

***TEST WELLS T27 AND T28,
WHITE SANDS MISSILE RANGE,
DOÑA ANA COUNTY, NEW MEXICO***

By Robert G. Myers and Karen M. Pinckley

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CONVERSION FACTORS

In this report, measurements are given in inch-pound units. The following table contains factors for converting to metric units:

<u>Multiply inch-pound units</u>	<u>by</u>	<u>To obtain metric units</u>
inch	25.40	millimeter
foot	0.3048	meter
mile	1.609	kilometer
cubic inch	16.39	cubic centimeter

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ABSTRACT

Two test wells, T27 and T28, were drilled at White Sands Missile Range in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in February and March 1983. Test wells T27 and T28 were drilled as observation wells in the vicinity of the Liquid Propellant Storage Area. Information obtained from these wells includes lithologic logs, driller's logs, and borehole-geophysical logs from the cased wells.

INTRODUCTION

Two test wells, T27 and T28 (fig. 1; table 1), were drilled at White Sands Missile Range in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in February and March 1983. The participants of the program were members of the U.S. Army (active) from White Sands Missile Range, New Mexico, and Fort Knox, Kentucky, and U.S. Army (reserve) from Missoula, Montana, and Bismarck, North Dakota. The U.S. Geological Survey assisted White Sands Missile Range in site selection, borehole-geophysical logging, analysis of well cuttings, and compilation of the lithologic logs. The hydraulic-rotary drilling method was used to drill the test wells. This study was done in cooperation with the U.S. Department of the Army, White Sands Missile Range, Engineering and Housing Directorate.

To date (December 1983), none of these wells have been developed. Therefore, there are no chemical analyses of water samples available. Depth to water below land surface in test well T27 was estimated from U.S. Geological Survey borehole-geophysical logs.

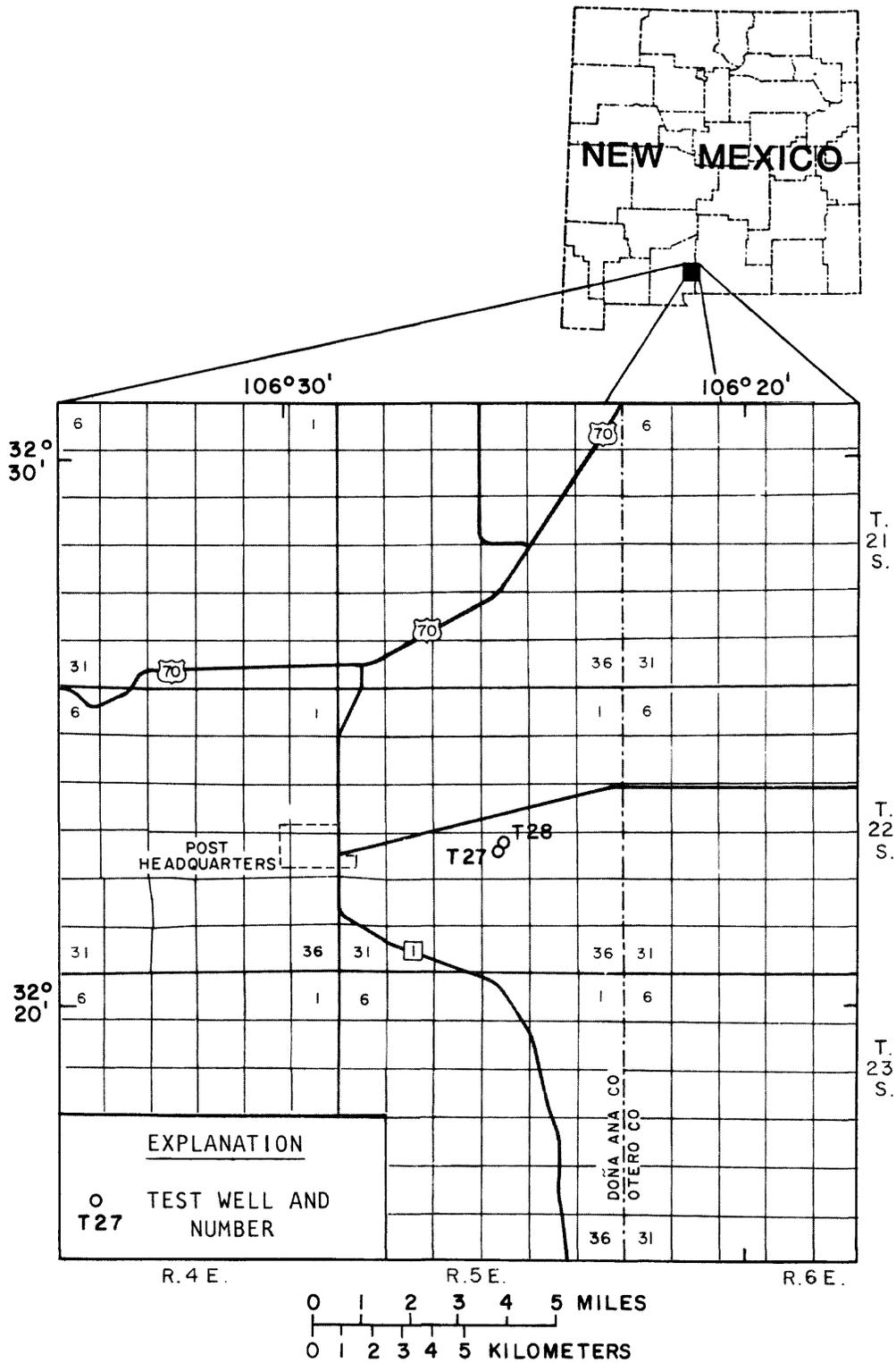


Figure 1.--Location of test wells T27 and T28, White Sands Missile Range.

Lithologic logs in this report were prepared by the U.S. Geological Survey from cutting samples collected by the U.S. Army. The following list defines the terms used to describe the grain size of the detritus:

Description	Size in millimeters	Size in inches
Pebbles	4-64	0.15-2.5
Granules	2-4	0.08-0.15
Very coarse sand	1.0-2.0	0.04-0.08
Coarse sand	0.5-1.0	0.02-0.04
Medium sand	0.25-0.5	0.01-0.02
Fine sand	0.125-0.25	0.005-0.01
Very fine sand	0.0625-0.125	0.0025-0.005
Silt	0.004-0.0625	0.00015-0.0025
Clay	less than 0.004	less than 0.00015

Rounding was determined from comparison with the grain models in the Manual of Field Geology (Compton, 1962). The degree of roundness can range from very angular to well rounded. Sorting is the degree to which grains in a sample approach the same size. This value can range from very well sorted (grains all the same size) to very poorly sorted (a wide range of grain sizes with no dominant grain sizes). The colors and any accompanying code numbers in the lithologic descriptions refer to the colors from the Rock-Color Chart (Goddard, 1948) prepared by the Rock-Color Chart Committee and distributed by the Geological Society of America.

Table 1. Well records of test wells T27 and T28

Well name	Location	Date drilled	Water level below land surface (feet)	Drilled depth (feet)	Finished depth (feet)	Slotted interval, depth below land surface (feet)	Casing diameter (inches)	Remarks
T27	22S.05E.22.141	02-83	163±	263±	250	170-250	4 (PVC)	No cap on bottom of casing
T28	22S.05E.22.122	03-83	—	300	100±	160-300	4 (PVC)	Caved above water table; casing broken at about 77 feet below land surface.

TEST WELL T27

Test well T27 (fig. 1) was drilled as an observation well in February 1983 (table 1). The main purpose of the well is to monitor water levels and water quality in the vicinity of the Liquid Propellant Storage Area. The well penetrated Quaternary alluvium and bolson fill composed of interbedded silty clay and clay with some sand and silt. A lithologic log prepared by the U.S. Geological Survey from analysis of the well cuttings collected by the U.S. Army is shown in table 2.

T27 was drilled with a 7 7/8-inch-diameter wing bit to a depth of 263 feet and completed at a depth of 250 feet. A driller's log for T27 is shown in table 3. The well was drilled with organic-polymer drilling fluid. The well was completed with 250 feet of 4-inch-inside-diameter PVC casing with a slotted interval from 170 feet to 250 feet. The bottom of the well is uncapped. Borehole-geophysical logs made in the cased well are shown in figure 2. The depth to water below land surface of about 163 feet was estimated from the borehole-geophysical logs.

Table 2. Lithologic log for test well T27 (22S.05E.22.141)

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-brown (5YR 4/4), with about 50 percent caliche.	5	0-5
Clay, moderate-reddish-brown (10R 4/6), with about 20 percent caliche.	5	5-10
Clay, moderate-yellowish-brown (10YR 5/4), with a little silt and caliche.	5	10-15
Clay, moderate-yellowish-brown (10YR 5/4), with massive caliche.	10	15-25
Clay, moderate-brown (5YR 4/4).	10	25-35
Clay, moderate-brown (5YR 4/4) and moderate-reddish-brown (10R 4/6), with a little silt and massive caliche.	5	35-40
Clay, moderate-brown (5YR 4/4), with a little silt.	5	40-45
Clay, moderate-brown (5YR 4/4), with pockets of very fine black sand and some moderate-reddish-brown (10R 4/6) clay.	5	45-50
Clay, moderate-brown (5YR 4/4), with caliche.	15	50-65
Clay, silty, moderate-reddish-brown (10R 4/6) and moderate-yellowish-brown (10YR 5/4), with a little caliche.	25	65-90
Clay, very hard, moderate-brown (5YR 4/4), with caliche.	5	90-95
Clay, silty, moderate-brown (5YR 4/4), with a little caliche.	5	95-100

Table 2. Lithologic log for test well T27 (22S.05E.22.141) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, silty, moderate-brown (5YR 4/4) and moderate-reddish-brown (10R 4/6).	15	100-115
Clay, silty, light-brown (5YR 5/6) and moderate-reddish-brown (10R 4/6), with much caliche.	5	115-120
Clay, moderate-brown (5YR 4/4), with a little silt and caliche.	30	120-150
Clay, silty, moderate-brown (5YR 4/4), with moderate-reddish-brown (10R 4/6) clay and much caliche.	5	150-155
Clay, moderate-brown (5YR 4/4), very hard, with caliche.	5	155-160
Clay, silty, moderate-brown (5YR 4/4), with bits of caliche.	5	160-165
Clay, moderate-brown (5YR 4/4), with caliche.	10	165-175
Clay, silty, moderate-brown (5YR 4/4) and moderate-reddish-brown (10R 4/6), with some caliche.	10	175-185
Clay, silty, light-brown (5YR 5/6), with very hard moderate-brown (5YR 4/4) clay and much caliche.	5	185-190
Clay, silty, light-brown (5YR 5/6) and moderate-reddish-brown (10R 4/6), with caliche.	20	190-210

Table 2. Lithologic log for test well T27 (22S.05E.22.141) - Concluded

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Silt, moderate-reddish-brown (10R 4/6), with very fine to fine-grained, well-rounded quartz sand and caliche.	10	210-220
Clay and silty clay, moderate-brown (5YR 4/4) and some moderate-reddish-brown (10R 4/6), with caliche.	15	220-235
Clay, moderate-brown (5YR 4/4), with a little very fine, greenish quartz sand and caliche.	5	235-240
Clay and silty clay, moderate-brown (5YR 4/4) and moderate-reddish-brown (10R 4/6), with much massive caliche.	20	240-260

Table 3. Driller's log for test well T27 (22S.05E.22.141)

[All information taken directly from field notes
provided by White Sands Missile Range]

Date drilling started: 2-28-1983

Hour	Date	Lithology	Depth below land surface (feet)	Marsh-funnel viscosity	Remarks
1100	02-28	Top soil	0	64	Started kelly in
1115	02-28	Clay	10	64	Normal drilling
1117	02-28	Clay	20	64	Added 20' section
1120	02-28	Clay	30	64	Normal drilling
1150	02-28	Clay	40	64	Added 20' section
1155	02-28	Clay	50	56	Normal drilling
1210	02-28	Clay and gravel	60	56	Added 20' section
1215	02-28	Clay and gravel	70	56	Normal drilling
1220	02-28	Clay and gravel	80	56	Added 20' section
1225	02-28	Clay and sand	90	45	Normal drilling
1235	02-28	Clay and sand	100	45	Added 20' section
1304	02-28	Silt	110	45	Few cuttings
1308	02-28	Gravel	115	45	Logged
1311	02-28	Silt and clay	120	45	Added 20' section
1315	02-28	Clay	130	36	Normal drilling
1322	02-28	Clay	140	36	Added 20' section
1324	02-28	Clay	150	36	Normal drilling
1335	02-28	Clay	160	36	Added 20' section
1343	02-28	Clay	170	36	Normal drilling
1350	02-28	Silt and clay	180	36	Added 20' section
1356	02-28	Silt and clay	190	36	Normal drilling
1402	02-28	Silt and clay	200	36	Added 20' section
1411	02-28	Silt and clay	210	36	Normal drilling
1420	02-28	Silt and clay	220	36	Added 20' section
1425	02-28	Silt and clay	230	36	Normal drilling
1442	02-28	Silt and clay	240	36	Added 20' section
1446	02-28	Silt and clay	250	36	Normal drilling
1450	02-28	Silt and clay	260	36	Done drilling
1600	02-28	Silt and clay	263	36	Reamed hole, began pulling steel

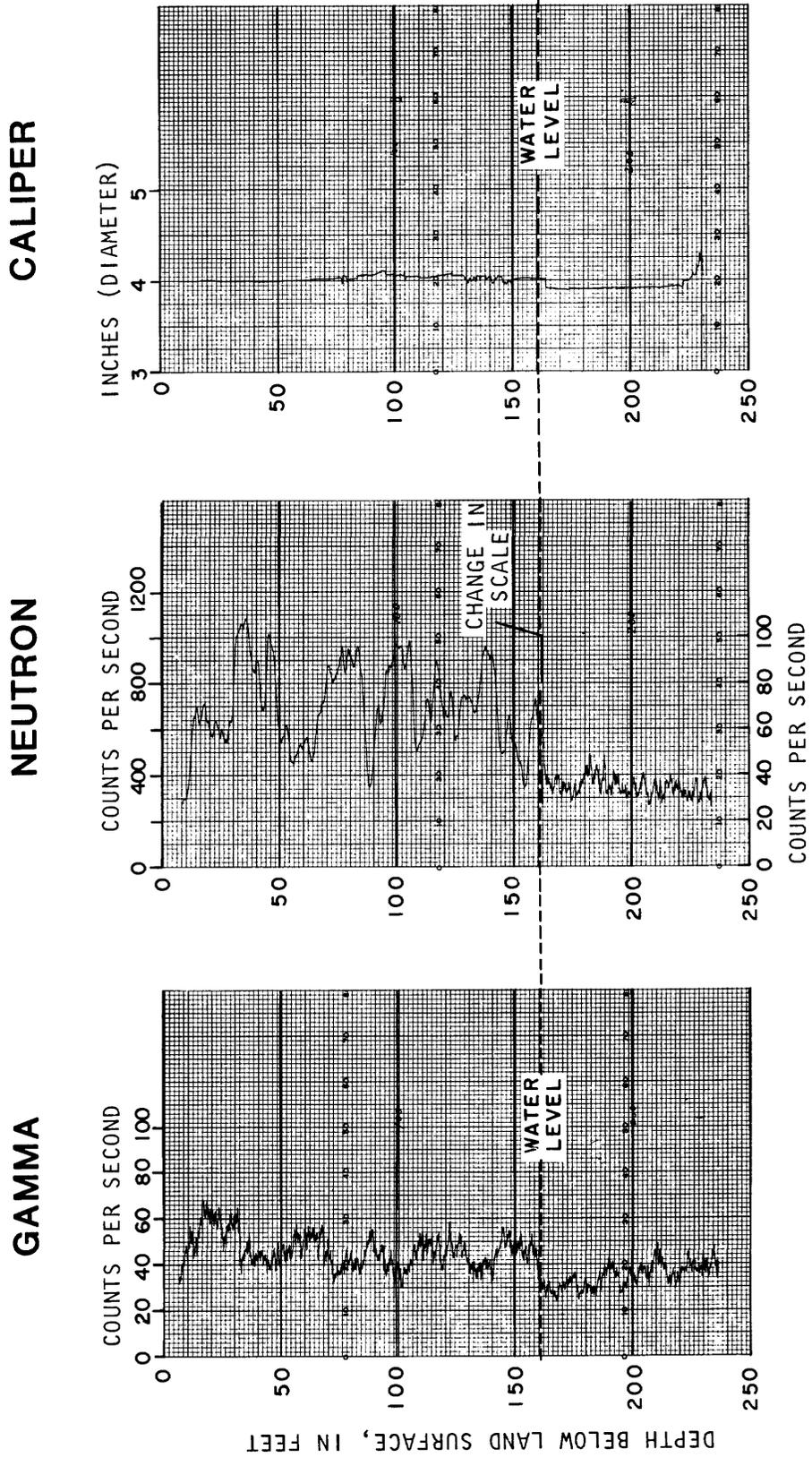


Figure 2.--Gamma, neutron, and caliper logs for test well T27 (22S.05E.22.141) with casing.

TEST WELL T28

Test well T28 (fig. 1) was drilled as an observation well in March 1983 (table 1). The main purpose of the well is to monitor water levels and water quality in the vicinity of the Liquid Propellant Storage Area. The well penetrated Quaternary alluvium and bolson fill composed of interbedded clay, silt, sand and gravel. A lithologic log prepared by the U.S. Geological Survey from analysis of the well cuttings collected by the U.S. Army is shown in table 4.

T28 was drilled with a 9 7/8-inch-diameter wing bit to a depth of 300 feet and completed at a depth of 300 feet. A driller's log for T28 is shown in table 5. The well was drilled with a bentonite drilling fluid. The well was completed with 300 feet of 4-inch-inside-diameter PVC casing with a slotted interval from 160 feet to 300 feet. The bottom of the well is uncapped. A caliper log made in the cased well is shown in figure 3. The casing is separated at about 77 feet below land surface (fig. 3). A dummy probe was used to break through the bridge in the casing at 80 feet below land surface. The probe was spudded to about 100 feet below land surface and could not go beyond that depth. The finished well depth is above the water table.

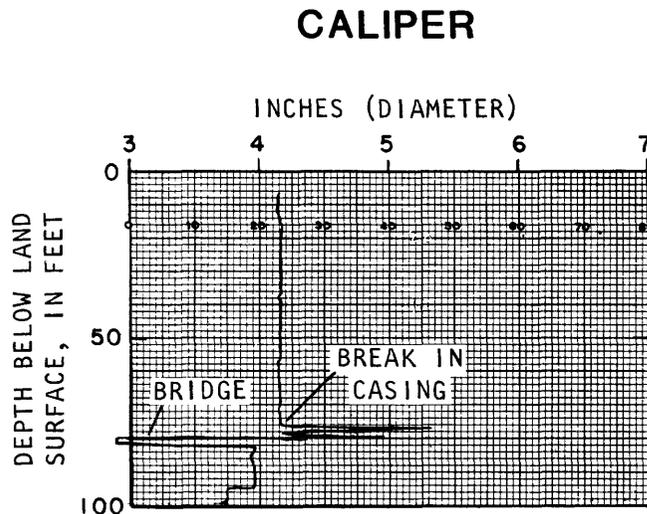


Figure 3.--Caliper log for test well T28 (22S.05E.22.122) with casing.

Table 4. Lithologic log for test well T28 (22S.05E.22.122)

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-brown (5YR 4/4), with a little silt and some very coarse grained sand and granules consisting of subrounded quartz, feldspar, granite, and purple igneous rock; contains massive caliche and biotite flakes.	15	0-15
Clay, moderate-brown (5YR 3/4), with granules of subrounded quartz, granite, feldspar, and purple igneous rock; much fine-grained, well-rounded quartz sand from 25-30 feet; caliche and biotite throughout.	15	15-30
Sand, fine-grained, quartz, moderately well-rounded, with bits of hard, moderate-brown (5YR 4/4) clay and soft caliche; a little rounded, coarse-grained quartz.	5	30-35
Clay, moderate-brown (5YR 4/4), with much massive caliche.	5	35-40
Sand, fine- to medium-grained, quartz, subrounded, with some subrounded, coarse-grained sand consisting of quartz, chert, feldspar, and moderate-reddish-orange (10K 6/6) igneous rock; also bits of hard, moderate-brown (5YR 4/4) clay and moderate-orange-pink (10R 7/4) caliche.	10	40-50
Pebbles, subrounded to well-rounded, quartz, feldspar, and chert with a little moderate-brown (5YR 4/4) clay and hard caliche; poorly sorted.	5	50-55
Clay, moderate-brown (5YR 4/4), with very coarse grained sand to granules of quartz, chert, and feldspar; medium- to coarse-grained sand from 60-65 feet.	15	55-70

Table 4. Lithologic log for test well T28 (22S.05E.22.122) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, medium- to very coarse grained, with a few granules consisting of subrounded to well-rounded quartz with a little chert, purple (5RP) igneous rock, and granite; contains caliche; poorly sorted.	5	70-75
Granules, subrounded to well-rounded; composed mostly of quartz with some brown (5YR) and purple (5RP) igneous rock and a little granite and caliche.	5	75-80
Clay, silty, pale-yellowish-brown (10YR 6/2), with a few subrounded granules of quartz, and igneous rocks with massive pinkish-gray (5YR 8/1) caliche.	15	80-95
Clay, pale- (10YR 6/2) to moderate-yellowish-brown (10YR 5/4), with a few granules and some caliche.	10	95-105
Clay, moderate-yellowish-brown (10YR 5/4), with caliche.	25	105-130
Clay, silty, yellowish-brown (10YR 5/4), with caliche.	5	130-135
Clay with silt, moderate-brown (5YR 4/4), and much rounded quartz grains ranging in size from fine to coarse grained with scattered granules; some fine-grained sand is cemented with pinkish-gray (5YR 8/1) caliche; feldspar, chert, and igneous rocks are present in small amounts.	5	135-140
Sand, fine- to medium-grained, quartz, rounded, cemented (very hard) with caliche; a few subrounded granules of quartz, chert, and feldspar are present.	5	140-145

Table 4. Lithologic log for test well T28 (22S.05E.22.122) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Caliche, massive, with fine- to medium-grained, well-rounded quartz sand cemented within; a few subrounded quartz and igneous granules and a little moderate-brown (5YR 4/4) clay are present from 155-160 feet.	15	145-160
Sand, fine-grained, well-rounded, quartz, and pale-yellowish-brown (10YR 6/2) clay with some medium-grained sand and granules, mostly consisting of well-rounded quartz, and caliche; very poorly sorted.	5	160-165
Clay and silty clay, moderate-brown (5YR 4/4), with much caliche and fine- to medium-grained quartz sand from 165-170 feet.	15	165-180
Clay, moderate-yellowish-brown (10YR 5/4), with fine-grained sand and caliche.	10	180-190
Clay, silty, pale- (10YR 6/2) to moderate-yellowish-brown (10YR 5/4), with much massive caliche.	10	190-200
Clay, silty, moderate-yellowish-brown (10YR 5/4), with fine- to medium-grained sand and much caliche.	10	200-210
Clay, silty, moderate-yellowish-brown (10YR 5/4), with much caliche.	5	210-215
Clay, moderate-yellowish-brown (10YR 5/4), with much caliche; some fine- to coarse-grained sand from 220-225 feet.	10	215-225

Table 4. Lithologic log for test well T28 (22S.05E.22.122) - Concluded

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay silty, moderate-yellowish-brown (10YR 5/4), with caliche; some fine-grained sand from 225-230 feet.	10	225-235
Clay, moderate-brown (5YR 4/4), with a little silt and caliche.	25	235-260
Clay, silty, moderate-brown (5YR 4/4), with large chunks of carbonate-cemented fine-grained sublitharenite and bits of caliche; interval from 270-275 feet contains much fine-grained quartz sand.	15	260-275

Table 5. Driller's log for test well T28 (22S.05E.22.122)

[All information taken directly from field notes
provided by White Sands Missile Range]

Date drilling started: 3-1-1983

Hour	Date	Lithology	Depth below land surface (feet)	Marsh-funnel viscosity	Remarks
1300	03-01	Silt, large sand, and clay	10	36	Spud in
1328	03-01	Caliche, silt, and coarse sand	20	32	Normal drilling, added 20' steel
1340	03-01	Small gravel	25-26	32	1 foot
1403	03-01	Red to white clay and small gravel	40	34	Added bentonite (2), normal drilling
1425	03-01	Silt, clay, and small gravel	42-50	31	10 feet, normal drilling
1450	03-01	Silt, clay, sand, and small gravel	60	31	Normal drilling
1500	03-01	Silt, clay, sand, and small gravel	70	28	Added 500 gal. water, normal drilling
1505	03-01	Coarse sand, clay, silt, and gravel	80	27	Normal drilling
1525	03-01	Small gravel, clay, and silt	90	27	Normal drilling
1535	03-01	Red and white clay, small gravel, and silt	100	26	Normal drilling

Table 5. Driller's log for test well T28 (22S.05E.22.122) - Continued

Hour	Date	Lithology	Depth below land surface (feet)	Marsh-funnel viscosity	Remarks
1545	03-01	Red clay, sand, silt, small gravel	110	26	105'-107' gravel, normal drilling
1555	03-01	Red clay, sand, and silt	123	26	Normal drilling
1600	03-01	--	123	26	Bit clogged
1605	03-01	--	123	--	Pulled steel
1655	03-01	--	--	--	Disconnected bit to wash
1740	03-01	--	--	--	Reconnected bit
1745	03-01	--	--	--	Trip back into hole
1855	03-01	Clay, sand, silt	125	35	Started drilling, added 5 bags of mud
1905	03-01	Clay, sand, silt	130	35	Normal drilling
1925	03-01	Clay, sand, silt	140	35	Normal drilling, added 20' steel
1945	03-01	Clay, sand, silt	150	35	Normal drilling
2005	03-01	Clay, sand, silt	160	35	Added 20' steel
2028	03-01	Clay, sand, silt	170	38	Normal drilling

Table 5. Driller's log for test well T28 (22S.05E.22.122) - Continued

Hour	Date	Lithology	Depth below land surface (feet)	Marsh-funnel viscosity	Remarks
2055	03-01	Sand, clay, silt	180	38	Added 20' steel
2100	03-01	Sand, clay, silt	190	39	Normal drilling
2110	03-01	Sand, clay, silt	200	39	Added 20' steel
2142	03-01	Clay and silt	210	42	Normal drilling
2153	03-01	Clay and silt	220	42	Added 20' steel
2255	03-01	Clay and silt	230	43	Normal drilling
2300	03-01	Clay and silt	240	43	Added 20' steel
2316	03-01	Clay and silt	250	43	Normal drilling
2322	03-01	Clay and silt	260	40	Added 20' steel
2345	03-01	Clay and silt	270	40	Normal drilling
0002	03-02	Clay and silt	280	40	Normal drilling
0020	03-02	Clay and silt	290	40	Normal drilling
0040	03-02	Clay and silt	300	40	Circulating on bottom

Table 5. Driller's log for test well T28 (22S.05E.22.122) - Concluded

Hour	Date	Lithology	Depth below land surface (feet)	Marsh-funnel viscosity	Remarks
0125	03-02	--	--	--	Started tripping out
0210	03-02	--	--	--	Take off bit, set up for casing
0255	03-02	--	--	--	Started putting 4" PVC in hole
0515	03-02	--	--	--	Finished casing, started to put steel down hole
0555	03-02	--	--	--	Aux. cable undone from fixed end
0615	03-02	--	--	--	Started putting steel in hole
0640	03-02	--	--	--	Ready to develop
0820	03-02	--	--	--	Pull steel, steel caught in casing

REFERENCES

- Compton, Robert R., 1962, Manual of field geology: New York, John Wiley and Sons, Inc., 378 p.
- Goddard, E. N., chm., and others, 1948, Rock-color chart: Washington, National Research Council (reprinted by Geological Society of America, 1951, 1963, 1970, 1975, 1979, 1980).