DESCRIPTION OF GEOPHYSICAL-LOG DATA BASE FOR BOREHOLES AND WELLS IN AND ADJACENT TO THE ALBUQUERQUE BASIN, NEW MEXICO

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CONVERSION FACTORS

Multiply	By	To obtain
inch	2.540	centimeter
foot	0.3048	meter
mile	1.609	kilometer

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) by the equation:

$$°C = 5/9 (°F - 32)$$

DESCRIPTION OF GEOPHYSICAL-LOG DATA BASE FOR BOREHOLES AND WELLS IN AND ADJACENT TO THE ALBUQUERQUE BASIN, NEW MEXICO

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ABSTRACT

Digital geophysical logs for boreholes and wells in and adjacent to the Albuquerque Basin area have been entered into a data base established by the New Mexico District of the U.S. Geological Survey and documented as of September 1994. The logs were digitized from paper or mylar copies or were collected as digital data during the logging of boreholes and wells. The location of these boreholes and wells with digital geophysical logs is shown in a map. The 1,020 logs and the types of logs for the 186 sites are listed in a table.

INTRODUCTION

The Albuquerque Basin and adjacent areas in central New Mexico encompass Albuquerque, New Mexico, and neighboring communities (fig. 1). Ground water is the source of all public-supply drinking water, and the Santa Fe Group aquifer system is the primary aquifer in the basin. Geophysical logging of boreholes and wells has been conducted in the Albuquerque Basin since the 1960's. As part of the U.S. Geological Survey's (USGS) responsibility to collect and disseminate hydrologic information, a USGS logging unit began operating in the 1960's and has acquired a library of logs for areas of the Albuquerque Basin, as well as for other areas of New Mexico. Boreholes and wells were logged in the Albuquerque Basin where data were lacking. Geophysical logs, also called logs in this report, provide information about the character of the aquifer, the water, the borehole, or the well if logging is conducted in a finished well. Logs in digital form are more easily analyzed, resulting in more available information about the aquifer system that supplies water for Albuquerque and the surrounding area.

In 1987 the USGS in cooperation with the City of Albuquerque Public Works Department began to develop a data base of digitized geophysical logs. The intent was to develop an easily accessible, central storage location for selected digital geophysical logs.

This report describes the digital geophysical-log data base and the general types of logs available in the Albuquerque Basin, shows the locations of borehole and well sites for which digital geophysical logs are available, and lists the types of logs available for each site. Additional information and specific details about available logs, boreholes, or wells are available at the New Mexico District Office, Albuquerque, New Mexico. The general area of data collection is the Albuquerque Basin. Some locations are outside of the basin because the initial compilation of geophysical logs was for all of Sandoval, Bernalillo, and Valencia Counties. *Borehole* as used in this report is a drilled hole prior to completion as a well. During logging, the borehole is usually filled with drilling fluid. *Well* as used in this report is a borehole that has usually been cased and screened to produce water from specific aquifer zones.

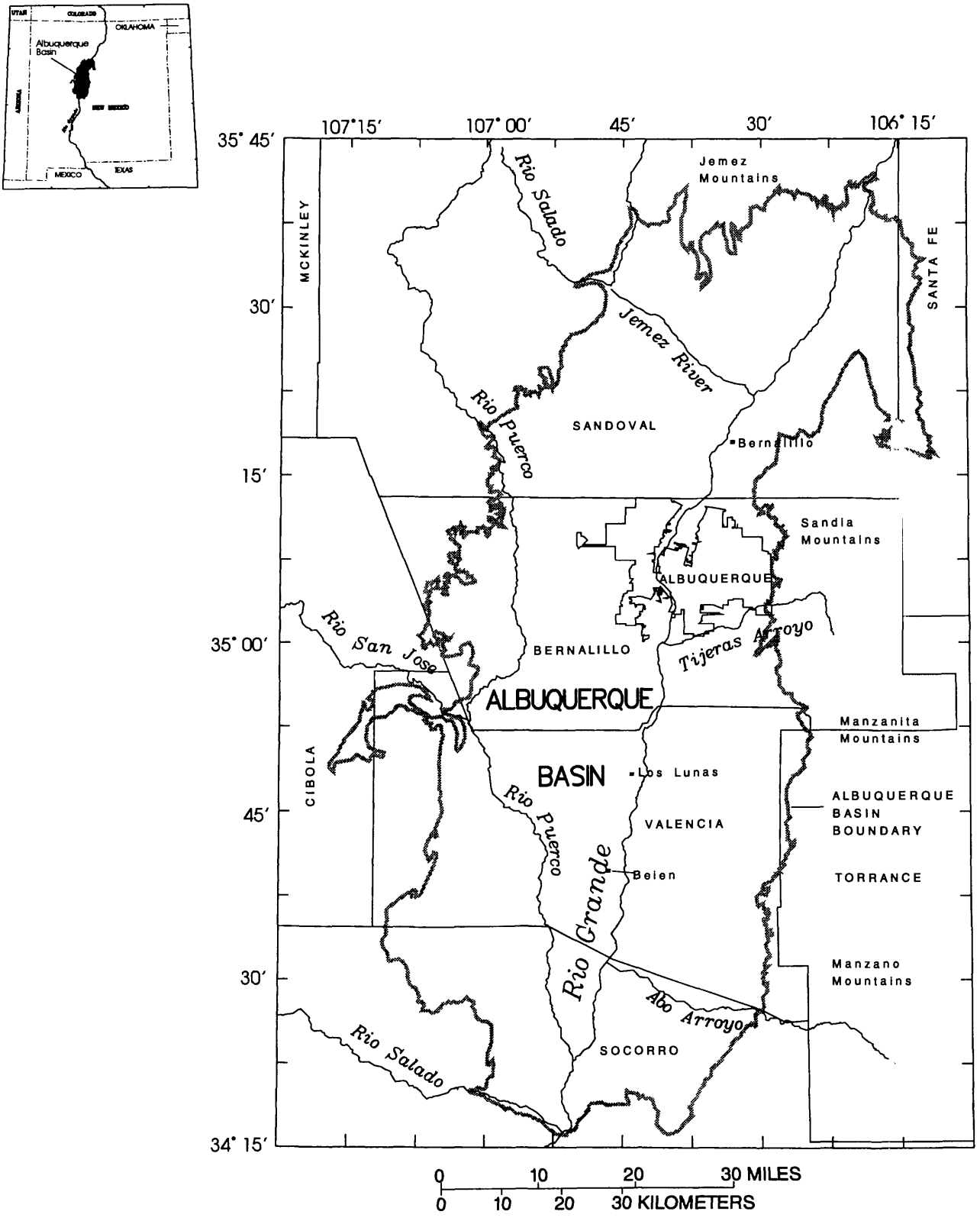

Figure 1.--Albuquerque Basin and major geographical features.

DESCRIPTION OF DIGITAL GEOPHYSICAL-LOG DATA BASE

The digital geophysical-log data base is on a Data General[1] UNIX-based workstation system of the USGS New Mexico District office. Each log (file) is in ASCII format and has two columns. The first column is the depth below land surface, in feet; the second column is the log response for that depth.

Data Base Design

Each log in the data base is in a separate file; the file naming convention consists of a two-letter abbreviation of the company or agency that did the logging followed by a site identification number. The site identification number is a 15-digit number based on the latitude and longitude of the borehole or well (13 digits) with the last 2 numbers being a sequence number of the boreholes or wells at that site. The first borehole or well at a site has a sequence number of 01, the second 02, and so forth. The last two to four letters of the file name are an abbreviation of the type of log. For example, for log GS350404106382501GA, GS = USGS logging equipment; 3504041063825 = latitude and longitude; 01 = sequence number; and GA = natural gamma log. The name of the company that ran the log has been retained in the data base. Each company has specific geophysical tools for generating each type of log. These tools vary from company to company. Each log has been assigned to a generalized log type that is abbreviated with two to four letters.

Methods of Obtaining Digital Geophysical-Log Data

Several formats and different mediums were used to record the 1,020 geophysical logs from various sources. Most commercial logs have been obtained as multiple traces on paper or mylar. Commercial geophysical logs for City of Albuquerque boreholes and wells have been obtained in digital format at the borehole or well site since 1992. Prior to 1991, USGS logs were recorded as multiple traces on paper; since 1991, USGS logs have been collected in digital format at the borehole or well site.

[1]Use of brand names is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Geophysical logs originally recorded on paper or mylar were digitized. A copy of the log was placed on a digitizer tablet, and the minimum value of the depth and of the value recorded by the logging equipment was set to a known point on the digitizer tablet. Values of the distance on the digitizer that represented a specific increment in depth and values that represented an increment in the recorded log value were entered into the program controlling the digitizer. The digitizer program usually was set to record about four values of depth and the corresponding log value for each foot of depth. With the digitizer set, the trace of a specific log was followed using the cross hairs on the digitizer keypad. The depth and recorded log values were determined by the location on the digitizer tablet and the distance moved from the origin. Logs for the same borehole or well may have different logging intervals caused by equipment stoppage at different depths. The copy of the log trace might not have been of a quality that could be digitized at the top or bottom. Digitized logs were checked. Each file was read by a computer program that selected and printed the recorded value of the log at each 100-foot depth marker. These values were then checked against the corresponding values on the paper or mylar copy of the log. The digitized log then was plotted and checked against the original copy of the log.

Geophysical logs originally collected in digital format were separated into files that contained only one set of depth and recorded log values. The data were then entered into the geophysical-log data base after the Ground-Water Site-Inventory (GWSI) data base had been updated and the correct file name for the digital log data had been established and assigned.

DESCRIPTION OF GEOPHYSICAL LOGS

Geophysical logs listed in this report were obtained from municipal, State, and Federal agencies. Many logs presented in this report were furnished by the City of Albuquerque. These logs of boreholes and wells drilled by the City of Albuquerque were run by commercial logging companies. Some logs presented in this report were obtained from the New Mexico Bureau of Mines and Mineral Resources, which also were run by commercial logging companies. The Bureau Of Mines and Mineral Resources maintains a library of commercial geophysical logs for New Mexico. Other logs presented in this report were run by the USGS.

In general, all geophysical logs in the data base for the Albuquerque Basin and adjacent area can be grouped into one of four types: electric, nuclear, acoustic, or caliper. The general methods of data collection and uses of geophysical logs in each of these four log types are discussed in the following sections.

Electric Logs

Electric geophysical-logging equipment measures potential differences caused by flow of electrical current in and adjacent to the borehole or well (Keys, 1990). Keys (1990) subdivided electric logs into spontaneous-potential and resistivity logs. The spontaneous-potential measuring unit recorded on the log is the volt. Resistance logs, a type of resistivity log, measure response in ohms; the other resistivity log responses discussed in this report are measured in ohms meter squared per meter (ohm-meters).

Spontaneous-potential logging equipment, SP or self-potential, records the potentials or voltages that develop at contacts between shale or clay and sand in an aquifer system. Spontaneous-potential measuring equipment consists of a lead electrode in the well connected through a multivoltmeter or a sensitive recorder channel to a second lead electrode that is grounded at land surface (Keys, 1990, p. 49). Spontaneous-potential logs can be used to determine lithology, bed thickness, and salinity of formation water.

Single-point resistance logs have been widely used in geophysical logging for water-well applications in the past. The logging equipment records potential in volts or millivolts but is converted to ohms using ohm's law. A constant current is used that allows the conversion to ohms. The same electrode configuration is used in the single-point resistance log as in the spontaneous-potential log. Both logs can be recorded at the same time if a two-channel recorder is available. Single-point resistance logs can be used to determine lithologic differences.

Short- and long-normal resistivity logs are probably the most widely used geophysical logs in ground-water hydrology. The logging equipment measures apparent resistivity of the formation, mud cake on the borehole wall, drilling fluid, and formation water in ohm-meters. Two electrodes, commonly designated as A and M, are located in the well. The distance between the electrodes determines if the log is a short- or a long-normal log. Common spacings are 16 inches for the short-normal log and 64 inches for the long-normal log. Two other electrodes are usually designated B and N. One of these electrodes is in the well about 50 feet from the A or M electrodes. The other of the B or N electrodes is usually at land surface (Keys, 1990, p. 60). The most important use of normal-resistivity logs is for estimating ground-water quality. Qualitative interpretations of lithology can be made using the short- and long-normal logs together.

Focused-resistivity logging equipment (focused deep resistivity, focused shallow resistivity, and focused resistivity) is used to measure the resistivity of thin beds within the aquifer matrix. The equipment can provide high resolution and greater penetration than other resistivity logging equipment. The electrode spacing is similar to the normal-resistivity logging configuration except that guard electrodes above and below the A and M electrodes direct the current into the aquifer in narrow sheets. The focused-resistivity equipment can penetrate several feet into the adjacent formation (Keys, 1990, p. 64). Only commercial companies have provided focused-resistivity logs in the data base.

Induction logs (induction deep resistivity, induction medium resistivity, and induction resistivity) are generated using an induction coil to transmit alternating current into the formation. Induction-logging equipment was designed to obtain resistivity logs where no conductive medium is present between the probe and the formation. A second coil in the probe receives the returning signal. The magnitude of the received signal is proportional to the electrical conductivity of the rocks.

Microresistivity logs (micro focused resistivity, micro normal resistivity) typically are used to determine the presence or absence of mud cake on the wall of the borehole. Microresistivity logging equipment is designed for a shallow-depth investigation. The electrode configuration is as described for the normal-resistivity logs except that the microresistivity equipment has a short electrode spacing. The electrodes can be mounted on a rubber pad with dime-size electrodes spaced 1 to 2 inches apart (Keys, 1990, p. 66-67).

Nuclear Logs

Nuclear logs detect the presence of unstable isotopes. For gamma logs the logging equipment detects gamma radiation from isotopes that occur naturally in the aquifer. For gamma-gamma and neutron logs the logging tool contains a radioactive source that transmits particles into the aquifer material and detects the number and time required for the particles to return to the receiver. Commercial gamma-gamma and neutron-logging equipment usually is calibrated. Nuclear logs can be obtained in open boreholes or cased wells. The penetrating capability of the particles and photons permits their detection through well casing with no regard to the type of fluid in the borehole (Keys, 1990, p. 68).

Gamma logs, also called natural gamma, provide a record of the total gamma radiation detected in a borehole or well. In the Albuquerque Basin, fine-grained sediments usually have a greater gamma count than coarse materials. The gamma log is used to correlate lithology and stratigraphic zones within the basin. Gamma-spectrometry logging is a specialized technique that allows the identification and quantitative analysis of the radioisotopes that contribute to the gross count rate recorded on the gamma log (Keys, 1990, p. 82).

Gamma-gamma logs are records of radiation received at a detector from a gamma source in the probe after the radiation is attenuated and scattered in the borehole and the surrounding rocks. The main use of calibrated gamma-gamma logs is for the estimation of bulk density. Gamma-gamma logs can be used also to determine lithologic units and well-construction characteristics in a completed well.

Neutron logs are a record of neutron interactions in the vicinity of the borehole. The neutron probe contains a source of neutrons and a detector that records the returning neutrons. Most of the neutron interactions are related to the quantity of hydrogen present. In ground-water environments neutron interactions are related to the water content of the rocks penetrated by the borehole. In the Albuquerque Basin, most neutron logs are used to determine water content in the formation and depth to the water table in fluid-filled boreholes. Neutron logs can also be used to determine porosity of the formation rocks (Keys, 1990, p. 68-93).

Acoustic Logs

Acoustic logging uses a transducer to transmit an acoustic wave through the fluid in the borehole and the surrounding rocks. Acoustic-velocity logs, also called sonic logs, are a record of the traveltime of an acoustic wave from one or more transmitters to receivers in the probe. The acoustic energy travels through the fluid in the borehole and through surrounding rocks at a velocity that is related to the matrix mineralogy and porosity of the rocks. Sonic logs are used to identify lithology and measure porosity (Keys, 1990, p. 109).

Caliper Logs

Caliper logs provide a continuous record of borehole or well diameter. Changes in borehole diameter may be related to drilling technique and lithology. Caliper logs are essential in interpreting other logs because most other logs are affected by changes in borehole diameter. Caliper logs also provide information on well construction, lithology, and porosity resulting from fractures and faults penetrated by the borehole (Keys, 1990, p. 119).

DIGITAL GEOPHYSICAL LOGS IN AND ADJACENT TO THE ALBUQUERQUE BASIN

The locations of 186 boreholes or wells in and adjacent to the Albuquerque Basin with geophysical logs in the data base are listed in table 1 and shown in figure 2. The numbers shown in figure 2 are the site numbers (sites 170 through 186 are outside the map area and are not shown in figure 2). Because borehole or well locations are so close that individual sites cannot always be distinguished, some site numbers in figure 2 are listed in ascending order in an adjacent box and the area that contains the sites has been delineated. In general, if electric logs are available the logs were completed in a borehole, whereas nuclear logs may have been obtained in a borehole or well.

Table 1 lists the site number that is used for location purposes in this report; USGS site identification number; site location in Township, Range, section, and quarter-quarter-quarter section; and types of logs available for each site, including an abbreviation of the organization that logged the well and an abbreviation of the log type. By locating the site number in figure 2 and table 1, specific borehole or well location and type of log information can be obtained.

To assist in locating boreholes or wells that have logs or to determine what logs are available for a specific borehole or well, all sites and log information have also been entered into the USGS GWSI data base (Mathey, 1990). This data base is designed for entry of well location, well construction, water level, pump discharge, water quality, and information about available geophysical logs. The GWSI data base is in the public domain and the data are available to the public.

SUMMARY

Ground water is the source of all public-supply drinking water in the Albuquerque Basin. The Santa Fe Group aquifer system is the primary aquifer in the basin. The USGS began a study in 1987 in cooperation with the City of Albuquerque Public Works Department to develop a data base of digitized geophysical logs. The intent was to develop an easily accessible, central storage location for selected digital geophysical logs.

Each log (file) in the data base is in ASCII format and has two columns. The first column is the depth below land surface, in feet. The second column is the log response for that depth. Each log in the data base is in a separate file; the file-naming convention consists of a two-letter abbreviation of the company or agency that did the logging, a 15-digit site identification number, and a two- to four-letter abbreviation of the type of log.

All geophysical logs in the data base for boreholes and wells in the Albuquerque Basin and adjacent area can be grouped into one of four types: electric, nuclear, acoustic, or caliper. The data base now contains 1,020 geophysical logs. Geophysical logs recorded on paper or mylar were digitized. Geophysical logs that were originally collected in digital format were separated into files that contain only one set of depth and recorded log values.

Locations of boreholes or wells in and adjacent to the Albuquerque Basin that have logs in the data base are shown on a map. A table lists the site number, site identification, site location, and the types of logs available for each site. All sites and log information have been entered into the USGS GWSI data base.

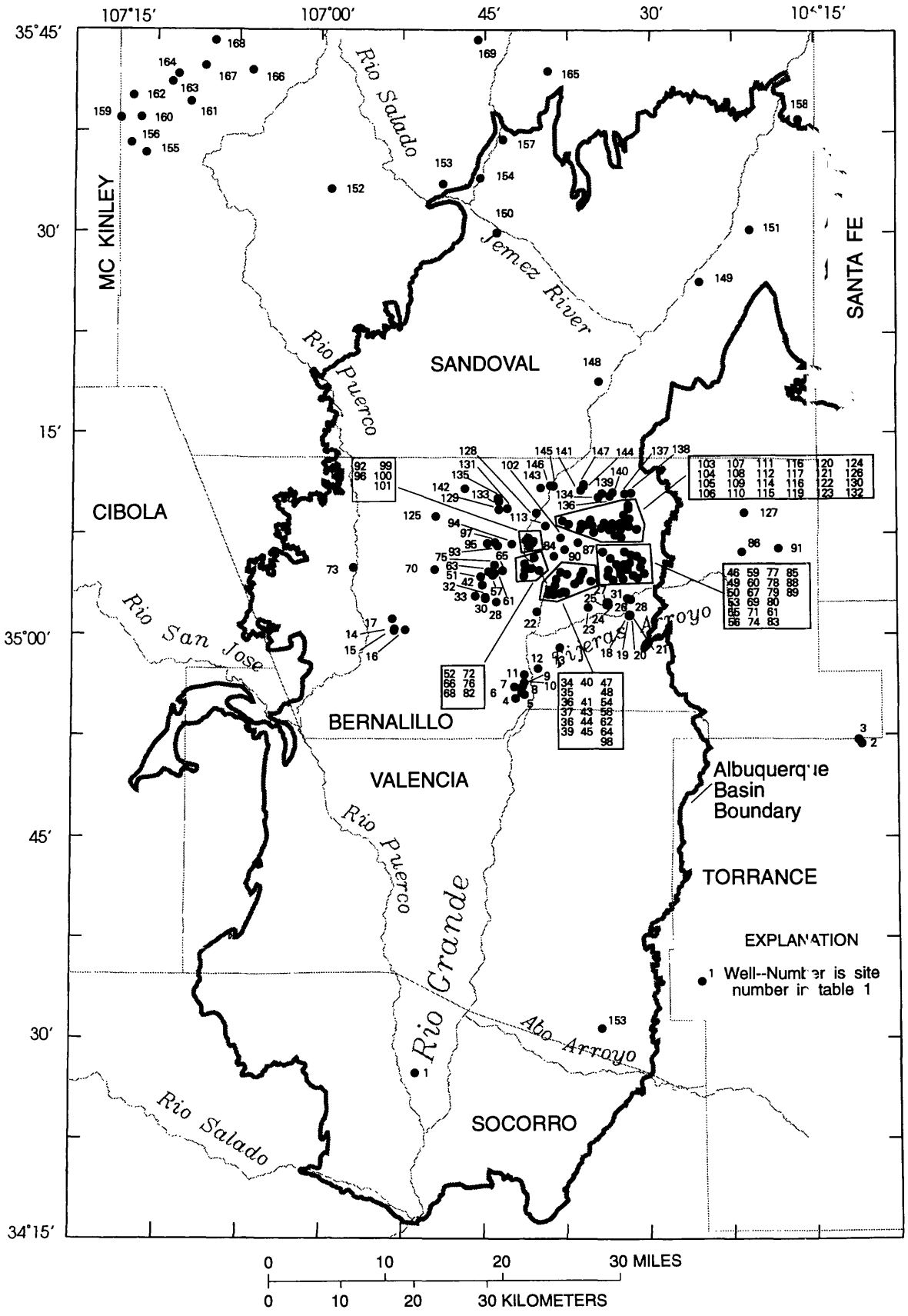

Figure 2.--Location and site number of boreholes and wells with geophysical logs in and adjacent the Albuquerque Basin. (See table 1 for log information.)

REFERENCES CITED

Keys, W.S., 1990, Borehole geophysics applied to ground-water investigations: U.S. Geological Survey Techniques of Water-Resource Investigations, book 2, chap. E2, 150 p.

Mathey, S.B., 1990, National Water Information System user's manual--Volume 2, Chapter 4. Ground-Water Site-Inventory System: U.S. Geological Survey Open-File Report 89-587, variously paged.

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico

EXPLANATION

Site number: a unique number assigned to the site that corresponds with figure 2. * indicates that the log is in the data base, but the borehole or well is outside the map area (fig. 2). Site identification: unique number assigned to the site from the Ground-Water Site-Inventory data base. Site location: Township, Range, section, and quarter-quarter-quarter section in which the site is located. Loggers: GS, U.S. Geological Survey; LW, Lane Western; SC, Schlumberger; DA, Dresser Atlas; WE, Welex; BW, Birdwell; HB, Halliburton.

Types of logs: bd, bulk density; ca, caliper; fdrs, focused deep resistivity; fsrs, focused shallow resistivity; frs, focused resistivity; ga, natural gamma; gg, gamma gamma (number following gg, if given, is the spacing, in inches, between source and receiver); indr, induction deep resistivity; inmr, induction medium resistivity; inrs, induction resistivity; k, potassium isotope; ln, long-normal resistivity; mfrs, micro focused resistivity; mnrs, micro normal resistivity; npor, neutron porosity; nu, neutron; rst, resistance; rs, resistivity; sgr, spectral gamma; sn, short-normal resistivity; so, sonic; sp, spontaneous potential; th, thorium isotope; tm, temperature; u, uranium isotope. The letter following a log type indicates that a is the first log, b is the second log, and so forth.

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Continued

Site number	Site identification	Site location	Available logs
1	342719106511201	03N.01E.29.421	GS (ga, ln, nu, rs, sn, sp-a, sp-b)
2	345150106104701	07N.073.02.134	GS (ca, ga, nu, rs, sp)
3	345208106110301	07N.07E.03.222	GS (ga, nu)
4	345511106420701	08N.02E.14.322	LW (rst, sp)
5	345528106411801	08N.02E.13.114	LW (rst, sp)
6	345538106413401	08N.02E.14.222	LW (rst, sp)
7	345603106421301	08N.02E.11.321	LW (rst, sp)
8	345604106413001	08N.02E.12.311	LW (rst, sp)
9	345621106412101	08N.02E.12.114	LW (rst, sp)
10	345622106412001	08N.02E.12.114	LW (rst, sp, rst, sp, bd)
11	345658106412001	08N.02E.01.312	LW (rst, sp)
12	345726106400501	09N.03E.31.343	GS (ga, gg, rst, sp)
13	345858106380601	09N.03E.28.1144	GS (ga, ln, nu, sn)
14	350014106531301	09N.01W.13.442	SC (bd, ca, ga, indr, inmr, sp)
15	350017106521201	09N.01E.18.444	GS (ln, sn)
16	350021106531101	09N.01E.18.333	GS (ln, sn)
17	350107106532301	09N.01W.12.432	GS (ga, gg, nu)
18	350121106314301	09N.04E.09.1342	GS (ca, ga, gg, ln, nu, sn, sp)
19	350121106314801	09N.04E.09.1341	GS (ca, ga, gg, ln, nu, sn, sp)
20	350124106314201	09N.04E.09.1324	GS (ca, ga, gg, ln, nu, sn, sp)
21	350125106314601	09N.04E.09.132	GS (ca, ga, gg, ln, nu, sn, sp)
22	350138106401103	09N.03E.07.114B	GS (ca, ga, gg, ln, nu, sn)
23	350157106353001	09N.03E.02.432	GS (ca, ga, gg, ln, nu, sn, sp)
24	350208106334101	09N.04E.06.3212	GS (ca, ga, gg, ln, nu, rs, sn, sp)
25	350210106334901	09N.04E.06.3122	GS (ca, ga, gg, ln, nu, sn, sp)
26	350221106334201	09N.04E.06.14122	GS (ca, ga, gg, ln, nu, sn, sp)
27	350221106334901	09N.04E.06.1411	GS (ca, ga, gg, ln, nu, sn, sp)
28	350223106435401	09N.02E.04.232	DA (bd, ca, ga, indr, inmr, mfrs, sn, sp)
29	350234106313901	09N.04E.04.121	GS (ca, ga, gg, ln, nu, sn, sp)
30	350237106445201	10N.02E.33.442	SC (ca, inrs, mfrs, mnrs, sn, sp)
31	350239106315801	10N.04E.32.422	GS (ca, ga, ln, nu, sn)
32	350244106445301	10N.02E.33.421	SC (ca, frs, indr, inmr, inrs, mfrs, mnrs, sn, sp)
33	350249106454801	10N.01E.31.443	GS (ca, ga-a, ga-b, gg, nu-a, nu-b, rs, sp)
34	350254106384101	10N.03E.32.414	WE (inrs, sn, sp)

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Continued

Site number	Site identification	Site location	Available logs
35	350255106384401	10N.03E.32.413	WE (ca, mfrs, mnrs)
36	350256106390801	10N.03E.32.314	GS (ga, nu, tm), SC (ca, inrs, mfrs, mnrs, sn, sp)
37	350300106380501	10N.03E.33.314	GS (ca, ga, rs, sp)
38	350304106383401	10N.03E.32.412	GS (ga), SC (ca, inrs, mfrs, mnrs, sn, sp)
39	350305106373301	10N.03E.33.234	GS (ga, ln, nu, sn)
40	350308106374601	10N.03E.33.233	GS (ga), SC (bd, ca, ga, inrs, mfrs, mnrs, sn, sp)
41	350336106383201	10N.03E.29.443	GS (ga, nu, tm)
42	350338106450901	10N.02E.29.344	GS (ga, ln, nu, sn)
43	350343106364401	10N.03E.27.413	SC (bd, ca, frs, ga, indr, mfrs, mnrs, sp), WE (ca, ga)
44	350355106351501	10N.03E.26.422	SC (bd, ca, frs, ga, indr, inmr, k, npor, sp, th, u)
45	350358106372901	10N.03E.28.243	WE (ca, inrs, mfrs, mnrs, sn, sp)
46	350401106331401	10N.04E.30.243	GS (ga, nu, tm), SC (bd, ca, ga, inrs, mfrs, mnrs, sn, sp)
47	350401106363201	10N.03E.27.244	DA (bd, ca, ga, indr, inmr, mfrs, mnrs), GS (ga, gg, nu)
48	350404106382501	10N.03E.29.242	GS (ga, ln, nu, sn)
49	350405106322001	10N.04E.29.231	WE (ca, inrs, mfrs, mnrs, sn, sp)
50	350410106310001	10N.04E.28.22	BW (bd, ca, ga, inrs, npor, sn, sp)
51	350416106451801	10N.02E.29.141	SC (ca, inrs, mfrs, mnrs, sn, sp)
52	350418106412201	10N.02E.25.111	SC (bd, ca, ga, mfrs, mnrs, sp)
53	350420106334401	10N.04E.30.121	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, th, u)
54	350421106361001	10N.03E.26.111	GS (ga), SC (ca, inrs, mfrs, mnrs, sn)
55	350422106312401	10N.04E.21.433	GS (ga, nu, tm)
56	350422106312601	10N.04E.21.344	BW (bd, ca, ga, inrs, mfrs, mnrs, sn. sp)
57	350422106441201	10N.02E.28.122	GS (ga, nu, rst, sp)
58	350426106372601	10N.03E.21.443	WE (ca, inrs, mfrs, mnrs, sn, sp)
59	350427106323401	10N.043.20.343	BW (ca, ga, inrs, mfrs, mnrs, sn, sp)
60	350430106302401	10N.04E.22.342	SC (ca, inrs, mfrs, mnrs, sn, sp)
61	350430106440201	10N.02E.21.433	GS (ga, ln, nu, sn, sp)
62	350435106380101	10N.03E.21.331	WE (ca, inrs, mfrs, mnrs, sn, sp)
63	350438106443501	10N.02E.21.343	SC (ca, inrs, mfrs, mnrs, sn, sp)

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Continued

Site number	Site identification	Site location	Available logs
64	350440106355801	10N.03E.23.314	SC (inrs, sn, sp)
65	350442106431801	10N.02E.22.321	GS (ga, gg, nu, tm), SC (bd, ca, ga, mfrs, mnrs)
66	350443106395801	10N.02E.21.412	GS (ga, gg, nu, tm), SC (ca, inrs, mfrs, mnrs, sn, so, sp)
67	350445106334001	10N.04E.19.322	SC (ca, inrs, mfrs, mnrs, sn, so, sp)
68	350445106411501	10N.02E.24.312	GS (ga, gg, nu, tm)
69	350449106315701	10N.04E.20.244	SC (ca, inrs, mfrs, mnrs, sn, sp)
70	350449106493101	10N.01E.22.322	GS (ga, gg1, gg17, gg5, nu, rst, sp, tm)
71	350452106323901	10N.04E.20.143	SC (ca, inrs, mfrs, mnrs, sn, sp)
72	350452106404201	10N.02E.24.412	GS (ga, nu)
73	350455106565601	10N.01W.21.144	GS (ca, ga, nu, rst, sp)
74	350459106304601	10N.03E.22.113	GS (ga, nu), WE (ca, inrs, mfrs, sn, sp)
75	350507106440201	10N.02E.21.214	SC (ca, mfrs, mnrs)
76	350508106411901	10N.02E.24.112	GS (ga, nu, tm-a, tm-b, tm-c), SC (ca, inrs, mfrs, mnrs, sn, sp)
77	350511106321401	10N.04E.20.212	SC (ca, mfrs, mnrs)
78	350511106325601	10N.04E.20.111	SC (ca, inrs, mfrs, mnrs, sn, sp)
79	350517106314401	10N.04E.16.334	GS (fc, ga, nu, tm-a, tm-b, tm-c, tm-d)
80	350526106303801	10N.04E.15.314	WE (ca, mfrs, mnrs, sn, sp)
81	350538106333001	10N.04E.18.311	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, th, u)
82	350540106402601	10N.02E.13.422	GS (ga, rs, sp)
83	350547106310601	10N.04E.16.241	SC (bd, ca, inrs, sn, sp)
84	350548106383901	10N.03E.17.232	GS (ga, nu)
85	350553106313801	10N.04E.16.123	SC (bd, ca, inrs, sn, sp)
86	350606106213202	10N.05E.12.342	GS (ga, nu)
87	350606106214901	10N.05E.12.332	GS (ga, nu)
88	350606106341101	10N.03E.13.222	GS (ca, ga, nu)
89	350607106321301	10N.04E.08.234	SC (ca, inrs, mfrs, mnrs, sn, sp)
90	350616106373801	10N.03E.09.442	GS (ga, rs, sp)
91	350623106181201	10N.06E.09.4113	GS (ga)
92	350629106405101	10N.02E.12.412	SC (ca, inrs, mfrs, mnrs, sn, sp)
93	350633106434501	10N.02E.03.422	SC (bd, ca, ga, inrs, mfrs, mnrs, sp)
94	350642106422801	10N.02E.11.142	HB (bd, ca, ga, indr, inmr, k, mfrs, mnrs, npor, sp, th, tm, u)
95	350643106444201	10N.02E.09.131	BW (inrs, sn, sp)

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Continued

Site number	Site identification	Site location	Available logs
96	350646106403601	10N.02E.12.241	GS (ga, nu)
97	350647106440001	10N.02E.09.232	BW (bd, ca, ga, inrs, mfrs, mnrs, sn, sp)
98	350648106362501	10N.03E.10.223	WE (ca, indr, mfrs, mnrs, sn, sp)
99	350653106403001	10N.02E.12.222	GS (ga, nu, tm)
100	350655106395001	10N.02E.12.121	GS (ga, nu, tm)
101	350708106405801	10N.02E.01.431	GS (ga, gg, nu, ca, inrs, mfrs, mnrs, sn, sp)
102	350709106380201	10N.03E.04.332	GS (ga, nu)
103	350711106323101	10N.04E.05.342	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, sp, th, u)
104	350720106330401	10N.04E.06.422	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, sp, th, u)
105	350732106350101	10N.03E.01.133	SC (ca, inrs, mfrs, mnrs, sn, sp)
106	350744106333501	10N.04E.06.124	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, sp, th, u)
107	350747106310701	10N.04E.04.221	SC (ca, inrs, mfrs, mnrs, sn, sp)
108	350747106323301	10N.04E.05.122	SC (ca, inrs, mfrs, mnrs, sn, sp)
109	350747106361401	10N.03E.03.224	SC (ca, inrs, mfrs, mnrs, sn, sp)
110	350752106342101	11N.03E.36.443	SC (inrs, sn, sp)
111	350754106332101	11N.04E.32.333	GS (ga, nu, tm), SC (ca, mfrs, mnrs)
112	350800106315001	11N.04E.33.331	GS (ga, nu, tm), SC (sp, bd, ca, inrs, sn)
113	350802106392501	11N.03E.31.442	GS (ga, gg, nu), SC (ca, inrs, mfrs, mnrs, sn, sp)
114	350803106351101	11N.03E.35.442	SC (ca, inrs, mfrs, mnrs, sn, sp)
115	350805106354901	11N.03E.35.324	SC (ca, inrs, mfrs, mnrs, sn, sp)
116	350809106360901	11N.03E.35.313	SC (ca, inrs, mfrs, mnrs, sn, sp)
117	350809106371901	11N.03E.33.424A	GS (ga, nu)
118	350813106324001	11N.04E.32.321	GS (ga, nu, tm), SC (ca, inrs, mfrs, mnrs, sn, sp)
119	350813106332101	11N.04E.31.412	SC (ca, inrs, mfrs, mnrs, sn, sp)
120	350815106340601	11N.03E.36.422	SC (ca, mfrs, mnrs)
121	350820106321701	11N.04E.32.234	GS (ga, nu, tm), WE (bd, ca, ga, inrs, sn, sp)
122	350824106375301	11N.03E.33.143	GS (ga, nu)
123	350828106352101	11N.03E.35.241	GS (ga, nu, tm), SC (ca, inrs, mfrs, mnrs, sn, sp)
124	350834106314901	11N.043.33.114	BW (bd, ca, ga, inrs, mfrs, mnrs, sn, sp)
125	350846106492601	11N.01E.27.421	SC (bd, ca, fdrs, frs, fsrs, ga, indr, inmr, mfrs, npor, sp)

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Continued

Site number	Site identification	Site location	Available logs
126	350851106322001	11N.04E 29.432	BW (bd, ca, ga, inrs, mfrs, mnrs, sn)
127	350859106212001	11N.05E.25.412	GS (ga, gg, nu)
128	350859106401603	11N.03E.30.313B	GS (ca, ga, gg, ln, nu, sn)
129	350914106434001	11N.02E.28.422	SC (inrs, mfrs, mnrs, sn, sp)
130	350918106315401	11N.04E.28.131	BW (bd, ca, ga, mfrs, sn, sp)
131	350918106425401	11N.02E.27.232	HB (bd, ca, ga, indr, inmr, npor)
132	350931106315501	11N.04E.28.111	BW (bd, ca, ga, inrs, sn, sp)
133	350950106434001	11N.02E.28.222	SC (ca, mfrs, mnrs), WE (inrs, sn, sp)
134	351007106343801	11N.03E.24.144	SC (bd, ca, frs, ga, indr, inmr, k, npor, sgr, sp, th, u)
135	351007106434201	11N.02E.21.244	SC (bd, ca, frs, ga, indr, mfrs, mnrs, sp)
136	351013106333501	11N.04E.19.142	BW (ca, inrs, mfrs, mnrs, sn, sp), DA (bd, ca, frs, ga, indr, inrs, sn, sp)
137	351023106321301	11N.04E.20.241	GS (tm), SC (bd, ca, frs, ga, mfrs, mnrs)
138	351025106323801	11N.04E.21.121	SC (bd, ca, frs, ga, indr, mfrs, mnrs, sp)
139	351025106341601	11N.03E.24.221	WE (bd, ca, ga, inrs, sn, sp)
140	351029106332001	11N.04E.18.434	BW (bd, ca, ga, inrs, mfrs, mnrs, sn, sp)
141	351038106361301	11N.03E.15.442	GS (ga, nu)
142	351046106464701	11N.02E.18.313	GS (ga, gg13, gg17, gg6, nu, rst, sp, tm)
143	351051106395301	11N.03E.18.411A	GS (ga, gg17, gg5, nu, rst, tm)
144	351056106355801	11N.03E.14.134	GS (ga, nu)
145	351057106384202	11N.03E.17.233A	GS (ga, gg, ln, nu, sn)
146	351059106385903	11N.03E.17.141B	GS (ca, ga, gg, ln, nu, sn)
147	351104106355701	11N.03E.14.141	GS (ca, ga, nu)
148	351849106343401	13N.03E.36.144	GS (ga, nu, rst, sp)
149	352616106252501	14N.05E.16.333	GS (ga, gg, nu, tm)
150	352954106435401	15N.02E.28.414	GS (ga, gg17, gg5, nu)
151	353008106204901	15N.06E.30.144	GS (ga, gg, nu)
152	353310106590301	15N.01W.06.333	GS (ca, ga, gg17, gg5, nu)
153	353333106485001	16N.01E.34.444	GS (ga, gg, nu)
154	353358106452601	15N.02E.32.314	GS (ga, gg, nu)
155	353551107160701	16N.04W.21.332	GS (ga, gg17, gg5, nu)
156	353637107172801	16N.04W.18.4444	GS (bd, ga, nu)
157	353651106432301	16N.02E.15.313	GS (ga-a, ga-b, gg, nu, rst, sp)
158	353825106162201	16N.06E.02.1434	GS (ga, gg, nu)
159	353827107182501	16N.04W.06.331	GS (bd, ga, nu, rst, sp)

Table 1.--Site and geophysical-log information for boreholes and wells in and adjacent to the Albuquerque Basin, New Mexico--Concluded

Site number	Site identification	Site location	Available logs
160	353831107163301	16N.04W.05.223	GS (ca, ga, gg17, nu)
161	353940107120001	17N.03W.31.133	GS (bd, ga)
162	354007107171701	17N.04W.29.3334	GS (bd, ga, rs, sp)
163	354107107134301	17N.04W.23.342	GS (bd, ga, nu)
164	354142107131001	17N.04W.23.222	GS (ca, ga, gg17, gg5, nu)
165	354157106391801	17N.03E.17.332	GS (ga)
166	354200107062201	17N.03W.13.3412	GS (bd, ga, nu, rs, sp)
167	354219107104301	17N.03W.17.1431	GS (bd, ga, nu, rst, sp)
168	354410107094701	17N.03W.04.1321	GS (bd, ga, nu, rs, sp)
169	354416106454101	18N.02E.31.444	GS (ga, gg, nu)
170*	354512107164401	18N.04W.32.212	GS (bd, ga, nu)
171*	354522106420001	18N.02E.26.334	GS (ga-a, ga-b, gg, nu)
172*	354558107153001	18N.04W.28.223	GS (bd, ga)
173*	354622107092401	18N.03W.21.4311	GS (bd, ga)
174*	354632107112701	18N.03W.20.311	GS (bd, ga, nu)
175*	354835107070701	18N.03W.11.2143	GS (bd, ga)
176*	354902106471401	18N.01E.01.321	GS (ga, nu, ga, gg, nu)
177*	354905106471401	18N.01E.01.321	GS (ga, gg, nu)
178*	354905107093501	18N.03W.04.3214	GS (bd, ga, nu)
179*	354936106362001	18N.03E.03.211	GS (ga)
180*	354949106385601	19N.03E.32.331	GS (ga)
181*	355217106400301	19N.03E.18.333	GS (ca, fc, ga, gg, nu, tm)
182*	355339106572201	19N.01W.08.241	GS (ga, gg, nu)
183*	355412107023001	19N.02W.04.42	GS (ga, nu)
184*	355503106401101	20N.02E.36.442	GS (ca, fc, ga, gg, nu, tm)
185*	355833106590601	20N.01W.07.323	GS (ga, gg, nu)
186*	360238107035601	21N.02W.17.44A	GS (ga, gg17, gg5, nu)

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