	1.7	< .4	--	4,762	369	--	6,340	7.9	--
601	300	Trs	July --, 1948	USGS	4	13	9	952	516	454	850	--	.5	--	2,560	71	--	4,280	--	--
608	129	Trs	July 16, 1963	TSDH	10	10	5	700	540	337	560	3.1	< .4	--	1,894	49	--	3,200	8.1	--
711	25±	Ca	July 3, 1963	do	43	232	168	710	393	483	1,350	2.8	44	--	3,229	1,270	--	5,170	7.6	--
713	263	Trd	July 18, 1963	do	11	77	33	1,540	359	1,300	1,500	1.5	< .4	--	4,637	328	--	6,850	7.5	--
716	45	Ca	do	do	38	106	40	395	478	413	283	2.0	83	--	1,596	430	--	2,390	7.7	--
803	137	Trd	July 3, 1963	do	10	114	82	2,140	282	2,030	2,240	1.7	< .4	--	6,756	620	--	9,240	7.9	--
806	300±	Trs	do	do	8	93	41	2,420	389	2,030	2,310	1.8	2.0	--	7,102	400	--	9,830	7.8	--
47-604	106	Trc	July 8, 1963	do	30	60	39	212	378	230	148	2.4	< .4	--	907	311	--	1,450	8.1	--
48-302	65	Trd	June 28, 1963	do	15	79	66	159	345	430	62	1.2	4.0	--	984	467	--	1,450	8.0	--
501	65	Trs	Apr. 17, 1963	do	14	341	145	620	244	1,630	650	1.7	22	--	3,546	1,450	--	4,520	7.6	--
601	212	Trs	July 11, 1963	do	27	99	74	1,540	273	1,590	1,520	2.3	< .4	--	4,991	550	--	7,030	7.6	--
602	27	Trd	Apr. 17, 1963	do	24	218	377	1,150	510	3,170	570	7.4	63	--	5,840	2,090	--	6,780	7.6	--
702	100	Ca	July 6, 1963	do	92	55	40	15	366	7	1	6.7	.5	--	393	299	--	568	8.1	--
901	65	Trs	July 8, 1963	do	4	280	171	3,700	293	3,500	4,150	2.0	< .4	--	11,951	1,400	--	12,000	7.5	--
56-201	20	Ca	Apr. 17, 1963	do	16	84	8	4	303	5	5	.4	< .4	--	270	242	--	460	8.1	--
701	62	Ca	Aug. 29, 1963	do	33	117	10	25	349	18	37	.2	26	--	442	333	--	740	7.5	--

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Laboratory	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorption ratio
28-63-201	100	Ca	Aug. 29, 1963	TSDH	14	41	14	56	188	45	60	1.0	2.1	--	332	160	--	580	7.6	--
64-301	93	Ca	May 16, 1963	do	26	18	18	64	166	55	80	.9	1.0	--	365	171	--	644	8.0	--
303	Spring	Ca	Dec. 14, 1963	do	15	50	4	17	162	17	22	.5	< .4	--	205	143	--	364	7.9	--
29-25-702	do	Trs	May --, 1948	USGS	9	184	93	214	184	914	145	--	.5	--	1,780	842	--	2,240	--	--
706	68	Trs	June 6, 1963	TSDH	16	118	39	141	226	510	44	.9	2.3	--	1,005	456	--	1,390	7.9	--
801	143	Trs	May --, 1948	USGS	18	19	15	605	424	579	315	--	5.0	--	1,760	109	--	2,800	--	--
903	100+	Trs	July 11, 1963	TSDH	19	86	31	58	257	173	60	3.7	< .4	--	559	344	--	878	7.9	--
26-702	115	Trs	Aug. 2, 1963	do	18	152	26	104	257	180	192	.2	69.0	--	869	485	--	1,400	7.3	--
801	332	Trs	Mar. 29, 1963	do	18	97	32	97	243	159	146	1.0	2.0	--	676	374	--	1,126	7.2	2.1
903	91	Trs	June 4, 1963	do	21	78	18	88	264	73	96	.7	37.0	--	545	270	--	900	7.6	--
33-101	117	Trs	May --, 1948	USGS	20	184	61	132	104	492	220	--	111.0	--	1,410	710	--	1,960	--	--
103	101	Trs	do	do	20	56	28	80	124	135	126	--	4.5	--	577	255	--	901	--	--
108	80±	Trs	July 10, 1963	TSDH	15	277	200	660	270	1,970	520	2.2	22.0	--	3,802	1,510	--	4,600	7.8	--
201	121	Trs	May --, 1948	USGS	14	44	98	214	228	510	170	--	26.0	--	1,340	513	--	1,939	--	--
202	160	Trs	do	do	12	56	56	1,800	216	935	2,210	--	3.5	--	5,250	370	--	8,630	--	--
206	96	Trs	Aug. 26, 1963	TSDH	48	378	154	377	275	1,730	250	.7	< .4	--	3,070	1,580	--	3,600	7.5	--
207	180	Trs	July 11, 1963	do	12	483	261	1,110	293	2,000	3,090	1.3	< .4	--	7,951	2,280	--	10,660	7.5	--
306	187	Trs	do	do	19	107	23	53	328	134	43	.1	29.0	--	573	362	--	880	7.9	1.2
401	57	Trs	May --, 1948	USGS	20	57	25	259	190	180	290	--	52.0	--	1,010	246	--	1,720	--	--
402	83	Trs	do	do	18	23	16	115	270	28	62	--	6.5	--	426	124	--	730	--	--
403	49	Trs	July --, 1948	do	7	34	10	187	392	111	23	--	45.0	--	601	126	--	990	--	--
501	48	Trs	do	do	9	410	111	282	116	1,390	390	--	.5	--	2,860	1,480	--	3,440	--	--
601	170	Trs	Feb. 3, 1964	TSDH	16	91	49	263	337	455	176	1.1	< .4	0.5	1,218	431	--	1,890	8.1	5.5
601	170	Trs	May --, 1953	USGS	17	93	54	255	343	466	178	.4	.5	--	1,230	454	--	1,880	7.9	--
801	125	Trs	May --, 1946	do	--	--	--	--	282	1,080	748	--	--	--	--	--	--	--	--	--
806	72	Trs	July 1, 1963	TSDH	13	186	104	120	145	860	69	.6	19.0	--	1,447	890	--	1,850	7.8	--

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Laboratory	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorption ratio
29-33-902	100	Trs	May --, 1946	USGS	--	192	62	108	292	406	217	--	0.0	--	1,350	734	--	--	--	--
906	131	Trs	May --, 1953	do	16	60	35	170	318	242	102	1.0	.5	0.48	783	294	--	1,260	7.7	4.8
906	136	Trs	Oct. 8, 1962	TSDH	17	33	28	154	245	194	80	1.2	< .4	--	632	197	--	1,050	8.5	--
908	200	Trs	June 6, 1963	do	14	200	62	620	207	520	930	.7	11.0	--	2,524	750	--	4,040	7.3	10.0
909	135	Trs	June --, 1945	CL	--	--	--	--	270	--	80	--	--	--	--	240	--	--	--	--
910	160	Trs	Mar. 29, 1963	TSDH	14	150	75	810	306	550	1,120	1.8	< .4	--	2,874	683	--	4,610	7.8	19.0
914	50	Trs	May 27, 1963	do	15	42	8	152	264	89	42	2.2	121	--	605	137	--	936	7.6	--
915	142	Trs	July 3, 1963	do	42	201	84	1,220	305	1,020	1,560	1.1	< .4	--	4,274	850	--	6,400	7.9	--
34-106	200	Trs	Aug. 3, 1963	do	14	55	76	301	317	610	154	1.7	< .4	--	1,368	449	--	2,005	7.9	6.2
207	178	Trs	July 18, 1963	do	17	209	182	377	412	750	670	2.9	21	--	2,430	1,270	--	3,580	7.6	4.6
209	205	Trs	Apr. 30, 1963	do	15	60	52	120	348	219	77	1.7	6	--	723	363	--	1,150	7.6	--
301	230	Trs	May --, 1953	USGS	28	94	48	119	339	270	87	.8	.0	.43	834	314	37	920	7.4	--
302	290	Trs	July 24, 1963	TSDH	22	119	76	139	359	227	268	.1	27	--	1,057	610	--	1,750	7.4	2.5
401	250	Trs	Mar. 24, 1960	USGS	14	43	34	139	328	198	49	1.5	.0	.68	644	248	55	1,010	7.7	3.9
413	203	Trs	May --, 1953	do	16	52	36	173	333	260	67	1.8	.0	.58	770	278	58	1,210	7.8	--
414	215	Trs	Aug. 23, 1963	TSDH	28	77	75	366	377	475	323	4.0	21	--	1,558	500	--	2,320	7.9	7.2
426	220	Trs	Mar. 29, 1963	do	14	55	33	165	333	240	66	2.0	< .4	--	740	272	--	1,150	8.1	3.3
501	51	Trs	May --, 1946	USGS	--	102	57	78	322	277	76	--	.0	--	805	489	--	--	--	--
505	160	Trs	May --, 1953	do	22	60	40	81	325	164	42	1.8	.0	.43	574	314	37	920	7.4	--
509	176	Trs	Dec. --, 1956	CL	--	96	60	101	342	320	70	--	--	--	815	490	30	--	7.4	2.0
515	248	Trs	Apr. 30, 1963	TSDH	18	67	45	128	294	187	108	1.9	66	--	770	351	--	1,200	7.5	--
701	238	Trs	Dec. --, 1955	USGS	15	58	35	112	281	227	46	1.2	.7	--	631	288	--	1,000	8.0	--
702	165	Trs	May --, 1946	do	--	196	91	91	316	696	55	--	.0	--	1,490	863	--	1,490	--	--
703	256	Trs	Mar. --, 1946	do	--	187	62	37	316	455	50	--	.0	--	1,010	722	--	--	--	--
706	105	Trs	Aug. 27, 1963	TSDH	15	118	63	405	397	510	428	1.5	< .4	--	1,738	550	--	2,670	7.6	--
714	233	Trs	Mar. 10, 1963	do	16	59	54	107	259	301	43	1.6	< .4	.47	708	369	--	1,075	8.0	--

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Labor-atory	Silica (SiO_2)	Cal-cium (Ca)	Magne-sium (Mg)	Sodium and potassium (Na + K)	Bicar-bonate (HCO_3)	Sul-fate (SO_4)	Chlo-ride (Cl)	Fluo-ride (F)	Ni-trate (NO_3)	Boron (B)	Dis-solved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorp-tion ratio
29-34-801	117	Trs	May --, 1946	USGS	--	126	62	69	310	393	40	--	--	--	966	570	--	966	--	--
802	28	Trs	do	do	--	205	51	28	266	396	52	--	98.0	--	994	721	--	--	--	--
803	188	Trs	Aug. 16, 1963	TSDH	16	82	42	54	314	193	35	1.3	< .4	0.49	580	380	19	885	8.0	1.2
804	170	Trs	May 6, 1953	USGS	18	226	97	73	325	689	105	1.0	.0	.24	1,370	963	13	1,870	7.6	--
905	232	Trs	do	do	18	66	35	35	310	70	36	1.4	.0	.20	379	308	20	703	7.6	--
908	150	Trs	May --, 1953	do	18	74	41	56	310	122	63	1.4	.0	.29	530	353	26	881	7.6	1.2
35-108	44	Trs	Apr. 29, 1963	TSDH	18	184	19	121	204	115	186	1.6	320.0	.30	1,066	540	--	1,650	7.3	2.3
202	230±	Trs	Apr. 18, 1963	do	18	81	43	60	353	163	35	2.3	< .4	.40	580	377	--	760	8.2	--
208	310	Trs	July 24, 1963	do	12	55	33	217	310	313	108	2.0	11.0	1.00	902	273	--	1,440	8.2	--
301	308	Trs	May --, 1960	USGS	26	86	37	54	314	150	50	--	4.0	.21	567	109	24	902	7.0	1.2
313	335	Trs	May 3, 1963	TSDH	16	92	46	63	321	217	51	2.2	< .4	.40	646	418	--	1,007	7.9	--
401	196	Trs	May --, 1953	USGS	18	63	28	42	272	60	27	2.0	2.0	.27	380	272	24	655	8.1	--
406	262	Trs	Apr. 24, 1963	TSDH	15	74	33	46	318	115	29	2.3	< .4	.44	468	322	--	777	8.0	1.1
416	200	Trs	Apr. 26, 1963	do	16	68	33	41	321	78	31	2.3	< .4	.35	426	307	--	710	7.6	1.1
504	250	Trs	Apr. 23, 1963	do	15	60	31	45	315	67	28	2.8	< .4	.42	399	278	--	695	7.8	--
507	280	Trs	Oct. --, 1954	--	--	66	42	52	263	180	30	--	--	--	498	334	25	--	8.5	--
601	333	Trs	July 16, 1963	TSDH	14	87	22	37	251	74	77	1.2	< .4	.36	432	309	--	766	7.6	.9
603	330	Trs	Aug. 7, 1963	do	14	70	43	35	326	113	29	1.9	< .4	.47	466	351	--	770	8.0	--
702	250	Trs	1951	do	30	122	41	75	287	275	75	2.3	6.0	--	674	473	--	1,440	--	--
704	268	Trs	Mar. 23, 1960	USGS	15	70	28	39	290	91	30	--	.2	--	416	290	23	695	7.3	1.0
704	268	Trs	May --, 1951	TSDH	18	108	38	61	287	258	39	1.8	.4	--	528	426	--	--	--	--
708	220	Trs	May --, 1953	USGS	14	66	30	45	320	66	34	1.4	.0	.21	395	288	24	703	8.1	--
712	185	Trs	--	TSDH	13	58	50	193	317	274	151	4.8	21	.75	918	350	--	1,440	8.0	[illegible]
801	315	Trs	May --, 1953	USGS	17	53	24	31	260	38	27	2.2	.0	.34	321	230	23	593	7.7	--
802	250	Trs	Aug. 17, 1963	TSDH	36	62	24	27	264	36	39	1.5	< .4	.32	355	253	--	590	[illegible]	[illegible]
905	310	Trs	Apr. 18, 1963	do	20	510	121	84	118	1,730	25	1.8	< .4	.82	2,550	1,750	--	2,750	[illegible]	[illegible]

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Labor- atory	Silica (SiO_2)	Cal- cium (Ca)	Magne- sium (Mg)	Sodium and potassium (Na + K)	Bicar- bonate (HCO_3)	Sul- fate (SO_4)	Chlo- ride (Cl)	Fluo- ride (F)	Ni- trate (NO_3)	Boron (B)	Dis- solved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorp- tion ratio
29-35-907	340	Trs	July 24, 1963	TSDH	13	65	22	26	260	36	40	1.2	< 0.4	0.38	331	254	--	588	7.9	--
36-301	152	Trs	do	do	16	122	61	80	212	424	85	1.3	< .4	--	892	560	--	1,300	7.7	1.4
401	248	Trs	Apr. 18, 1963	do	16	74	26	29	278	67	37	2.4	< .4	.29	388	290	--	665	8.0	--
414	335	Trs	do	do	15	81	24	29	248	59	54	1.9	15	.32	404	300	--	710	7.7	--
416	230	Trs	Aug. 17, 1963	do	14	51	33	25	185	109	39	1.7	< .4	.37	364	262	--	616	7.9	.7
501	208	Trs	July --, 1960	USGS	21	76	23	35	277	52	36	1.4	3.5	--	436	284	16	--	--	--
601	165	Trs	Mar. --, 1960	do	21	94	27	31	258	74	75	1.6	20	.34	477	346	--	817	7.1	.7
602	165	Trs	1947	do	38	74	22	17	220	53	50	1.8	8.0	--	398	275	--	--	--	--
702	300	Trs	July 24, 1963	TSDH	12	68	21	24	268	32	36	.7	2.0	.29	327	259	--	585	7.9	--
811	240	Trs	July 19, 1963	do	22	68	20	14	261	39	24	.9	< .4	.28	316	255	--	555	7.3	.4
820	200	Trs	Aug. 17, 1963	do	15	60	14	28	204	36	43	.6	3.0	.30	300	207	--	532	7.6	--
905	180	Trs	Apr. 13, 1960	USGS	15	79	12	16	275	22	19	--	4.0	--	304	246	--	529	7.1	.4
41-104	81	Trs	June 28, 1963	TSDH	11	170	52	186	359	670	53	1.7	< .4	--	1,317	640	--	1,750	7.9	--
302	78	Trs	May --, 1946	USGS	--	--	--	--	374	1,020	678	--	--	--	--	--	--	--	--	--
304	160	Trs	May 27, 1963	TSDH	22	112	49	220	222	129	218	1.0	462	.41	1,327	483	--	1,940	7.3	--
501	62	Trs	June 28, 1963	do	36	78	37	141	272	251	136	1.7	3.0	--	821	346	--	1,240	7.7	--
701	131	Trs	July 18, 1963	do	5	32	34	650	282	520	600	1.7	12	--	1,996	221	--	3,170	7.4	--
702	120	Trs	July 26, 1963	do	14	228	178	497	311	1,630	331	1.3	< .4	--	3,031	1,300	--	3,720	8.0	--
802	120	P	Aug. 14, 1963	do	27	116	77	975	427	1,400	600	1.5	< .4	--	3,402	610	--	4,800	7.8	--
42-101	132	Trs	May --, 1946	do	--	163	82	68	334	507	36	--	.0	--	970	744	--	--	--	--
102	120	Trs	Oct. 8, 1962	do	22	132	65	63	273	432	31	1.0	< .4	--	880	600	--	1,270	7.9	1.1
203	110	Trs	May --, 1946	USGS	--	--	--	--	314	204	40	--	--	--	--	--	--	--	--	--
205	139	Trs	do	do	--	122	89	149	320	367	209	--	47.0	--	1,320	670	--	--	--	--
207	180	Trs	July 25, 1963	TSDH	19	77	50	59	345	196	34	1.3	< .4	--	604	398	--	947	7.8	5.3
209	120	Trs	July 28, 1963	do	21	402	94	72	183	1,260	51	1.5	37	--	2,027	1,390	--	2,340	7.3	.8
301	150	Trs	May 7, 1953	USGS	18	90	39	34	304	118	57	1.0	.0	--	506	385	14	852	7.5	--

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Labor-atory	Silica (SiO_2)	Cal-cium (Ca)	Magne-sium (Mg)	Sodium and potassium (Na + K)	Bicar-bonate (HCO_3)	Sul-fate (SO_4)	Chlo-ride (Cl)	Fluo-ride (F)	Ni-trate (NO_3)	Boron (B)	Dis-solved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorp-tion ratio
29-42-302	170	Trs	May 20, 1960	USGS	16	84	31	41	288	127	49	--	0.5	0.16	494	337	21	817	7.1	1.0
304	170	Trs	Aug. 7, 1963	TSDH	39	92	58	97	309	274	99	2.1	5	.56	822	469	--	1,220	7.3	--
307	261	Trs	May 7, 1953	USGS	21	362	118	200	172	1,480	103	1.8	.2	.83	2,370	1,390	24	2,840	7.3	--
601	120	Trs	Feb. 3, 1964	TSDH	16	171	64	39	326	406	61	1.2	< .4	--	914	690	--	1,350	7.9	.7
802	125±	Trs	May 18, 1953	USGS	24	135	45	79	239	116	220	.8	70	.18	974	522	25	1,390	7.5	--
902	100±	Trs	July 19, 1963	TSDH	21	113	46	50	377	188	65	1.5	< .4	.42	668	468	--	1,035	7.7	1.0
43-102	150	Trs	Aug. 19, 1963	do	35	85	29	32	248	108	63	1.1	< .4	.35	474	331	--	763	7.5	--
103	130	Trs	May 7, 1953	USGS	17	84	31	33	288	81	61	.8	2.2	.90	505	337	16	775	7.6	--
110	260	Trs	Apr. 24, 1963	TSDH	15	126	47	69	288	166	169	4.1	12	.35	753	510	--	1,250	7.4	--
123	115	Trs	Apr. 21, 1963	do	18	315	89	61	181	1,010	43	1.4	< .4	.51	1,628	1,150	--	1,990	8.4	--
202	283	Trs	July 18, 1963	do	14	79	27	33	284	74	58	1.2	< .4	.35	425	311	--	732	7.9	--
209	138	Trs	Apr. 23, 1963	do	15	79	21	22	266	39	46	1.2	4	.15	357	283	--	640	7.7	--
402	115	Trs	May 7, 1953	do	19	73	33	29	239	102	56	.6	2.2	.18	341	318	17	792	7.8	--
404	230	Trs	do	do	16	86	32	25	303	90	39	1.5	< .4	.20	435	348	--	750	7.9	.6
502	200	Trs	July 19, 1963	do	43	77	27	28	294	65	39	1.0	1.5	.31	430	304	--	685	7.8	.7
507	117	Trs	--	do	--	246	160	46	266	100	100	--	--	--	570	406	--	--	7.3	--
510	113	Trs	June 26, 1963	do	40	63	43	36	218	97	82	1.4	26	.34	499	334	--	804	8.0	--
602	220	Trs	Aug. 16, 1963	do	14	178	42	190	264	280	319	1.2	50	.69	1,205	620	--	1,960	7.4	--
701	210±	Trs	Apr. 30, 1963	do	18	29	32	26	301	85	32	1.4	< .4	.30	416	327	--	713	7.5	--
804	90	Trs	June 25, 1963	do	12	49	52	29	376	48	30	.6	< .4	--	408	337	--	706	8.3	--
902	135	Trs	May 22, 1963	do	15	131	59	101	379	309	97	1.0	2.5	.48	907	570	--	1,400	7.7	[illegible]
44-102	215	Trs	May 5, 1960	USGS	15	61	30	27	296	36	36	--	1.2	.08	355	276	17	616	[illegible]	[illegible]
104	150	Trs	Apr. 18, 1963	TSDH	14	80	17	30	256	43	51	.6	9	.20	369	270	--	[illegible]	[illegible]	[illegible]
116	232	Trs	Mar. 11, 1963	do	15	98	16	37	272	62	73	.3	4.5	.26	441	311	--	762	[illegible]	[illegible]
308	205	Trs	Aug. 7, 1963	do	12	43	7	15	149	15	16	.5	3.5	.23	185	136	--	[illegible]	[illegible]	[illegible]
501	215	Trs	May 1, 1962	CL	8	356	64	72	--	132	142	--	--	--	--	420	--	[illegible]	[illegible]	[illegible]

Table 8.--Chemical analyses of water from selected wells and springs--Continued

Well	Depth of well (ft)	Water bearing unit	Date of collection	Labor-atory	Silica (SiO_2)	Cal-cium (Ca)	Magne-sium (Mg)	Sodium and potassium (Na + K)	Bicar-bonate (HCO_3)	Sul-fate (SO_4)	Chlo-ride (Cl)	Fluo-ride (F)	Ni-trate (NO_3)	Boron (B)	Dis-solved solids	Total hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C.)	pH	Sodium adsorp-tion ratio
29-44-603	100±	Kt	July 26, 1963	TSDH	13	77	4	22	246	24	17	0.5	7	0.28	286	211	--	496	7.5	0.7
901	290	Kt	July 29, 1963	do	11	73	19	18	245	46	31	.6	< .4	.42	318	261	--	565	7.6	.5
45-101	206	Trs	Apr. 21, 1950	USGS	16	79	18	20	276	38	32	--	6.1	--	366	271	--	639	7.3	--
703	262	Kt	Mar. 21, 1960	do	13	74	19	20	282	28	30	--	4.5	--	328	262	14	579	7.1	.5
49-201	56±	Trs	Aug. 26, 1963	TSDH	14	111	61	397	282	440	447	1.0	1.3	--	1,696	530	--	2,650	7.6	
301	97±	Trs	Aug. 25, 1963	do	13	119	43	151	327	670	43	1.5	< .4	--	1,283	680	--	1,660	7.6	--
702	Spring	Ca	May 16, 1963	do	18	45	6	27	148	20	30	.5	9.0	.18	229	138	--	402	7.8	--
703	105	Ca	do	do	27	47	17	55	209	37	69	.9	1.0	--	356	188	--	625	7.9	--
801	26	Ca	do	do	30	46	17	46	217	32	57	1.0	2.0	--	337	186	--	582	[illegible]	--
50-402	300	P	--	CL	--	1,500	304	38,196	55	7,400	57,000	--	--	--	--	--	--	--	7.2	--
501	70	P	May 16, 1963	TSDH	20	610	154	109	66	1,930	233	2.8	< .4	--	3,096	2,150	--	3,492	7.1	--
603	83	P	do	do	14	640	206	184	90	1,850	540	1.8	20.0	--	3,504	2,450	--	4,160	7.7	--
51-106	119	Trs	Aug. 17, 1963	do	20	80	38	34	303	110	47	1.7	.5	.4	475	357	--	796	7.5	.8
801	100±	P	Nov. 2, 1962	do	29	491	102	60	128	1,500	54	.5	4.3	--	2,304	1,648	--	2,550	7.5	--
903	145	Trs	Apr. 7, 1961	USGS	13	99	30	36	344	99	44	.7	.0	--	491	370	17	816	[illegible]	.8
52-104	155±	Kt	July 31, 1963	TSDH	12	79	7	14	242	30	15	.4	1.0	.28	277	226	--	482	7.4	.4
312	156±	Kt	Nov. 7, 1962	do	11	33	11	20	122	36	19	.7	< .4	.34	191	127	--	340	8.2	.4
602	150	Kt	Aug. 2, 1963	do	11	63	16	13	248	24	14	.6	1.5	.26	265	223	--	470	7.4	--
807	280	Kt	Mar. 1, 1963	do	13	69	15	20	260	29	23	1.1	1.0	.28	298	234	--	525	7.3	.5
53-106	145	Kf	Aug. 19, 1963	do	14	96	16	43	277	50	70	.6	19.0	.47	449	305	--	780	7.7	--
702	45±	Kt	May 29, 1963	do	12	53	21	6	256	9	7	.2	1.5	--	235	218	--	424	7.9	.2
58-101	178	P	Nov. 9, 1962	do	15	113	66	232	273	653	108	1.5	< .4	--	1,323	552	--	1,940	7.5	--
59-104	70	P	May 16, 1963	do	20	590	93	37	87	1,730	57	1.9	.5	.34	2,576	1,850	--	2,700	7.3	--
303	150	P	Nov. 2, 1962	do	19	535	126	268	23	2,186	136	.3	< .4	--	3,281	1,856	--	3,550	6.5	--
304	117	Trs	May 28, 1963	do	14	80	45	31	357	97	42	.9	< .4	--	488	385	--	815	8.1	.7
60-202	162	Kt,Trs	May 29, 1963	do	12	63	36	8	351	21	11	< .1	< .4	.19	321	306	--	575	8.0	.2
301	83	Kt	do	do	11	59	26	15	282	30	13	.7	1.5	.25	294	253	--	520	8.0	--

Table 9.--Oil wells and stratigraphic tests selected as data-control points*

Log type: D, Driller's Log; E, Electric; ER, Resistivity Log; G, Gamma Ray; GE, Gamma Ray-Electric; GN, Gamma Ray-Neutron; GS, Gamma Ray-Sonic.

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
28-32-706	Hunt Oil Co.	Lucy Hodnett No. 1	G	2,250
39-301	Union Sulfur & Oil Co.	E. E. Erwin No. 1	G	2,302
302	Deep Rock Oil Co.	C. L. Jones No. 1	GE	2,311
40-202	W. R. Goddard Enterprises	C. P. Coleman No. B2	GN	2,220
303	Kay Kimbell et al.	Willard Thurman No. 1	GN	2,213
304	Bill Holland	E. E. Erwin No. 1-B	GN	2,282
305	British-American Oil Co.	Everts Est. No. 1	G	2,251
306	do	W. C. Berry No. 1	G	2,269
307	W. H. Black	Lucy Coleman No. B-1	GN	2,221
308	O. P. Leonard	Erwin No. 1	G	2,194
403	Bob Dean Ltd.	Brennand No. 1	GN	2,162
404	Durham Drilling Co.	R. S. Brennand No. 1	D	2,103
502	R. M. Vandergrift	J. C. Womack No. 1	GN	2,173
503	Ibex Co.	Stockard-Smart No. 4	GN	2,136
505	Standard of Texas	Adams No. 2	D	2,126
506	do	Elder No. 2	D	2,137
604	Blue Danube Oil Co.	Strain No. B-4	GN	2,140
701	Paul Hoskins	Henderson No. 1	GN	2,212
706	do	Henderson No. 2	GN	2,212
709	Anderson & Manor Oil Co.	Ellett No. A-3	GN	2,180
710	Union Exploration	York No. 1	GN	2,219
801	Standard of Texas	H. C. Miller No. 11	GN	2,161
805	Norma Producing Co.	Morrison No. 3	GN	2,171
904	W. B. Rice	Butler No. 1	GN	2,145

*Logs in files of Texas Water Development Board.

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
28-47-301	Texaco Inc.	Mitchell No. B-2	GN	2,233
302	do	Mitchell No. B-1	GN	2,249
603	Standard of Texas	Foster No. 3-B	GN	2,343
902	Magnolia Petroleum Co.	Mary Foster No. 57	GN	2,262
48-101	R. S. Anderson	Morrison 38A No. 1	GN	2,183
102	Anderson & Manor Oil Co.	Sayers No. 1	GN	2,182
104	TXL Oil Co.	Mitchell No. 2	GN	2,194
201	Standard of Texas	Z. F. Morrison No. 1	GN	2,180
202	Anderson Prichard Oil Co.	Morrison B-9	GN	2,122
203	do	Morrison C-4	GN	2,211
204	Standard of Texas	LeSure No. 2	D	2,150
305	Blue Danube Oil Co.	May No. 1	GN,D	2,165
402	do	Lotspeich No. 1	GN	2,259
403	R. S. Anderson	Mobil No. 1	GN	2,240
404	Humble Oil Co.	Maud Farmer et. al. No. 1	GN	2,307
405	do	J. S. Trulock No. 1	GN	2,197
607	Gulf Oil Corp.	Dillingham No. 1	G	2,181
701	Robinson Drilling Co.	Bell "A" No. 1	GN	2,226
55-601	Lawless Drilling Co.	F. L. Terry No. 1	GS	2,257
901	Daugherty Oil Co.	Scott No. 1	GN	2,371
906	D. W. Varel	Scott No. 1	GN	2,343
56-301	Skelly Oil Co.	Margaret L. Moore No. 1	E	2,198
501	Schkade Bros. Drilling	P. H. Lawson No. 1	GN	2,137
502	Humble Oil Co.	Minnie P. Cooper No. 1	GE	2,157
63-301	Cities Service Oil Co.	Ellwood No. 1	GN	2,353
64-101	Continental Oil Co.	Ellwood No. 1	GE	2,312
29-25-704	Large Drilling Co.	Jackson No. 1	GN	2,210

Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
29-25-802	Frank Waters Oil Co.	R. J. Byrd No. 19	GN	2,156
26-806	Marty Freedman	Hart No. 1	G	2,332
33-204	Burdell Oil Co.	F. M. Mills No. 2	--	2,195
209	Stanton Barbour	F. M. Mills No. 1	GN	2,168
406	Kay Kimbrell et. al.	T. L. Holman No. 1	GN	2,226
503	Miami Operating Co.	J. Dell Barber 1-A	E	2,150
916	W. A. Delaney Jr.	Brown Estate No. 1	GN	2,195
34-103	James P. George	Mary E. Johnson	GE	2,198
522	Standard of Kansas	George Tickle No. 1	E	2,211
35-209	Texas Crude Oil Co.	Pitzer No. 1-20	E	2,330
210	Capitol Oil Co.	Mary Ebie No. 1	E	2,426
317	General Crude Oil Co.	Emil Shattel No. 1	E	2,381
411	Hussie Hunt Trust	L. E. Bennett No. 1	GE	2,245
36-206	C. B. Drilling Co.	Hayden No. 1	E	2,404
509	Cities Service Oil Co.	J. P. Cooper No. 1	GE	2,386
522	Miami Operating Co.	Roy Rasco No. 1	E	2,393
523	American Trading & Prod. Co.	Fischer No. 1	E	2,392
703	Skelly Oil Co.	--	E	2,458
807	do	--	ER	2,421
823	do	E. A. Ater No. 1	GN	2,446
920	Guffey & McLaughin	Mattie Harp No. 1	E	2,444
37-403	Plymouth Oil Co.	McClure No. 1	E	2,396
705	Rex Moore	C. T. Tatum No. 1	E	2,304
706	Union Oil Co.	--	ER	2,422
41-107	Pure Oil Co.	W. T. Brooks No. 1	GN	2,097
303	W. W. Murray	C. C. Thompson No. 1	E	2,084
504	Seaboard Oil Co.	Thompson No. 1	G	2,062
505	California Company	Richardson No. 1	D	2,105

Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
29-41-801	Roark & Hooper	J. E. Northcutt No. 1	GN	2,108
42-321	Sohio Petroleum Co.	Yarbrough No. 1	E	2,211
505	Phillips Petroleum Co.	Wulfgen No. 1	G	2,133
604	Flour Bluff Oil Co.	Girvin No. 1	GE	2,142
905	Miami Operating Co.	McAdams No. 1-A	E	2,251
906	Cosden Petroleum Co.	Stubblefield No. 1	G	2,254
43-211	Great Western Drilling Co.	O. W. Baumann No. 1	G	2,266
407	Tex-West Oil Corp.	R. C. Small No. 1	E	2,292
608	Deep Rock Oil Corp.	Georgia Tech 1-A	GE	2,343
44-206	Choya Drilling Co.	A. J. Winberly No. 1	GE	2,414
207	Skelly Oil Co.	--	ER	2,333
302	Union Oil Co.	--	ER	2,494
303	Skelly Oil Co.	--	ER	2,497
307	Union Oil Co.	Evelyn Daniels No. 1	E	2,526
416	Thomas & Billups Drlg. Co.	Richey Est No. 1	E	2,439
507	Skelly Oil Co.	--	D	2,491
509	do	--	D	2,499
703	British American Oil Co.	O. F. Lindsey B1	G	2,378
804	C. L. Norsworthy Jr.	Daniels No. 1	E	2,407
902	J. S. Michael	Gus Farrar No. 1	E	2,593
904	Sun Oil & Seaboard Oil Co.	Stone No. 18	E	2,535
45-102	Union Oil Co.	--	ER	2,499
401	Sun Oil Co.	Mary S. B. Cook No. 1	E	2,567
403	do	B. K. Stone No. 1	E	2,554
404	Hanley Co.	TXL No. 1K	--	2,490
49-202	S. F. Hurlbut	Wallis No. 1	G	2,063
602	Sunray-Mid-Continent	Chappell No. 1	G	2,005
901	Sun Oil Co.	Ellwood Est. No. 2	E	2,132

Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
29-50-202	Hurlbut & Olson	Ellwood Est. No. 1	G	2,079
701	Sun Oil Co.	Ellwood No. 1	GE	2,168
51-104	Richardson & Bass	J. H. Nail Est. No. 1	GN	2,177
107	R. S. Brennand	Byrne No. 1	E	2,207
302	American Liberty Co.	Spires No. 1	E	2,333
502	R. S. Brennand	D. W. Wallace No. 1	E	2,260
805	Richardson & Bass	J. H. Jameson No. 1	GE	2,265
901	C. L. Norsworthy	A. G. Compton A-1	E	2,335
52-206	Skelly Oil Co.	Sears A-24	GN	2,488
207	Union Oil of Calif.	Lance Sears No. 1-151	E	2,476
304	Skelly Oil Co.	--	ER	2,572
305	do	--	ER	2,557
309	Champlin Oil Corp.	Lone Star Cement No. 3	E	2,581
310	Pure Oil Co.	Lance Sears No. 2	E	2,540
311	C. L. Norsworthy	Sears No. 1	E	2,516
408	Sun Oil Co.	M. L. Compton No. 1	E	2,449
410	Honolulu Oil Corp.	Spires No. 1	GE	2,596
502	Sun Oil Company	Virginia Baker No. C-1	E	2,562
702	Norsworthy & Foree	Helen Compton No. 1	GR	2,493
801	Sun Oil Co.	Enice Parramore No. 2	E	2,575
802	do	Enice Parramore No. 1	E	2,586
805	do	Enice Parramore No. A-3	E	2,592
806	Pure Oil Co.	Enice Parramore No. 1	E	2,552
901	Sun Oil Co.	J. P. Maddox No. 1	E	2,524
905	C. L. Norsworthy	J. P. Maddox No. 1	E	2,491
53-102	Skelly Oil Co.	--	ER	2,569
402	Harper & Huffman	Sears No. 1	GE	2,533

Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

Well	Operator	Lease and well	Log type	Approximate land-surface elevation
29-53-701	A. W. & Blair Cherry	J. P. Maddox No. 1	E	2,446
57-101	Gulf Oil Corp.	Jessie Chappell et al.	GN	2,259
59-106	Amerada Petroleum	McCable No. 1	G	2,158
203	Magnolia Petroleum	J. S. Walker No. 1	GN	2,191
305	Forest Exploration	Foster Price No. 1	GS	2,399
60-201	Sun Oil Co.	Jo Ella Leeper No. 1	E	2,428
61-102	Humble Oil Co.	Z. P. Arledge et al. No. 1	E	2,435