TEST WELLS T23, T29, AND T30, WHITE SANDS MISSILE RANGE AND FORT BLISS MILITARY RESERVATION, 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 only (except for grain size). The following table contains factors for converting to metric units. To convert millimeters (mm) to inches, multiply by 0.03937.

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

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ABSTRACT

Three test wells, T23, T29, and T30, were drilled in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in November 1982. Test well T23 was drilled as an exploratory and monitoring well in the proposed Soledad well field at Fort Bliss Military Reservation. Test wells T29 and T30 were drilled at White Sands Missile Range. Test well T29 was drilled as an observation well in the vicinity of the outfall channel from the sewage-treatment plant. Test well T30 was drilled as an observation well for a land fill south of the well site. Information obtained from these wells includes lithologic logs for all wells and borehole-geophysical logs from the cased wells for test wells T29 and T30.

INTRODUCTION

Three test wells, T23, T29, and T30 (fig. 1; table 1), were drilled in south-central New Mexico as part of a joint military training program sponsored by the U.S. Army in November 1982. Test well T23 was drilled at Fort Bliss Military Reservation, New Mexico, and test wells T29 and T30 were drilled at White Sands Missile Range, New Mexico. The participants of the program were members of the U.S. Army from Fort Knox, Kentucky, and civilians from Fort Irwin, California, and Fort Campbell, Kentucky. The U.S. Geological Survey assisted White Sands Missile Range personnel 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, Facilities Engineering Directorate.

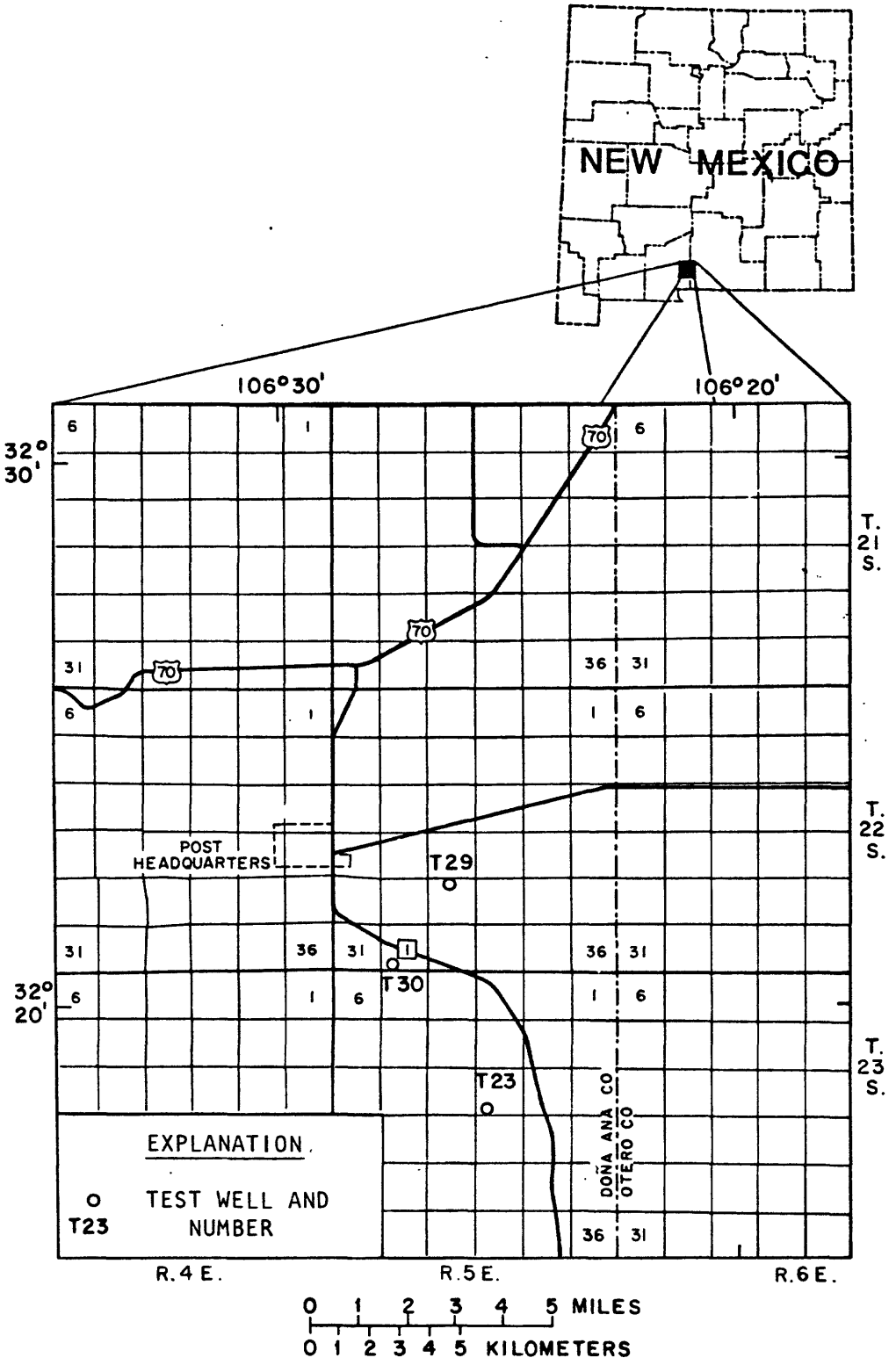

Figure 1.--Locations of test wells T23, T29, and T30, White Sands Missile Range and Fort Bliss Military Reservation.

To date (November 1983), none of these wells have been developed. Therefore, there are no chemical analyses of water samples available. Driller's logs are not available. Depth to water below land surface in test wells T29 and T30 was estimated from U.S. Geological Survey borehole-geophysical logs.

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 T23, T29, and T30

Well name	Location	Date drilled	Water level below land surface (feet)	Drilled depth (feet)	Finished depth (feet)	Slot or screen interval, depth below land surface (feet)	Casing diameter (inches)	Remarks
T23	23S.05E.15.332	11-82	—	860±	—	—	—	Abondoned with 860± feet of drill stem and bit.
T29	22S.05E.28.122	11-82	148±	300	255	210-245-slot 245-250-screen 250-255-slot	4 (PVC)	
T30	22S.05E.32.334	11-82	213±	340	305	280-290-slot 290-300-screen 300-305-slot	4 (PVC)	

TEST WELL T23

Test well T23 (fig. 1) was drilled as an exploratory and monitoring well in November 1982 (table 1). The main purposes of a well at this location are to obtain hydrogeologic data in the proposed Soledad well field (Wilson and Myers, 1981) and to use the completed well for monitoring water levels and water quality after installation of the well field. The drill stem was stuck during drilling and several attempts to remove it were unsuccessful. T23 was drilled to a depth of about 860 feet. The well was drilled with a bentonite drilling fluid. The well penetrated interbedded clay, silt, sand, and gravel in the Quaternary alluvium and bolson fill. A lithologic log prepared by the U.S. Geological Survey from analysis of the well cuttings collected by the U.S. Army to a depth of 850 feet is shown in table 2.

Table 2.—Lithologic log for test well T23 (23S.05E.15.332)

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, coarse-grained, angular to subangular, very well sorted; composed of granite with some felsic igneous rock and a little quartz, feldspar, and mafics including biotite and magnetite; sand is subangular to subrounded from 0-10 feet.	20	0-20
Sand, coarse- to very coarse grained, sub-angular, well-sorted; mainly composed of felsic igneous rock with some granite, quartz, and feldspar; 30-35 foot interval has some angular grains.	15	20-35
Granules, subrounded, well-sorted; composed of felsic igneous rock, quartz, and granite.	5	35-40
Sand, very coarse grained, with granules, angular to subangular, moderately to well-sorted; composed of felsic igneous rock, granite, feldspar, and quartz.	25	40-65
Granules, angular to subangular, well-sorted; composed of felsic igneous rock, granite, feldspar, and quartz.	5	65-70
Sand, medium-grained, to granules, subangular with some subrounded, moderately to poorly sorted; composed of felsic to intermediate igneous rock, granite, quartz, and a little limestone.	10	70-80
Granules to pebbles as large as 5 mm, subangular, moderately well sorted; composed of granite with some igneous rock, quartz, and limestone; spherulites and greater amount of pebbles in the 85-90 foot interval.	10	80-90
Pebbles, subangular, well-sorted; composed of igneous rock and granite; pebbles are 4 to 6 mm from 95-100 feet, 5 to 8 mm from 100-105 feet, and 5 to 10 mm from 105-120 feet.	30	90-120

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Pebbles, 4 to 12 mm, subangular, poorly sorted; composed of granite and igneous rock; grains become more rounded by 135 feet.	15	120-135
Silt, moderate-reddish-brown (10R 4/6), with subangular to subrounded, fine-grained sand and a few pebbles composed of felsic igneous rock and granite; interval is very poorly sorted.	5	135-140
Clay, moderate-reddish-brown (10R 4/6), with some subrounded, medium-grained sand and angular pebbles; interval is very poorly sorted.	5	140-145
Silt to pebbles as large as 10 mm, angular to rounded, very poorly sorted; composed of quartz, granite, igneous rock, and chert; 1 percent biotite and magnetite grains present in the silt.	5	145-150
Sand, very fine to medium-grained, with some coarse-grained sand to pebbles (as large as 8 mm), subrounded, very poorly sorted; composed of quartz, granite, igneous rock, and chert.	5	150-155
Sand, coarse-grained, to pebbles as large as 10 mm, angular to subangular, poorly sorted; composed of granite, igneous rock, and some quartz.	5	155-160
Clay, moderate-brown (5YR 4/4), with silt to pebbles as large as 6 mm; grains are subangular and composed of granite and igneous rock; less clay and silt from 165-170 feet; interval is very poorly sorted.	10	160-170

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, very coarse grained, with some silt, granules, and pebbles as large as 6 mm, angular and subangular, moderately to poorly sorted; composed of igneous rock and granite; finer grains are quartz.	5	170-175
Clay, moderate-brown (5YR 4/4), and silt with some subangular, medium-grained sand to pebbles, mostly composed of igneous rock and granite; interval is very poorly sorted.	5	175-180
Silt to pebbles as large as 6 mm, with some clay, very poorly sorted; grains are subangular to subrounded; composed of assorted felsic to intermediate igneous rock.	5	180-185
Sand, very coarse grained, subrounded, very poorly sorted; composed of quartz, granite, feldspar, and some igneous rock; interval contains some rounded to well-rounded, fine-grained quartz sand and a small amount of subrounded pebbles.	5	185-190
Silt and sand, coarse- to very coarse grained, with some granules, subrounded to rounded, very poorly sorted; composed of quartz, granite, and igneous rock.	5	190-195
Sand, coarse-grained, and granules with a few pebbles as large as 5 mm, and bits of clay, angular to subangular, moderately sorted; composed of granite, quartz, felsic igneous rock, and a small amount of gneiss and chert.	5	195-200
Clay, moderate-brown (5YR 4/4), with silt and some medium- to very coarse grained sand, which is subrounded and composed of granite, quartz, felsic igneous rock, and some gneiss and chert.	5	200-205

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, very coarse grained, to granules with some pebbles and some silt; grains are angular to subangular, poorly sorted; composed of quartz, granite, much felsic to intermediate igneous rock, and a small amount of feldspar.	5	205-210
Clay, silty, moderate-brown (5YR 4/4), with some rounded medium-grained quartz sand and subangular to subrounded granules composed of quartz, igneous rock, and granite; interval is poorly sorted.	5	210-215
Sand, very coarse grained, to granules, sub-rounded with some subangular, moderately sorted; composed of igneous rock, quartz, and some feldspar, granite, and chert; some well-rounded, fine-grained quartz sand and a slight amount of silty clay.	5	215-220
Sand, fine-grained, to pebbles as large as 10 mm, subrounded with some subangular, very poorly sorted; composed of granite, quartz, chert, and felsic to intermediate igneous rock; roundness increases with depth; a small amount of light-brown (5YR 5/6) to pinkish-light-brown (10R 5/4) clay with caliche is present.	10	220-230
Sand, fine-grained, to pebbles as large as 6 mm, rounded to well-rounded, very poorly sorted; composed of igneous rock with some chert, quartz, and some granite; some moderate-reddish-brown (10R 3/4) clay is present.	5	230-235

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Granules with sand, very coarse grained, and pebbles as large as 8 mm, along with some moderate-yellowish-brown (10YR 5/4) clay, poorly sorted; grains are rounded with some subrounded to well rounded; composed of quartz, granite, and igneous rock.	5	235-240
Clay, moderate-brown (5YR 4/4), with a few subangular pebbles as large as 10 mm, composed of igneous rock and some quartz; clay is very sticky and contains massive caliche.	5	240-245
Granules with sand, very coarse grained, and some pebbles as large as 8 mm, subrounded to rounded, moderately sorted; composed of quartz, granite, and igneous rock, with some limestone, chert, carbonate-cemented fine-grained sandstone, and metamorphic rock.	5	245-250
Clay, moderate-yellowish-brown (10YR 5/4), with some medium-grained sand to pebbles as large as 10 mm, very poorly sorted; grains are composed of rounded quartz and subangular to subrounded igneous rock, granite, chert, and some limestone; contains caliche.	10	250-260
Sand, very coarse grained, to granules with some pebbles as large as 5 mm, moderately well sorted; composed of rounded quartz with angular to subangular igneous rock, granite, and limestone; contains some very well cemented caliche from 270-275 feet.	15	260-275
Clay moderate-brown (5YR 4/4) to light-brown (5YR 5/6), with a few granules and pebbles that are subrounded to rounded and composed of quartz, igneous rock, and granite; contains hard bits of caliche that increase with depth.	10	275-285

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, very coarse grained, with pebbles as large as 4 mm, and some hard, moderate-brown (5YR 4/4) clay, poorly sorted; grains are subangular to subrounded; composed of quartz, granite, and igneous rock; massive caliche is present.	5	285-290
Clay, moderate-brown (5YR 4/4), with much massive caliche and some subangular fine-grained sand to granules composed of quartz and igneous rock; sand content increases with depth; clay is very sticky from 295-300 feet.	20	290-310
Clay, moderate-brown (5YR 4/4), with caliche and sand, poorly sorted; grains are angular to subangular, medium to very coarse grained from 315-320 feet and subrounded to rounded fine-grained sand to pebbles as large as 4 mm, from 330-335 feet; sand is composed of quartz, igneous rock, granite, and chert.	25	310-335
Clay, moderate-brown (5YR 4/4) to light-brown (5YR 5/6), with much caliche and sub-rounded, medium-grained sand to granules composed of quartz, igneous rock, and some granite.	5	335-340
Granules with some medium- to very coarse grained sand, and a few pebbles as large as 5 mm, moderately sorted; grains are composed of subrounded igneous rock and granite with well-rounded quartz; interval contains some moderate-brown (5YR 4/4) clay with caliche.	5	340-345
Clay, moderate-brown (5YR 4/4), with caliche and coarse-grained sand to pebbles as large as 5 mm, poorly sorted; grains are subrounded and composed of igneous rock, granite, quartz, and a little carbonate-cemented sandstone and chert; grain size decreases with depth.	20	345-365

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-brown (5YR 4/4), with fine-grained sand to granules, very poorly sorted; grains are composed of subrounded to well-rounded quartz and angular to subangular igneous rock.	5	365-370
Sand, very coarse grained, to granules, moderately sorted; composed of quartz, igneous rock, plus some chert, feldspar, and carbonate-cemented sandstone; finer grains of quartz are well rounded, other grains are angular; contains some light-brown (5YR 5/6) clay with caliche; greater amount of clay from 375-380 feet; some granite present from 380-385 feet.	15	370-385
Clay, moderate-brown (5YR 4/4), with much medium- to very coarse grained sand, poorly sorted; composed of felsic igneous rock, quartz, and granite; quartz is rounded; most other grains are angular to subangular; contains much caliche-cemented sand.	5	385-390
Sand, very fine to coarse-grained, to granules, subangular to subrounded, poorly sorted; composed of felsic to intermediate igneous rock, quartz, and some granite; much well-cemented caliche is present.	5	390-395
Clay, moderate-yellowish-brown (10YR 5/4), with some rounded, fine-grained sand composed of igneous rock and quartz; biotite present in the clay.	5	395-400
Clay, silty, moderate-brown (5YR 4/4), with much fine-grained sand to pebbles as large as 5 mm, poorly sorted; grains are composed of subangular to subrounded igneous rock and granite, with rounded quartz and chert; caliche present in medium-sized masses that contain biotite.	5	400-405

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-yellowish-brown (10YR 5/4), with much subrounded to rounded, coarse-grained sand, poorly sorted; grains are composed of felsic to intermediate igneous rock, quartz, and some granite; contains massive caliche with sand and biotite cemented within; sand is slightly finer from 410-415 feet.	10	405-415
Clay, moderate-yellowish-brown (10YR 5/4), with much fine- to very fine grained, sub-rounded sand, poorly sorted; grains are composed of quartz and mixed igneous rock; contains a few granules of quartz and igneous rock and caliche.	5	415-420
Sand, very coarse grained, to granules with a few pebbles as large as 5 mm, subangular to subrounded, moderately sorted; composed of quartz, igneous rock, chert, and some carbonate-cemented sandstone, plus some rounded very fine to fine-grained sand composed of quartz and a very small amount of igneous rock; contains hard bits of moderate-yellowish-brown (10YR 5/4) clay and soft masses of pinkish-white caliche that contain lithic grains.	5	420-425
Clay, moderate-brown (5YR 4/4), very sticky, with much subangular medium- to very coarse grained sand, poorly sorted; grains are composed of quartz and mixed igneous rock; contains caliche.	5	425-430
Clay, moderate-yellowish-brown (10YR 5/4), with subrounded, fine-grained sand, moderately to well-sorted; sand is composed of quartz and igneous rock; interval is slightly more sandy and contains some coarse-grained sand from 435-440 feet; caliche throughout.	10	430-440

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-yellowish-brown (10YR 5/4), with much rounded, fine-grained quartz sand and some subangular, medium- to very coarse grained sand, moderately sorted; sand is composed of quartz, intermediate igneous rock, and feldspar.	5	440-445
Sand, fine- to coarse-grained; moderate-brown (5YR 4/4) clay; finer grains are rounded and composed of quartz, coarser grains are subangular and composed of quartz and igneous rock; fine-grained sand becomes very fine grained to silty with increasing depth; interval contains much caliche and is poorly sorted.	15	445-460
Sand, coarse-grained, to pebbles, angular to subangular, poorly sorted; composed of quartz, feldspar, igneous rock, and some chert, and granite; from 460-465 feet, pebbles are as large as 5 mm; from 465-470 feet, pebbles are as large as 12 mm and interval contains some well-rounded, fine-grained quartz sand, some clay, and much caliche-cemented sand.	10	460-470
Clay, moderate-yellowish-brown (10YR 5/4), with some angular to rounded, fine-grained sand to granules, poorly sorted; grains are composed of quartz, chert, felsic igneous rock, and granite; caliche-cemented sand present.	10	470-480
Granules with a few pebbles as large as 8 mm, angular to subrounded, moderately well sorted; composed of quartz, feldspar, granite, felsic igneous rock, and chert; contains caliche.	5	480-485

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, moderate-yellowish-brown (10YR 5/4) with some light-brown (5YR 5/6) clay, caliche and subangular to subrounded, coarse- to very coarse grained sand, mostly composed of quartz, igneous rock, and feldspar; interval is poorly sorted.	5	485-490
Sand, coarse- to very coarse grained, with a few pebbles as large as 5 mm, subangular to subrounded, poorly sorted; composed of quartz, felsic igneous rock, chert, granite, and feldspar; a small amount of moderate-brown (5YR 4/4) clay and abundant caliche.	5	490-495
Sand, very coarse grained, to pebbles as large as 7 mm, poorly sorted; grains are subrounded with some subangular; composed of granite, quartz, feldspar, chert, and purple igneous rock; also contains much caliche with biotite and sand grains cemented within.	5	495-500
Sand, very coarse grained, to granules, subangular to subrounded, moderately well sorted; composed of quartz, feldspar, felsic igneous rock, chert, and granite; small amount of clay and fine-grained sand present from 510-515 feet; more clay from 525-530 feet; massive caliche throughout.	30	500-530
Clay, moderate-brown (5YR 4/4), with some subrounded, very coarse grained sand to granules, poorly sorted; grains are composed of quartz, felsic igneous rock, chert, and granite; much caliche.	10	530-540

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Granules, subrounded, composed of quartz with some feldspar, felsic igneous rock, granite, and some metamorphic rock; contains much massive caliche; interval from 540-550 feet contains some subrounded, well-sorted, very coarse grained sand; subrounded, very well sorted granules predominate from 550-555 feet; a few small pebbles, 4-6 mm, are present from 555-565 feet.	25	540-565
Sand, very coarse grained, to granules, subangular to subrounded, poorly sorted; composed of quartz, feldspar, felsic igneous rock, granite, and chert; some moderate-yellowish-brown (10YR 5/4) to pale-yellowish-brown (10YR 6/2) clay from 570-580 feet; well-cemented caliche containing sand grains throughout.	15	565-580
Clay, moderate-yellowish-brown (10YR 5/4), with some rounded to well-rounded sand composed of quartz, and some subangular to subrounded felsic igneous rock, feldspar, and granite, very poorly sorted; from 580-585 feet, sand is coarse grained to granular; from 585-590, feet clay is silty and sand is very fine to medium grained; from 590-595 feet, granules and pebbles as large as 6 mm; coarse-grained sand to granules present from 595-605 feet; very coarse to medium-grained sand present from 605-610 feet; pale-yellowish-brown (10YR 6/2) clay from 595-610 feet; caliche is abundant throughout.	30	580-610
Sand, very coarse grained, to granules, angular to subrounded with some light-brown (5YR 5/6) clay with caliche; sand consists of quartz, chert, and felsic igneous rock.	5	610-615

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Clay, silty, pale-yellowish-brown (10YR 6/2), with some subrounded, fine- to coarse-grained sand, poorly sorted; sand is composed of quartz, chert, and felsic igneous rock; contains much caliche; sand content increases with depth.	15	615-630
Clay, moderate-yellowish-brown (10YR 5/4), with some subrounded, medium- to coarse-grained sand, poorly sorted; sand is composed of quartz, felsic igneous rock, chert and feldspar; interval from 630-635 feet has rounded, fine- to medium-grained sand composed of quartz; caliche throughout.	15	630-645
Clay, silty, moderate-yellowish-brown (10YR 5/4), with abundant subangular to subrounded, very coarse grained sand composed of quartz, feldspar, and felsic igneous rock; poorly sorted; contains caliche.	5	645-650
Sand, very coarse grained, subangular, moderately sorted; composed of quartz, feldspar, chert, and felsic igneous rock; interval from 650-655 feet contains some angular pebbles as large as 6 mm, and some subrounded sand; some moderate-yellowish-brown (10YR 5/4) clay and more subrounded sand is present from 655-660 feet.	10	650-660
Clay, moderate-yellowish-brown (10YR 5/4), with much angular to subangular sand, poorly sorted; grains are composed of quartz, chert, feldspar, and felsic igneous rock; very coarse grained sand to pebbles as large as 5 mm are present; from 670-675 feet, sand is medium to coarse grained and clay is very sticky; caliche throughout.	15	660-675

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Granules, subangular to rounded, moderately well sorted; composed of quartz, feldspar, chert, felsic igneous rock, and granite; some moderate-yellowish-brown (10YR 5/4) clay.	5	675-680
Clay, moderate-yellowish-brown (10YR 5/4), with much subangular to subrounded, coarse-grained sand, poorly sorted; sand is composed of quartz, feldspar, and felsic igneous rock; contains caliche.	10	680-690
Clay, pale-yellowish-brown (10YR 6/2), with some medium-grained sand, moderately sorted.	10	690-700
Clay, silty, moderate-yellowish-brown (10YR 5/4), with some subrounded, medium- to coarse-grained sand, poorly sorted; sand is composed of quartz, feldspar, and felsic igneous rock; contains caliche.	10	700-710
Clay, silty, moderate-yellowish-brown (10YR 5/4), with much subrounded, medium-grained sand to granules, very poorly sorted; grains are composed of igneous rock, quartz, and feldspar; contains caliche.	10	710-720
Clay, silty, moderate-yellowish-brown (10YR 5/4), with some subrounded, medium- to coarse-grained quartz sand, moderately sorted; contains caliche.	10	720-730
Clay, moderate-yellowish-brown (10YR 5/4), with some subangular to subrounded, coarse- to very coarse grained sand, moderately sorted; sand is composed of quartz and felsic igneous rock; clay is very sticky and contains caliche.	10	730-740

Table 2.--Lithologic log for test well T23 (23S.05E.15.332) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Silt, clay, fine-grained sand, and some very coarse grained sand, very poorly sorted; sand is subrounded and composed of quartz, granite, and igneous rock.	10	740-750
Clay, moderate-yellowish-brown (10YR 5/4), with silt and caliche, well-sorted.	10	750-760
Clay, moderate-yellowish-brown (10YR 5/4), with subangular, coarse-grained sand to granules, very poorly sorted; grains are composed of quartz and felsic to intermediate igneous rock.	10	760-770
Clay, moderate-yellowish-brown (10YR 5/4), with subangular, coarse-grained sand, poorly sorted; sand is composed of quartz and felsic to intermediate igneous rock.	10	770-780
Clay, moderate- (10YR 5/4) to pale-yellowish-brown (10YR 6/2), with caliche and some rounded, fine-grained quartz sand; well sorted.	10	780-790
Clay, pale-yellowish-brown (10YR 6/2), with some rounded, fine- to coarse-grained sand, moderately sorted; sand is composed of quartz and igneous rock.	10	790-800
Sand, very coarse grained, subrounded, moderately sorted; composed of quartz, feldspar, igneous rock, and chert with some fine-grained, well-rounded quartz sand; contains some silt, clay, and caliche.	10	800-810
Clay, pale-yellowish-brown (10YR 6/2), very sticky, very well sorted.	10	810-820

Table 2.—Lithologic log for test well T23 (23S.05E.15.332) - Concluded

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, very coarse grained, subangular to sub-rounded, moderately sorted; composed of feldspar, quartz, and igneous rock; some of the quartz grains are well rounded; contains some silt, clay, caliche.	10	820-830
Clay, moderate-yellowish-brown (10YR 4/4), with caliche.	10	830-840
Clay, moderate-yellowish-brown (10YR 4/4), with rounded, fine-grained quartz sand and biotite, well-sorted.	10	840-850

TEST WELL T29

Test well T29 (fig. 1) was drilled as an observation well in November 1982 (table 1) as a replacement for borehole B1. The main purpose of the well is to monitor water levels and water quality in the vicinity of the outfall channel from the sewage-treatment plant. The well penetrated interbedded clay, silt, sand, and gravel in the Quaternary alluvium and bolson fill. A lithologic log prepared by the U.S. Geological Survey from analysis of the well cuttings collected by the U.S. Army to a depth of 260 feet is shown in table 3.

Test well T29 was drilled to a depth of 300 feet and completed at a depth of 255 feet. The well was drilled with organic-polymer drilling fluid. The well was completed with 255 feet of 4-inch-inside-diameter PVC casing with a screened interval from 245 to 250 feet and slotted intervals from 210 to 245 feet and 250 to 255 feet. The screened interval is gravel packed with subrounded silica sand with a grain-size diameter of about 3 millimeters. Borehole-geophysical logs made in the cased well are shown in figure 2. The depth to water below land surface of about 148 feet was estimated from the borehole-geophysical logs.

Table 3.—Lithologic log for test well T29 (22S.05E.28.122)

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Granules with a few pebbles, subangular to subrounded, moderately well sorted; composed of feldspar with lesser amounts of quartz and granite; disseminated caliche present; less than 4 percent biotite, magnetite, and other mafics present.	20	0-20
Sand, coarse- to very coarse grained, subrounded, moderately sorted; composed of feldspar, quartz, and granite; caliche present; less than 4 percent mafics include biotite, hematite, magnetite, and limonite.	20	20-40
Granules with some very coarse grained sand, subangular to subrounded, moderately well sorted; composed of feldspar, quartz, and granite; mafics include less than 2 percent iron oxides and micas.	10	40-50
Sand, very coarse and coarse-grained, with scattered granules, subangular to subrounded, moderately sorted; composed of quartz with less feldspar and granite; less than 4 percent mafics include biotite, altered micas and iron oxides.	20	50-70
Sand, medium- to very coarse grained, subangular to subrounded, poorly sorted; composed of quartz, granite, and feldspar; less than 4 percent mafics include altered micas and iron oxides.	10	70-80
Clay, moderate-brown (5YR 4/4), with scattered coarse-grained quartz sand; caliche present; less than 2 percent mafics include altered micas.	20	80-100

Table 3.--Lithologic log for test well T29 (22S.05E.28.122) - Concluded

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, medium-grained, with scattered granules, subrounded to rounded, poorly to moderately sorted; composed of quartz, granite, feldspar, and tuff; about 5 percent mafics include altered micas, iron oxides, biotite, and magnetite.	20	100-120
Clay, moderate-brown (5YR 4/4), with a little coarse-grained sand, subrounded; composed mostly of quartz and feldspar; caliche present; less than 4 percent mafics include biotite and iron oxides.	30	120-150
Clay, light-brown (5YR 5/6) with some greyish-black (N2), and small amount of fine-grained quartz sand; massive caliche present; less than 4 percent mafics include altered micas.	20	150-170
Clay, light- (5YR 5/6) to moderate-brown (5YR 4/4), very sticky from 200-210 feet; some silty to sandy clay lenses; caliche present throughout; about 1 percent mafics include biotite, altered micas, and hematite.	90	170-260

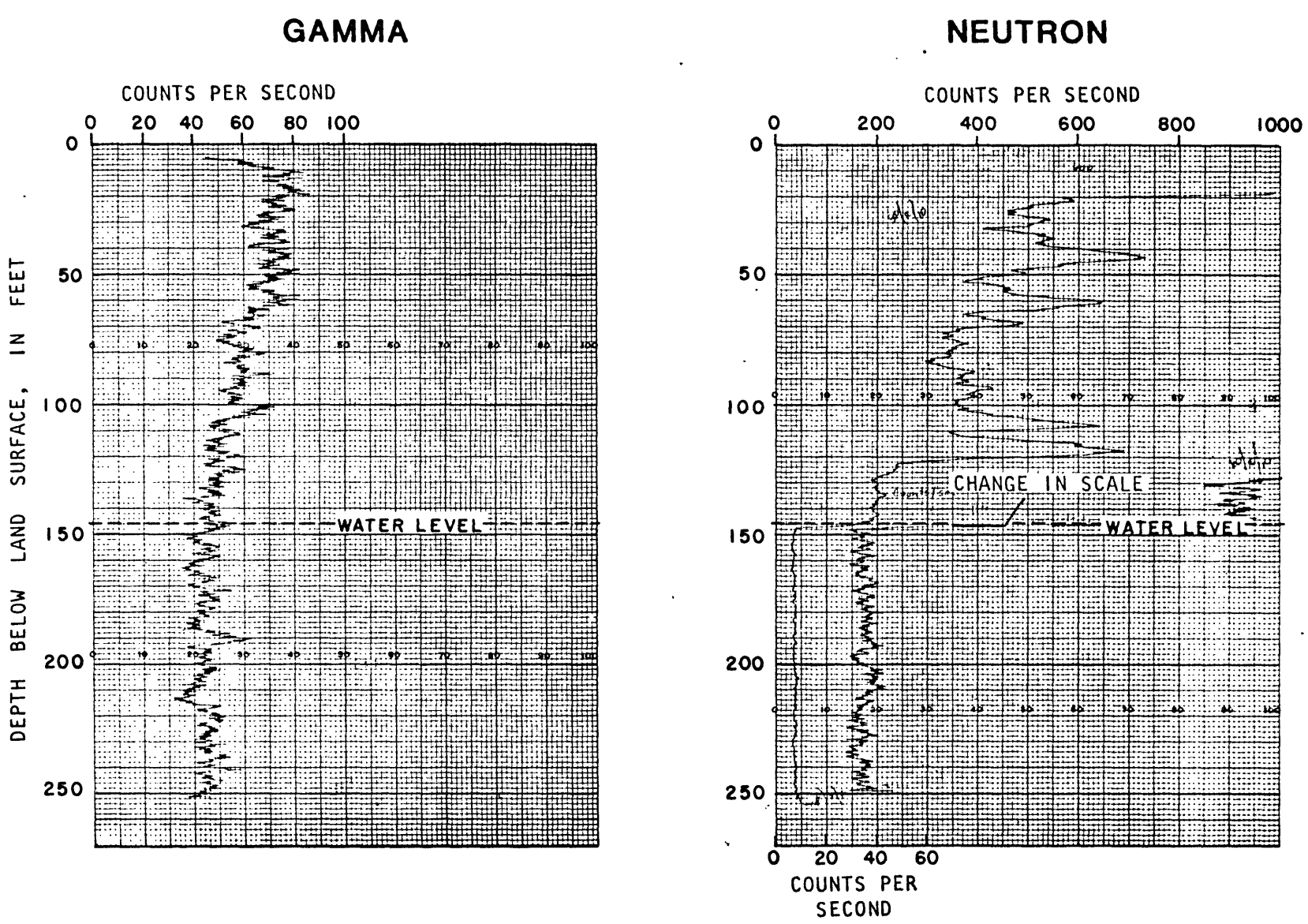

Figure 2.--Gamma and neutron logs for test well T29 (22S.05E.28.122) with casing.

TEST WELL T30

Test well T30 (fig. 1) was drilled as an observation well in November 1982 (table 1). The main purpose of the well is to monitor the migration of any possible contamination from a landfill south of the well site. The well penetrated interbedded clay, silt, sand, and gravel in the Quaternary alluvium and bolson fill. A lithologic log prepared by the U.S. Geological Survey from analysis of the well cuttings collected by the U.S. Army to a depth of 320 feet is shown in table 4.

Test well T30 was drilled to a depth of 340 feet and completed at a depth of 305 feet. The well was drilled with organic-polymer drilling fluid. The well was completed with 305 feet of 4-inch-inside-diameter PVC casing with a screened interval from 290 to 300 feet and slotted intervals from 280 to 290 feet and 300 to 305 feet. The screened interval is gravel packed with subrounded silica sand with a grain-size diameter of about 3 millimeters. Borehole-geophysical logs made in the cased well are shown in figure 3. The depth to water below land surface of about 213 feet was estimated from the borehole-geophysical logs.

Table 4.—Lithologic log for test well T30 (22S.05E.32.334)

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, coarse- to very coarse grained, mostly subangular to subrounded, well-sorted; composed of feldspar with lesser amounts of quartz; less than 4 percent biotite, magnetite, and other mafics are present.	10	0-10
Sand, medium- to coarse-grained, subangular to subrounded, well-sorted; composed of feldspar and quartz; less than 4 percent biotite, magnetite, and other mafics are present.	30	10-40
Sand, coarse- to very coarse grained, mostly subrounded with some subangular, well-sorted; composed of quartz and lesser amounts of feldspar; less than 4 percent magnetite, biotite, amphiboles, hematite, and other mafics present.	20	40-60
Sand, coarse- to very coarse grained, subangular to subrounded, moderately well sorted; composed of quartz with some feldspar; less than 1 percent mafics include biotite, magnetite, amphiboles, and micas.	30	60-90
Sand, very coarse grained, to granules, subrounded, moderately to moderately well sorted; composed of quartz with some feldspar; less than 4 percent biotite, amphiboles, magnetite, and other mafics present.	20	90-110
Sand, coarse-grained, with some medium- and fine-grained, subangular to subrounded, moderately sorted; composed of quartz with some feldspar; less than 4 percent mafics include biotite, magnetite, and others.	20	110-130

Table 4.--Lithologic log for test well T30 (22S.05E.32.334) - Continued

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Sand, very coarse grained, subangular to subrounded, moderately sorted; composed of quartz with some feldspar; less than 4 percent mafics include biotite and magnetite.	10	130-140
Sand, coarse- to very coarse grained, subangular to subrounded, poorly to moderately sorted; composed of quartz with a small amount of feldspar; 2 to 4 percent mafics include biotite, amphiboles, magnetite, and hematite.	40	140-180
Granules with some very coarse grained sand, mostly subrounded with some subangular, very well sorted; composed of quartz and feldspar; less than 4 percent mafics include biotite, magnetite, amphiboles, and hematite.	20	180-200
Sand, coarse- to medium-grained, subangular to subrounded, moderately well sorted; composed of quartz and small amount of feldspar; less than 4 percent mafics include altered micas, magnetite, and hematite.	20	200-220
Granules with coarse- to medium-grained sand, subrounded, moderately sorted; composed of quartz and a little feldspar; less than 4 percent mafics include biotite, hematite, and magnetite.	10	220-230
Sand, very coarse to coarse-grained, subangular to subrounded, moderately to well-sorted; composed of quartz with a small amount of feldspar; mafics, present in minor amount, include biotite and magnetite.	50	230-280

Table 4.--Lithologic log for test well T30 (22S.05E.32.334) - Concluded

Lithology	Thickness (feet)	Depth interval below land surface (feet)
Granules and pebbles, subrounded, well-sorted; composed of quartz and feldspar, small amount of clay and caliche present; less than 4 percent mafics present.	10	280-290
Sand, medium- to coarse-grained, with granules, subangular and some subrounded, poorly sorted; composed of quartz and feldspar with caliche; less than 1 percent mafics present.	10	290-300
Clay and silt with some coarse-grained quartz sand, poorly sorted; caliche in some places; less than 1 percent mafics present.	20	300-320

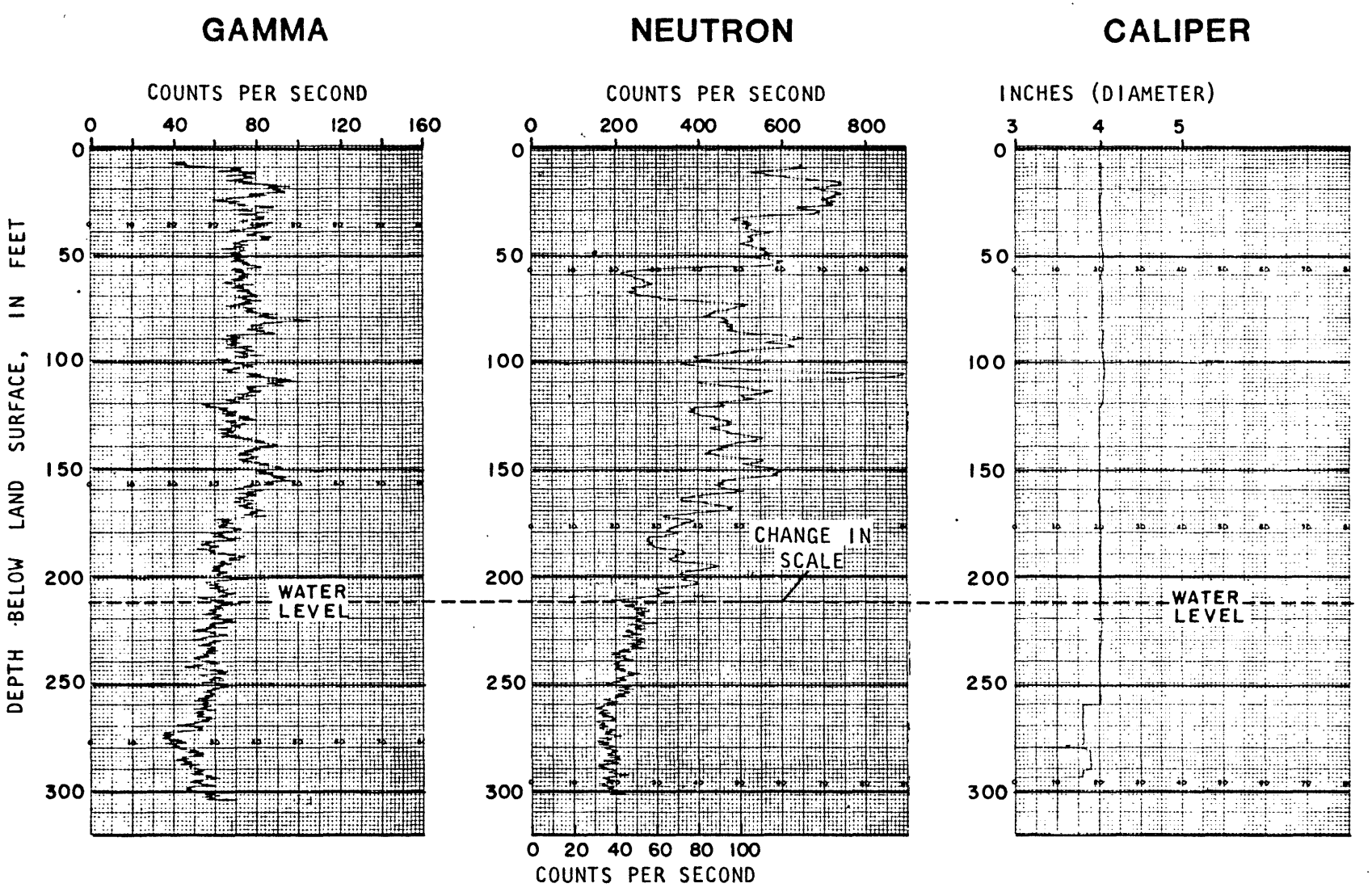

Figure 3.--Gamma, neutron, and caliper logs for test well T30 (22S.05E.32.334) with casing.

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