1R - 164

REPORTS

DATE:

7-23-1980

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
WESTERN BANK BUILDING, 7TH FLOOR
505 MARQUETTE N.W., ALBUQUERQUE, N.M. 87102

MAILING ADDRESS:
P.O. BOX 26659, ALBUQUERQUE, N.M. 87125

WALTER A. MOURANT
GEOLOGIST/HYDROLOGIST

TELEPHONE:
766-2810

July 23, 1980

Tom Parkhill
OCC
P.O. Box 2088
Santa Fe, NM 87501

Dear Tom,

Enclosed are copies of SF 9-260 that you requested.

Best regards,

Walt Mourant

Ground Water Study
in and around Section 13, Township 19 South, Range 32 East, and Section 18, Township 19 South, Range 33 East, Lea County, New Mexico

Thomas A. Parkhill
Oil Conservation Division
July 15, 1980

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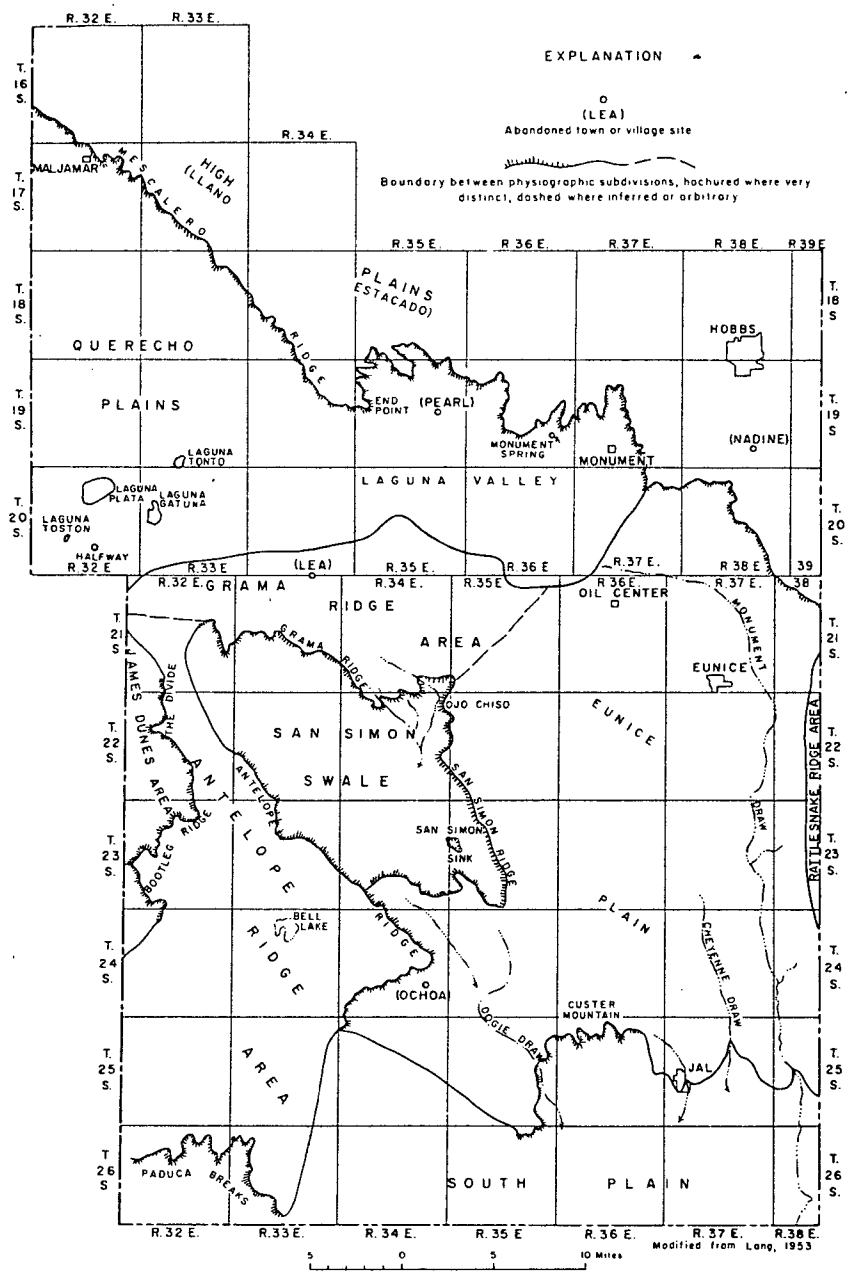


Figure 1

PHYSIOGRAPHIC SUBDIVISIONS OF SOUTHERN LEA COUNTY, N. MEX.

From Nicholson and Clebsch, 1961

INTRODUCTION

A ground water study was done to determine whether or not the surface disposal of oil field brines should be continued in and around Section 13, Township 19 South, Range 32 East, and Section 18, Township 19 South, Range 33 East, Western Lea County, New Mexico. This area is currently given an exemption from the provisions of Order R-3221 which allows for surface disposal of oil field brines. The land owners who have water wells in this area are Mr. Larry Squires and Mr. Mark Smith.

PHYSIOGRAPHY

The topography of this area is dominated by the Querecho Plains (fig. 1) which is a vast area of stable or semi-stable sand dunes covering approximately 400 square miles. A very irregular surface exists here with no drainage features except at the edges of several playa lakes. The four playa lakes which form the prominent features of this area are Laguna Plata, Laguna Gutuna, Laguna Tonto, and Laguna Toston.

GEOLOGY

The surface geology of the study area is dominated by sediments of Quaternary and Triassic age which relate directly to useable ground water. The subsurface geology of the area includes the large, highly complex structure known as the Permian basin. Rocks here range from Precambrian to Permian in age. They are not significant to useable ground water, but they are the source of the highly mineralized water produced with oil. Rocks of these ages will not be described here.

Triassic age rocks of the Dockum group unconformably overlie rocks of Permian age and range in thickness from 0 to 1570 feet in southern Lea County. The Triassic formations have a gentle dip in a south to southeast direction. The Dockum group can be divided into the Santa Rosa sandstone and the Chinle formation, but the distinction is not made in this area because of lithologic similarities and poor exposures. The Santa Rosa is a fine to coarse-grained sandstone with a thickness which varies from 140 to more than 400 feet. In places it contains minor shale layers. The sand grains approach silt size in some places and conglomeratic rock can be found elsewhere. Its color is generally red but it contains sands colored white, gray, and greenish-gray. The Santa Rosa is exposed in the southwestern parts of T20S, R32E.

Table 1. Stratigraphic Units in and around T19S, R32E and T19S, R33E

	Geologic Age	Geologic Unit	Thickness (ft.)	General Character	Water-Bearing Properties
Cenozoic Quaternary	Recent and Pleistocene	Sand	0-30±	Dune sand, unconsolidated, stabilized to drifting, semiconsolidated at depth; fine to medium-grained.	Above the zone of saturation, hence does not yield water to wells. Aids recharge to underlying formations by permitting rapid infiltration of rain water.
		Alluvium	0-400±	Channel and lake deposits; alternating thick bedded calcareous silt, fine sand, and clay; thickest in San Simon Swale; less than 100 feet thick in most places.	Saturated and highly permeable in places in east end of Laguna Valley. Forms continuous aquifer with Ogallala formation. Will usually yield less than 30 gpm. Locally above the water table.
Mesozoic Triassic Dockum group		Chinle formation	0-1,270±	Claystone, red and green, minor fine-grained sandstones and siltstones; underlines all of eastern part of southern Lea County area; thins westward; absent in extreme west.	Yields small quantities of water from sandstone beds. Yields are rarely over 10 gpm. Water has high sulfate content.
		Santa Rosa sandstone	140-300±	Sandstone, chiefly red but locally white, gray, or greenish-gray; fine- to coarse-grained; exposed in extreme west; underlies Cenozoic rocks in western part of area, and is present at depth in eastern part.	Yields small quantities of water over most of the area. Some wells are reported to yield as much as 100 gpm. Water has high sulfate content.
Paleozoic Permian or Triassic		Undifferentiated	90-400+	Siltstone, red, shale, and sandstone; present at depth under all of southern Lea County.	No wells are known to be bottomed in the red beds. Probably can yield very small quantities of high-sulfate water.
Paleozoic Ordovician through Permian			6,500-17,000±	Thick basin deposits ranging in character from evaporites to coarse clastics; thinnest on the east side of the area over the Central basin platform, thickest toward the southwest.	No presently usable water supply available from these rocks. Source of highly mineralized oil-field waters.
Precambrian				Granite, granodioritic and other igneous and metamorphic rocks; complex structure.	Not hydrologically significant.

Modified from Nicholson and Clebsch, 1961

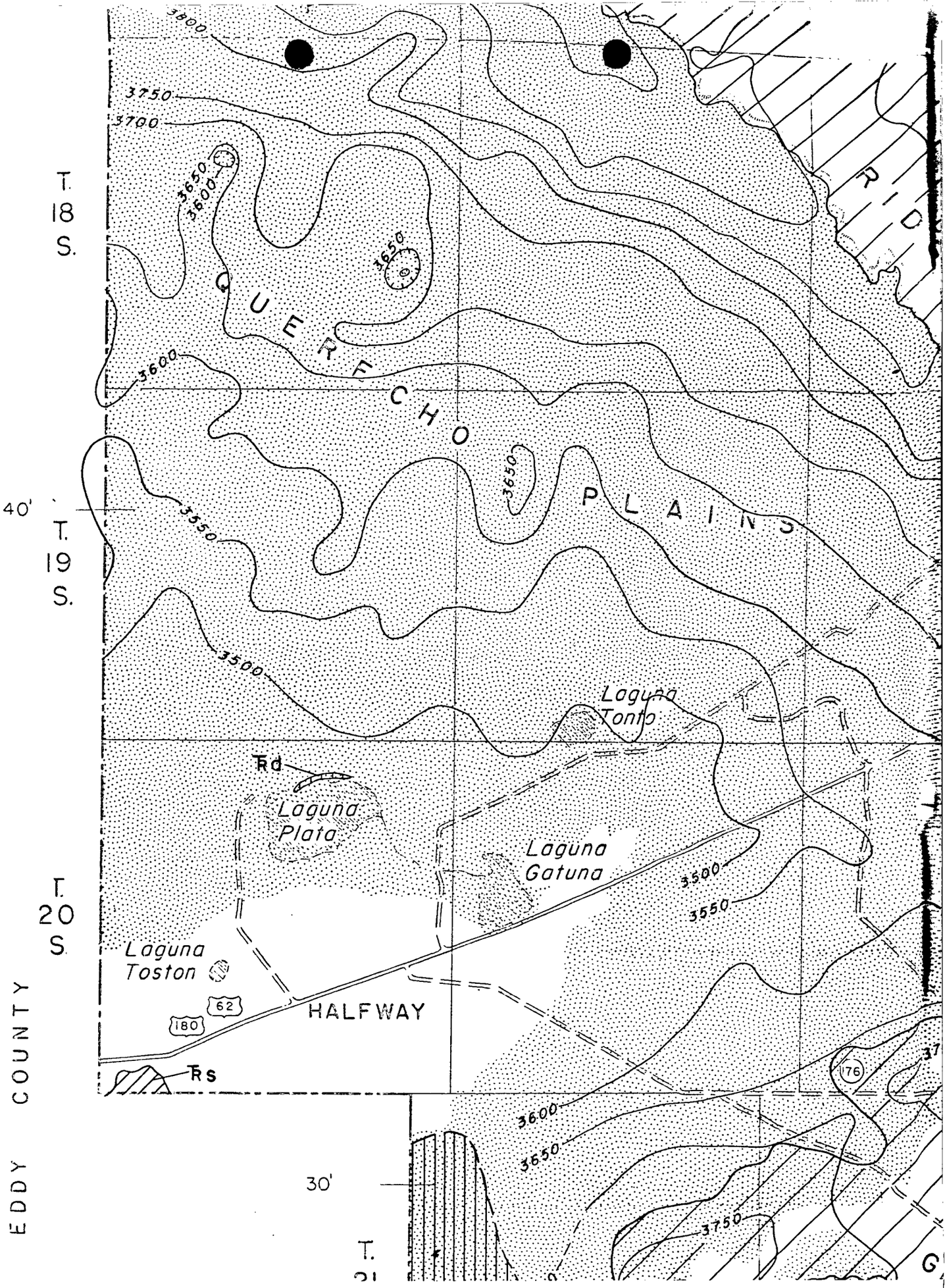


Figure 2. Geologic Map of T19S, R32E and T19S, R33E

EXPLANATION

Sand

Thin cover of drift sand in most places; locally dunes 20 - 40 feet high

Trc Trd Trs

Dockum group

Trc -Chinle formation, red and green claystone, minor siltstone, and fine-grained sandstone;

Trs -Santa Rosa sandstone, red to white poorly sorted, coarse-grained, crossbedded

Recent

Qal

nary

Triassic

assic

The Chinle is the uppermost formation of the Dockum group and ranges in thickness from 0 to 1270 feet. It is thickest in eastern Lea County and entirely absent in western Lea County because of post-Mesozoic erosion. The Chinle is dominantly a red and green claystone, but it contains thin beds of fine grained sandstones and siltstones.

Quaternary age rocks present in Lea County are in the form of alluvial deposits, with some channel and lake deposits which are probably both Pleistocene and Recent age. The dune sands are of Recent age. The alluvium in the study area has been deposited directly on the Triassic Dockum group erosion surface which forms a topographically low area. The thickness of the alluvium ranges from a few inches to more than 400 feet (in the San Simon Sink) but it is generally less than 100 feet thick. The alluvium is composed of a poorly consolidated calcareous silt, fine sand and clays.

The red dune sands (called "Mescalero Sands") are the extensive Quaternary unit, which covers about 80% of southern Lea County. Much of this sand has probably been derived from rocks of Permian and Triassic age in the Pecos Valley in Eddy County. This sand is generally fine to medium grained, with a uniformly reddish brown color.

GROUND WATER RESOURCES

All useable ground water in this study area comes from two (2) principal geologic units, the Dockum group and Quaternary alluvium. No potable water is found below the Permian-Triassic unconformity.

The water wells of the Quaternary alluvium is generally a better chemical quality than that from rocks of Triassic age. The younger rocks are more permeable, therefore producing wells with better yields.

The Santa Rosa sandstone is the principal aquifer present in the western third of southern Lea County. The unit is recharged by precipitation on the Quaternary sand dunes; by precipitation and runoff directly on the outcrops; and probably by ground water flow from the overlying Quaternary alluvium. The study area is probably being recharged by the ground water mound located in T22S, R32E, which represents recharge from the outcrop and infiltration through the dune-sand cover (Nicholson and Clebsch, 1961).

The study area's water table contour map indicates that water discharges from the Triassic rocks are in the vicinity of the four (4) playa lakes. The ground water flow is in a generally south-westward direction. No water discharges into the atmosphere because the lake surfaces are 200 feet higher than the pressure surface in the Santa Rosa aquifer. Nicholson and Clebsch, 1961, concluded that the Santa Rosa discharges downward into the Permian rocks, inasmuch

as the lakes appear to be collapse structures, which probably has greatly increased the vertical permeability.

Information about the Quaternary alluvium indicates that it acts as both an aquifer and a means of recharge for the Triassic rocks. Quoting from Nicholson and Clebsch, 1961, "Some water apparently spills over the buried red-bed ridge and moves southwestward; however, on the basis of the limited data available, there does not seem to be a continuous saturated zone in the thin cover of alluvium in the Querecho Plains. This probably results partly from the fact that precipitation is significantly lower in the Querecho Plains and partly from the fact that the Santa Rosa sandstone, which underlies much of the area, is sufficiently permeable to accept most of the water that infiltrates through the alluvium." The ground water movement in the Quaternary sediments in this area appears to be the same southwesterly direction as the Triassic rocks.

The following list of data on aquifers that have produced fresh water was obtained from J. Runyan's April, 1970 report.

1. Upper water sand/aquifer

    a) Windmill, Mr. Smith's house - Unit H, Section 26, T19S, R33E - household and domestic use. TD 98 feet, water level 91 feet, chlorides 298 PPM, specific conductance 2560.

    b) Windmill - Unit B, Section 31, T19S, R34E - TD 120 feet, chlorides 289 PPM, specific conductance 2290.

    c) Windmill - Unit E, Section 31, T19S, R34E - TD 66 feet, water level 58 feet, chlorides 717 PPM, specific conductance 4420.
    This mill is abandoned due to rods and pump in hole, due to broken rod.

    d) Windmill - Unit P, Section 4, T20S, R34E - used for cattle, shallow well, chlorides 1450 PPM, specific conductance 9890.

2. Middle water sand/aquifer

    a) Fresh water well - drilled for rig water, Unit M, Section 16, T19S, R34E - TD 408 feet, water level 360 feet, reported by Gulf Oil to be fresh.

    b) Water sand encountered in P & A well, when drilled, Unit O, Section 33, T19S, R34E. Water sand at 280 - 290 feet. Reported on C-105.

3. Lower water sand - Santa Rosa:

a) Encountered in P & A well, when drilled, Unit F, Section 28, T19S, R34E. Depth 808 - 860 feet. Reported on C-105.

b) Encountered in P & A well, when drilled, Unit N, Section 28, T19S, R34E. Depth 830 to 850 feet. Reported on C-105.

c) Encountered in P & A well, when drilled, Unit L, Section 30, T19S, R34E. Depth 785 to 810 feet. Reported on C-105.

The saturated thickness of the Quaternary aquifer is thin, ranging from a thickness of 6 to 10 feet thick. Triassic rocks contain aquifers with saturated thickness which range from 10 to 52 feet thick.

Hydrologic cross sections developed from available information were drawn on N-S and E-W lines. They indicate that the Quaternary and Triassic aquifer have their own distinct water tables which dip in a southerly direction.

Ground water flow lines were added to figure 3. The direction of flow of ground water was determined to be a south to southwesterly direction. This is true for both the Quaternary and Triassic aquifers.

The brine pit (Unit E, Section 18, T19S, R33E) could, with time, contaminate the Snyder Ranch's East and West well.

The water contamination plume would travel in a southwest direction and is apt to pollute any fresh water well in its path. The period of time for pollution to occur may vary from about 10 to 30 years from the time the pit was first used.

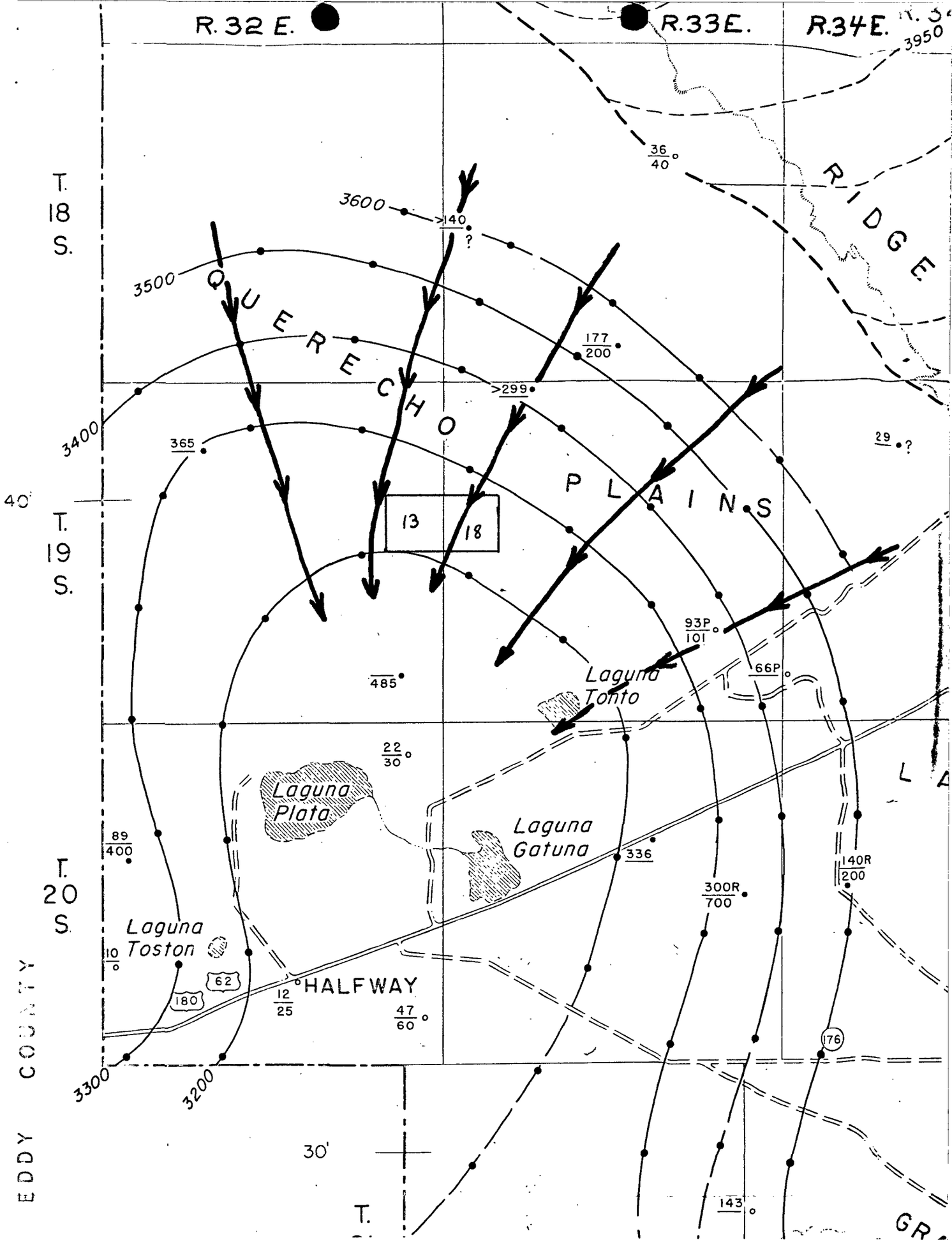


Figure 3. Ground Water Map of T19S, R32E and T19S, R33E

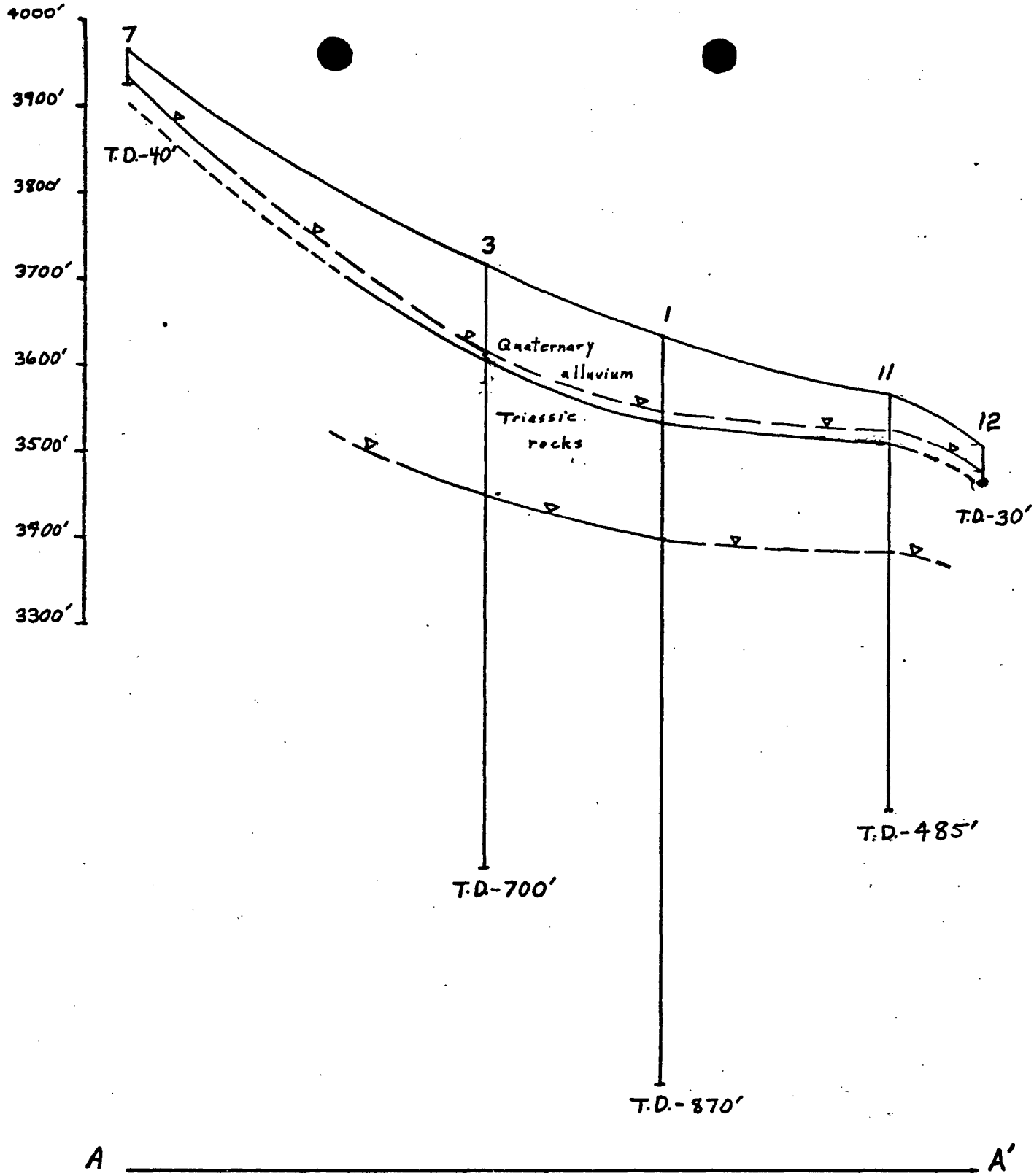
EXPLANATION

150/252 — Water well

Upper figure is depth to water; lower figure is depth of well. Open circles are wells finished in Tertiary or Quaternary rocks;

Ground-water flow lines

R = Reported
P = Water level measured while pumping
? = Uncertainty as to aquifer
> = More than



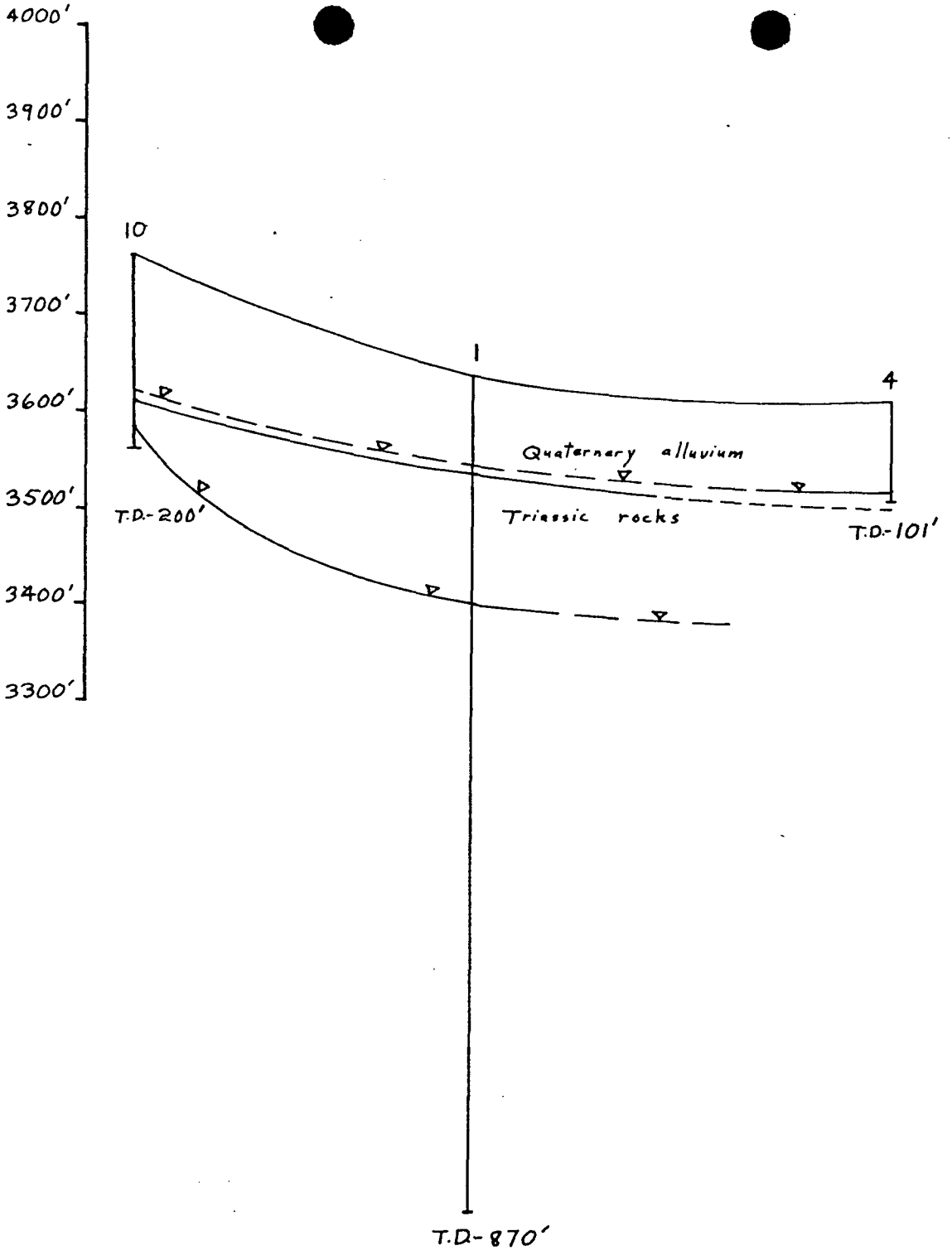
Hydrologic Cross Section N-S

Contact dashed where uncertain

Water table dashed where uncertain

1 Inch = 2 Miles Horizontal Scale

by Thomas A. Parkhill
Hydrogeologist
July 7, 1980



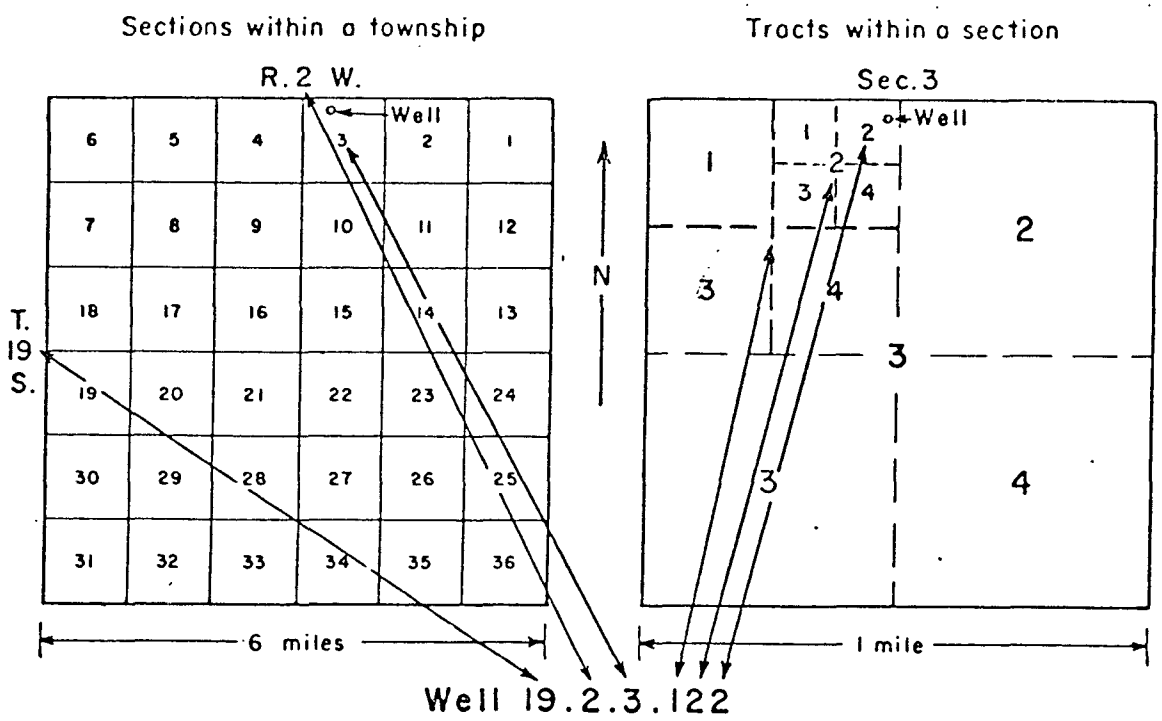
Hydrologic Cross Section E-W

Contact dashed where uncertain

Water table dashed where uncertain

1 Inch = 2 Miles Horizontal Scale

by Thomas A. Parkhill
Hydrogeologist
July 7, 1980



.-- System of numbering wells in New Mexico.

Records of Water Wells in T18S, R32, 33E, T19S, R32, 33E, and T20S, R32, 33E

LOCATION NUMBER: Explanation in section on well-numbering system.

AQUIFER: Tr, Triassic rocks; Qal, Quaternary alluvium.

DEPTH OF WELL: M, measured, all other depths are reported.

ALTITUDE: Altitudes interpolated from topographic maps. Probable error less than 10 feet.

WATER LEVEL: Measured depths are given to nearest tenth of a foot; reported depths are given to nearest foot. All are non-pumping water levels.

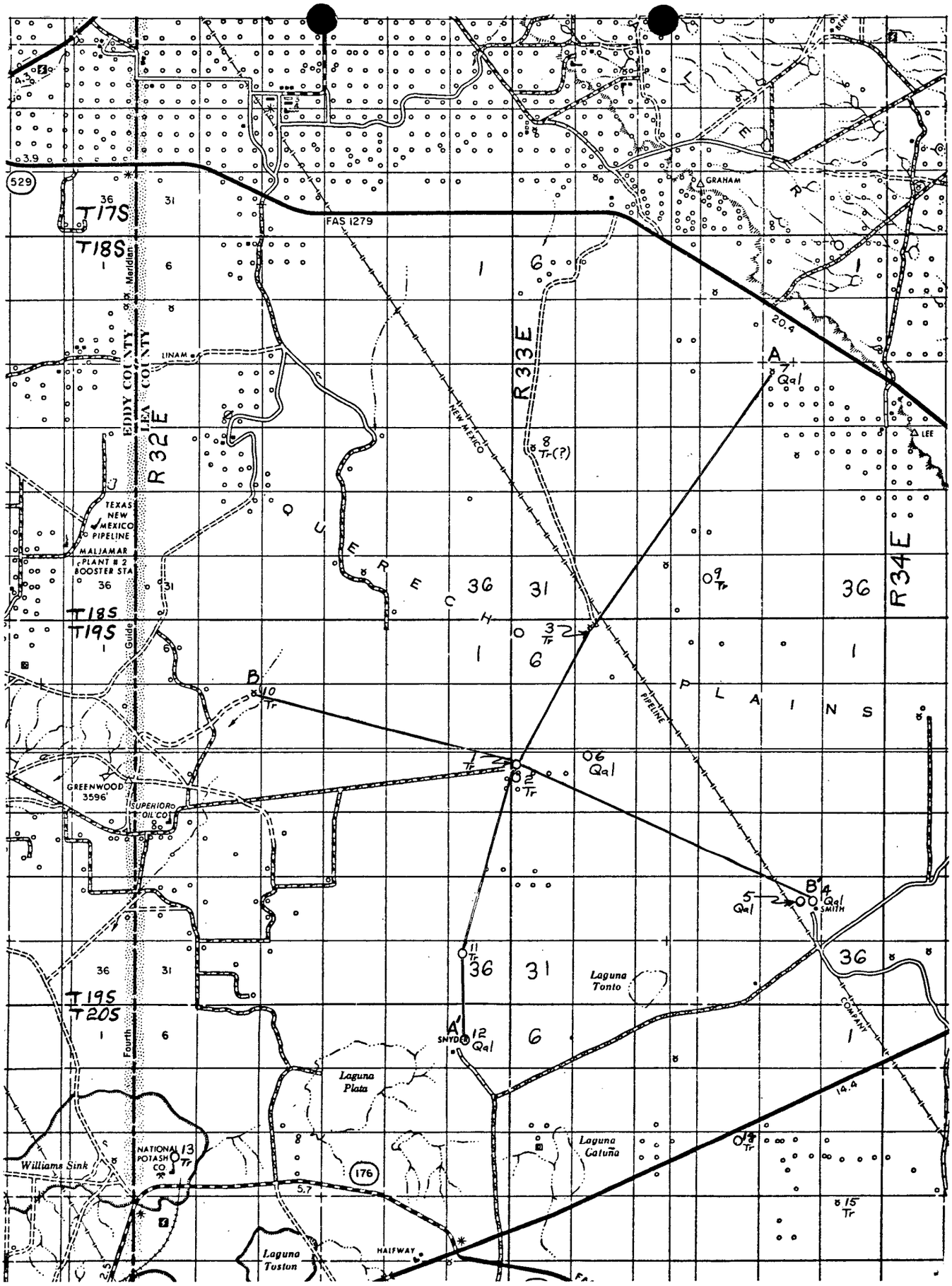
SURFACE DIAMETER OF WELLS: Expressed in inches unless otherwise indicated. Diameters of cased, drilled wells are given in inches.

METHOD OF LIFT: Lw, lift pump, windmill powered; Li, lift pump, internal-combustion-engine powered; Le, lift pump electrically driven; N, unequipped or partly equipped.

USE OF WATER: D, domestic; L, domestic use other than drinking, such as watering lawns and gardens; In, industrial; S, stock; N, none.

Well No.	Location	Owner	Aquifer	Depth of well (feet)	Water level: Altitude of well (feet)	Water level: Depth below land surface (feet)	Water level: Date measured	Year completed	Surface diameter of wells	Method of lift	Use of water
7	18.33.14.111	--	Qal	40M	3,965	35.8	6- 3-54	--	5	N	N
8	19.142	--	Tr(?)	--	3,820	140	12- 9-58	--	4	Lw	S
9	34.133	--	Tr	200M	3,760	177.4	12- 9-58	--	8½	N	N
10	19.32.8.200	--	Tr	--	3,650	365.3	12- 9-58	--	7½	Lw	S
11	36.100	W. M. Snyder	Tr	485	3,565	---	---	--	--	Li	D, S
3	19.33.5.123	--	Tr	700	3,713	433.7	11-18-65	--	8 5/8	Lw	S
6	17.112	--	Qal	131	3,650	121.1	12- 8-65	--	7	N	N
2	18.133	Pan Amer. Pet.	Tr	850	3,635	---	---	--	8 5/8	Le	In
1	18.133	do	Tr	870	3,635	232.5	11-18-65	10-27-59	7	Le	In
4	26.422	Mark Smith	Qal	101	3,600	92.9	7- 1-54	--	-	Lw	D, S
5	26.422	do	Qal	100	3,608	90.5	11-17-63	--	-	Lw	S
12	20.32.1.322	W. M. Snyder	Qal	30	3,510	21.8	7- 1-54	--	6	Li	S
13	18.233	Freeport	Tr	400	3,450	89.2	3-24-54	1954	8	Li	In
14	20.33.15.221	--	Tr	--	3,570	336.1	4-20-55	--	4	Li	N
15	24.122	D. C. Berry	Tr	700±	3,630	300±	---	--	10	Lw	S

Modified from Nicholson and Clebsch, 1961



Water Well Status Map

O^{5}_{Qal} $\not\sigma^{1}_{Tr}$ Water Wells with Records

$\not\sigma$ Water Wells without Records

o Oil & Gas Wells

Tr - Triassic rocks

Qal - Quaternary alluvium

N

1

1" = 2 Miles

by Thomas A. Parkhill
Hydrogeologist
July 2, 1980

GROUND WATER ANALYSES

John Runyan of the Oil Conservation Division, Hobbs office, collected five water samples on June 19, 1980. They were sent to Albuquerque Analytical Lab, Albuquerque, New Mexico, for chemical analyses of the content of Chlorides (Cl), Sulfates (SO_4) and Total Dissolved Solids (T.D.S.). The results of the water analysis for the following four wells (see location on Water Well Status Map) are:

SAMPLE ID	TDS (ppm)	Cl (ppm)	SO_4 (ppm)
4) Mark Smith Ranch 19-33-26-42221	1,864.0	290.0	693.1
1) L. Squires E-18-19-33 West Well	1,264.0	138.0	428.1
2) L. Squires E-18-19-33 East Well	3,544.0	96.0	1,455.4
10) L. Squires 19-32-8-22411 West Mill	944.0	68.4	123.5

The results of the chemical analysis indicate that all the ground water is well below 10,000 ppm. Two of the samples are near or below the human health standards set for drinking water. The maximum amount allowed for Chlorides (Cl) is 250 ppm, Sulfates (SO_4) is 600 ppm, and Total Dissolved Solids (T.D.S.) is 1000 ppm.

Two of these wells, numbers 1 and 2, are closest to the brine pit in Section 18, Township 19 South, Range 33 East. The distance between these two wells is 150 feet and the water is obtained from the same Triassic rock aquifer. Well number 2's T.D.S. is 2.8 times higher than well number 1's T.D.S. and well number 2's Chloride content is 3.3 times higher than well number 1's Chloride content. The high sulfate and Total Dissolved Solids content in the ground water of water well number 2 may be due to the solution of the gypsum ($Ca\ SO_4 \cdot 2H_2O$) present in the Triassic rocks or it may be an indication of ground water contamination. Only a long term ground water monitoring program will determine which explanation is correct.

An additional sample was taken from the brine water line at the point where it pours into the battery pit located in Unit E, Section 18, Township 19 South, Range 33 East (see Oil & Gas Status Map). The results of the chemical analyses are:

TDS (ppm)	Cl (ppm)	SO_4 (ppm)
20,444.0	9,480.0	2,634.2

A brine water sample was taken and analyzed on February 22, 1968, by Hudson & Hudson for Case No. 3892 (see Exhibit #6). No Total Dissolved Solids analysis was run, but Chlorides present ran 9,950 ppm and Sulfates ran 2,400 ppm. This compares very closely with the recent Oil Conservation Division water chemical analysis. The results indicate that the water chemistry has remained stable during the period of brine water production.

For: W. A. and E. R. Hudson
200 Booker Bldg.
Artesia, New Mexico

February 22, 1968

MK20149

Midland, Texas

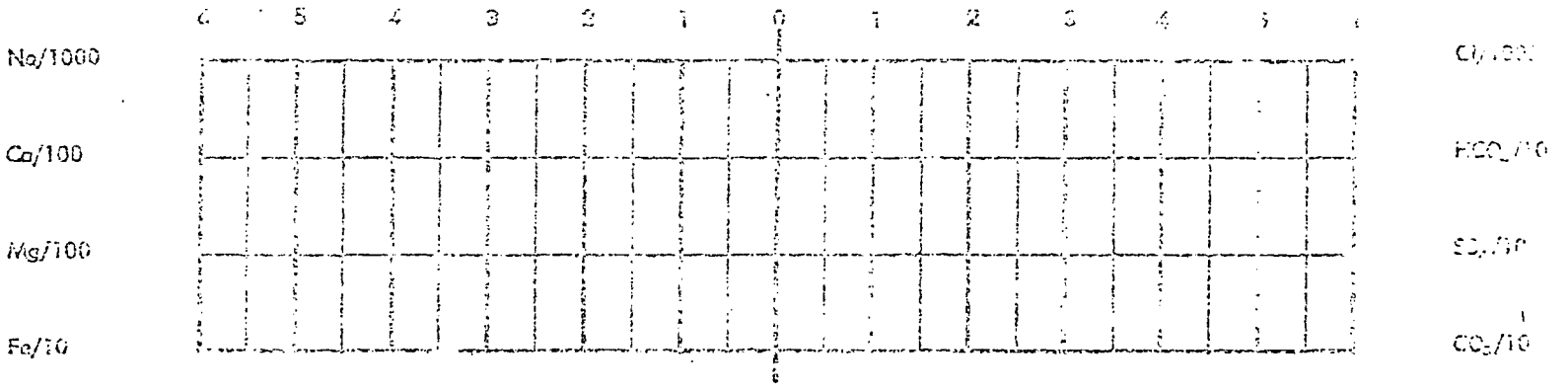
Attn: Mr. Ralph Gray

Work Tonto Federal #18

Yates

Source			pH		
Tank Battery			7.6	1.012	71
CONSTITUENTS	A/L	M/L	CONSTITUENTS	A/L	M/L
Sodium	6,110	266	Chloride	9,950	280
Calcium	800	40	Bicarbonate	390	6
Magnesium	366	30	Sulfate	2,400	50
Iron	Not determined		Carbonate	0	0

STIFF DIAGRAM
(m/L)



Remarks: Hydrogen Sulfide - present

George N. Greer Jr.
Crenshaw - 2
Tulsa Lab

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. 6
Case No. 3892

ANALYSIS BASED ON API RECOMMENDED PROCEDURE

EXHIBIT #6.

INFORMATION FROM STATE ENGINEERS OFFICE

The Roswell branch of the State Engineer's Office has been very concerned about the possible contamination of ground water from the disposal of brine in unlined pits in Township 19 South, Range 33 East. In a letter to the O.C.D. Hobbs office dated February 8, 1980, James I. Wright stated that the water present in the alluvium is of fairly good quality with most samples having a chloride content less than 300 ppm. He also enclosed well records of six (6) water wells in the area which are being used for domestic, stock and oil well drilling. Three wells produced water from Quaternary Alluvium and three produced water from Triassic Santa Rosa sandstone. Mr. Wright confirmed that the two (2) principal aquifers in this area have ground water flow to the southwest.

The State Engineer's Office conducted a ground water contamination study (Wright, April, 1979) which indicates that the chloride content for both the alluvium and Santa Rosa sandstone is less than 300 ppm. The average conductance of the Triassic Santa Rosa sandstone from a well with two (2) analyses was 691 micromhos. A conversion factor of 0.65 (Nicholson and Clebsch, 1971) was multiplied by 691 micromhos to obtain a figure of 449.1 ppm Total Dissolved Solids (T.D.S.) The average conductance of the Quaternary Alluvium from a well with four (4) analyses was 2,616.7 micromhos. A conversion factor of 0.69 (Nicholson and Clebsch, 1971) was multiplied by 2,616.7 micromhos to obtain a figure of 1,805.5 ppm T.D.S. This figure for T.D.S. seems to be anomalously high for the alluvium in the western part of southern Lea County.

A structural contour map was drawn on the elevation of the base of the alluvium (Wright, 1980) in the immediate area of the location of the brine pit. This map (figure 5) indicates that the pit (Section 18, T19S, R33E) is located in a structural depression. Another depression is located in northern two-thirds of Section 19, T19S, R33E. The whole area of the "Mescalero Sand" appears to be a series of small highs and small depressions. The hydrological significance of these depressions is to provide a suitable place for water to collect for recharge of both the Quaternary and Triassic aquifers.

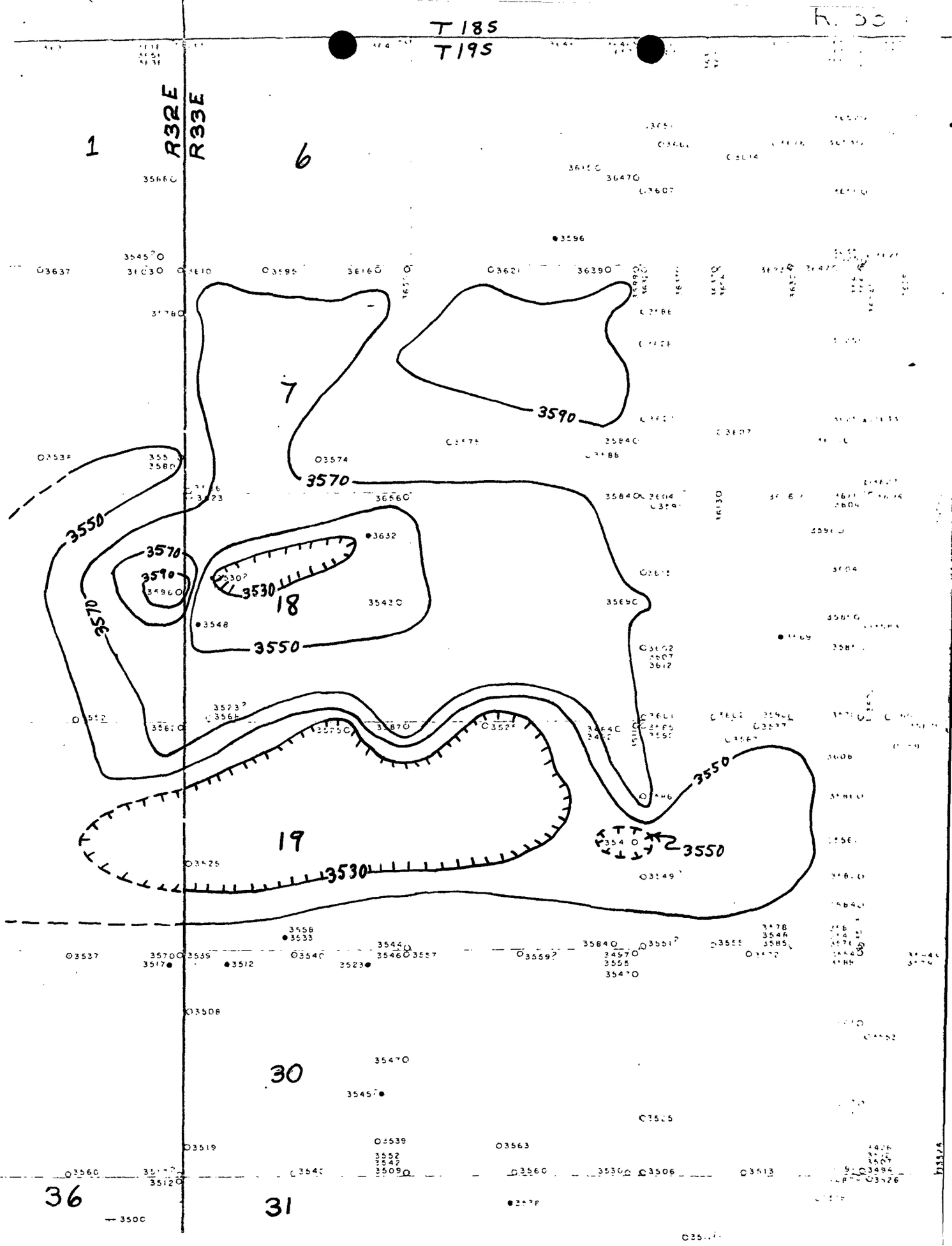


Figure 5 Structural Contour of the base of the Quaternary Alluvium.

Dashed where inferred or uncertain.
Contour interval 20 feet.
Datum mean sea level.

Modified from Wright, 1980

SEEPAGE LOSSES FROM BRINE PIT

Quantitative estimates of the seepage losses from the brine pit (Unit E, Section 18, T19S, R33E) were studied to assess the potential impact on the major ground water aquifers. Unfortunately, many of the perimeters needed for the calculations were missing, which made a quantitative analysis of the vertical migration to ground water impossible to complete.

Vertical migration was determined in a qualitative manner by reviewing the description of the aquifer's sediments found in Nicholson and Clebsch, 1961. Both the Quaternary and Triassic age sediments were deposited in a wide range of depositional environments, causing a large variation of grain sizes. The data from this area indicates that no major or minor impermeable clays or caliche are present in the geologic section to prevent any downward vertical migration of fluids into the water table.

When the pit was first put into service, the seepage rate was probably quite rapid because it occurred under partially saturated conditions. When the brine water reached the water table, it created a rising ground-water mound under the brine pit. When a ground-water mound establishes contact with the brine pit, saturated seepage occurs through a mound whose height is defined by the elevation of the impoundment.

This brine pit has been in use since 1968 and it is possible that the brine has reached the water table. Evidence of this comes from Mr. Larry Squires' statement of June 25, 1980, which was that the brine pit was never empty.

FIELD WORK CONDUCTED IN STUDY AREA

On May 20, 1980, John Runyan (O.C.D. - Hobbs) and I interviewed Mrs. Mark Smith about ground water quality and use. She told us that they still used well water for household uses, but not for drinking water due to its high sulfate content. The source of their drinking water is the nearby Potash Mine water line. Mrs. Smith was highly concerned about the economic hardship that could be brought about if their wells were contaminated by the oil field brine water.

John Runyan and I also visited the area of this report to study the geology of the area, the brine pits and locate the areas of the water, gas and oil wells.

GEOPHYSICAL WELL LOG STUDY

A borehole geophysical log search revealed that only six wells had some of the information needed for a ground water study. To be fully useful for a ground water study, geophysical logs must be run for the first 2000 feet of uncased hole, log suite must include gamma, resistivity and S.P. logs, and a copy of a detailed lithologic well must be present. Five of the holes had a suite of gamma and resistivity logs run and the sixth had a suite of gamma and neutron logs. Most of the holes have the top 350 feet missing and could not be used for this study. A study of the logs was conducted from 350 feet to about 1200 feet. There appears to be one (1) and sometimes two (2) low yield sandstone aquifers present, which are clayey and have T.D.S.'s which run from 4000 to 7500 ppm (see table 2).

Table 2. Geophysical Well Log Study of Parts of T18S, R33E and T19S, R33E

Nellis A Federal - Sec. 8, T19S, R33E 1980 FNL & 660 FWL
Elev. 3668 ft. 500' to 530' - water sand about 1000 ppm - clayey

Amoco Bondurant - Sec. 13, T19S, R32E 2310 FSL & 1980 FEL
Elev. 3629 ft. 350' to 380' water sand about 5000 ppm - clayey
Rest of hole very saline water

Inexco Fed. Com. #1-7 - Sec. 7, T19S, R33E 1980 FNL & 660 FEL
Elev. 3665 ft. 760' to 870' water sand about 5000 ppm - clayey
885' to 945' poor water sand about 7500 ppm - very clayey

Amoco Bondurant Federal 1 - Sec. 12, T19S, R32E 1980 FSL & 1980 FEL
Elev. 3649.5 ft. 730' to 785' water sand about 5000 ppm - clayey
1030' to 1045' water sand about 6000 ppm

Amoco Federal "AC" 1 - Sec. 18, T19S, R33E 660 FNL & 1980 FEL
Elev. 3749.5 ft. 562' to 588' water sand about 4000 ppm - clayey

W. A. & E. R. Hudson Fed. 19 No. 1 - Sec. 19, T19S, R33E 330 FSL & 2310 FWL Elev. 3601 ft. 542' to 552' water sand (?) No information about water quality. U.S.G.S. Log Report of well indicates important water sand from 548 to 560 ft.

OIL AND GAS PRODUCTION

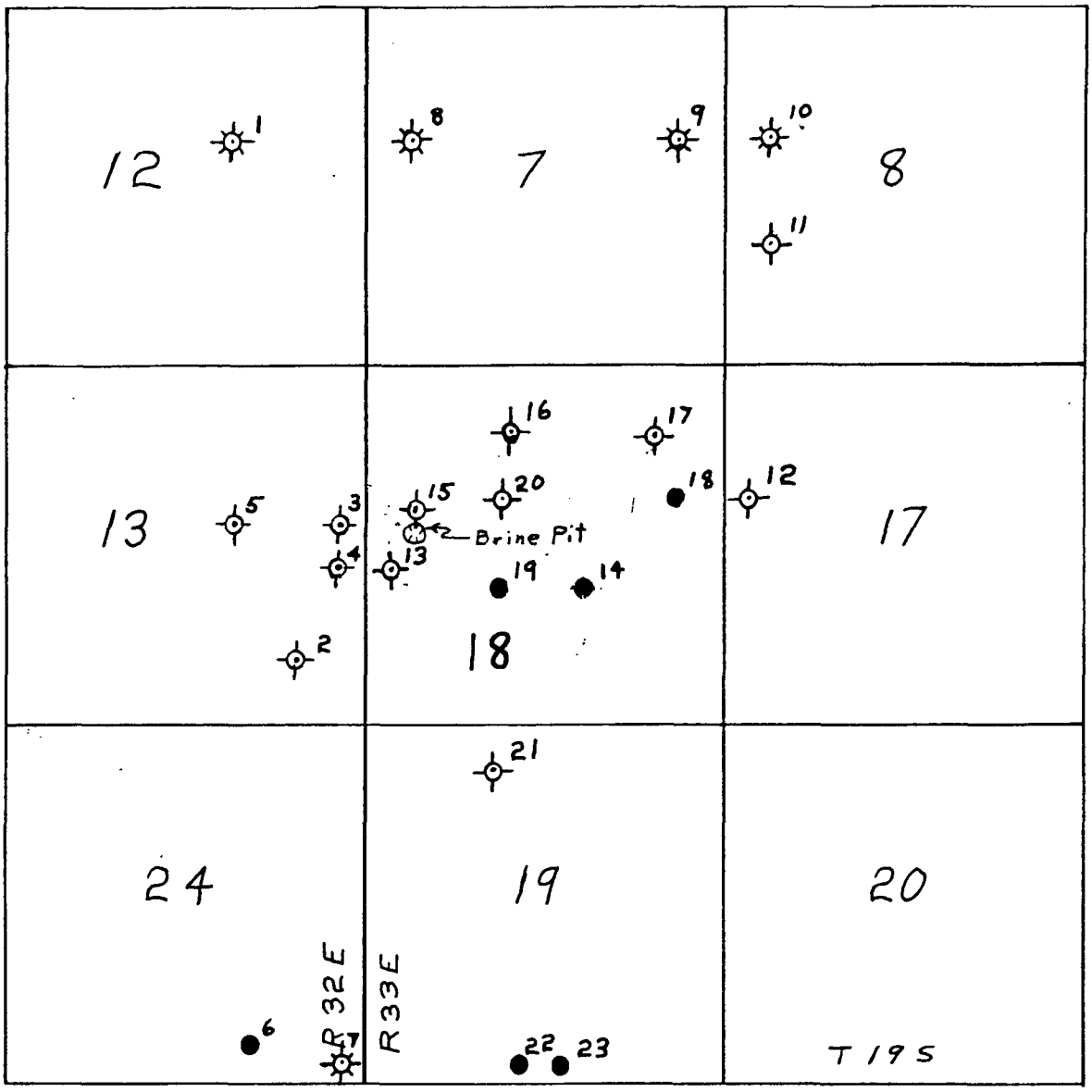
The petroleum production of Section 18, Township 19 South, Range 33 East, and the immediate surrounding area is dominated by the West Tonto-Yates Pool.

Oil Conservation Division records indicate that twenty-three oil and gas test holes have been drilled in a nine square mile area (see Oil & Gas Well Status Map). Most of the test holes were drilled to about 3500 feet, but a few were drilled to about 13,700 feet.

Of the twenty-three wells, six are currently producing oil, five are producing gas, and the rest have been plugged and abandoned. Records of the Oil Conservation Division indicate that no salt water disposal wells exist in this area.

Brine water from the production of oil is disposed of into unlined pits at a battery located in Unit E of Section 18, Township 19 South, Range 33 East. The pit has not been monitored to determine if any ground water pollution has taken place as the result of brine water disposal practices.

OIL & GAS WELL STATUS MAP



Legend

- ● ☼ Oil well (left) and gas
- ☼ Well drilled for oil or gas, dry
- Brine pit
- 1 Well No. - see list for name & location

2" = 1 MILE

N

by Thomas A. Parkhill
Hydrogeologist
June 30, 1980

Oil & Gas Well Status Map Name and Location Index

Section 12, Township 19 South, Range 32 East

(1) Bondurant Federal 1980' FSL & 1980' FEL

Section 13, Township 19 South, Range 32 East

(2) W. E. Bondurant No. 3 990' FSL & 990' FEL
(3) Bondurant Federal No. 8 2310' FNL & 330' FEL
(4) W. E. Bondurant No. 1 2310' FSL & 330' FEL
(5) Bondurant Federal No. 4 2310' FSL & 1980' FEL

Section 24, Township 19 South, Range 32 East

(6) Big Circle No. 3 660' FSL & 1650' FEL
(7) Big Circle No. 2 330' FSL & 330' FEL

Section 7, Township 19 South, Range 33 East

(8) Federal Com. 7 No. 2 1980' FNL & 660' FWL
(9) Federal No. 1 1980' FNL & 660' FEL

Section 8, Township 19 South, Range 33 East

(10) Nellis A Federal No. 1 1980' FNL & 660' FWL
(11) USA Culbertson-Irwin No. 1 1980' FSL & 660' FWL

Section 17, Township 19 South, Range 33 East

(12) Walton Federal No. 1 1980' FSL & 330' FWL

Section 18, Township 19 South, Range 33 East

(13) Fed. 18 No. 7 2310' FSL & 330' FWL
(14) Fed. 18 No. 3 1980' FNL & 1980' FEL
(15) Fed. 18 No. 1 2180' FNL & 690' FWL
(16) Fed. 18 No. 6 990' FNL & 2045' FWL
(17) Fed. 18 No. 8 990' FNL & 990' FEL
(18) Fed. 18 No. 4 1980' FNL & 660' FEL
(19) Fed. 18 No. 5 1980' FSL & 2039' FWL
(20) Fed. 18 No. 2 1980' FNL & 2039' FWL

Section 19, Township 19 South, Range 33 East

(21)	Saunders "A" No. 1	660' FNL & 1980' FWL
(22)	Federal 19 No. 1	330' FSL & 2310' FWL
(23)	Federal 19 No. 1	330' FSL & 2310' FEL

Section 20, Township 19 South, Range 33 East

No oil and gas tests found for this section

REVIEW OF HUDSON & HUDSON CASE 3892
(R-3554)

On November 18, 1968, Hudson & Hudson was granted an exception from the "No Pit Order" No. R-3221.

From the transcripts of the hearing the following facts were obtained. Mr. Ralph Gray stated that water in area was very spotty and unsuitable for domestic use. He also stated that water had only limited stock use and many of these wells were abandoned. Other testimony from Mr. Kellahin stated deep water sources were not widely used in this area.

A disturbing aspect of this case was the lack of testimony from the land owners in the area, lack of water well chemical quality data, and no information from the State Engineer's Office on the area's water uses.

The research done on this area indicates that this testimony was not correct or complete. Therefore, the brine water pit exemption should not have been granted in this area.

RECOMMENDATIONS

The area around and including Section 13, Township 19 South, Range 32 East and Section 18, Township 19 South, Range 33 East, apparently does contain ground water of useable quality. The Water Quality Control Commission is charged with the protection of all ground water which has a Total Dissolved Solids of 10,000 ppm or less. Well water from this area has chlorides that range from 68.4 to 290.0 ppm, sulfates range of 123.5 to 2,634.2 ppm, and Total Dissolved Solids range of 944.0 to 3,544.0 ppm. The depth of the water wells in this area range from 100 to 870 feet (J. Wright, 1980).

My research indicates that the disposal of oil field brine water in unlined pits will eventually contaminate the fresh water present in this area. I recommend that any exception to Order R-3221 be cancelled as soon as possible. All existing pits should be drained of brine and safely disposed of elsewhere. Then the pits should be filled with sand to conform to the topography of the area.

References

Fetter, C. W., (1980), Applied Hydrogeology, Columbus, Ohio, Charles E. Merril Publishing Co., 488p.

McWhorter, D. B. and Nelson, J. D., (1980), Seepage in the Partially Saturated Zone Beneath Tailing Impoundments, Mining Engineer, p. 432-439.

Nicholson, A., and Clebsch, A., (1961), Geology and ground-water conditions in southern Lea County, New Mexico, N. Mex. Bur. of Mines Ground-Water Report 6, 123p.

Todd, D. K., (1959), Ground-Water Hydrology, New York, J. Wiley and Sons, 336p.

Wright, J. I., (February 8, 1980), Personal communication. Hobbs O.C.D. District Office.

APPENDIX - State Engineers Letter

STATE OF NEW MEXICO

STATE ENGINEER OFFICE

ROSWELL

S. E. REYNOLDS
STATE ENGINEER

ADDRESS CORRESPONDENCE TO:
P. O. BOX 1717
ROSWELL, NEW MEXICO
88201

February 8, 1980

Mr. A. Jerry Sexton
Oil Conservation Comm.
P. O. Box 1980
Hobbs, N.M. 88240

Dear Jerry:

In response to your telephone call regarding data on groundwater in Township 19 South, Range 33 East I am sending you copies of the schedules for wells which we have scheduled and a map showing the elevation of the base of the alluvium which has not been contoured. The direction of groundwater movement is from the northeast to the southwest in this township and the gradient on the top of the Triassic appears to be about the same direction.

The quality of water in the alluvium is fairly good. Samples which we have data on indicate a chloride content of less than 300 PPM.

It is my opinion that disposal of brine in unlined pits in this area will eventually contaminate the fresh water. If I can be of further assistance in this matter please advise.

Very truly yours,

James I. Wright
Field Engineer

JIW:ffc
cc: Santa Fe

P.S. There is a report on southern Lea County by Nicholson which might be helpful. I think John has a copy, but if he doesn't you can probably obtain one from the School of Mines at Socorro.

FE-1 State of New Mexico
State Engineer

WELL SCHEDULE

Source of data: Obser ☒ Owner ☒ Other _____

Date 11/18 19 65 Record by Mason

LOCATION: County Lea Map 107.4.0

OWNER Pan American Pet.

DRILLER Murel Abbott Completed 10/27 19 59

TOPO SITUATION _____ USGS Elev 3635

DEPTH 870 ft ☒ Rept ☐ Meas Use OWD

CASING 7 in to _____ ft Log _____

PUMP: Type piston Make _____

Ser.no./model _____ Size of discharge 4 in.

PRIME MOVER: Make None HP _____

Ser.no. _____ Power/Fuel _____

PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☐ Pump Jack

Make _____ Ser.no _____ ☐ VHS

WATER LEVEL: 233.54 ft (rept) (meas) 3/15 19 68 (above) (below) TC

_____

_____ which is 1.5 ft (above) (below) LS

PERMANENT RP is _____

_____

_____

_____

which is _____ ft (above) (below) described MP and _____ ft (above) (below) LS

REMARKS Well is located 522' FNL and 2120' FNL

AQUIFER(S): Rs

Well No. ___ on Photo _____ DPN 25-12193

File No CP-71 Loc. No. 19.33.18.133234

Remarks cont. of section 18. This is the east well of 2 wells which are about 150' apart. a 100 barrel storage tank is located 30' west of well. Well is located about 175' west and 30' north of Hudson oil well which is 2180 FNL and 690 FWL of section 18.

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below LS
	1st	2nd	3rd	
Date Mar 15, 1965	240.00	241.00		232.54
Hour 11:45 (AM) PM Obs BH-HP	7.45	8.46		1.50
Not POA (X) POA ( )	232.55	232.54		231.04

W L meas after pump shut off _____ min. Pumping W L ( )

Remarks _____

FE-1 State of New Mexico
State Engineer

WELL SCHEDULE

Source of data: Obser ☒ Owner ☒ Other _____

Date 11/18/ 1955 Record by Mason

LOCATION: County Lea Map 107.4.0

OWNER Pan American Pet.

DRILLER _____ Completed _____ 19__

TOPO SITUATION _____ 2 1/2 ST Elev 3635

DEPTH 850 ft ☒ Rept ☐ Meas Use OWD

CASING 8 5/8 in to _____ ft Log _____

PUMP: Type piston Make _____

Ser.no./model _____ Size of dischg _____ in.

PRIME MOVER: Make None HP _____

Ser.no. _____ Power/Fuel _____

PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☒ Pump Jack

Make Fuqua Ser.no _____ ☐ VHS

WATER LEVEL: _____ ft rept / meas _____ 19__ above / below _____

_____

_____ which is _____ ft above / below LS

PERMANENT RP is _____

_____

_____

_____

which is _____ ft above / below described MP and _____ ft above / below LS

REMARKS This is the west well of 2 wells which

AQUIFER(S): Rs

Well No. ___ on Photo _____ DPN 25-

File No CP- Loc. No. 19.33.18.133213

2

Remarks cont. are about 150' apart. Well is located 100' west of a 100 barrel storage tank. No access for tape.

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below LS
	1st	2nd	3rd	
Date ____ ____, 19____				
Hour ____ AM PM Obs ____				
Not POA ( ) POA ( )				

W L meas after pump shut off ____ min. Pumping W L ( )

Remarks ____

FE-1 — State of New Mexico
State Engineer

WELL SCHEDULE

Source of data: Obser ☒ Owner ☐ Other _____

Date 11/18 1965 Record by Marion

LOCATION: County Lea Map 107.4.0

OWNER _____

DRILLER _____ Completed _____ 19__

TOPO SITUATION sand dune 11S 34ST SPOT Elev 3713

DEPTH 700 ft ☒ Rept ☐ Meas Use Stock

CASING 8 5/8 in to _____ ft Log _____

PUMP: Type Piston Make _____

Ser.no./model _____ Size of dischg 2 in.

PRIME MOVER: Make Aermotor HP _____

Ser.no. Wooden Tower Power/Fuel Wind

PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☐ Pump Jack

Make _____ Ser.no _____ ☐ VHS

WATER LEVEL: 43369 ft rept (meas) 3/15 1968 above (below) Top of truck wheel

_____ which is 2.5 ft (above) below LS

PERMANENT RP is _____

which is ____ ft above below described MP and ____ ft above below LS

REMARKS Three large steel storage tanks are

AQUIFER(S): Rs

Well No. ___ on Photo _____ DPN 25-12191

File No CP- _____ Loc. No. 19.33.5.12322

Remarks cont. located south of well. /

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below LS
	1st	2nd	3rd	
Date Mar 15, 19 68	441.00	440.00	441.00	433.69 /
Hour 2:00 AM (PM) Obs BH-HP	6.13	6.11	7.31	2.50
Not POA ( ) POA (X)	434.87 /	433.89 /	433.69 /	431.19 /

W L meas after pump shut off 42 / min., Pumping W L ( )

Remarks _____

FE-1 State of New Mexico
State Engineer

WELL SCHEDULE
Source of data: Obser ☒ Owner ☒ Other USGS
Date 7/1 19 54 Record by Nicholson
LOCATION: County Lea Map 107.4.0
OWNER Mark Smith (Headquarters)
DRILLER _____ Completed _____ 19__
TOPO SITUATION _____ USGST Elev 3608
DEPTH 101 ft ☒ Rept ☐ Meas Use Dom-STK
CASING _____ in to _____ ft Log _____
PUMP: Type piston Make _____
Ser.no./model _____ Size of dischg _____ in.
PRIME MOVER: Make _____ HP _____
Ser.no. Wooden Tower Power/Fuel Wind
PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☐ Pump Jack
Make _____ Ser.no _____ ☐ VHS
WATER LEVEL: 94.21 ft rept (meas) 7/1 19 54 above (below) TC

_____ which is 1.4 ft (above) below LS
PERMANENT RP is _____

which is _____ ft above below described MP and _____ ft above below LS
REMARKS This is the east well of 2 windmills.
AQUIFER(S) Qal
Well No. ___ on Photo _____ DPN 25-12/95
File No CP- Loc. No. 19.33.26.422221

4

Remarks, cont. Mill is located about 200' North of ranch house. Well discharges into a 500 gallon elevated wooden tank on west side of well.
11/7/65 CHM - Water sample collected.
9/25/72 FPL - Water sample collected.

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below
	1st	2nd	3rd	LS
Date July 1, 1954	100.00			94.21
Hour ____ AM / PM Obs AN	5.79			1.40
Not POA ( ) POA (X)	94.21			92.81

W L meas after pump shut off ____ min. Pumping W L (X)
Remarks Mill pumping

FE-1 State of New Mexico
State Engineer

WELL SCHEDULE

Source of data: Obser ☒ Owner ☒ Other _____

Date 11/17 1965 Record by Mason

LOCATION: County Lea Map 107.4.0

OWNER Mark Smith. (Headquarters)

DRILLER _____ Completed _____ 19__

TOPO SITUATION _____ USGS Elev 3608

DEPTH 100 ft ☒ Rept ☐ Meas Use Stock

CASING _____ in to _____ ft Log _____

PUMP: Type piston Make _____

Ser.no./model _____ Size of dischg _____ in.

PRIME MOVER: Make Aermotor HP _____

Ser.no. _____ Power/Fuel Wind

PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☐ Pump Jack

Make _____ Ser.no _____ ☐ VHS

WATER LEVEL: 90.48 ft (rept) (meas) 3/14 1965 (above) (below) LS

_____

_____ which is 0.0 ft above below LS

PERMANENT RP is _____

_____

_____

_____

which is ____ ft above below described MP and ____ ft above below LS

REMARKS This is the west well of 2 wells. Well

AQUIFER(S): Gal

Well No. ___ on Photo _____ DPN 25-12194

File No CP Loc. No. 1933.26.42221

5

Remarks co[redacted] discharge into 2 stu[redacted] tank tanks which are in corral. Well is about 150' N'W of ranch house.

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below
	1st	2nd	3rd	LS
Date Mar 14, 1968	96.00	92.00		90.48
Hour 10:15 (AM) PM Obs GH-HP	5.52	1.50		-0-
Not POA (X) POA ( )	90.48	90.50X		90.48

W L meas after pump shut off _____ min. Pumping W L ( )

Remarks _____

FE-1 — State of New Mexico
State Engineer

WELL SCHEDULE

Source of data: Obser ☒ Owner ☐ Other _____

Date 12/8 19 65 Record by Mason

LOCATION: County Lea Map 107.4.0

OWNER _____

DRILLER _____ Completed _____ 19__

TOPO SITUATION sand dunes USGST Elev 3650

DEPTH 131 ft ☐ Rept ☒ Meas Use Not

CASING 7 in to _____ ft Log _____

PUMP: Type None Make _____

Ser.no./model _____ Size of dischg _____ in.

PRIME MOVER: Make _____ HP _____

Ser.no. _____ Power/Fuel _____

PUMP DRIVE: ☐ Gear Head ☐ Belt Head ☐ Pump Jack

Make _____ Ser.no _____ ☐ VHS

WATER LEVEL: 121.10 ft (rept) (meas) 12/8 19 65 (above) (below) Top of wooden damp

_____ which is 2.70 ft (above) (below) LS

PERMANENT RP is TC

which is 0.28 ft (above) (below) described MP and 2.42 ft (above) (below) LS

REMARKS Well is shown on USGS topo map.

AQUIFER(S): Qal

Well No. ___ on Photo _____ DPN 25-12192

File No CP- _____ Loc. No. 19.33.17.11224

6

Remarks cont. Well is located by remains of an old corral. Windmill tower has blown down. Need 4-inch drive or walk to well.

SKETCH:

INITIAL WATER-LEVEL MEASUREMENT	DEPTH TO WATER			
	Below MP			Below LS
	1st	2nd	3rd	
Date Dec 8, 1965	131.00			121.10
Hour ____ AM PM Obs C4M	9.90			2.70
Not POA (X) POA ( )	121.10'			118.40

W L meas after pump shut off ____ min. Pumping W L ( )

Remarks ____

17.32.4.442	W. Taylor	Qal	—	4,180	82.9	6- 3-54	—	6	N	N	—
11.231	MCRA	To	139	4,180	—	—	1947	7	Te	In,D	Well 4.
17.32.11.233	MCRA	To(?)	140	4,200	70	9-20-47	—	8	Li	In,D	Well 2. EY 9 gpm.
11.411	MCRA	To(?)	200	4,170	70	6-15-46	—	8	Te	In,D	Well 1. EY 90 gpm.
11.411a	MCRA	To(?)	130	—	70	9-23-47	—	8	Li	In,D	Well 3. EY 50 gpm.
17.33.13.341	Potash Co. of America	To	252M	4,124	149.7	11-20-53	1952	6	N	O	—
18.322	Kewanee Oil Co.	To	220	4,230	—	—	—	10¾	Te	In,D	Two wells. Chemical analysis in table 8.
26.422	Phillips Oil Co.	To	—	4,125	161.2	11-20-53	1950	8	N	In,O	—
28.110	—	To	241M	4,185	198.0	5-11-54	—	7	N	N	—
30.124	Walter Williams	Qal	—	4,045	70.0	7-29-54	—	7	Lw	S	PR
18.33.14.111	—	Qal	40M	3,965	35.8	6- 3-54	—	5	N—	N	—
19.142	—	Tr(?)	—	3,820	>140	12- 9-58	—	4	Lw —	S	—
34.133	—	Tr	200M	3,760	177.4	12- 9-58	—	8½	N —	N	—
19.32.8.200	—	Tr	—	3,650	365.3	12- 9-58	—	7½	Lw —	S	Chemical analysis in table 8.
36.100	W. M. Snyder	Tr	485	3,565	—	—	—	—	Li —	D,S	—
19.33.5.213	—	Tr	—	3,710	>299	12- 9-58	—	—	Lw —	S	—
26.244	Mark Smith	Qal	101	3,600	92.9	7- 1-54	—	—	Lw —	D,S	MWP
19.34.9.114	Scharbauer Cattle Co.	Tr(?)	33	3,790	28.6	6- 3-54	—	6	Lw	S	Chemical analysis in table 8.
31.131	Clark Scharbauer	Qal	—	3,625	65.8	7- 1-54	—	6	Lw	S	MWP
19.35.5.121	Gene Dalmont	To	88	3,890	50	7-28-54	—	8	Ti	I	—
5.234	Jules Smith	To	90	3,860	35	—	—	—	Lw	D,S	—
10.113	N. T. Roberts	To	36	3,860	19.9	7-28-54	—	6	Lw	S	EY 5 gpm.
12.444	—	Qal	—	3,740	34.2	7-28-54	—	3 ft.	Lw	S	—
19.35.17.122	J. D. Roberts	Qal	50	3,835	29.9	7-28-54	—	3×3 ft.	Lw	D,S	Dug 0-30 feet; drilled 30-50 feet.
22.334	—	Qal	—	3,740	23.5	7-28-54	—	8	Lw	N	—
24.121	—	Qal	—	3,735	28.6	11-16-53	—	6 ft.	N	N	—
25.424	—	Qal	—	3,675	22.6	11-16-53	—	—	N	N	Uncased shothole.
25.434	—	Qal	—	3,660	22.8	11-16-53	—	6	Lw	S	—

19.36.5.233	Tom Green	To	60	3,815	52.3	7-28-54	—	—	Lw	D,S	—
19.313	—	Qal	44.6M	3,685	18.6	11-16-53	—	—	N	N	Uncased shothole.
20.111	Tom Green	Qal	—	3,695	25.7	7-28-54	—	—	Lw	S	EY 10 gpm. PR
25.123	—	To	43M	3,680	16.0	3-18-54	—	6	N	N	Northwest well of six. Chemical analysis in table 8.
19.36.26.224	J. E. Weir	Qal	12.7M	3,650	6.7	5- 7-54	—	4×5 ft.	N	N	At Monument Spring.
28.422	Mrs. Abi Hall	To	52M	3,720	36.6	3-18-54	—	7	N	N	—
28.441	do.	To	27M	3,680	22.7	3-18-54	—	6	N	N	—
32.110	S. P. Jordan	Qal	32	3,645	19	11-20-29	—	—	—	—	Chemical analysis in table 8.
32.324	—	Qal	30	3,630	27.2	7-28-54	—	4×4 ft.	Lw	N	—
19.37.4.110	V. Linam	To	29	3,680	21	9-19-29	—	—	—	—	Chemical analysis in table 8.
18.111	Amerada Oil Co.	To	134	3,705	35	9- -47	1947	10¾	Ti	D	Monument District Camp. WBZ 67-108 feet, 112-125 feet. EY 385 gpm.
18.331	EPNG	To	—	3,710	51.9	3-18-54	—	10	N	N	—

19.34.9.114	Scharbauer Cattle Co.	Tr(?)	33	3,790	28.6	6- 3-54	—	6	Lw	S	Chemical analysis in table 8.
31.131	Clark Scharbauer	Qal	—	3,625	65.8	7- 1-54	—	6	Lw	S	MWP
19.35.5.121	Gene Dalmont	To	88	3,890	50	7-28-54	—	8	Ti	I	—
5.234	Jules Smith	To	90	3,860	35	—	—	—	Lw	D,S	—
10.113	N. T. Roberts	To	36	3,860	19.9	7-28-54	—	6	Lw	S	EY 5 gpm.
12.444	—	Qal	—	3,740	34.2	7-28-54	—	3 ft.	Lw	S	—
19.35.17.122	J. D. Roberts	Qal	50	3,835	29.9	7-28-54	—	3×3 ft.	Lw	D,S	Dug 0-30 feet; drilled 30-50 feet.
22.334	—	Qal	—	3,740	23.5	7-28-54	—	8	Lw	N	—
24.121	—	Qal	—	3,735	28.6	11-16-53	—	6 ft.	N	N	—
25.424	—	Qal	—	3,675	22.6	11-16-53	—	—	N	N	Uncased shothole.
25.434	—	Qal	—	3,660	22.8	11-16-53	—	6	Lw	S	—

19.36.5.233	*Tom Green*	*To*	*60*	*3,815*	*52.3*	*7-28-54*	—	—	Lw	D,S	—
19.313	—	Qal	44.6M	3,685	18.6	11-16-53	—	—	N	N	Uncased shothole.
20.111	Tom Green	Qal	—	3,695	25.7	7-28-54	—	—	Lw	S	EY 10 gpm. PR
25.123	—	To	43M	3,680	16.0	3-18-54	—	6	N	N	Northwest well of six. Chemical analysis in table 8.
19.36.26.224	J. E. Weir	Qal	12.7M	3,650	6.7	5- 7-54	—	4×5 ft.	N	N	At Monument Spring.
28.422	Mrs. Abi Hall	To	52M	3,720	36.6	3-18-54	—	7	N	N	—
28.441	do.	To	27M	3,680	22.7	3-18-54	—	6	N	N	—
32.110	S. P. Jordan	Qal	32	3,645	19	11-20-29	—	—	—	—	Chemical analysis in table 8.
32.324	—	Qal	30	3,630	27.2	7-28-54	—	4×4 ft.	Lw	N	—
19.37.4.110	V. Linam	To	29	3,680	21	9-19-29	—	—	—	—	Chemical analysis in table 8.
18.111	Amerada Oil Co.	To	134	3,705	35	9- -47	1947	10¾	Ti	D	Monument District Camp. WBZ 67-108 feet, 112-125 feet. EY 385 gpm.
18.331	EPNG	To	—	3,710	51.9	3-18-54	—	10	N	N	—
20.242	Humble Oil Co.	—	80	3,660	Dry	—	1937	—	N	N	Plugged and abandoned.
21.132	do.	To	67	3,635	—	—	1937	—	—	—	State "D" well 2. EY 30 gpm.
19.37.25.422	—	To	—	3,600	40	4- 6-54	—	—	Lw	S	—
29.333	—	Qal	—	3,595	13.3	7-28-54	—	7	Lw	D	MWP
29.344	Hobbs School district	Qal	30±	—	21.5	3-23-60	—	8	Te	P	—
29.344a	do.	Qal	30±	—	—	—	—	6	Te	P	Chemical analysis in table 8.
30.113	Continental Oil Co.	Qal	60	3,660	—	—	—	—	Te	D	Pumps dry in summer.
20.32.1.322	W. M. Snyder	Qal	30	3,510	21.8	7- 1-54	—	6	Li —	S	Water not potable.
18.233	Freeport Sulfur Co.	Tr	400	3,450	89.2	3-24-54	1954	8	Li —	In	WBZ 215-243 feet.
27.144	Joel Frey	Qal	25	3,545	12.3	6-11-54	—	—	Lw	N	—
30.142	—	Qal	—	3,530	9.9	6-11-54	—	8⅝	N	N	Located in sink.
36.214	Mrs. Bingham	Qal	60	3,588	46.6	6- 6-55	1950	7¼	Lw	D	West well of three.
20.33.15.221	—	Tr	—	3,570	336.1	4-20-55	—	4	Li —	N	—
24.122	D. C. Berry	Tr	700±	3,630	300±	—	—	10	Lw —	S	—
20.34.17.334	Mark Smith	Tr	200	3,635	140	7- 1-54	1940	10	Lw	S	MWP
22.223	D. C. Berry	Tr	235	3,655	—	—	—	10	Lw	S	—
20.35.1.221	J. L. Wood	Qal	35	3,655	24.5	11-16-53	—	4×4 ft.	N	O	—
31.113	Leo Sims	To	85	3,740	68.4	6-25-54	—	6	Lw	S	PR
33.433	do.	To	135	3,700	94.1	6-25-54	—	7	Lw	S	MWP
35.333	do.	To	105	3,690	88.9	4-15-54	—	—	Lw	D,S	MWP Southeast well of two.
20.36.1.412	Amerada Oil Co.	Qal	72M	3,565	33.1	3-30-54	—	7	N	N	—

TABLE 8. CHEMICAL ANALYSES OF WATER FROM WELLS IN SOUTHERN LEA COUNTY, N. MEX.

(Analyses by U.S. Geological Survey except as noted; chemical constituents in parts per million and equivalents per million [underscored].)

Sample	Location number*	Date of collection	Geologic source†	Depth† (ft)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium plus potassium (Na+K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (sum)	Hardness as $CaCO_3$ Calcium, Magnesium	Percent sodium	Specific conductance (micromhos at 25°C)	pH
1	17.32.3.140	7-21-54	To	—	—	—	—	34	194	0	25	17	—	—	—	136	35	419	—
						2.72		1.46	3.18		.52	.48							
2	17.33.18.322	7-19-54	To	220	—	—	—	27	177	0	40	23	—	—	—	160	27	442	—
						3.20		1.18	2.90		.83	.65							
3	19.32.8.200	12- 9-58	Tr	—	19	10	13	131	306	0	74	21	1.2	6.4	426	80	78	682	8.0
						.50	1.10	5.71	5.02		1.54	.59	.06	.10					
4	19.34.9.114	12- 9-58	Tr(?)	33	41	430	65	675	189	0	1,680	560	.3	139	3,680	1,340	52	4,660	7.1
						21.46	5.34	29.33	3.10		34.98	15.79	.02	2.24					
5	19.36.35.123	4- 9-58	To	43	—	—	—	—	—	—	212	31	—	—	—	—	—	562	—
											4.41	.87							
6	19.36.32.110	11-20-29	To	32	—	84	—	158	261	0	225	79	—	6.8	668	222	—	—	—
						4.44		6.86	4.28		4.68	2.23		.11					
7	19.37.4.110	9-19-29	To	29	—	68	—	71	307	0	54	32	—	—	383	198	—	—	—
						3.96		3.09	5.03		1.12	.90							
8	19.37.29.344a	7-15-54	Qal	30±	—	—	—	52	296	0	62	91	—	—	—	322	26	865	—
						6.44		2.27	4.85		1.29	2.57							
9	do.	9- 9-58	Qal	30±	—	—	—	—	215	0	54	73	—	—	—	252	—	678	7.6
						5.04			3.52		1.12	2.06							
10	20.36.15.421	3-30-54	Qal	50	—	—	—	—	304	0	1,840	1,080	—	—	—	—	—	6,780	—
									4.98		38.30	30.46							
11	20.36.15.421	9- 9-58	Qal	50	—	—	—	—	292	0	2,250	1,240	—	—	—	1,720	—	7,500	7.4
						34.40			4.79		46.84	34.97							
12	20.37.4.111	4- 2-54	Qal	40	—	—	—	—	423	0	67	450	—	—	—	—	—	2,180	—
									6.93		1.39	12.69							
13	20.37.4.111	4-22-55	Qal	40	—	—	—	—	438	0	78	425	—	—	—	670	—	2,090	7.2
						13.40			7.18		1.62	11.99							
14	20.37.4.111	9- 9-58	Qal	40	—	—	—	—	318	0	108	425	—	—	—	460	—	1,670	7.5
						9.20			5.21		2.25	9.16							
15	20.37.4.221	4-22-55	Qal	45	—	—	—	—	269	0	90	51	—	—	—	278	—	758	8.1
						5.56			4.41		1.87	1.44							
16	20.37.4.221	9- 9-58	Qal	45	—	—	—	—	255	0	87	47	—	—	—	246	—	708	8.0
						4.92			4.18		1.69	1.33							
17	20.38.19.320	4- 2-54	Qal	115	—	—	—	—	227	0	—	39	—	—	—	—	—	627	—
									3.72			1.10							
18	20.38.19.320	9- 9-58	Qal	115	—	—	—	—	104	0	23	49	—	—	—	68	—	376	8.1
						1.36			1.70		.48	1.38							
19	21.33.2.231	9- 4-58	Tr	1,150	—	—	—	—	336	0	95	20	—	—	—	22	—	778	8.0
						.44			5.51		1.98	.56							
20	21.33.2.422	6-28-54	To	120	—	—	—	—	116	0	17	1,020	—	—	—	—	—	3,370	—
									1.90		.35	28.77							
21	21.33.2.422	4-22-55	To	120	—	—	—	2.5	115	0	20	1,170	—	13	—	1,770	0.3	3,730	7.3