

Prepared in cooperation with the Fort Irwin National Training Center

# Construction, Water-Level, and Water-Quality Data for Multiple-Well Monitoring Sites and Test Wells, Fort Irwin National Training Center, San Bernardino County, California, 2009–12



Data Series 788

**Cover.** U.S. Geological Survey drilling rig at Nelson Lake, Fort Irwin National Training Center, California. Photograph by Joseph Nawikas, U.S. Geological Survey.

# **Construction, Water-Level, and Water-Quality Data for Multiple-Well Monitoring Sites and Test Wells, Fort Irwin National Training Center, San Bernardino County, California, 2009–12**

By A.R. Kjos, J.N. Densmore, J.M. Nawikas, and A.A. Brown

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## Conversion Factors

Inch/Pound to SI

<b>Multiply</b>	<b>By</b>	<b>To obtain</b>
<b>Length</b>		
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
<b>Area</b>		
acre	4,047	square meter (m <sup>2</sup> )
acre	0.4047	hectare (ha)
square mile (mi <sup>2</sup> )	259.0	hectare (ha)
square mile (mi <sup>2</sup> )	2.590	square kilometer (km <sup>2</sup> )
<b>Radioactivity</b>		
picocurie per liter (pCi/L)	0.037	becquerel per liter (Bq/L)

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C}=(^{\circ}\text{F}-32)/1.8$$

Vertical coordinate information is referenced to North American Vertical Datum of 1988 (NAVD 88).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius ( $\mu\text{S}/\text{cm}$  at 25 °C).

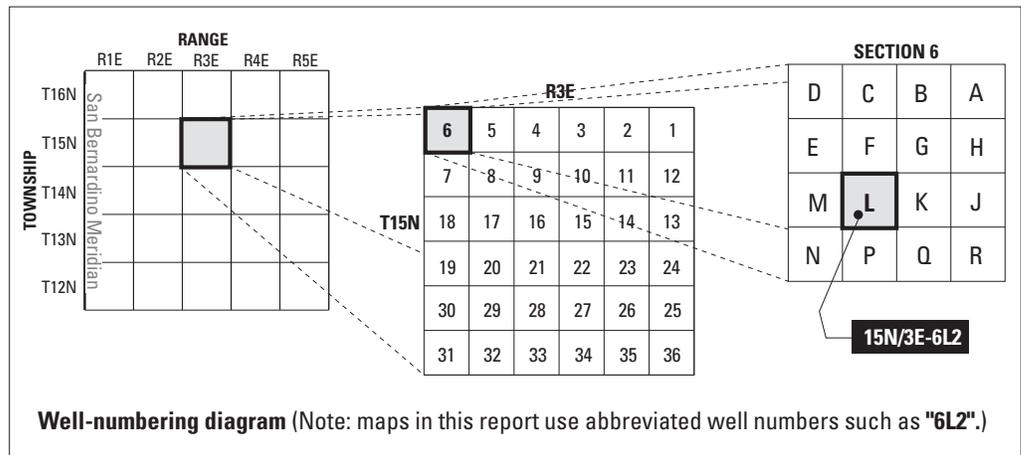
Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter ( $\mu\text{g}/\text{L}$ ). Milligrams per liter is equivalent to parts per million (ppm) and micrograms per liter is equivalent to parts per billion (ppb).

## Abbreviations

ASL	above sea level
CDWR	California Department of Water Resources
EM	electromagnetic
MCL	maximum contaminant level (USEPA)
NFM	National Field Manual
NOSAMS	National Ocean Sciences Accelerator Mass Spectrometry Facility
NTC	(Fort Irwin) National Training Center
NWIS	National Water Information System (USGS)
NWQL	National Water Quality Laboratory, Denver, Colorado (USGS)
QC	quality-control
RSD	relative standard deviation
SD	standard deviation
SP	spontaneous potential
STIL	Stable Isotope Laboratory, Reston, Virginia
TDS	total dissolved solids
USGS	U.S. Geological Survey

## Well-Numbering and Naming System

Wells are assigned a state well number (station name) by the California Department of Water Resources according to the location in the rectangular township and range grid system for the subdivision of public lands. Station names consist of the township number, north or south; the range number, east or west; and the section number. Each section is divided into sixteen 40-acre tracts lettered consecutively (except "I" and "O"), beginning with "A" in the northeast corner of the section and progressing in a sinusoidal manner to "R" in the southeast corner. Within the 40-acre tract, numbers are assigned sequentially in the order the wells are inventoried. The next letter within the station name refers to the base line and meridian. California has three base lines and meridians—Humboldt (H), Mount Diablo (M), and San Bernardino (S). Wells in the study area are referenced to the San Bernardino and Mount Diablo base line and meridian (S and M). Well numbers consist of 15 characters and follow the format 012N003E01M001S. In this report, wells are abbreviated and written as 12N/03E-01M1S. Wells are abbreviated in figures by their section number, tract letter, and sequence number (for example, 1M1). In addition to a station name assigned by the California Department of Water Resources, wells were assigned a common name derived from the basin in which they were installed and a sequence number. Wells were also assigned a 15-digit site identification number in the U.S. Geological Survey National Water Information System database.



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## Abstract

Because of increasing water demands at the U.S. Army Fort Irwin National Training Center, the U.S. Geological Survey in cooperation with the U.S. Army carried out a study to evaluate the water quality and potential groundwater supply of undeveloped basins within the U.S. Army Fort Irwin National Training Center. In addition, work was performed in the three developed basins—Langford, Bicycle, and Irwin—proximal to or underlying cantonment to provide information in support of water-resources management and to supplement monitoring in these basins. Between 2009 and 2012, the U.S. Geological Survey installed 41 wells to expand collection of water-resource data within the U.S. Army Fort Irwin National Training Center. Thirty-four monitoring wells (2-inch diameter) were constructed at 14 single- or multiple-well monitoring sites and 7 test wells (8-inch diameter) were installed. The majority of the wells were installed in previously undeveloped or minimally developed basins (Cronise, Red Pass, the Central Corridor area, Superior, Goldstone, and Nelson Basins) proximal to cantonment (primary base housing and infrastructure). Data associated with well construction, water-level monitoring, and water-quality sampling are presented in this report.

## Introduction

The U.S. Army Fort Irwin National Training Center (NTC), approximately 35 miles (mi) north-northeast of Barstow, California, is comprised of 13 groundwater basins (fig. 1). Currently (2012), the NTC withdraws all its potable water from three basins (Irwin, Langford, and Bicycle Basins) located proximal to the cantonment area where all base housing and substantial infrastructure is located. Extraction

of groundwater at the NTC began as early as 1941 in Irwin Basin. Since the 1990s, reduced pumping in the Irwin Basin and artificial recharge by infiltration of wastewater from Irwin, Bicycle, and Langford Basins have caused water levels to stabilize or recover throughout much of the Irwin Basin (Voronin and others, 2013). However, water levels have declined in Bicycle and Langford Basins. Continued groundwater extraction has resulted in the following two unintended consequences: (1) land subsidence and earth fissuring, presumably as a result of water-level declines and differential compaction in Bicycle Basin; and (2) elevated total dissolved solid (TDS) and nitrate concentrations in Irwin Basin as a result of infiltration of treated wastewater (Densmore and Longquist, 1997; Densmore, 2003). The U.S. Geological Survey (USGS) has been working on water-resource studies at Fort Irwin since the early 1990s, because planned expansion of the NTC could put a further strain on these limited water resources. In 2010, the USGS entered into cooperative agreements with the U.S. Army to conduct a broad study of water resources within groundwater basins (focusing primarily on undeveloped basins) at the NTC. In addition to collection of new hydrologic and drilling data under the 2010 agreement, this broad study included compiling hydrologic data and data from drilling performed in 2004 and 2009 under previous agreements.

Various land-based and air-based geophysical techniques were used to evaluate all the groundwater basins prior to drilling, and results of these evaluations will be presented in a separate report (David Buesch, U.S. Geological Survey, written commun., 2012). Drilling and well installation were concentrated in undeveloped or minimally developed basins. Multi-depth monitoring wells and test wells were installed in Bicycle, Langford, Cronise, Red Pass, the Central Corridor area, Superior, Goldstone, and Nelson Basins to help evaluate the long-term availability and quality of water resources within the NTC.

## Hydrogeologic Setting

The NTC is in the Mojave Desert region of southern California. It is approximately 130 mi northeast of Los Angeles and approximately 35 mi north-northeast of Barstow, Calif. The NTC covers approximately 1,070 square miles (mi<sup>2</sup>) and includes ten groundwater basins whose boundaries are defined by the California Department of Water Resources (CDWR): Riggs Valley, Red Pass Valley, Bicycle Valley, Avawatz Valley, Leach Valley, Cronise Valley, Langford Valley, Coyote Lake Valley, Goldstone Valley, and Superior Valley Basin (California Department of Water Resources, 2003). For the purposes of this report, these basins have been broken up into 13 basins and subbasins, referred to as Riggs (Riggs Valley), Red Pass (Red Pass Valley), the Central Corridor area (Red Pass Valley), Bicycle (Bicycle Valley), Nelson (Bicycle Valley), Drinkwater (Avawatz Valley), Leach (Leach Valley), Cronise (Cronise Valley), Langford (Langford Valley), Irwin (Langford Valley), Coyote (Coyote Lake Valley), Goldstone (Goldstone Valley), and Superior (Superior Valley) Basin (fig. 1).

Limited natural recharge to these basins occurs as precipitation runoff and infiltration, along ephemeral washes and near the base of the surrounding hills, primarily during winter rains or short summer thunderstorms (Densmore and Londquist, 1997). No perennial streams are present on the NTC (Mendez and Christensen, 1997). Limited official precipitation data are available for the basins on the NTC; the most current data from the Goldstone ECHO 2, Calif., weather station (043498) in Goldstone Basin from December 01, 1973, to July 31, 2006, indicate an average annual precipitation of 5.80 (inch) in. (Western Region Climate Center, 2009). Because of similar climatic conditions across the basins, similar precipitation values are expected for all basins on the NTC. The Bicycle, Langford, and Irwin Basins, listed in order of most temporally active pumping, currently (2012) supply all potable water to the NTC. For the purpose of this report, only the basins and subbasins in which wells were constructed for this part of the study (Bicycle, Nelson, Langford, Superior, Goldstone, Cronise, Red Pass, and the Central Corridor area) are discussed (fig. 2).

CDWR defines the Bicycle Valley Basin as having a surface area of approximately 140 mi<sup>2</sup> and encompassing the Nelson and Bicycle Valleys (California Department of Water Resources, 2003). This report divides the Bicycle Valley Basin into Bicycle and Nelson subbasins, referred to as Bicycle Basin and Nelson Basin, respectively. Bicycle Basin is bounded to the northwest and northeast by low-lying unnamed granitic and volcanic hills and to the east by the Tiefert Mountains (fig. 2). To the south, low-lying hills separate Bicycle Basin from Irwin Basin (California Department of Water Resources, 2003). Bicycle Lake (dry), a playa, lies in the southern part of the basin (fig. 2). The floor of Bicycle Basin ranges in elevation from approximately 2,350 feet (ft) above sea level (ASL) at the playa to about 2,600 ft ASL at the base of Tiefert Mountain (fig. 2). Surface runoff drains internally to Bicycle Lake; however, there is underflow from Bicycle

Basin to the east of Bicycle Lake through fractured rock in the faulted area along the southeastern edge of the playa (Diane Rewis, U.S. Geological Survey, written commun., 2010).

Nelson Basin is bounded to the north and east by the Granite Mountains, to the southwest by Tertiary volcanic highlands, and to the south-southeast by low-lying granitic and volcanic hills separating it from Central Corridor area and Bicycle Basin, respectively (fig. 2). A surficial drainage divide forms a part of the eastern boundary (Jennings and others, 1962). The basin elevation ranges from approximately 3,050 ft ASL at Nelson Lake (dry), a playa, to approximately 3,400 ft ASL in the southwest of the basin. Surface runoff drains from the Tertiary volcanic highlands and Granite Mountains to Nelson Lake (dry) and McLean Lake (dry), a playa, in the central and northern part of the basin, respectively, and along an ephemeral wash that terminates at Bicycle Lake (dry) in the southeastern part of Bicycle Basin (fig. 2).

Langford Valley Basin is subdivided into two subbasins by the CDWR—Langford Well Lake and Irwin—and for the purposes of this report, these subbasins are referred to as the Langford and Irwin Basins, respectively. The Langford Basin has a surface area of approximately 30 mi<sup>2</sup> (California Department of Water Resources, 2003; Densmore and Londquist, 1997). The Langford Basin is bounded to the northeast by low-lying hills at the base of the Tiefert Mountains, to the northwest by low-lying hills separating it from Irwin Basin, to the west by Noble Dome, and to the south by Alvord Mountain (fig. 2). To the east, the low-lying hills form a drainage divide that separates Langford Basin from Cronise Basin. Langford Well Lake (dry), a playa (fig. 2), is in the northeastern part of the basin. The basin ranges in elevation from approximately 2,160 ft ASL at Langford Well Lake to approximately 2,800 ft ASL at the base of Alvord Mountain. Surface runoff drains to Langford Well Lake, but the low permeability of the playa sediments impedes groundwater recharge. Groundwater flows from Irwin Basin into Langford Basin beneath an unnamed wash paralleling the Garlic Spring Fault (Densmore and Londquist, 1997; fig. 2). Groundwater also flows through a heavily faulted zone out of the basin beneath the low-lying drainage divide east of the Langford Well Lake (Voronin and others, 2013).

Superior Valley Basin, referred to as Superior Basin for the purpose of this report, has a surface area of approximately 188 mi<sup>2</sup> (California Department of Water Resources, 2003). The basin is bounded to the north by Eagle Crags, to the east and southeast by low-lying hills dividing Superior Basin from Goldstone Basin and Coyote Basin, to the south by Lane Mountain and Opal Mountain, and to the west by Slocum Mountain (fig. 2; California Department of Water Resources, 2003). The basin ranges in elevation from approximately 2,990 ft ASL at Superior Lake (dry), a playa, to approximately 3,400 ft ASL at the base of Eagle Crags. Superior Lake (dry) is the eastern most of three playas in the south-central part of the basin where surface runoff drains internally (fig. 2). The middle playa is informally referred to as Inferior Lake by NTC personnel (fig. 2).

Goldstone Valley Basin, referred to as Goldstone Basin for the purpose of this report, has a surface area of approximately 44 mi<sup>2</sup> (California Department of Water Resources, 2003). The basin is bounded to the west and southwest by consolidated nonwater-bearing rocks of the Goldstone Hills and to the north, east, and south by Tertiary volcanic and pyroclastic hills (fig. 2). The basin ranges in elevation from approximately 3,025 ft ASL at Goldstone Lake (dry), a playa, to approximately 3,700 ft ASL at the southwestern end of the basin. Surface runoff drains internally to Goldstone Lake in the northern part of the basin (fig. 2).

Cronise Valley Basin (alternatively spelled Cronese), referred to as Cronise Basin for the purpose of this report, has a surface area of approximately 198 mi<sup>2</sup> (California Department of Water Resources, 2003). The basin is bounded to the west by low-lying hills separating Cronise Basin from Langford Basin, to the east and northeast by the Soda Mountains, and to the north-northwest by Tiefert Mountains (fig. 2; California Department of Water Resources, 2003). The basin extends south beyond the edge of the NTC to a low point at the eastward extension of the Alvord and Cronise Mountains near West and East Cronise Lakes (dry), playas (fig. 2). The basin ranges in elevation from 1,065 ft ASL at West Cronise Lake to 2,500 ft ASL in the northern part of the basin. Surface runoff drains internally to West and East Cronise Lakes in the southeastern part of the basin (fig. 2). The heavily faulted, low-lying drainage divide east of Langford Lake allows subsurface underflow into the basin (fig. 2).

The Red Pass Valley Basin, including the Central Corridor area, has a surface area of approximately 250 mi<sup>2</sup> (California Department of Water Resources, 2003). For this report, the Red Pass Basin is divided into the Red Pass sub-basin in the east and the Central Corridor area subbasin in the west, referred to as Red Pass Basin and the Central Corridor area, respectively. The Red Pass Basin is bounded to the north by the Avawatz Mountains, to the east by low-lying hills that separate Red Pass Basin from the Riggs Basin, to the south by the Soda Mountains, and to the southeast by low-lying hills that separate Red Pass Basin from Cronise Basin (fig. 2; California Department of Water Resources, 2003). A low rise to the northwest separates Red Pass Basin from the Central Corridor area, which is bounded to the north by the Granite Mountains and to the south by the Tiefert Mountains and low-lying hills that separate Central Corridor area from Cronise Basin. Surface runoff flows from the Granite Mountains through the Central Corridor area into Red Pass Basin from the west and from the Avawatz Mountains in the north. Red Pass, a narrow canyon, cuts through the low-lying hills separating Red Pass Basin from Riggs Basin to the east and allows surface runoff from the northern part of the basin to exit into Riggs Basin (California Department of Water Resources, 2003). The basin ranges in elevation from approximately 1,600 ft ASL at Red Pass to approximately 2,600 ft ASL at the base of Avawatz Mountain. Red Pass Lake (dry), a playa (fig. 2), is in the southern part of the Red Pass Basin. Red Pass Lake is approximately 1,850 ft ASL and is separated from the northern part

of the basin by a small rise acting as a barrier to surface-water drainage from the north. The southern part of the basin is drained internally to Red Pass Lake. The northern part of Red Pass Basin is drained externally through Red Pass to the east into Riggs Basin.

## Purpose and Scope

The purpose of this study was to collect hydrogeologic data from new monitoring sites and test wells in basins proximal to the cantonment area on the NTC and to supplement data collected in already developed basins. This report describes the sites, the construction and data-collection methods, and the results associated with the installation of 14 (2-in. diameter) single-well and multiple-well “nested” monitoring sites—2 of which were replacement sites for failed or abandoned wells—and 7 test wells (8-in. diameter) within the NTC. This report details the construction and data-collection methods for the newly drilled well sites and presents the lithologic, borehole-geophysical, water-level monitoring, and water-quality sampling data collected.

## Drilling Procedures and Associated Construction Data

Well drilling, construction, lithologic, core, and borehole-geophysical data were collected from most boreholes drilled for this study. The total depth and perforated intervals of well casings installed in the boreholes were chosen on the basis of the newly collected lithologic and borehole-geophysical data and historical data from nearby wells. The lithology of each borehole was described initially in the field on the basis of cuttings and cores retrieved during drilling. Descriptions were subsequently modified after site completion on the basis of an examination of the cuttings and core sub-samples using a binocular microscope. Generally, borehole-geophysical logs were conducted after the drilling of each borehole at a previously unlogged location and prior to well construction.

## Well Drilling and Construction

During 2009–12, 14 multiple-well or single-well monitoring sites and 7 test wells were drilled on the NTC. Sites LL04B (12N/03E-01M4S, -01M5S) and BLA5B (14N/03E-26K4S) contained replacement wells for failed and abandoned wells (fig. 2). The wells were installed in eight basins (Bicycle, Langford, Cronise, Red Pass, Central Corridor area, Superior, Goldstone, and Nelson). Boreholes were drilled using a mud-rotary method. Sites were chosen where previous depth-dependent lithologic, borehole-geophysical, water-level, and water-quality data were unavailable or limited. Diameters of the boreholes ranged from 5 to 15 in. Generally, a pilot borehole was initially drilled (5- to 10-in. diameter) allowing

## 4 Construction, Water-Level, and Water-Quality Data for Multiple-Well Monitoring Sites and Test Wells

geophysical logs to be collected in a smaller diameter hole, improving their quality. Typically, a full suite of borehole-geophysical logs were run for each borehole before wells were constructed. Analyses of lithologic and geophysical data were used to determine the number, diameter, type of well(s), and depths of screened intervals to be placed in each borehole. If necessary, boreholes were reamed to enlarge them up to a 15-in. diameter, depending on the number and diameter of the well casing(s) placed in each borehole. Generally, the larger diameter boreholes contained test wells, which were larger in diameter. One to three wells were installed in each borehole.

Well construction began with the casing and screen being placed in the borehole to the desired depth. Well casings varied from approximately 2 to 8 in. in diameter, dependent on whether it was a single- or multiple-well monitoring site or a test well. Test wells were constructed with multiple screen intervals. Adjacent to and extending above and below the screened intervals, the boreholes were packed with #3 Monterey sand, medium aquarium Monterey sand, and (or) gravel, dependent on whether it was a monitoring site or test well. Larger aggregate and screen openings were typically used for test wells to allow for greater flow. Sand-packed intervals in each borehole were isolated by bentonite grout (30 percent solids) pumped into the annular space, time-release bentonite pellets, and (or) bentonite chips. In the multiple-well monitoring sites, this method was repeated for each well. The bentonite seal was extended to land surface in all boreholes except RDPS (15N/06E-33L1S), where a surface cement seal was placed above the bentonite seal. Well sites were protected and secured by a flush-mount traffic-rated vault, manhole, or steel stove-pipe with a cement pad. Well-construction data are given in table 1. Diagrams of the well construction for the monitoring and test sites are shown in figures 3–21.

### Lithologic Data

In addition to onsite description of cuttings and cores, the drill cuttings were later examined in more detail at the USGS San Diego Projects Office, San Diego, Calif., under a binocular microscope, using the Folk (1954) classification (fig. 22) and a Munsell soil color chart (Munsell Color, 1998, 2000). For each site, lithology of the drill cuttings and core “shoe” samples was described. Drill cuttings were collected by the following two methods: (1) “sieved” samples were collected throughout a 20-ft interval from the returning drilling fluid by using a 120-mesh [125-micrometer ( $\mu\text{m}$ )] U.S.A. Standard Testing Sieve; and (2) “shaker” samples were collected as grab samples every 10 ft from the 20 mesh (841- $\mu\text{m}$ ) shaker screen, which is the initial phase of the drilling fluid recycling process. Sieved samples represent a composite of finer-grained material from the entire 20-ft drilling interval, whereas shaker samples represent the coarser-grained material at discrete points. Cores were collected in most boreholes, and their depths are depicted in figures 3–21. Additionally, core depths and a description of the bottom of the core or “shoe” and occasionally the top

of the core were also described and included in the shaker lithologic log. Cores were typically collected after major lithologic changes and at the bottom of the hole, at the discretion of the project chief. Rounding and sorting classification of lithologic samples was determined on the basis of visual examination under a binocular microscope. Separate lithologic logs of shaker and sieve cuttings for all sites, except replacement well sites, are presented in tables 2–20. The lithologic information in figures 3–21 is summarized from the notes of the onsite geologist, geophysical logs, and subsequent microscope examination of the drill cuttings and is generalized for presentation purposes.

### Geophysical Logs

In addition to lithologic logs, a suite of geophysical logs were collected from the boreholes at most sites to aid in selecting screened intervals for construction of the wells (figs. 3–21). Geophysical logs were not collected at new sites LL04B (12N/03E-01M4S, -01M5S), BLA5B (14N/03E-26K4S), and SBMW (31S/46E-05B2M, -05B3M) because log data existed for already established sites LL04 (12N/03E-01M1S, -01M2S, -01M3S), BLA5 (14N-03E-26K1S, -26K2S, -26K3S), and SBTW (31S/46E-05B1M), which are in close proximity to the new sites. Geophysical log data from the established sites are combined with well-construction information from the new sites and presented in figures 3, 7, and 20. Site RDPS (15N/06E-33L1S) did not have electromagnetic induction (EM) or sonic logs because of onsite equipment malfunction (fig. 14). In all wells, except wells previously mentioned, caliper (hole-diameter), electric (temperature, spontaneous potential (SP), 16- and 64-in. normal resistivity, and lateral resistivity) and sonic ( $\Delta T$ ) tools were used to collect logs. Geophysical logs were collected in uncased open boreholes, backfilled with drilling mud to prevent collapse and provide a consistent medium, before well construction commenced. Geophysical tools were calibrated as specified by the manufacturer; the caliper tool was calibrated onsite according to the specifications of the borehole. In most cases, especially when large diameter (approximately 8 in.) wells were installed, a pilot hole was drilled allowing the logs to be collected in a smaller-diameter borehole to improve the quality. Site GOLD1-T (15N/01E-28R4S) was an exception; a pilot hole was not drilled because it was in close proximity to GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), where a geophysical log was previously collected.

Down-hole caliper logging tools measured the inside diameter of the open borehole. The caliper log allowed for the detection of any “wash-out zones” where unconsolidated sand had been washed away by the drilling process and also aided in identifying zones in which a clay unit might have expanded because of a decrease in down-hole pressure. In addition, the caliper log was used to determine the quantity of sand and grout needed to fill the annular space during the construction of the observation wells.

The electric logging tools measured the electrical properties of the formation around the borehole and the fluid in the formation. SP, normal-resistivity (16- and 64-in.), and lateral resistivity logs were used to distinguish fine-grained silt and clay from coarser sand and gravel. In freshwater systems, sand and gravel beds were indicated by a negative deflection (toward the left) on the SP log and by a high resistivity response (toward the right) on the resistivity logs.

The EM tools were used primarily to identify lithologic indicators and to provide geologic correlations. Natural-gamma logs measured the intensity of gamma-ray emissions from materials with high concentrations of potassium-40, uranium-238, uranium-235, and thorium-232. Generally, clay and potassium-feldspar-rich gravel have more intense gamma-ray emissions than gravels containing less potassium feldspar (Schlumberger Limited, 1972; Hearst and Nelson, 1985; Driscoll, 1986). Limestone and quartz-rich sandstones will yield lower gamma-ray values. Conductivity logs also provided a continuous log of the conductance of the aquifer material. In freshwater systems, sand and gravel beds were indicated by a negative deflection (toward the left) on conductivity logs.

The sonic tools measured the velocity of an acoustic pulse between a transmitter and a receiver on the tool with depth, recording an interval transit time (Delta-T). Sonic logs were useful in identifying contrasting lithologies. The sonic logs gave an indication of the degree of consolidation of the formation, as well as an approximate location of the water table.

## Water-Level and Water-Quality Methods And Data

Water levels were periodically measured from all wells installed, and water-quality samples were collected at most wells and analyzed for selected constituents. Water-quality samples at each site were collected after well construction was completed. All water-level and water-quality data are available through the USGS National Water Information System (NWIS) web interface at <http://water.usgs.gov/nwis/>. NWIS web is an interface to a database of site information, real-time, groundwater, surface-water, and water-quality data collected from locations throughout the United States and elsewhere. Data are updated from the USGS database at regularly scheduled intervals.

### Water-Level Methods and Data

Water levels were measured in wells on an approximately bi-annual basis and prior to collecting the water-quality sample. Water levels were measured and recorded to within 0.01 ft using a calibrated electric or steel tape. Representative water-level data for the sites are presented in table 21; all water-level data are available using NWIS and

can be accessed via hyperlinks in table 21. No hydrographs are presented in this report because of limited water-level data collected over time. The failed and abandoned wells LL04 #2 and #3 (12N/03E-01M2S, -01M3S) and BLA5 #2 (14N/03E-26K2S) do not have water-level data. Additionally, water levels may not be representative for CRTH1 #2 (13N/05E-28Q2S) because the grout reacted with the high-salinity formation water and started infiltrating the sand pack. Water levels for GOLD2 #3 (14N/01E-07R3S) may not be representative of the surrounding aquifer because the well had low flow rates and could not be adequately developed and is hypothesized to be in a perched zone.

### Water-Quality Methods and Data

Groundwater samples were collected and processed by USGS personnel following the protocols established by the USGS National Field Manual (NFM; U.S. Geological Survey, variously dated). These sampling protocols are designed to ensure a representative sample of groundwater is collected and potential contamination of samples during collection and handling is minimized. All monitoring wells were sampled using either a Bennett or Keck pump with Teflon tubing. Test wells, which had multiple perforated intervals, were sampled for bulk discharge (contributions from all the perforated intervals) or depth-dependent samples (contributions from individual perforated intervals). Test well SBTW (31S/46E-05B1M) was sampled using a Bennett pump with Teflon tubing. The bulk discharge samples for all other test wells were collected using a submersible pump with steel pipe. The depth-dependent samples were collected under typical pumping conditions using a small-diameter gas displacement pump developed for depth-dependent sampling (Izbicki, 2004). The depth-dependent samples represent a composite of all flow entering the perforated interval below the sample point if the pump intake of the test well was above the sample point or a composite of all flow entering the perforated interval above the sample point if the pump intake was below the sample point. Although, the tracer-pulse method of Izbicki and others (1999) was used to collect flow profiles of most of the test wells, these profiles are not presented in this report, and concentrations in the depth-dependent samples were not corrected for flow. Sampling equipment was cleaned after samples were collected at each well to prevent cross-contamination between wells (U.S. Geological Survey, variously dated).

Groundwater samples were sent to the National Water Quality Laboratory (NWQL) in Denver, Colorado, for analysis of major ions, nutrients, and selected trace elements, using methods by Fishman and Friedman (1989), Fishman (1993), and Garbarino and others (2002, 2006), respectively. Additionally, selected samples were sent to the Stable Isotope Laboratory (STIL) in Reston, Virginia, for analysis of the stable isotopes of oxygen ( $\delta^{18}\text{O}$ ) and hydrogen ( $\delta\text{D}$ ) by using mass spectrometry (Epstein and Mayeda, 1953; Coplen and others, 1991) and were sent to the Woods Hole Oceanographic Institute, National Ocean Sciences Accelerator Mass

Spectrometry Facility (NOSAMS), for analysis of inorganic carbon ( $\delta^{13}\text{C}$ ) and carbon-14 ( $^{14}\text{C}$ ) by using mass spectrometry (Vogel and others, 1987; Donahue and others, 1990; McNichol and others, 1992, 1994; Gagnon and Jones, 1993; Schneider and others, 1994). Tritium was analyzed with a detection limit of 0.3 to 0.5 picocurie per liter (pCi/L), dependent on sample volume, using an electrolytic enrichment-liquid scintillation method at the University of Miami Tritium Laboratory or the USGS Isotope Tracer Laboratory in Menlo Park, Calif. (Ostlund and Warner, 1962; Thatcher and others, 1977; Beukens, 1992). A summary of available water-quality data for well sites is presented in table 22; all data are available using NWIS and can be accessed via hyperlinks in table 22. The benchmark levels for all constituents in the summary are presented in table 22 and are based on drinking-water thresholds by the U.S. Environmental Protection Agency and the California Department of Public Health as presented by Mathany and others (2012). The upper secondary maximum contaminant level (MCL) was used for specific conductance, chloride, sulfate, and total dissolved solids. Results that exceeded benchmark levels in table 22 are in bold. The failed and abandoned wells LL04 #2 and #3 (12N/03E-01M2S, -01M3S) and BLA5 #2 (14N/03E-26K2S) do not have water-quality data. Additionally, GOLD2 #3 (14N/01E-07R3S), CRTH1 #2 (13N/05E-28Q2S), and CCT1 #3 (15N/03E-25L3S) were not sampled because low flow rates and influx of formational silt did not allow for sufficient purging of the well as required by the NFM.

## Quality-Control Methods and Data

Quality-control (QC) samples help to identify which data best represents environmental conditions and which data may have been affected by contamination or bias during sample collection, processing, storage, transportation, and (or) laboratory analysis. Two of the most common QC samples are blanks and replicates. In addition to blanks and replicates, other data comparisons can be useful in interpreting the quality of the data and are discussed in this section.

## Blank Samples

The primary purposes of collecting blank samples are to evaluate the magnitude of potential contamination of samples with compounds of interest during sample handling or analysis. Blanks are not feasibly collected for isotopic ratios. Isotopic ratios of hydrogen, oxygen, and carbon are an intrinsic property of these elements; therefore, the concept of a blank does not apply to these ratios. In addition, blanks were not collected for tritium. Tritium is ubiquitous in water in contact with the modern atmosphere, and tritium blank water is not readily available, making it impractical to collect a blank for tritium. However, tritium was not reported to be present above the detection limit in most samples, which demonstrates the ability to collect samples without influence

from near-surface sources of tritium. No blanks were collected for this study; however, previous and concurrent USGS studies performed with the same methods used for this study have demonstrated that samples (including blanks) for major and minor elements, nutrients, and most trace elements are routinely collected and analyzed without sample bias (for example, Schmitt and others, 2009; Mathany and others, 2012). Olsen and others (2009) discuss analysis of extensive field blank data sets from studies of groundwater in California using the same methods as were used in this study to quantify low-level bias in trace-element data. The study reporting levels developed by Olsen and others (2009) were used in reporting the results for trace elements for this study.

## Replicate Samples

Sequential replicate samples were collected to assess the precision of the water-quality data. Estimates of data precision are needed to assess whether differences between concentrations in samples occur because of differences in groundwater quality or because of variability that may result from collecting, processing, and analyzing the samples.

## Replicate Analysis

The acceptable limit for the difference in measured concentrations between replicate paired samples was determined using one of two criteria. The criterion selection depended on the magnitude of the measured concentration of a constituent relative to its reporting level. If the concentration of a constituent was measured at less than five times its reporting level, a standard deviation (SD) for the sample pair of less than half the reporting level was considered acceptable. If the measured concentration of a constituent was greater than or equal to five times its reporting level, a relative standard deviation (RSD) of less than 10 percent was considered acceptable. The RSD is defined as the SD divided by the mean concentration for each replicate pair of samples expressed as a percentage. An RSD of less than 10 percent was also used for isotopes, with the exception of tritium and carbon-14. There are no replicate data for tritium and carbon-14.

## Replicate Results

Three replicate sample pairs were collected throughout the course of this study. One bulk discharge pair was collected from wells BLA5 #1 (14N/03E-26K1S), NELT4 #1 (15N/03E-08L1S), and NELT3 #1 (16N/02E-31H1S). Replicate results were evaluated for 32 analyses. Two replicates showed unacceptable variability for iron. The iron concentrations for both these samples were less than five times the reporting level, and both replicate pairs were from test wells where steel pipe was used along with a submersible pump to collect the bulk discharge samples. One replicate pair also showed unacceptable variability for manganese and nitrite; both these constituents were greater than five times the reporting level and had a RSD of greater than 10 percent. In all

cases in which iron, manganese, and nitrite replicate results did not meet variability thresholds, concentrations were more than a factor of 10 less than drinking-water thresholds (U.S. Environmental Protection Agency, 2013). All other analyses were within acceptable limits for all three replicate pairs.

## Sample Comparisons to Sum of Major Constituents

Other means were used to evaluate the quality of the data and detect potential sources of error including an analysis of the sum of major constituents versus dissolved solids [residue on evaporation at 180 degrees Celsius ( $^{\circ}\text{C}$ )], and the sum of major constituents versus specific conductance, unfiltered (field). The sum of the major constituents analyzed (calcium, magnesium, potassium, sodium, bromide, chloride, fluoride, silica, sulfate, and nitrate + nitrite) should show a linear relation to the dissolved solids (residue on evaporation at 180  $^{\circ}\text{C}$ ) and to specific conductance, unfiltered (field). Both these values are independent of the major constituent analyses performed by the laboratory and can be used as a check of the quality of those analyses. Nearly all samples with complete data showed a linear relation for both independent comparisons; a single exception is discussed below (fig. 23).

NELT2 #2 (15N/03E-06L2S) was found to have abnormally high dissolved solids relative to the sum of major constituents (fig. 23). However, the relation between specific conductance and the sum of major constituents for NELT2 #2 followed the linear trend of the other samples. The dissolved-solids analysis for the NELT2 #2 (15N/03E-06L2S) sample was likely erroneous. NELT2 #2 (15N/03E-06L2S) lacked nutrient data, but it is unlikely that nutrient concentrations would have been high enough to substantially increase the sum of major constituents. NELT2 #2 would not have fit within the linear relation even with the addition of nitrate + nitrite. The high dissolved-solids result was likely because of a filter break during sample collection (likely after collection of the sample for trace elements but before collection of the sample for dissolved solids), skewing the results. The concentration of dissolved solids in table 22 is an approximation of what the result should have been and was calculated using a linear-regression method based on the trend of the rest of the dissolved-solids data for the sample set. The specific conductance of the sample from CRTH2 #2 (13N/05E-08B2S) was not compared because it was so high it was outside the calibration range of the meter and was only estimated. However, the relation between the sum of major constituents and the dissolved solids for CRTH2 #2 (13N/05E-08B2S) plots along the same linear trend as the rest of the samples (fig. 23), demonstrating consistency between the analytical analysis and field measurements. Two depth-dependent samples from NELT3 #1 (16N/02E-31H1S) did not have dissolved-solids data because of the low sample volume associated with these types of samples. The relation between the sum of major constituents and specific

conductance for these samples plots along the linear trend with other samples.

## References Cited

- Beukens, R.P., 1992, Radiocarbon accelerator mass spectrometry—Background, precision, and accuracy, *in* Taylor, R.E., Long, Austin, and Kra, R.S., eds., 1992, Radiocarbon after four decades—An interdisciplinary perspective: New York, Springer-Verlag, p. 230–239, [http://dx.doi.org/10.1007/978-1-4757-4249-7\\_16](http://dx.doi.org/10.1007/978-1-4757-4249-7_16).
- California Department of Water Resources, 2003, Bulletin 118—Statewide groundwater basin map version 3 (October 2003): California Department of Water Resources database, accessed November 03, 2011, at [http://www.water.ca.gov/groundwater/bulletin118/gwbasin\\_maps\\_descriptions.cfm](http://www.water.ca.gov/groundwater/bulletin118/gwbasin_maps_descriptions.cfm); Fort Irwin region: [http://www.water.ca.gov/groundwater/bulletin118/south\\_lahontan.cfm](http://www.water.ca.gov/groundwater/bulletin118/south_lahontan.cfm).
- Coplen, T.B., Wildman, J.D., and Chen, Julie, 1991, Improvements in the gaseous hydrogen-water equilibration technique for hydrogen isotope ratio analysis: *Analytical Chemistry*, v. 63, no. 9, p. 910–912, <http://dx.doi.org/10.1021/ac00009a014>.
- Densmore, J.N., 2003, Simulation of ground-water flow in the Irwin Basin aquifer system, Fort Irwin National Training Center, California: U.S. Geological Survey Water-Resources Investigations Report 02–4264, 69 p., <http://pubs.water.usgs.gov/wri024264>.
- Densmore, J.N., and Londquist, C.J., 1997, Ground-water hydrology and water quality of Irwin Basin at Fort Irwin National Training Center, California: U.S. Geological Survey Water-Resources Investigations Report 97–4092, 159 p.
- Donahue, D.J., Linick, T.W., and Jull, A.J.T., 1990, Isotope-ratio and background corrections for accelerator mass spectrometry radiocarbon measurements: *Radiocarbon*, v. 32, no. 2, p. 135–142.
- Driscoll, F.G., 1986, Groundwater and wells: Saint Paul, Minn., Johnson Filtration Systems, Inc., 1,089 p.
- Epstein, S., and Mayeda, T.K., 1953, Variation of  $^{18}\text{O}$  content of waters from natural sources: *Geochimica et Cosmochimica Acta*, v. 4, no. 5, p. 213–224, [http://dx.doi.org/10.1016/0016-7037\(53\)90051-9](http://dx.doi.org/10.1016/0016-7037(53)90051-9).

- Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93–125, 217 p.
- Fishman, M.J., and Friedman, L.C., ed., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p., <http://pubs.water.usgs.gov/twri5a1>.
- Folk, R.L., 1954, The distinction between grain size and mineral composition in sedimentary-rock nomenclature: *Journal of Geology*, v. 62, no. 4, p. 344–359, <http://dx.doi.org/10.1086/626171>.
- Gagnon, A.R., and Jones, G.A., 1993, AMS-graphite target production methods at the Woods Hole Oceanographic Institution during 1986–1991: *Radiocarbon*, v. 35, no. 2, p. 301–310.
- Garbarino, J.R., Bednar, A.J., and Burkhardt, M.R., 2002, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Arsenic speciation in natural-water samples using laboratory and field methods: U.S. Geological Survey Water-Resources Investigations Report 024144, 40 p.
- Garbarino, J.R., Kanagy, L.K., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment, and soil samples using collision/reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, sec. B, chap.1, 88 p., <http://pubs.water.usgs.gov/tm5b1>.
- Hearst, J.R., and Nelson, P.H., 1985, Well logging for physical properties: New York, McGraw-Hill, 571 p.
- Izbicki, J.A., 2004, A small-diameter sample pump for collection of depth-dependent samples from production wells under pumping conditions: U.S. Geological Survey Fact Sheet 2004–3096, 2 p., <http://pubs.usgs.gov/fs/2004/3096/>.
- Izbicki, J.A., Christensen, A.H., Hanson, R.T., Martin, Peter, Crawford, S.M., and Smith, G.A., 1999, U.S. Geological Survey combined well-bore flow and depth-dependent water sampler: U.S. Geological Survey Fact Sheet 196–99, 2 p., <http://pubs.usgs.gov/fs/1999/fs19699/>.
- Jennings, C.W., Burnett, J.L., and Troxel, B.W., comps., 1962, Geologic map of California—Trona sheet: California Geological Survey, Geologic Atlas of California, mpa no. 023, scale 1:250,000.
- Mathany, T.M., Wright, M.T., Beuttel, B.S., and Belitz, Kenneth, 2012, Groundwater-quality data in the Borrego Valley, central desert, and low-use basins of the Mojave and Sonoran Deserts study unit, 2008–2010—Results from the California GAMA Program: U.S. Geological Survey Data Series 659, 100 p., <http://pubs.usgs.gov/ds/659/>.
- McNichol, A.P., Gagnon, A.R., Jones, G.A., and Osborne, E.A., 1992, Illumination of a black box—Analysis of gas composition during graphite target preparation: *Radiocarbon*, v. 34, no. 3, p. 321–329.
- McNichol, A.P., Jones, G.A., Hutton, D.L., Gagnon, A.R., and Key, R.M., 1994, The rapid preparation of seawater  $\Sigma\text{CO}_2$  for radiocarbon analysis at the National Ocean Sciences AMS Facility: *Radiocarbon*, v. 36, no. 2, p. 237–246.
- Mendez, G.O., and Christensen, A.H., 1997, Regional water table (1996) and water-level changes in the Mojave River, and Morongo, and the Fort Irwin groundwaters basins, San Bernardino County, California: U.S. Geological Survey Water-Resources Investigations Report 97–4160, 34 p.
- Munsell Color, 1998 and 2000, Munsell soil color charts: Baltimore, Md., Munsell Color, X-Rite, Incorporated.
- Olsen, L.D., Fram, M.S., and Belitz, Kenneth, 2009, Review of trace-element field-blank data collected for the California Groundwater Ambient Monitoring and Assessment (GAMA) Program, May 2004–January 2008: U.S. Geological Survey Scientific Investigations Report 2009–5220, 47 p., <http://pubs.usgs.gov/sir/2009/5220/>.
- Ostlund, H.G., and Warner, E., 1962, Electrolytic enrichment of tritium and deuterium for natural tritium measurements, *in* Tritium in the physical and biological sciences: Vienna, Austria, International Atomic Energy Agency, v. 1, p. 96–104.
- Schlumberger, Limited, 1972, Log interpretation, v. 1—Principles: New York, Schlumberger Limited, 112 p.
- Schmitt, S.J., Milby Dawson, B.J., and Belitz, Kenneth, 2009, Groundwater-quality data in the Antelope Valley study unit, 2008—Results from the California GAMA program: U.S. Geological Survey Data Series 479, 79 p., <http://pubs.usgs.gov/ds/479/>.
- Schneider, R.J., Jones, G.A., McNichol, A.P., von Reden, K.F., Elder, K.L., Huang, Kelan, and Kessel, E.D., 1994, Methods for data screening, flagging, and error analysis at the National Ocean Sciences AMS Facility: *Nuclear Instruments and Methods in Physics Research*, v. 92, no. 1–4, p. 172–175.

- Thatcher, L.L., Janzer, V.J., and Edwards, K.W., 1977, Methods for determination of radioactive substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water Resources Investigations, book 5, chap. A5, 95 p., <http://pubs.water.usgs.gov/twri5a5>.
- U.S. Environmental Protection Agency, 2013, Drinking water contaminants: U.S. Environmental Protection Agency, accessed May 3, 2013, at <http://www.epa.gov/safewater/contaminants/index.html>.
- U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1–A9, available online at <http://pubs.water.usgs.gov/twri9A>.
- Vogel, J.S., Nelson, D.E., and Southon, J.R., 1987, 14C background levels in an accelerator mass spectrometry system: Radiocarbon, v. 29, no. 3, p. 323–333.
- Voronin, L.M., Densmore, J.N., Martin, Peter, Brush, C.F., Carlson, C.S., and Miller, D.M., 2013, Geohydrology, geochemistry, and groundwater simulation (1992–2011) and analysis of potential water-supply management options, 2010–60, of the Langford Basin, California: U.S. Geological Survey Scientific Investigations Report 2013–5101, 86 p., <http://pubs.er.usgs.gov/publication/sir20135101>.
- Western Region Climate Center, 2009, Goldstone ECHO 2—California (043498) Period of Record Monthly Climate Summary December 01, 1973, to July 31, 2006: Western Region Climate Center database, accessed September 27, 2012, at <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3498>.

## Figures



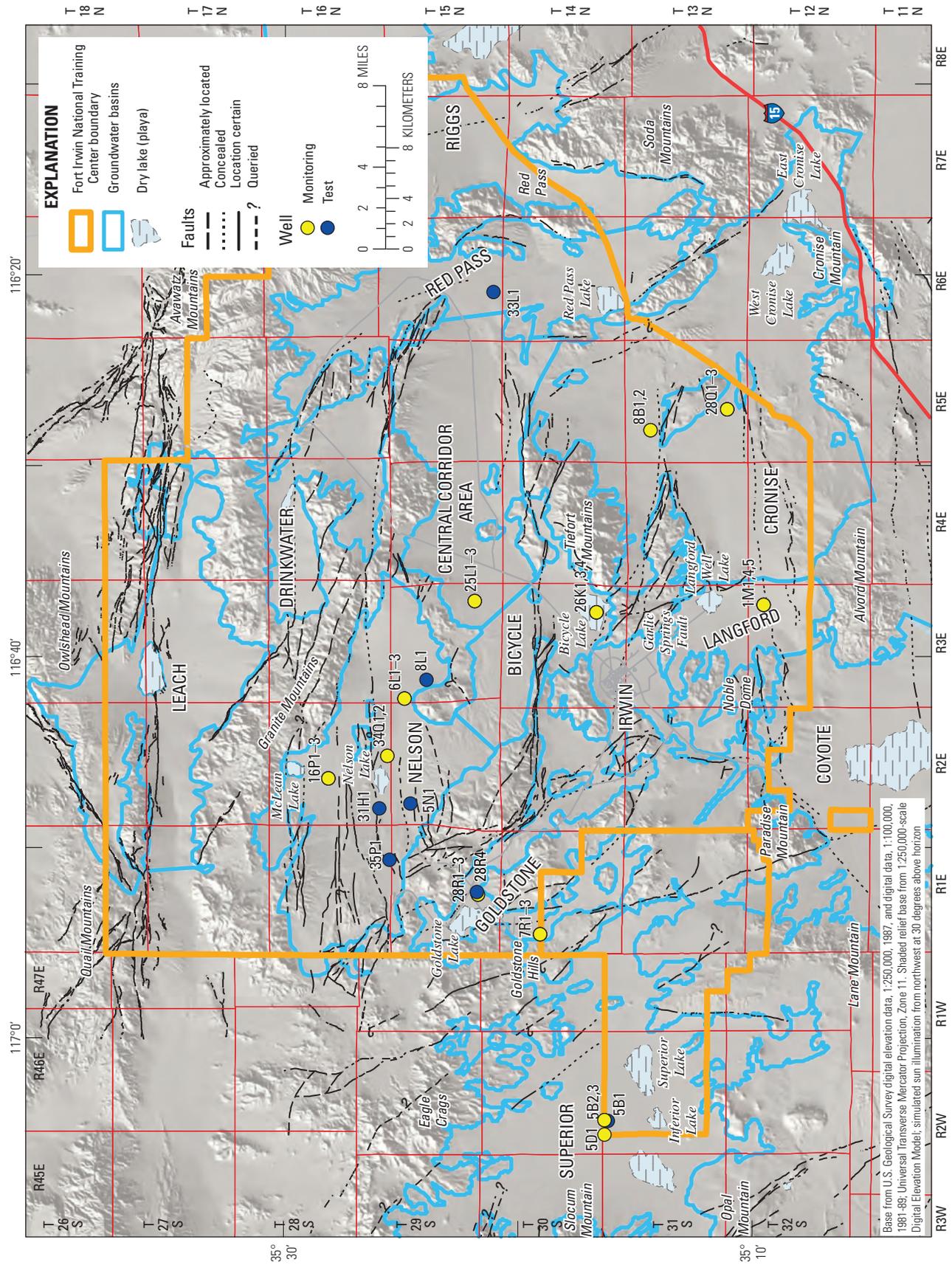
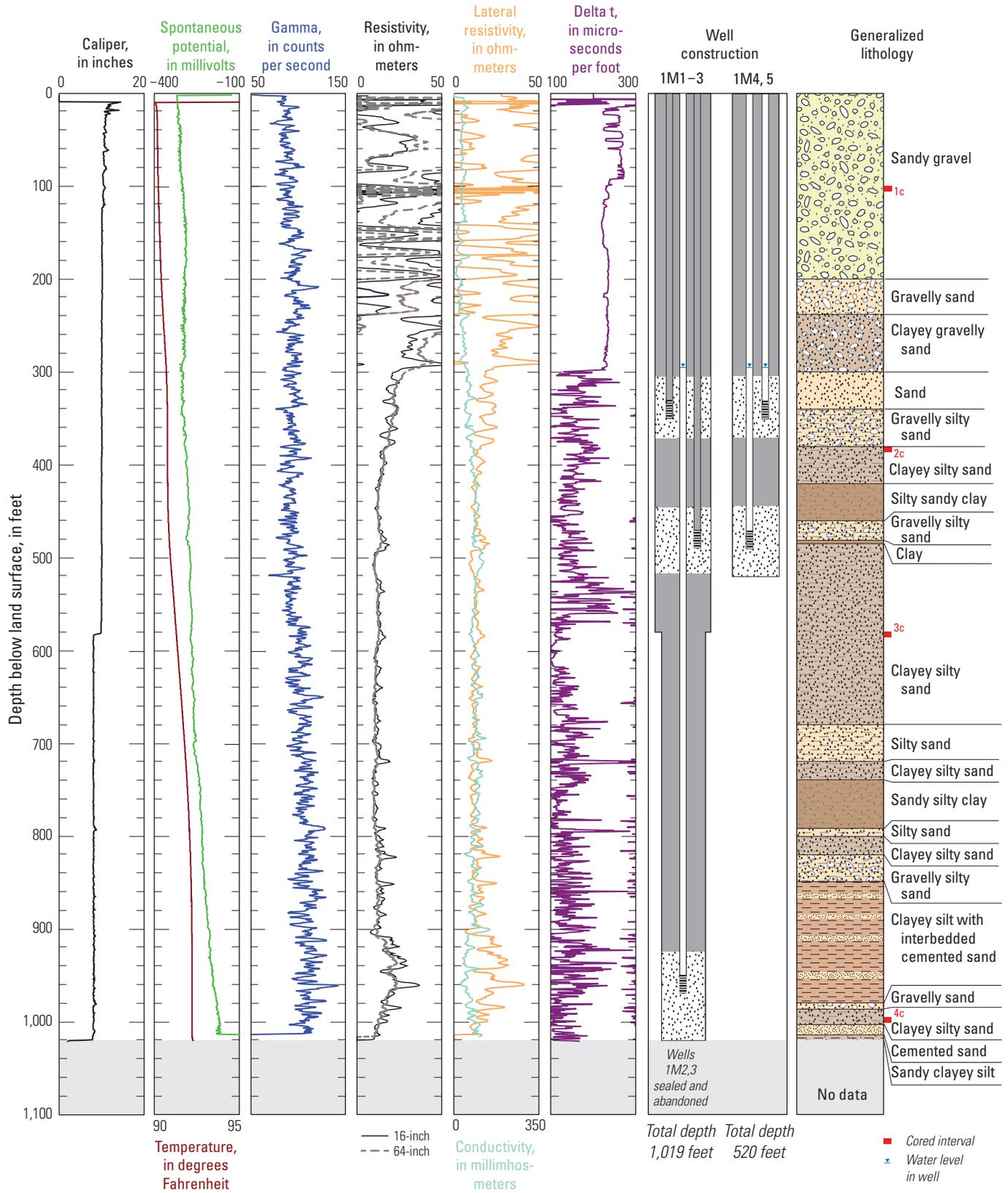


Figure 2. Location of study area, groundwater basins, and well locations within Fort Irwin National Training Center, California.



**Figure 3.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S) and well-construction diagram for multiple-well monitoring site LL04B (12N/03E-01M4S, -01M5S), Fort Irwin National Training Center, California.

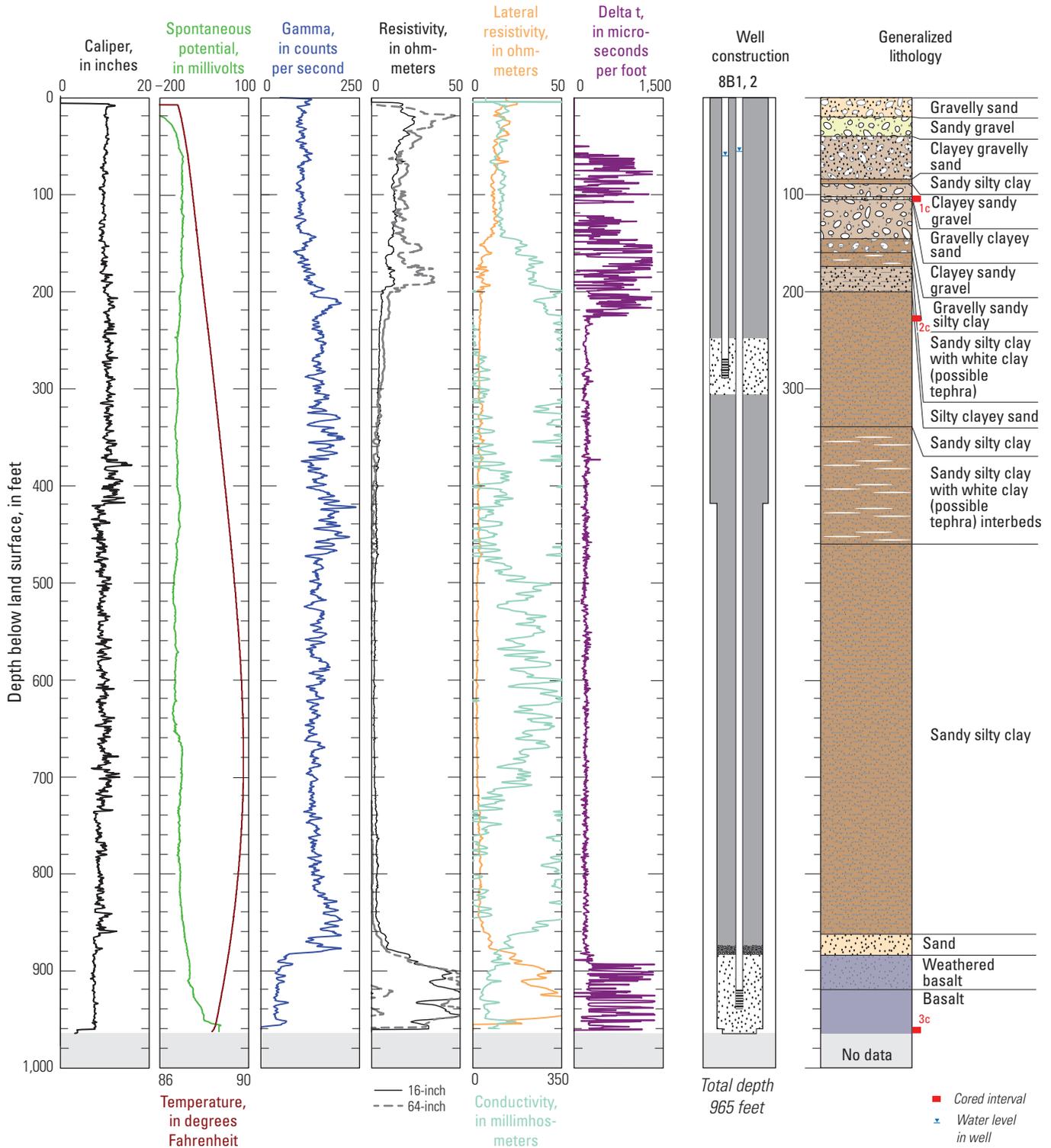
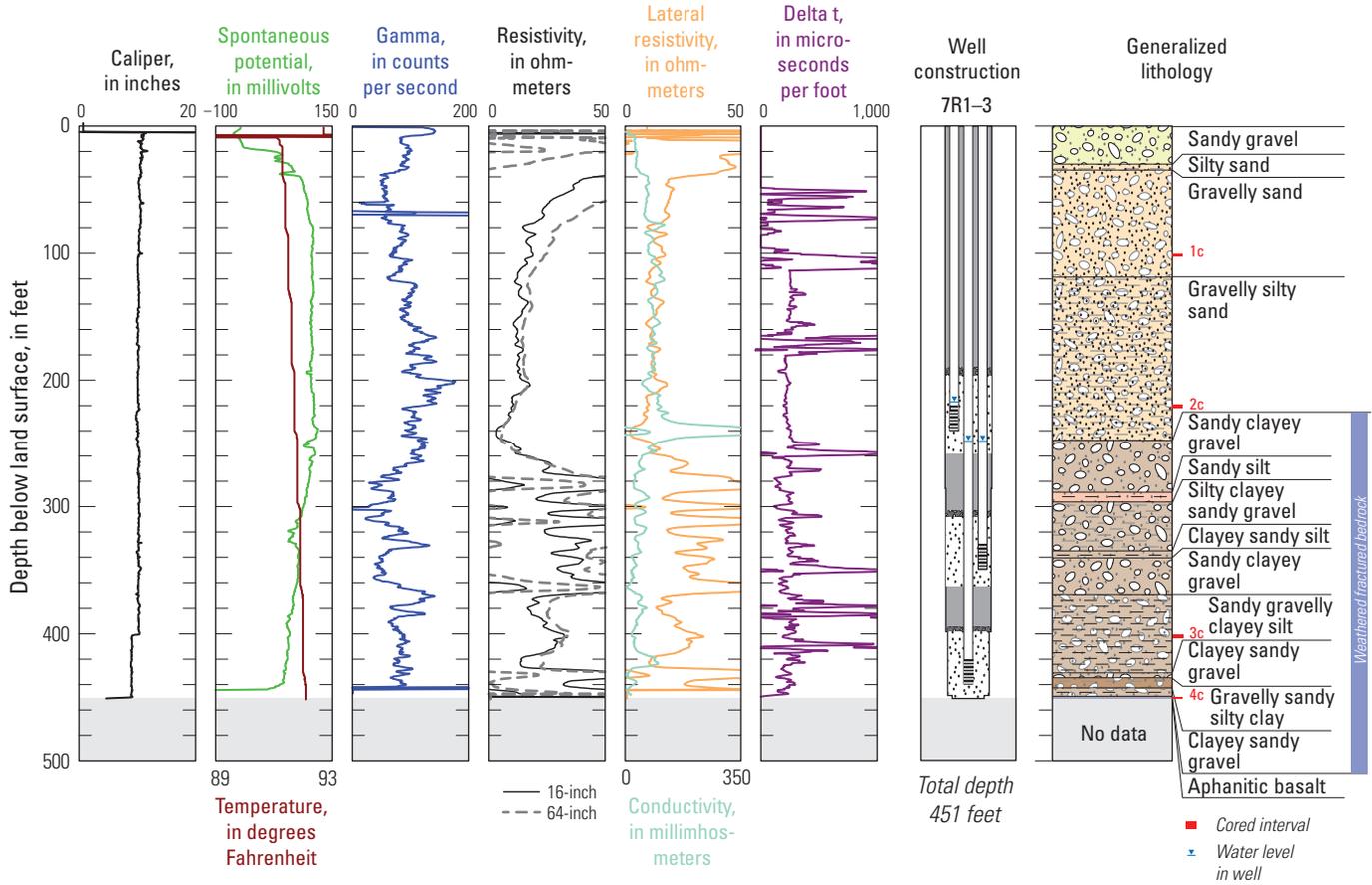
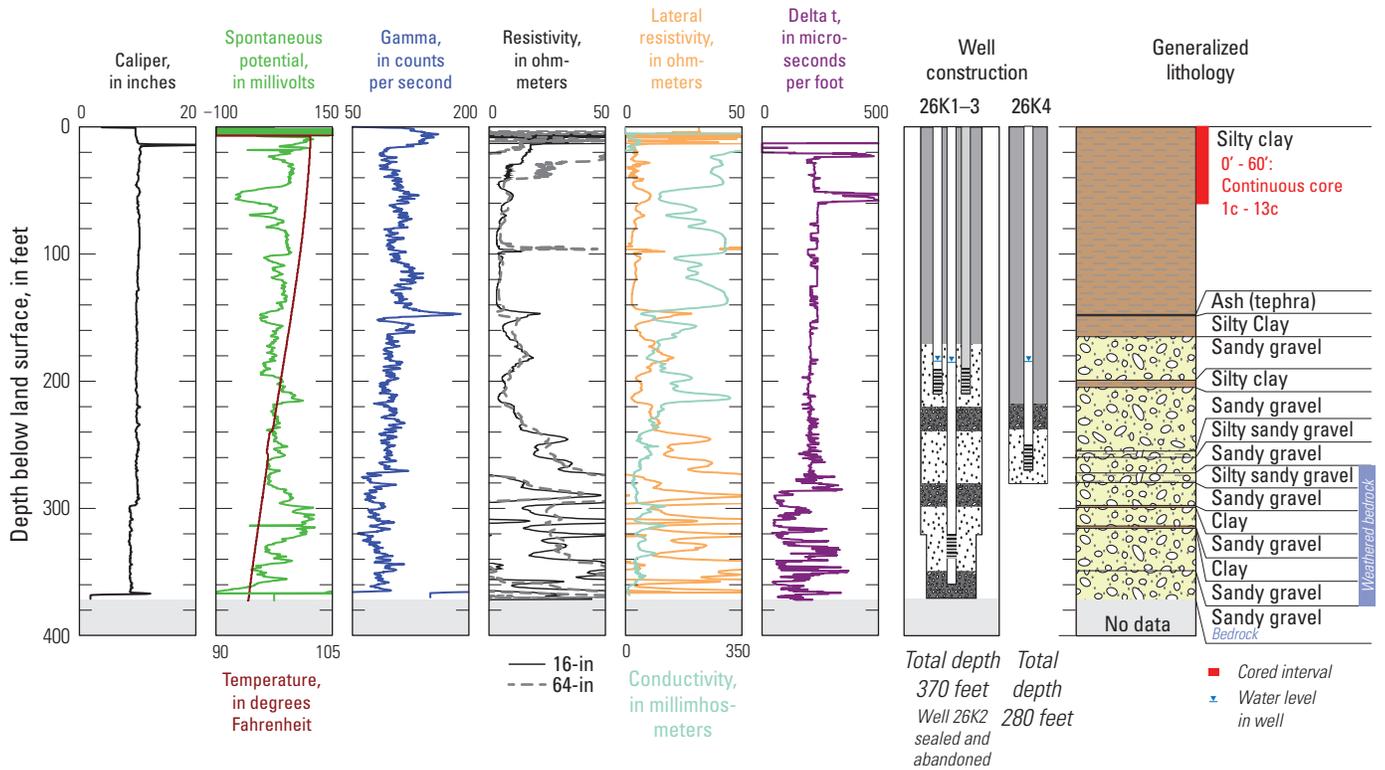


Figure 4. Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S), Fort Irwin National Training Center, California.

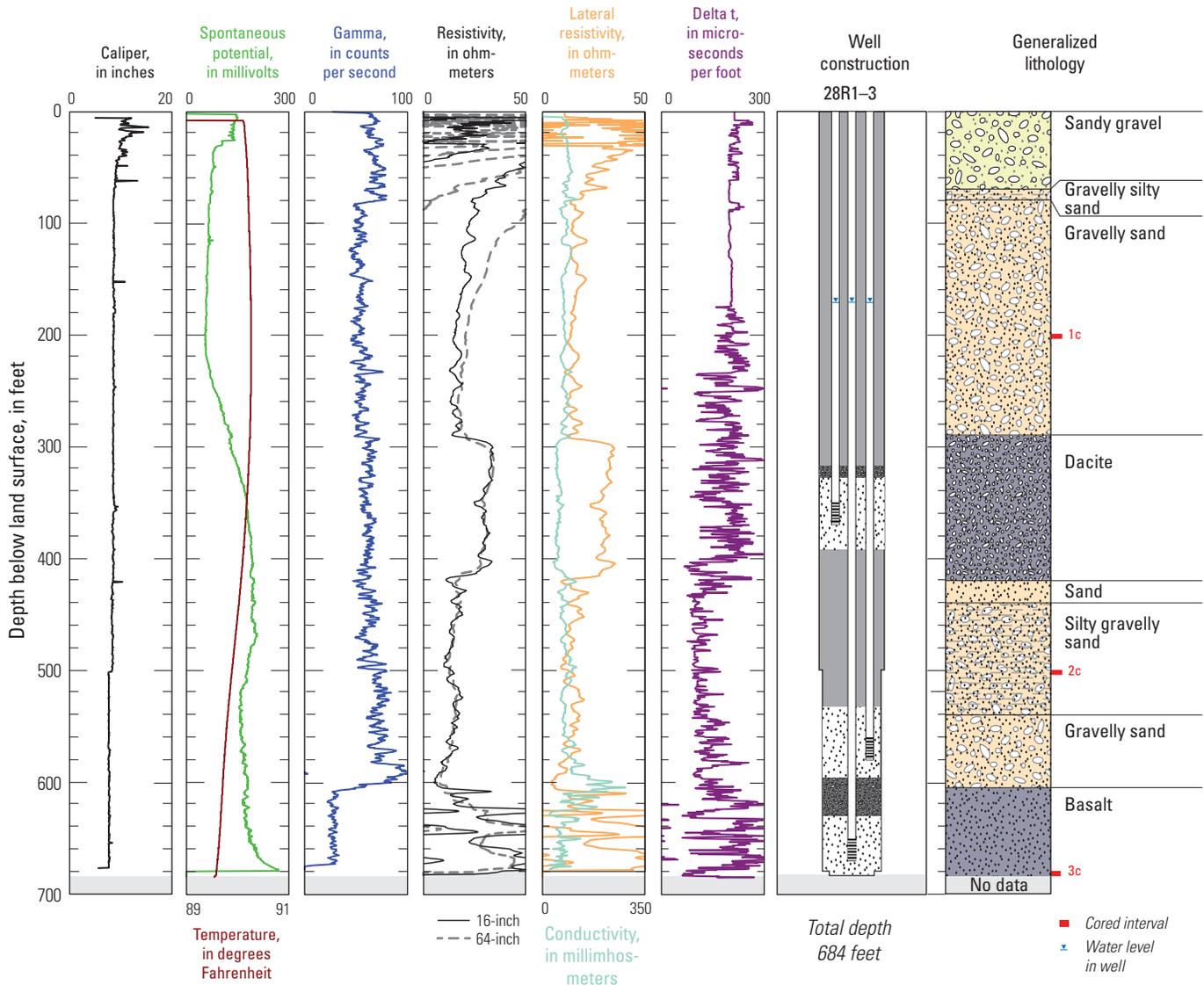




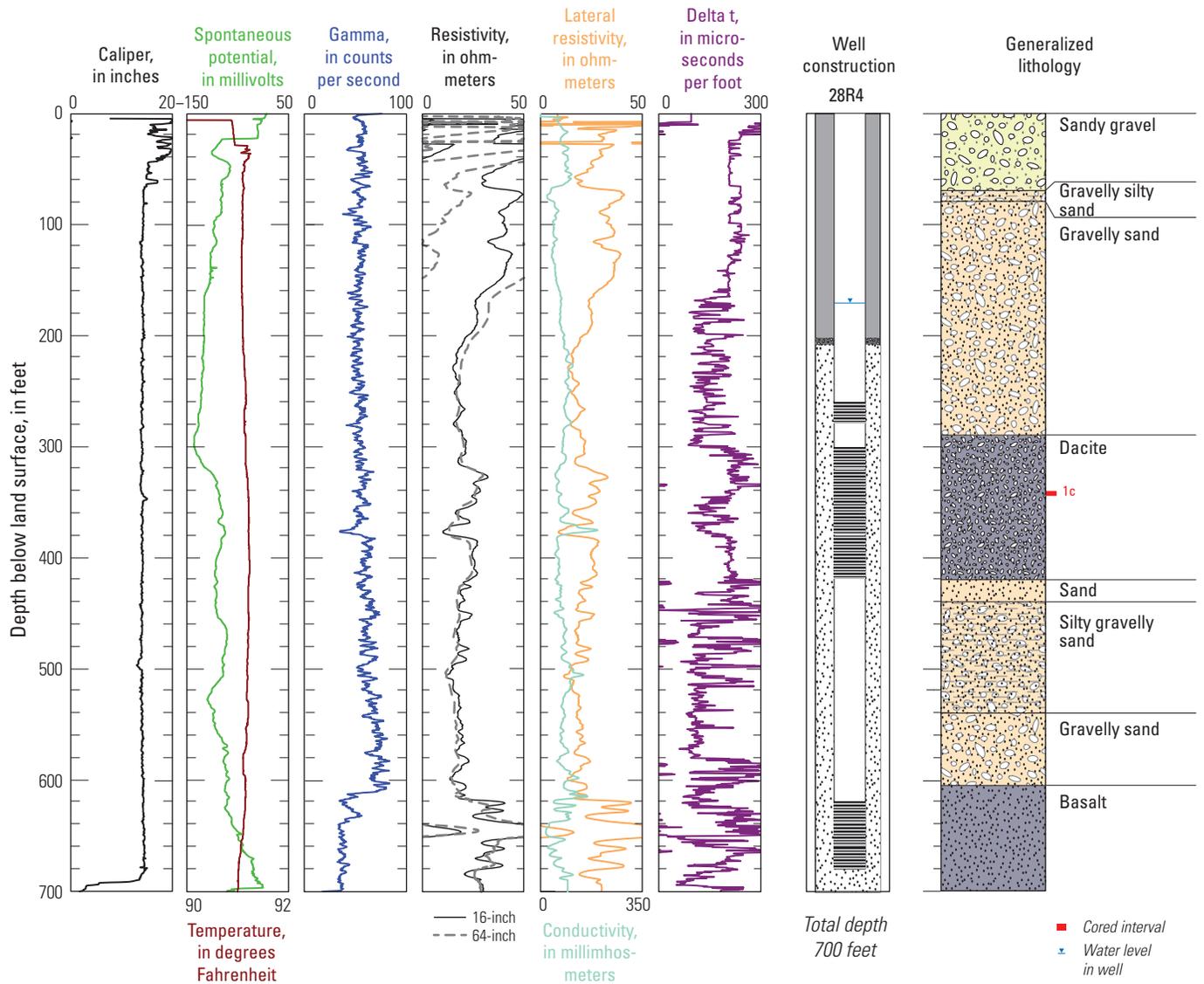
**Figure 6.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site GOLD2 (14N/01E-07R1S, -07R2S, -07R3S), Fort Irwin National Training Center, California.



**Figure 7.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site BLA5 (14N/03E-26K1S, -26K2S, -26K3S) and well-construction diagram for single-well monitoring site BLA5B (14N/03E-26K4S), Fort Irwin National Training Center, California.

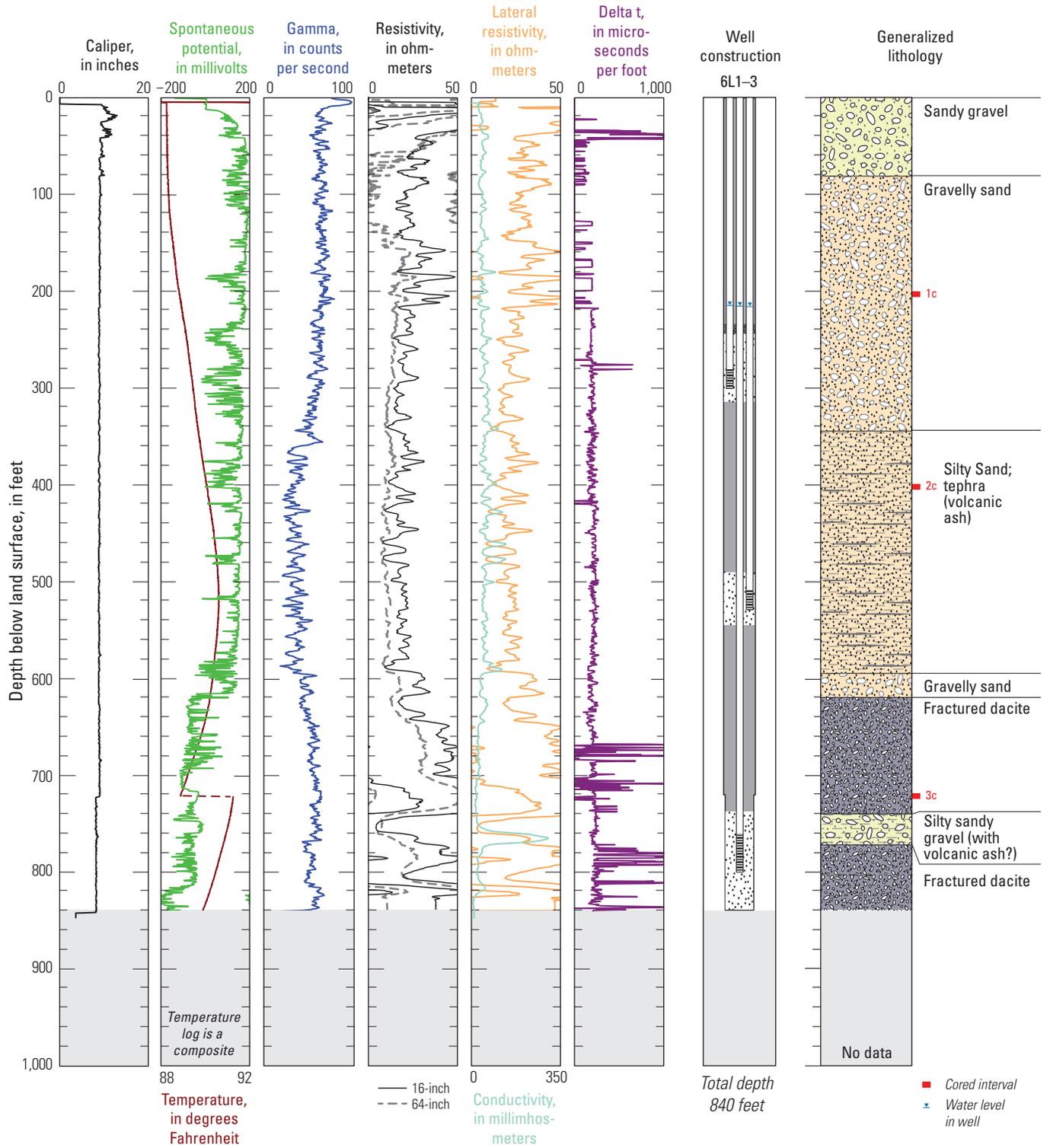


**Figure 8.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.



**Figure 9.** Geophysical logs, well-construction diagram, and generalized lithology for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California. Geophysical logs were collected in a large diameter borehole; therefore, the measurements are subdued relative to GOLD1.





**Figure 11.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.

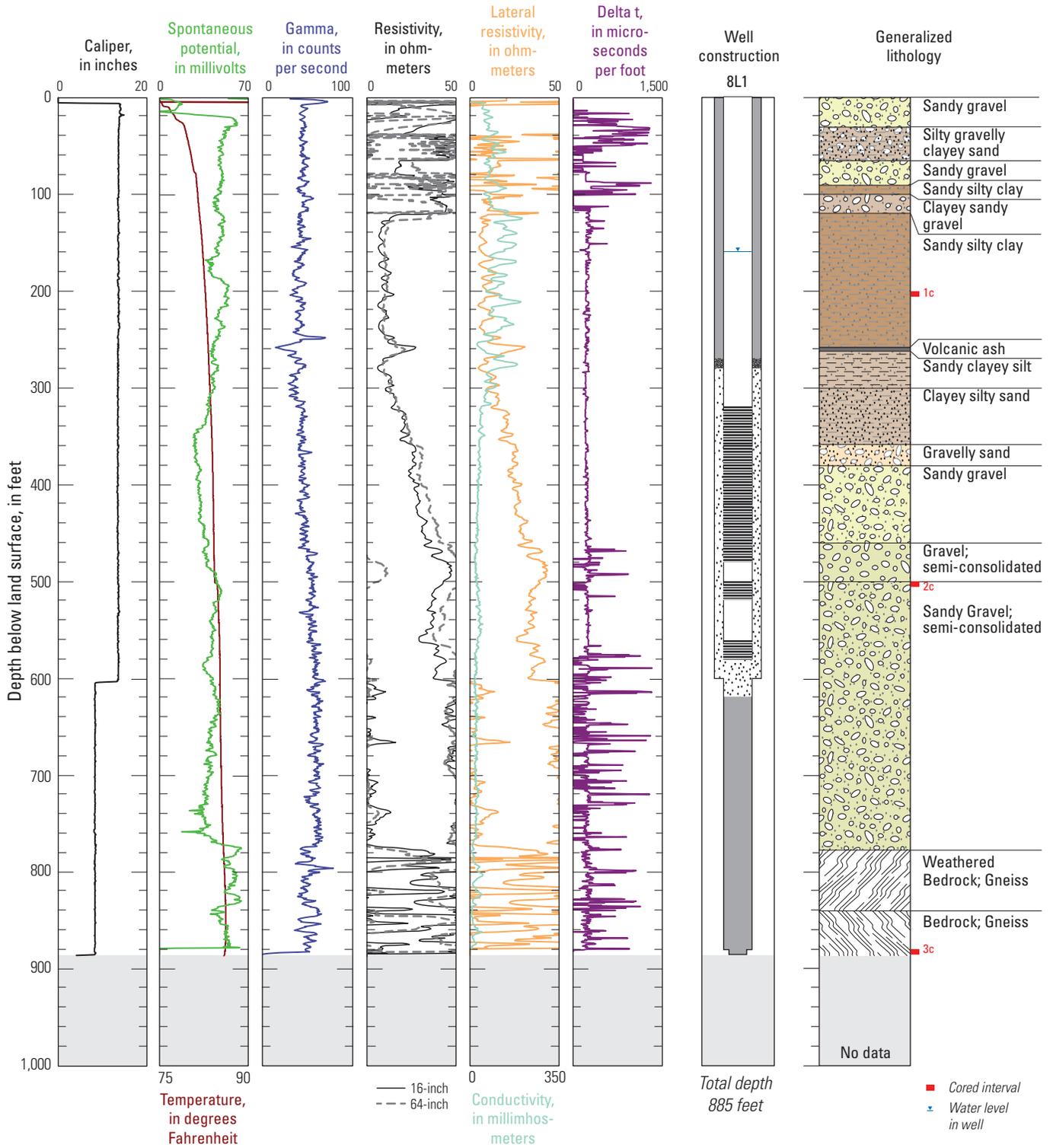
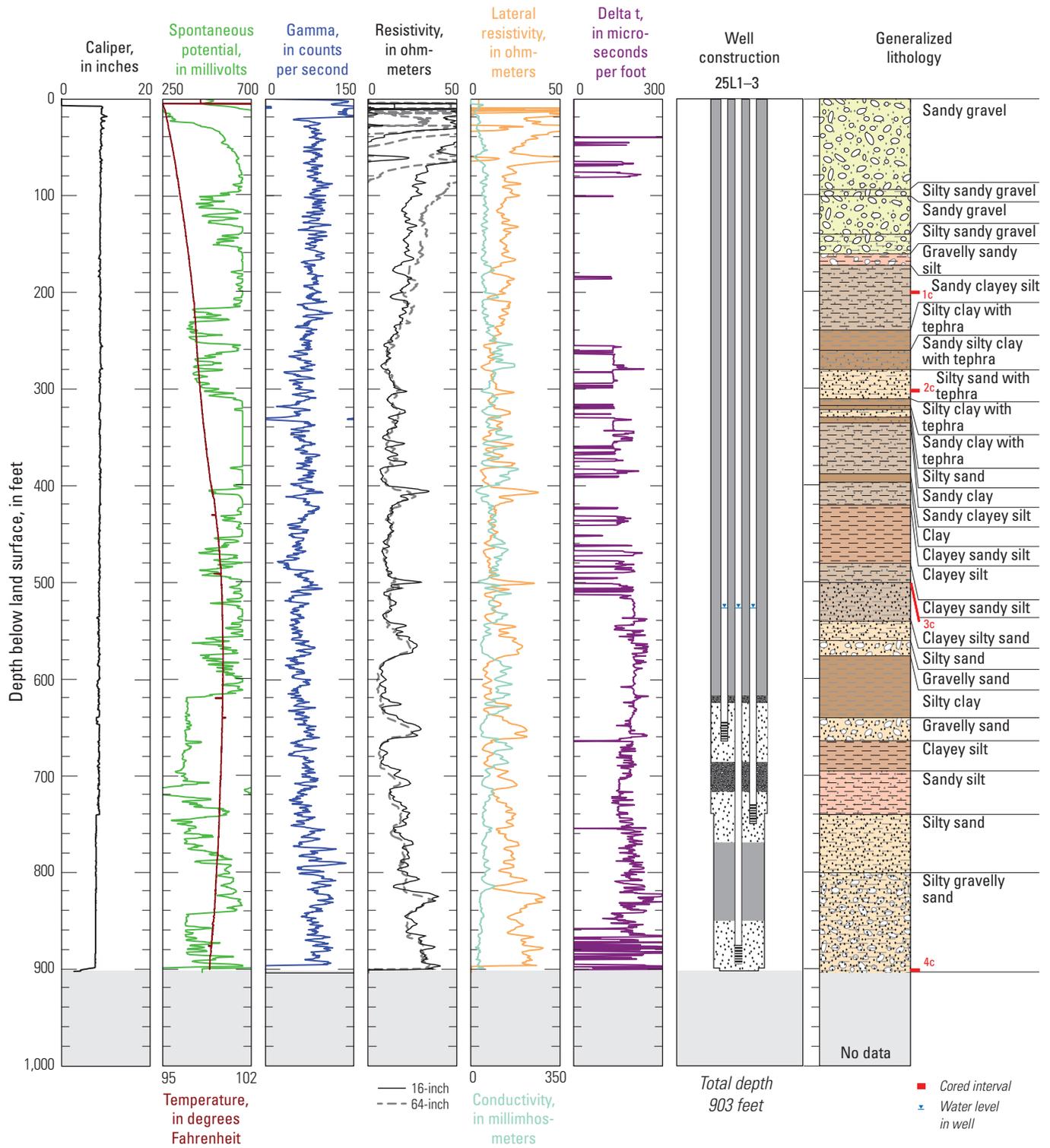
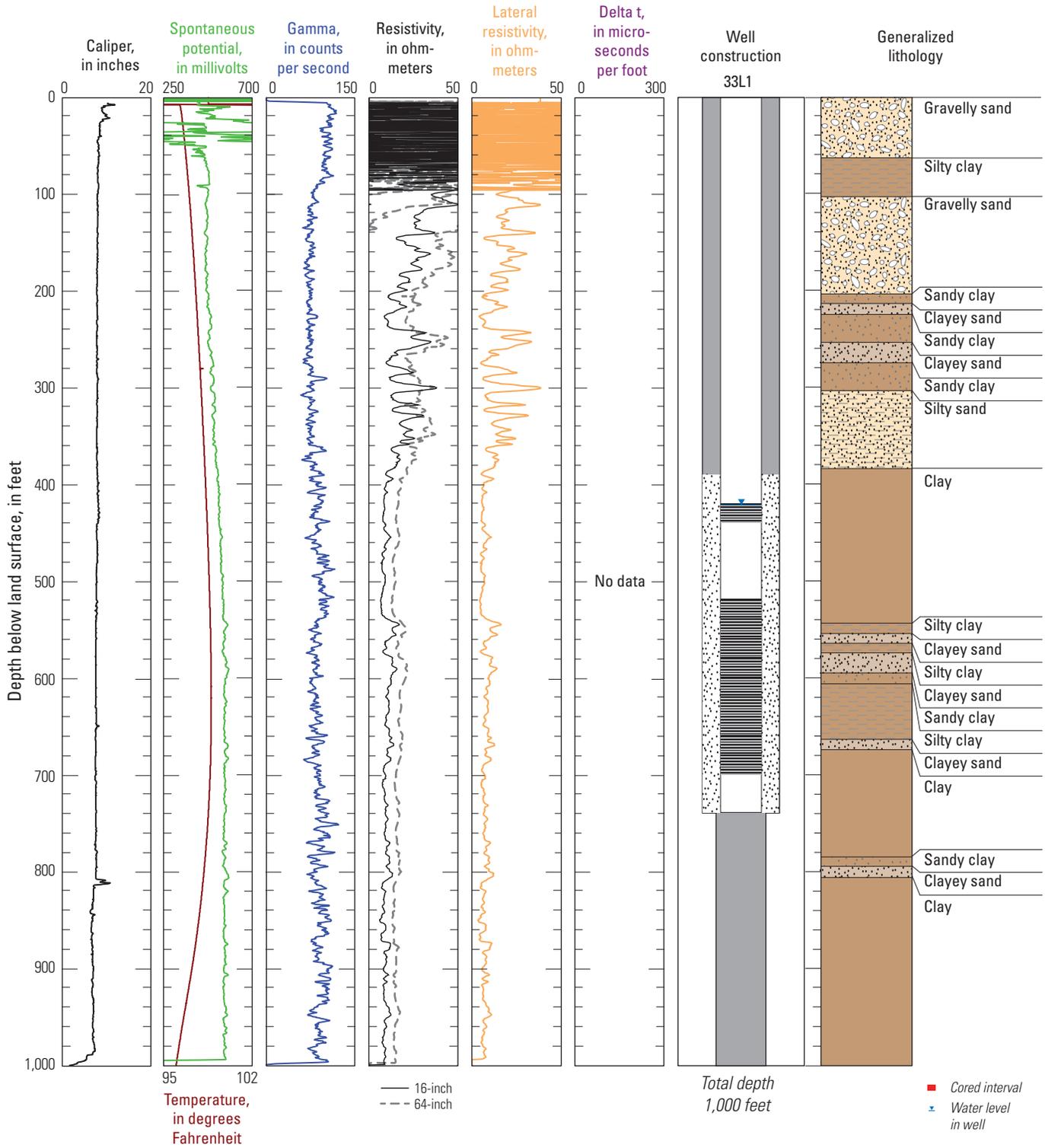


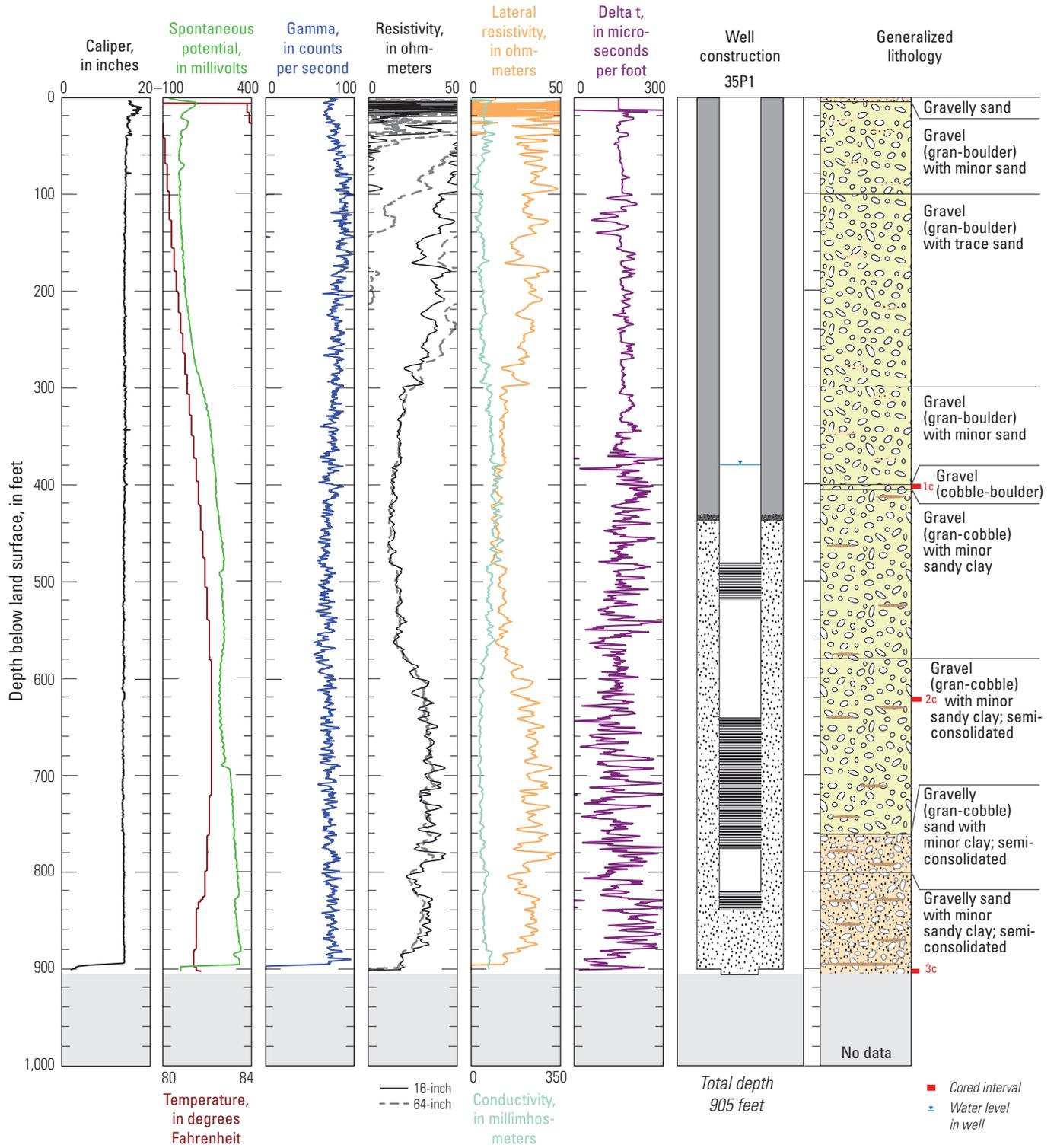
Figure 12. Geophysical logs, well-construction diagram, and generalized lithology for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.



**Figure 13.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S), Fort Irwin National Training Center, California.



**Figure 14.** Geophysical logs, well-construction diagram, and generalized lithology for test well RDPS (15N/06E-33L1S), Fort Irwin National Training Center, California.



**Figure 15.** Geophysical logs, well-construction diagram, and generalized lithology for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California [Abbreviations: gran, granule].

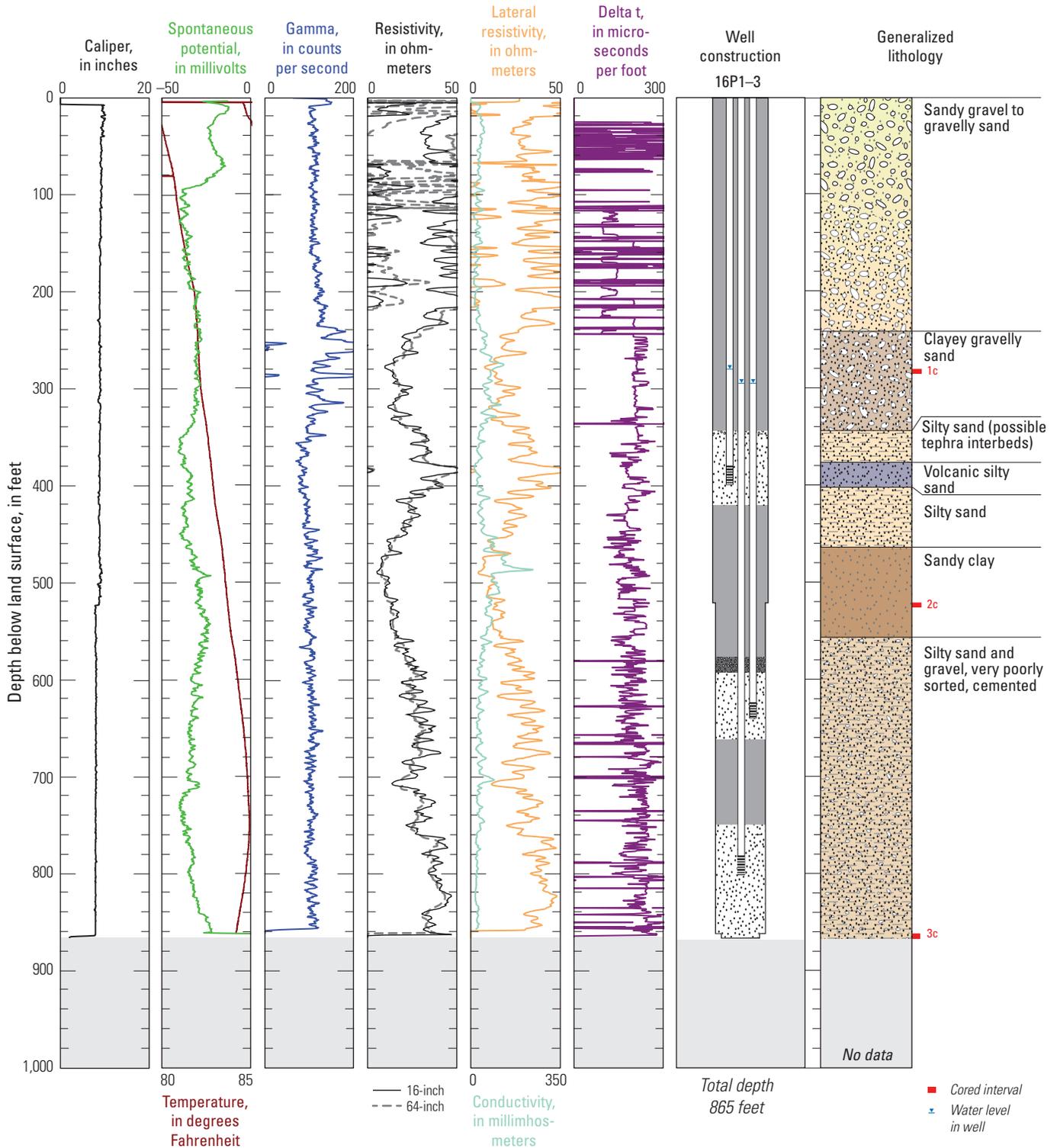
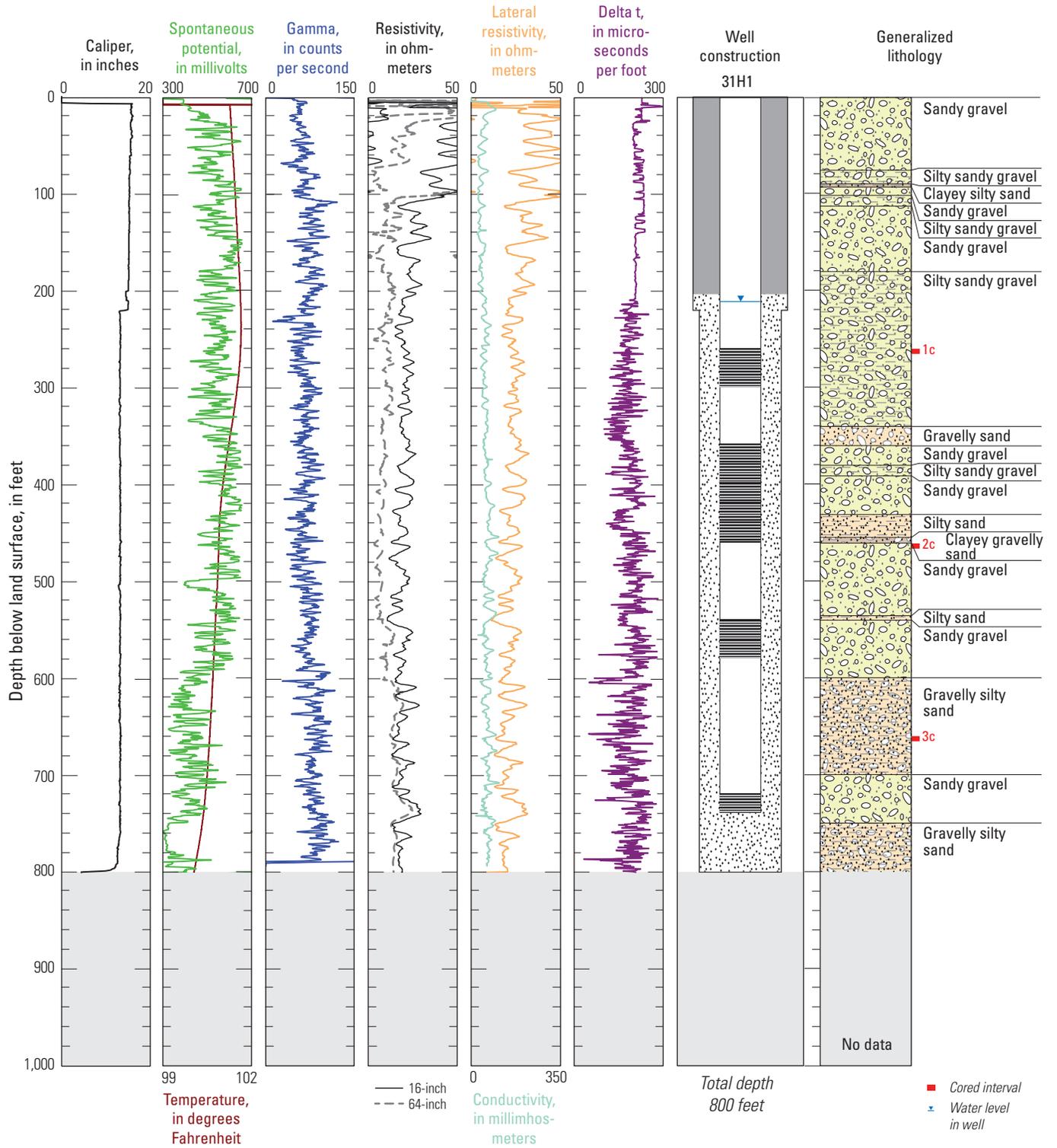
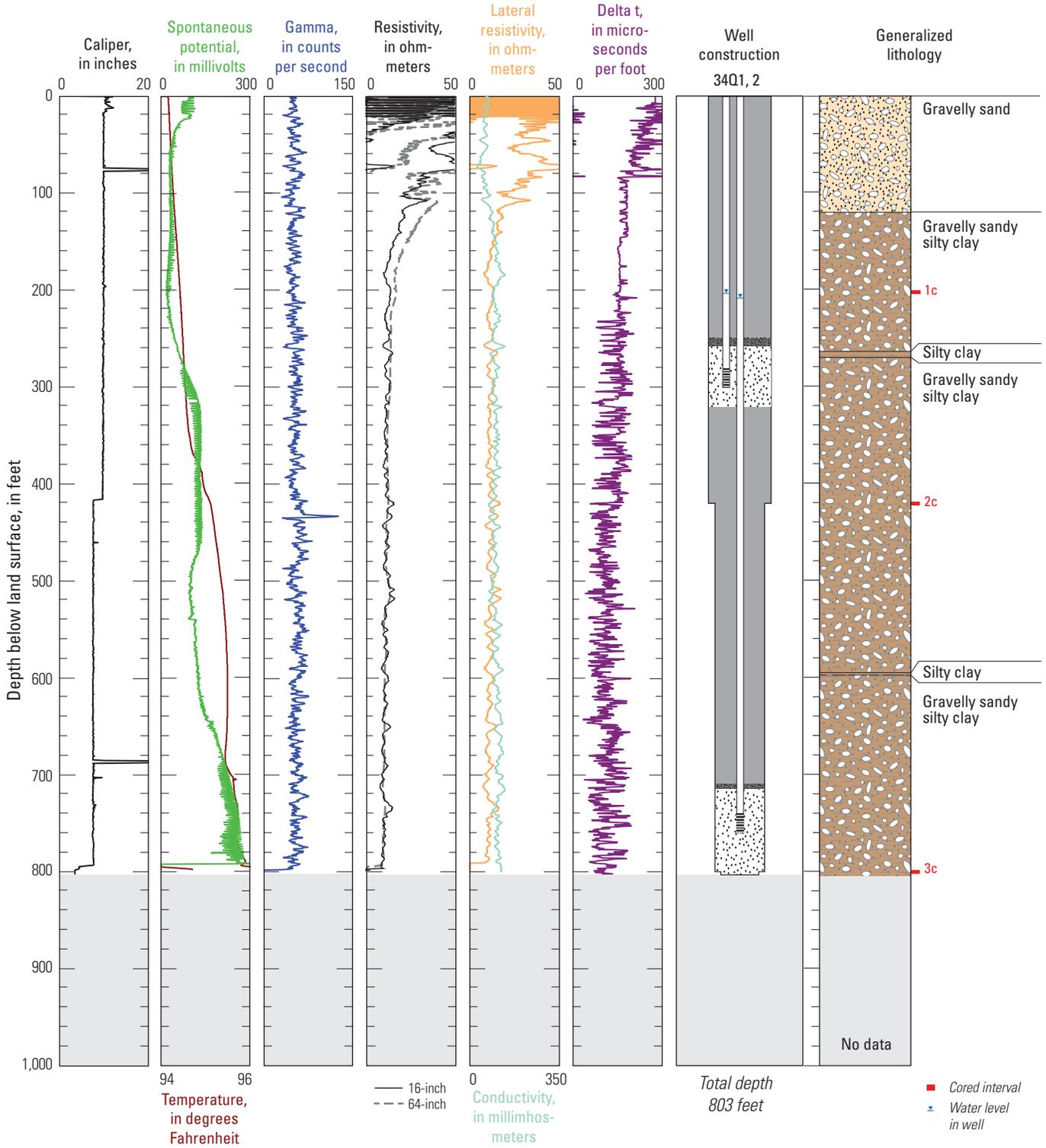


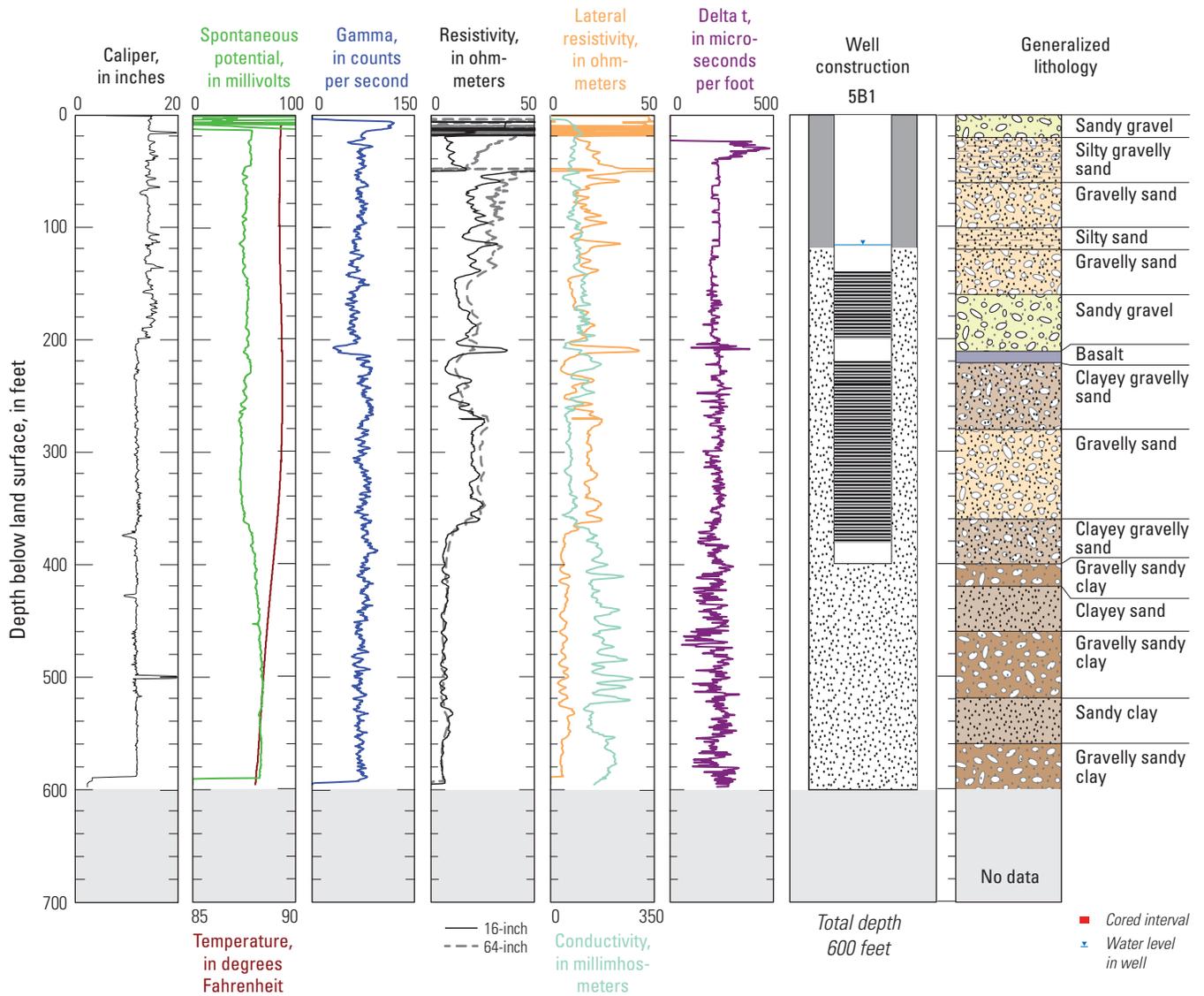
Figure 16. Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site NELT7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.



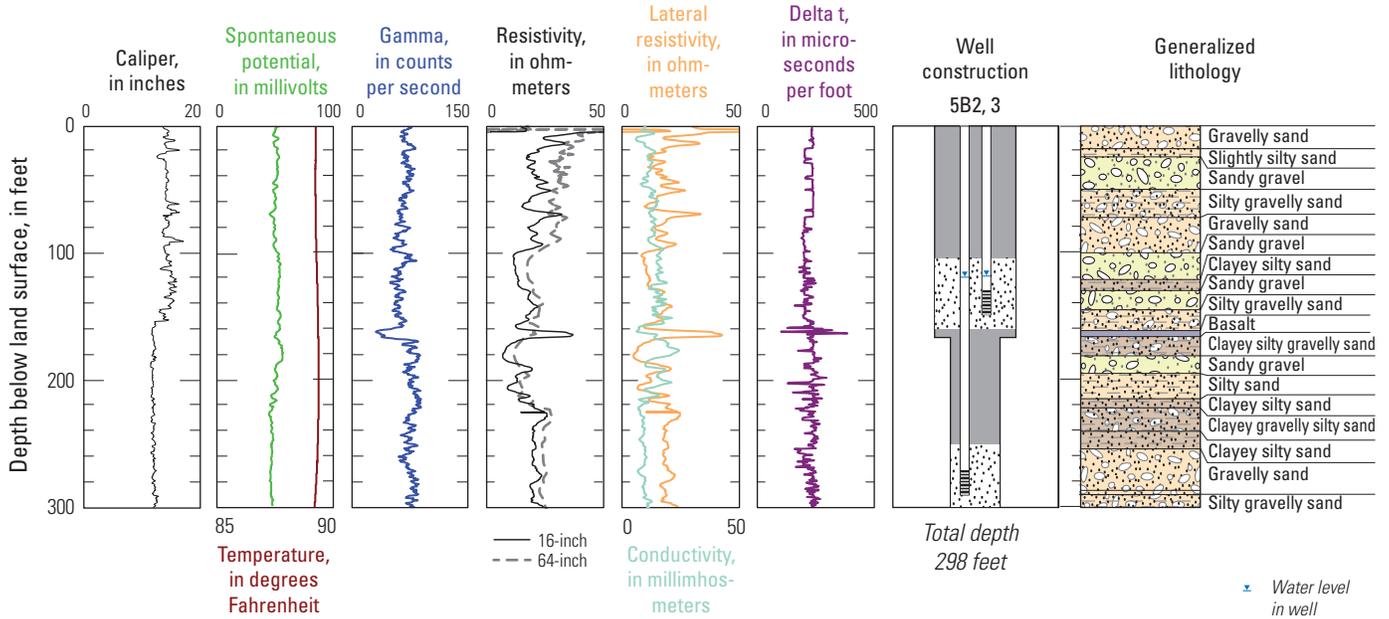
**Figure 17.** Geophysical logs, well-construction diagram, and generalized lithology for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.



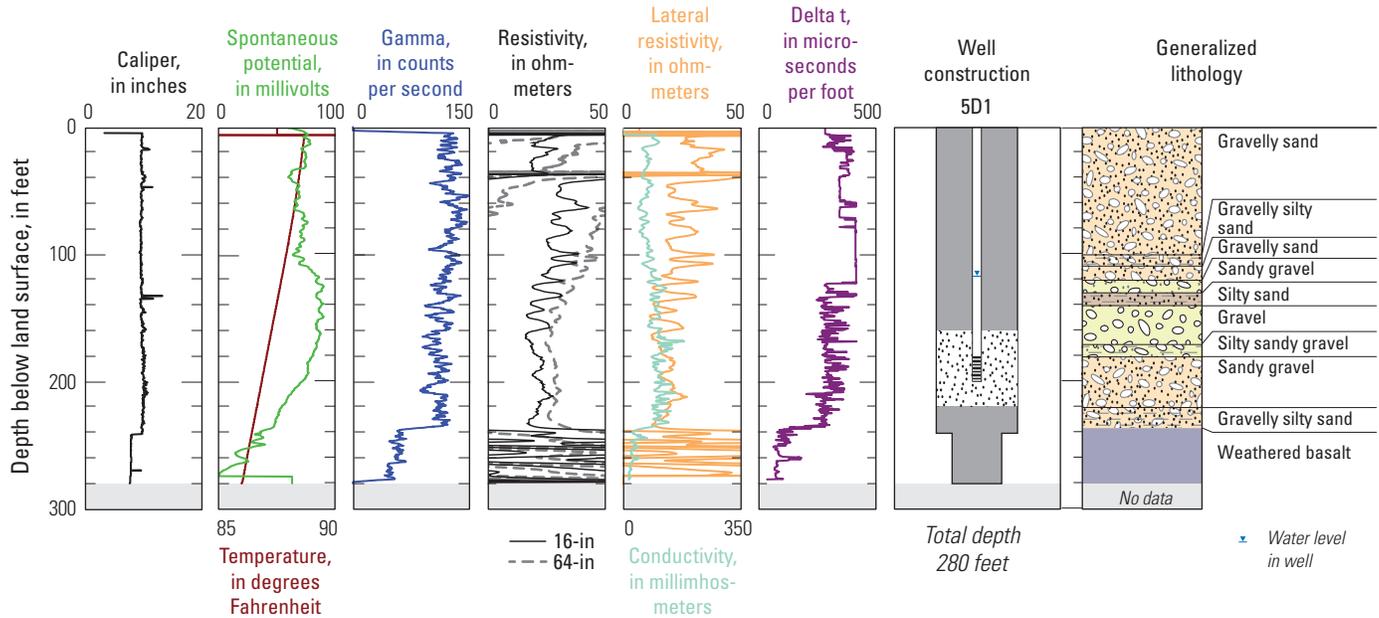
**Figure 18.** Geophysical logs, well-construction diagram, and generalized lithology for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.



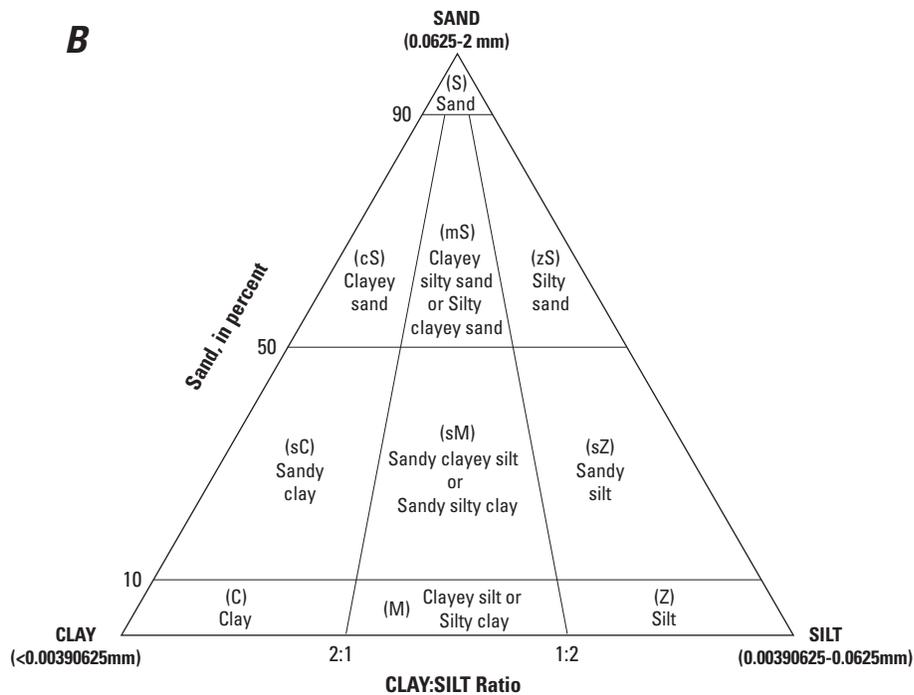
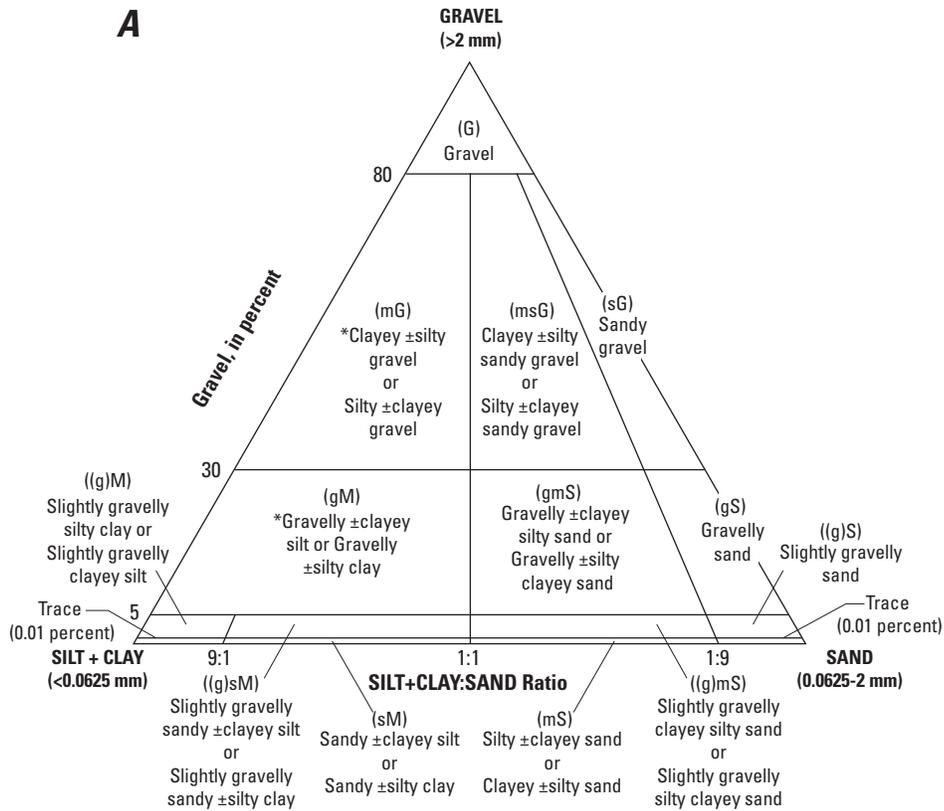
**Figure 19.** Geophysical logs, well-construction diagram, and generalized lithology for test well SBTW (31S/46E-05B1M), Fort Irwin National Training Center, California.



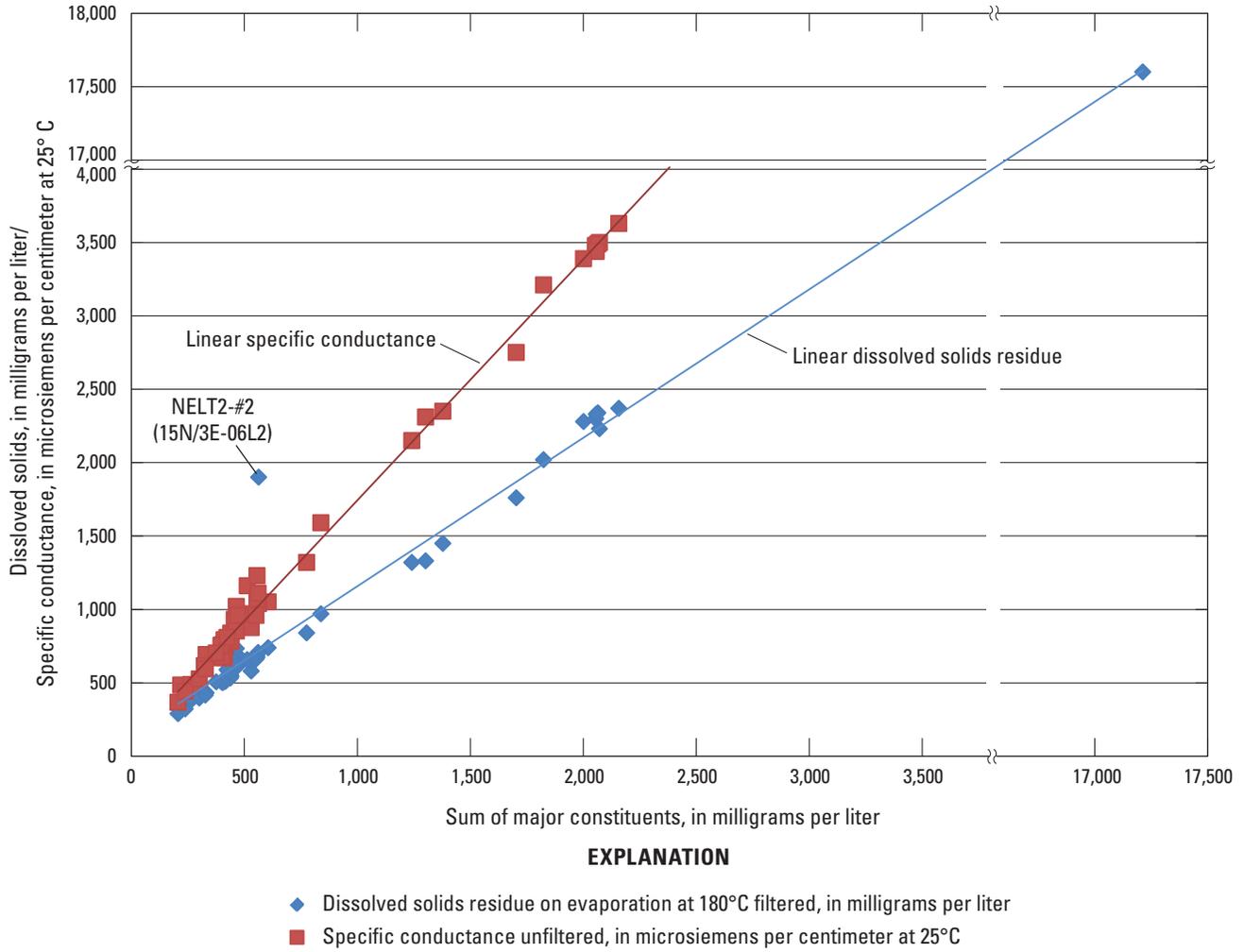
**Figure 20.** Well-construction diagram and generalized lithology for multiple-well monitoring site SBMW (31S/46E-05B2M, -05B3M) Fort Irwin National Training Center, California, and geophysical logs from SBTW (31S/46E-05B1M). Because of its proximity to SBTW, no geophysical logs were collected for SBMW.



**Figure 21.** Geophysical logs, well-construction diagram, and generalized lithology for single-well monitoring site SBMC (31S/46E-05D1M), Fort Irwin National Training Center, California.



**Figure 22.** Nomenclature used for description of texture in lithologic logs. *A*, ternary diagram used for samples containing gravel; *B*, ternary diagram used for samples lacking gravel (adapted from Folk, 1954). [\* samples in these fields may be prefaced by the term “sandy” if >10% sands occur in the sample; mm, millimeters]



**Figure 23.** Relation between the sum of major constituents and dissolved solids and specific conductance from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California., 2009–12.

## Tables

**Table 1.** Well construction data for monitoring and test wells, Fort Irwin National Training Center, California.

[Altitudes were interpolated from a topographic map. All wells were constructed with schedule-80 polyvinyl chloride (PVC) casing and slotted screens, except RDPS, which was constructed with steel casing with steel slotted screens. **Abbreviations:** fbis, feet below land surface; G, Grout; GC, Grout and Bentonite Chips; GP, Grout and Bentonite Pellets; GPC, Grout and Portland Cement; ID, identification; mm-dd-yyyy, month-day-year; MWMS, multiple-well monitoring site; NAVD 88, North American Vertical Datum of 1988; P, Bentonite Pellets; SWMS, single-well monitoring site; SWTS, single-well test site; #, number; USGS, U.S. Geological Survey; —, not applicable, bottom of hole was grouted in and well was continuously sanded across screened intervals]

Common name	State well number	USGS site ID	Type and purpose of well	Depth of well (fbis)	Sand-pack interval (fbis)	Seal interval (fbis)	Type of seal	Perforated interval (fbis)	Inner diameter of well (inches)	Altitude of land-surface datum (NAVD 88)	Date drilled (mm-dd-yyyy)
Site LL04											
LL04 #1	12N/03E-01M1S	350929116372301	MWMS	970	925–1,019	515–925	G	950–970	1.94	2,410	02-03-2011
LL04 #2	12N/03E-01M2S	350929116372302	MWMS	490	445–515	371–445	G	470–490	1.94	2,410	02-03-2011
LL04 #3	12N/03E-01M3S	350929116372303	MWMS	350	305–371	0–305	GC	330–350	1.94	2,410	02-03-2011
Site LL04B											
LL04B #1	12N/03E-01M4S	350929116372201	MWMS	490	446–520	366–446	G	470–490	1.94	2,410	03-01-2011
LL04B #2	12N/03E-01M5S	350929116372202	MWMS	350	307–366	0–307	G	330–350	1.94	2,410	03-01-2011
Site CRTH2											
CRTH2 #1	13N/05E-08B1S	351416116281501	MWMS	940	883–965	306–883	GP	920–940	1.94	1,432	08-11-2011
CRTH2 #2	13N/05E-08B2S	351416116281502	MWMS	290	249–306	0–249	G	270–290	1.94	1,432	08-11-2011
Site CRTH1											
CRTH1 #1	13N/05E-28Q1S	351100116271001	MWMS	1,260	1,182–1,301	736–1,182	G	1,240–1,260	1.94	1,577	06-10-2011
CRTH1 #2	13N/05E-28Q2S	351100116271002	MWMS	720	679–736	268–679	G	700–720	1.94	1,577	06-10-2011
CRTH1 #3	13N/05E-28Q3S	351100116271003	MWMS	255	219–268	205–219	P	235–255	1.94	1,577	06-10-2011
Site GOLD2											
GOLD2 #1	14N/01E-07R1S	351904116543101	MWMS	440	400–451	362–400	GP	420–440	1.94	3,107	03-09-2012
GOLD2 #2	14N/01E-07R2S	351904116543102	MWMS	350	308–362	258–308	GP	330–350	1.94	3,107	03-09-2012
GOLD2 #3	14N/01E-07R3S	351904116543103	MWMS	240	196–258	0–196	GP	220–240	1.94	3,107	03-09-2012
Site BLA5											
BLA5 #1	14N/03E-26K1S	351638116374301	MWMS	360	299–349	349–370	P	320–340	1.94	2,345	03-19-2011
BLA5 #2	14N/03E-26K2S	351638116374302	MWMS	210	240–280	220–240	P	190–210	1.94	2,345	03-19-2011
BLA5 #3	14N/03E-26K3S	351638116374303	MWMS	210	171–220	0–171	GP	190–210	1.94	2,345	03-19-2011
Site BLA5B											
BLA5B #1	14N/03E-26K4S	351638116374304	SWMS	270	238–280	0–238	GP	250–270	1.94	2,345	03-22-2011
Site GOLD1											
GOLD1 #1	15N/01E-28R1S	352144116522601	MWMS	670	631–684	595–631	GP	650–670	1.94	3,058	06-30-2011
GOLD1 #2	15N/01E-28R2S	352144116522602	MWMS	580	534–595	392–534	GP	560–580	1.94	3,058	06-30-2011
GOLD1 #3	15N/01E-28R3S	352144116522603	MWMS	370	328–392	0–328	GP	350–370	1.94	3,058	06-30-2011

**Table 1.** Well construction data for monitoring and test wells, Fort Irwin National Training Center, California.—Continued

[Altitudes were interpolated from a topographic map. All wells were constructed with schedule-80 polyvinyl chloride (PVC) casing and slotted screens, except RDPS, which was constructed with steel casing with steel slotted screens. **Abbreviations:** fbIs, feet below land surface; G, Grout; GC, Grout and Bentonite Chips; GP, Grout and Bentonite Pellets; GPC, Grout and Portland Cement; ID, identification; mm-dd-yyyy, month-day-year; MWMS, multiple-well monitoring site; NAVD 88, North American Vertical Datum of 1988; P, Bentonite Pellets; SWMS, single-well monitoring site; SWTS, single-well test site; #, number; USGS, U.S. Geological Survey; —, not applicable, bottom of hole was grouted in and well was continuously sanded across screened intervals]

Common name	State well number	USGS site ID	Type and purpose of well	Depth of well (fbIs)	Sand-pack interval (fbIs)	Seal interval (fbIs)	Type of seal	Perforated interval (fbIs)	Inner diameter of well (inches)	Altitude of land-surface datum (NAVD 88)	Date drilled (mm-dd-yyyy)
Site GOLD1-T											
GOLD1-T #1	15N/01E-28R4S	352145116522401	SWTS	680	208–700	0–208	GP	300–420 260–280	7.63	3,064	03-5-2012
Site NELT6											
NELT6 #1	15N/02E-05N1S	352436116474001	SWTS	840	355–903	0–355	GP	760–840 500–560 400–460	7.63	3,139	02-23-2012
Site NELT2											
NELT2 #1	15N/03E-06L1S	352450116421101	MWMS	800	738–840	545–738	G	760–800	1.94	3,054	09-06-2011
NELT2 #2	15N/03E-06L2S	352450116421102	MWMS	530	490–545	313–490	G	510–530	1.94	3,054	09-06-2011
NELT2 #3	15N/03E-06L3S	352450116421103	MWMS	300	245–313	0–245	GP	280–300	1.94	3,054	09-06-2011
Site NELT4											
NELT4 #1	15N/03E-08L1S	352354116411201	SWTS	580	280–618	618–885 — 0–280	G — GP	560–580 500–520 320–480	7.63	2,990	12-14-2011
Site CCT1											
CCT1 #1	15N/03E-25L1S	352149116370701	MWMS	895	850–903	769–850	G	875–895	1.94	2,688	08-08-2011
CCT1 #2	15N/03E-25L2S	352149116370702	MWMS	750	716–769	686–716	P	730–750	1.94	2,688	08-08-2011
CCT1 #3	15N/03E-25L3S	352149116370703	MWMS	665	625–686	0–625	GP	645–665	1.94	2,688	08-08-2011
Site RDPS											
RDPS #1	15N/06E-33L1S	352058116205901	SWTS	740	388–739	739–1000 0–388	G GPC	520–700 420–440	6.00	2,102	04-23-2009
Site NELT5											
NELT5 #1	16N/01E-35P1S	352530116503601	SWTS	840	437–905	0–437	GP	820–840 640–780 480–520	7.63	3,243	02-20-2012
Site NELT7											
NELT7 #1	16N/02E-16P1S	352806116462101	MWMS	800	750–865	661–750	G	780–800	1.94	3,172	12-14-2011
NELT7 #2	16N/02E-16P2S	352806116462102	MWMS	640	592–661	421–592	GP	620–640	1.94	3,172	12-14-2011
NELT7 #3	16N/02E-16P3S	352806116462103	MWMS	400	348–421	0–348	GP	380–400	1.94	3,172	12-14-2011

**Table 1.** Well construction data for monitoring and test wells, Fort Irwin National Training Center, California.—Continued

[Altitudes were interpolated from a topographic map. All wells were constructed with schedule-80 polyvinyl chloride (PVC) casing and slotted screens, except RDPS, which was constructed with steel casing with steel slotted screens. **Abbreviations:** fb/s, feet below land surface; G, Grout; GC, Grout and Bentonite Chips; GP, Grout and Bentonite Pellets; GPC, Grout and Portland Cement; ID, identification; mm-dd-yyyy, month-day-year; MWMS, multiple-well monitoring site; NAVD 88, North American Vertical Datum of 1988; P, Bentonite Pellets; SWMS, single-well monitoring site; SWTS, single-well test site; #, number; USGS, U.S. Geological Survey; —, not applicable, bottom of hole was grouted in and well was continuously sanded across screened intervals]

Common name	State well number	USGS site ID	Type and purpose of well	Depth of well (fb/s)	Sand-pack interval (fb/s)	Seal interval (fb/s)	Type of seal	Perforated interval (fb/s)	Inner diameter of well (inches)	Altitude of land-surface datum (NAVD 88)	Date drilled (mm-dd-yyyy)
Site NELT3											
NELT3 #1	16N/02E-31H1S	352556116475501	SWTS	740	204–800	0–204	GP	720–740 540–580 360–460 260–300	7.63	3,097	07-25-2011
Site NELT1											
NELT1 #1	16N/02E-34Q1S	352535116451001	MWMS	760	715–803	321–715	G	740–760	1.94	3,074	07-10-2011
NELT1 #2	16N/02E-34Q2S	352535116451002	MWMS	300	258–321	0–258	GP	280–300	1.94	3,074	07-10-2011
Site SBTW											
SBTW #1	31S/46E-05B1M	351619117041301	SWTS	400	118–600	0–118	G	220–380 140–200	7.63	3,041	12-07-2009
Site SBMW											
SBMW #1	31S/46E-05B2M	351620117041101	MWMS	290	259–298	160–259	G	270–290	1.94	3,044	02-23-2010
SBMW #2	31S/46E-05B3M	351620117041102	MWMS	150	105–160	0–105	G	130–150	1.94	3,044	02-23-2010
Site SBMC											
SBMC #1	31S/46E-05D1M	351619117045701	SWMS	200	160–218	218–280 0–160	G G	180–200	1.94	3,041	11-17-2009

<sup>1</sup>Wells failed due to a grout manufacturing defect, sealed and abandoned, replaced by site LL04B.

<sup>2</sup>Well placed at wrong depth, sealed and abandoned, replaced by site BLA5B.

**Table 2A.** Lithologic SHAKER log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled: 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet. Ream—sample was collected while enlarging the hole after coring or following a change in the drill bit size or type]

Depth (feet)	Description	Depth (feet)	Description
10	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); abundant quartz.	130	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; brown (10YR 5/3); abundant quartz.
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous; abundant quartz.	140	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
30	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4); abundant quartz.	150	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand and trace medium pebbles; moderately sorted; angular to subangular; brown (10YR 5/3).
40	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; yellowish brown (10YR 5/6).	160	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subrounded; brown (10YR 5/3).
50	Sandy gravel (sG); granules to small pebbles with very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	170	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately sorted; subangular to subrounded; brown (10YR 5/3).
60	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	180	Gravelly sand (gS); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
70	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	190	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; brown (10YR 5/3).
80	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	200	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; brown (10YR 5/3).
90	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); slightly calcareous.	210	Gravelly sand (gS); very coarse sand with granules to small pebbles; well to moderately sorted; subangular to subrounded; brown (10YR 5/3).
100	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	220	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
105	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; poorly sorted; subangular to subrounded; pale brown (10YR 6/3); calcareous.	230	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; grayish brown (10YR 5/2); slightly calcareous.
1C shoe		240	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.
110	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand and trace medium pebbles; moderately sorted; angular to subangular; brown (10YR 5/3); abundant quartz.	250	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 5/3).
120	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).	260	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subrounded; brown (10YR 5/3).

**Table 2A.** Lithologic SHAKER log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled: 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet. Ream—sample was collected while enlarging the hole after coring or following a change in the drill bit size or type]

Depth (feet)	Description	Depth (feet)	Description
270	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	400	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; pale brown (10YR 6/3); calcareous.
280	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.	410	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly calcareous.
290	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 5/3).	420	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; pale brown (10YR 6/3).
300	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	430	Gravelly silty clayey sand (gmS); coarse to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; grayish brown (10YR 5/2); slightly calcareous.
310	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; grayish brown (10YR 5/2); calcareous.	440	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
320	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	450	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3); calcareous.
330	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).	460	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
340	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; grayish brown (10YR 5/2).	470	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; light brownish gray (10YR 6/2); trace white clay; calcareous.
350	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 5/3).	480	Silty sandy clayey gravel (msG); granules to medium pebbles with clay, silt and medium to very coarse sand; very poorly sorted; angular to subangular; light brownish gray (10YR 6/2); trace white clay; slightly calcareous.
360	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; light brownish gray (10YR 6/2); slightly calcareous.	490	Silty clayey sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).
370	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); slightly calcareous.	500	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
380	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).	510	Silty clayey sand (mS); medium to very coarse sand with clay and silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly calcareous.
385	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; very poorly sorted; angular to subangular; brown (10YR 4/3); slightly micaceous.		
2C shoe			
390	Clayey silty sand (mS); fine to coarse sand with silt and clay; poorly sorted; angular to subangular; brown (10YR 5/3).		

**Table 2A.** Lithologic SHAKER log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled: 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet. Ream—sample was collected while enlarging the hole after coring or following a change in the drill bit size or type]

Depth (feet)	Description	Depth (feet)	Description
520	Silty clayey sand (mS); medium to very coarse sand with clay and silt; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).	650	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and trace granules; very poorly sorted; subangular to subrounded; pale brown (10YR 6/3).
530	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).	660	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; light brownish gray (10YR 6/2); slightly calcareous.
540	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; light brownish gray (10YR 6/2).	670	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; angular to subangular; grayish brown (2.5Y 5/2); trace white clay; calcareous.
550	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; light brownish gray (10YR 6/2); slightly calcareous.	680	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2); calcareous.
560	Sandy gravelly clayey silt (gM); silt with clay, granules to small pebbles, and medium to very coarse sand; very poorly sorted; light brownish gray (10YR 6/2); calcareous.	690	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; angular to subrounded; light brownish gray (2.5Y 6/2).
570	Sandy gravelly clayey silt (gM); silt with clay, granules, and medium to very coarse sand; very poorly sorted; pale brown (10YR 6/3); calcareous.	700	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; angular to subangular; grayish brown (10YR 5/2).
580	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules to small pebbles; very poorly sorted; angular to subangular.	710	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3); slightly calcareous.
585	Silty clayey sand (mS); medium to very coarse sand with clay, silt and trace granules; very poorly sorted; angular to subangular; grayish brown (10YR 5/2); slightly calcareous.	720	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2); calcareous.
590	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	730	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3); slightly calcareous.
600	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; gray (2.5Y 5/1).	740	Clayey sand (cS); medium to very coarse sand with clay; poorly sorted; angular to subangular; brown (10YR 5/3); calcareous.
610	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2).	750	Clayey silty sand (mS); coarse to very coarse sand with silt and clay; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3); calcareous.
620	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; light brownish gray (2.5Y 6/2).	760	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2); calcareous.
630	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; light brownish gray (2.5Y 6/2).	770	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); slightly calcareous.
640	Silty clayey gravelly sand (gmS); medium to very coarse sand with silt, clay, and granules; very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2).		

**Table 2A.** Lithologic SHAKER log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled: 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet. Ream—sample was collected while enlarging the hole after coring or following a change in the drill bit size or type]

Depth (feet)	Description	Depth (feet)	Description
780	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; light brownish gray (2.5Y 6/2).	920	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; olive gray (5Y 5/2); slightly calcareous.
790	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; olive gray (5Y 5/2).	930	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; olive gray (5Y 4/2); slightly calcareous.
800	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; olive gray (5Y 5/2).	940	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; olive gray (5Y 5/2); calcareous.
810	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; olive gray (5Y 5/2).	950	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
820	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; olive gray (5Y 5/2); slightly calcareous.	960	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; olive gray (5Y 5/2); slightly calcareous.
830	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2); slightly calcareous.	970	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subrounded; olive gray (5Y 5/2); calcareous.
840	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2).	980	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; olive gray (5Y 4/2).
850	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; olive gray (5Y 4/2); slightly calcareous.	990	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.
860	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; grayish brown (2.5Y 5/2).	999	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
870	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules; very poorly sorted; angular to subangular; olive gray (5Y 5/2).	999	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to medium pebbles; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); extremely calcareous.
880	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; olive gray (5Y 5/2); slightly calcareous.	4C top	
890	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.	1,000	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; very poorly sorted; angular to subangular; olive gray (5Y 5/2).
900	Sand (S); medium to very coarse sand; very well to well sorted; angular to subangular; brown (10YR 5/3).	1,004	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; very poorly sorted; angular to subrounded; olive gray (5Y 5/2).
910	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; olive gray (5Y 5/2); slightly calcareous.	4C shoe	
		1,010	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subrounded; grayish brown (2.5Y 5/2).
		1,019	Sandy silty clay (sM); clay with silt and coarse to very coarse sand; poorly sorted; olive gray (5Y 5/2); calcareous.

**Table 2B.** Lithologic SIEVE log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S) Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled, 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Sand (S); medium to very coarse sand with trace fine sand; well sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	260	280	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2).
20	40	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace large pebbles; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); slightly calcareous; slightly micaceous.	280	300	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
40	60	Sand (S); medium to very coarse sand; well sorted; angular to subangular; yellowish brown (10YR 5/4).	300	320	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); micaceous.
60	80	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subangular to subrounded; brown (10YR 5/3).	320	340	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2).
80	100	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); slightly calcareous.	340	360	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; angular to subrounded; brown (10YR 5/3); slightly micaceous.
100	120	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly micaceous.	360	380	Silty sand (zS); very fine to medium sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); micaceous.
120	140	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subrounded; yellowish brown (10YR 5/4); slightly micaceous.	380	400	Silty gravelly sand (gmS); fine to coarse sand with granules to small pebbles, silt, and trace medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3); micaceous.
140	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous; micaceous.	400	420	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); micaceous.
160	180	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 5/3); micaceous.	420	440	Silty sand (zS); very fine to medium sand with silt and trace coarse to very coarse sand; moderately sorted; subangular to subrounded; brown (10YR 5/3); micaceous.
180	200	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); micaceous.	440	460	Silty sand (zS); very fine to medium sand with silt; moderately sorted; subangular to subrounded; grayish brown (10YR 5/2); micaceous.
200	220	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	460	480	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.
220	240	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	480	500	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.
240	260	Silty sand (zS); fine to coarse sand with trace very coarse sand and silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	500	520	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); micaceous.
			520	540	Silty sand (zS); very fine to medium sand with silt; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.

**Table 2B.** Lithologic SIEVE log for multiple-well monitoring site LL04 (12N/03E-01M1S, -01M2S, -01M3S) Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,410 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 3, 2011. Total depth drilled, 1,019 feet. Screened intervals, 950–970, 470–490, and 330–350 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
540	560	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	779	799	Silty sand (zS); fine to coarse sand with silt, trace granules, and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.
560	580	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); micaceous.	799	819	Silty gravelly sand (gmS); medium to very coarse sand with granules and silt; poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.
580	599	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	819	839	Silty sand (zS); fine to coarse sand with silt and trace granules to medium pebbles; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); slightly micaceous.
599	619	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	839	859	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
619	639	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	859	879	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
639	659	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	879	899	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); slightly micaceous.
659	679	Silty sand (zS); very fine to medium sand with silt and trace coarse sand; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	899	919	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
679	699	Silty sand (zS); very fine to medium sand with silt and trace coarse sand; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2); slightly calcareous; micaceous.	919	939	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
699	719	Silty sand (zS); fine to coarse sand with silt, trace granules, and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); micaceous.	939	959	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
719	739	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2); slightly micaceous.	959	979	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; dark gray (10YR 4/1); slightly calcareous; micaceous.
739	759	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); slightly micaceous.	979	999	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (10YR 3/2); micaceous.
759	779	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); slightly calcareous; slightly micaceous.	999	1,019	Silty sand (zS); fine to coarse sand with silt and trace medium pebbles; moderately to poorly sorted; subangular to subrounded; dark gray (10YR 4/1); slightly calcareous; micaceous.

**Table 3A.** Lithologic SHAKER log for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S) Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 1,432 feet. Drilled by U.S Geological Survey using mud-rotary drilling method, August 11, 2011. Total depth drilled, 965 feet. Screened intervals, 920–940 and 270–290 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Silty gravelly sand (gmS); medium to very coarse sand with granules and silt; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	140	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/4); calcareous.
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand and trace large pebbles; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	150	Sandy silty clay (sM); clay with silt, medium to very coarse sand, and trace granules; poorly to very poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
30	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	160	Gravelly sandy silty clay (gM); clay with silt, medium to very coarse sand, and granules to small pebbles; poorly to very poorly sorted; pale brown (10YR 6/3); calcareous; white clay.
40	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; brown (10YR 5/3).	170	Sandy clay (sC); clay with medium to very coarse sand and trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.
50	Clayey gravelly sand (gmS); medium to very coarse sand with granules to medium pebbles and clay; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	180	Sandy silty clay (sM); clay with silt and trace coarse to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
60	Clayey gravelly sand (gmS); medium to very coarse sand with granules to medium pebbles and clay; moderately to poorly sorted; angular to subangular; light yellowish brown (10YR 6/4); calcareous.	190	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
70	Silty gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and silt; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	200	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
80	Clayey gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and clay; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	210	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
90	Silty clayey gravelly sand (gmS); medium to very coarse sand and granules to small pebbles with clay and silt; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	220	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
100	Clayey sand (cS); medium to very coarse sand with clay and trace granules; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	225	Clay (C); clay with trace medium to coarse sand; well sorted; yellowish brown (10YR 5/4); slightly calcareous.
105	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace fine sand; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	2C shoe	
110	Sandy clayey gravel (mG); granules to medium pebbles with clay and medium to very coarse sand; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	230	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
120	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); slightly micaceous.	240	Sandy clay (sC); clay with fine to coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.
130	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt, clay, and granules to medium pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); calcareous; micaceous.	250	Sandy gravelly clay (gM); clay with granules to small pebbles and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
		260	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
		270	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
		280	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
		290	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.

**Table 3A.** Lithologic SHAKER log for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S) Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,432 feet. Drilled by U.S Geological Survey using mud-rotary drilling method, August 11, 2011. Total depth drilled, 965 feet. Screened intervals, 920–940 and 270–290 feet.]

Depth (feet)	Description	Depth (feet)	Description
300	Sandy gravelly clay (gM); clay with granules and medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	480	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
310	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	490	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.
320	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	500	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; yellowish brown (10YR 5/4); calcareous.
330	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	510	Gravelly sandy clay (gM); clay with fine to coarse sand and granules; poorly sorted; brown (10YR 5/3); calcareous.
340	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.	520	Sandy clay (sC); clay with fine to coarse sand and trace granules; poorly sorted; dark yellowish brown (10YR 4/4); calcareous.
350	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous; trace white clay.	530	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.
360	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	540	Sandy clay (sC); clay with medium to very coarse sand and trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.
370	Sandy clay (sC); clay with fine to coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	550	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules; poorly sorted; brown (10YR 5/3); calcareous.
380	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	560	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.
390	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	570	Sandy gravelly clay (gM); clay with granules and medium to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
400	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.	580	Sandy gravelly clay (gM); clay with granules to small pebbles and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
410	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; dark yellowish brown (10YR 4/4); calcareous.	590	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
420	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.	600	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.
430	Sandy silty clay (sM); clay with silt and medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	610	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.
440	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.	620	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.
450	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous; trace white clay.	630	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
460	Gravelly sandy clay (gM); clay with fine to coarse sand and granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.	640	Sandy gravelly clay (gM); clay with granules and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
470	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.		

**Table 3A.** Lithologic SHAKER log for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S) Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,432 feet. Drilled by U.S Geological Survey using mud-rotary drilling method, August 11, 2011. Total depth drilled, 965 feet. Screened intervals, 920–940 and 270–290 feet.]

Depth (feet)	Description	Depth (feet)	Description
650	Sandy clay (sC); clay with medium to very coarse sand and trace granules; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	830	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.
660	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	840	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.
670	Sandy clay (sC); clay with medium to very coarse sand and trace granules; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	850	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
680	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	860	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
690	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules to small pebbles; poorly sorted; brown (10YR 5/3); slightly calcareous.	870	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
700	Sandy gravelly clay (gM); clay with granules to small pebbles and medium to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	880	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt, clay, and granules to medium pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.
710	Sandy clay (sC); clay with medium to very coarse sand with trace granules; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	890	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2); fractured basalt.
720	Sandy clay (sC); clay with medium to very coarse sand and trace granules; moderately to poorly sorted; brown (10YR 5/3); calcareous.	900	Gravel (G); granules to medium pebbles with trace coarse to very coarse sand; well sorted; very angular to angular; very dark grayish brown (10YR 3/2); fractured basalt.
730	Sandy gravelly clay (gM); clay with granules to small pebbles and medium to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	910	Gravel (G); granules to medium pebbles with trace coarse to very coarse sand; well sorted; very angular to angular; dark grayish brown (10YR 4/2); fractured basalt.
740	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	920	Gravel (G); granules to medium pebbles with trace coarse to very coarse sand; well sorted; very angular to angular; dark grayish brown (10YR 4/2); fractured basalt.
750	Sandy silty clay (sM); clay with silt and fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	930	Gravel (G); granules to medium pebbles with trace coarse to very coarse sand; well sorted; very angular to angular; brown (10YR 4/3); fractured basalt.
760	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly sorted; brown (10YR 4/3); calcareous.	940	Gravel (G); granules to medium pebbles with trace coarse to very coarse sand; well sorted; very angular to angular; brown (10YR 4/3); fractured basalt.
770	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.	950	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; very angular to angular; very dark grayish brown (10YR 3/2); fractured basalt.
780	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); slightly calcareous.	960	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; very angular to angular; very dark grayish brown (10YR 3/2); fractured basalt.
790	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.	965	Basalt; fractured locally amygdaloidal vesicular basalt; 3C shoe very dark grayish brown (10YR 3/2).
800	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); slightly calcareous.		
810	Sandy clay (sC); clay with medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.		
820	Gravelly sandy clay (gM); clay with medium to very coarse sand and granules; very poorly sorted; yellowish brown (10YR 5/4); calcareous.		

**Table 3B.** Lithologic SIEVE log for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S) Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 1,432 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 11, 2011. Total depth drilled, 965 feet. Screened intervals, 920–940 and 270–290 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	220	225	No sample collected; cored interval.
20	40	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); slightly micaceous.	225	240	Silty sand (zS); fine to coarse sand with silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous; slightly micaceous; trace caliche.
40	60	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	240	260	Silty clayey sand (mS); fine to coarse sand with clay and silt; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.
60	80	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous; micaceous.	260	280	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; angular to subrounded; yellowish brown (10YR 5/4); slightly calcareous.
80	100	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	280	300	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous; slightly micaceous.
100	105	No sample collected; cored interval.	300	320	Sand (S); fine to coarse sand with trace very coarse sand and silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.
105	120	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous; micaceous.	320	340	Clay (C); clay with trace very fine to medium sand; well sorted; yellowish brown (10YR 5/4); calcareous.
120	140	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous; slightly micaceous.	340	360	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
140	160	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous; micaceous.	360	380	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
160	180	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous; micaceous; trace caliche.	380	400	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
180	200	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	400	420	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
200	220	Silty clayey sand (mS); fine to coarse sand with clay and silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous	420	440	Sandy silty clay (sM); clay with silt and fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
			440	460	Sandy silty clay (sM); clay with silt and fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
			460	480	Gravelly sandy silty clay (gM); clay with silt, medium to very coarse sand and granules; very poorly sorted; yellowish brown (10YR 5/4); calcareous.

**Table 3B.** Lithologic SIEVE log for multiple-well monitoring site CRTH2 (13N/05E-08B1S, -08B2S) Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,432 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 11, 2011. Total depth drilled, 965 feet. Screened intervals, 920–940 and 270–290 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
480	500	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4); calcareous.	740	760	Silty clayey sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.
500	520	Sandy silty clay (sM); clay with silt and medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	760	780	Clayey silty sand (mS); medium to very coarse sand with silt, clay and trace granules; poorly to very poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.
520	540	Silty clayey sand (mS); medium to very coarse sand with silt, clay and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	780	800	Clayey silty sand (mS); fine to coarse sand with silt and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.
540	560	Silty clayey sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	800	820	Sandy silty clay (sM); clay with silt and fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
560	580	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	820	840	Gravelly sandy silty clay (gM); clay with silt, medium to very coarse sand and granules; very poorly sorted; yellowish brown (10YR 5/4); calcareous.
580	600	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.	840	860	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.
600	620	Silty sandy clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4).	860	880	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.
620	640	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.	880	900	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); calcareous; basalt.
640	660	Sandy silty clay (sM); clay with silt and fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.	900	920	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/4); basalt.
660	680	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules to small pebbles; poorly to very poorly sorted; yellowish brown (10YR 5/4); calcareous.	920	940	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous; basalt.
680	700	Gravelly sandy silty clay (gM); clay with silt, medium to very coarse sand and granules to small pebbles; very poorly sorted; yellowish brown (10YR 5/4); calcareous.	940	960	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately sorted; very angular to angular; brown (10YR 4/3); basalt.
700	720	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	960	965	No sample collected; cored interval.
720	740	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.			

**Table 4A.** Lithologic SHAKER log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3); highly calcareous.	150	Slightly gravelly sandy clay ((g)sM); clay with fine to very coarse sand and granules to small pebbles; very poorly sorted; yellowish brown (10YR 5/4); calcareous.
20	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; moderately to poorly sorted; subangular to subrounded; light yellowish brown (2.5Y 6/3); calcareous.	160	Sandy clay (sC); clay with fine to very coarse sand and trace granules to small pebbles; poorly sorted; very pale brown (10YR 7/3); calcareous.
30	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; poorly sorted; subrounded; yellowish brown (10YR 5/4); calcareous.	170	Sandy clay (sC); clay with medium to very coarse sand and trace granules to small pebbles; poorly sorted; yellowish brown (10YR 5/4); calcareous.
40	Gravel (G); granules to large pebbles with minor coarse to very coarse sand; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	180	Sandy clay (sC); clay with fine to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.
50	Sandy gravel (sG); granules to large pebbles with fine to very coarse sand and minor clay; very poorly sorted; subrounded; brown (10YR 5/3); calcareous.	190	Sandy clay (sC); clay with fine to coarse sand with trace granules; poorly sorted; brown (10YR 5/3); calcareous.
60	Sandy gravel (sG); granules to very large pebbles with medium to very coarse sand and trace clay; poorly sorted; subrounded; brown (10YR 5/3); calcareous.	200	Slightly gravelly sandy clay ((g)sM); clay with fine to very coarse sand and granules to medium pebbles; very poorly sorted; brown (10YR 5/3); calcareous.
70	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand and minor clay; very poorly sorted; subrounded; brown (10YR 5/3); calcareous.	210	Clay (C); clay with minor fine to coarse sand and trace granules to small pebbles; moderately sorted; yellowish brown (10YR 5/4); calcareous.
80	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and minor clay; poorly sorted; subrounded; brown (10YR 5/3); calcareous.	220	Clay (C); clay with trace fine sand; very well sorted; yellowish brown (10YR 5/4); calcareous.
90	Gravelly sand (gS); medium to very coarse sand with granules; moderately to well sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.	230	Gravel (G); granules to large pebbles with trace clay; well sorted; very angular; black (10YR 2/1); calcareous; basalt.
100	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; poorly sorted; subrounded; brown (10YR 5/3); calcareous.	240	Gravel (G); granules to medium pebbles with minor clay; well sorted; angular to subangular; olive brown (2.5Y 4/3); calcareous; basalt.
110	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/3); calcareous.	250	Gravel (G); granules to medium pebbles with minor clay; well sorted; very angular; dark olive brown (2.5Y 3/3); calcareous; basalt.
120	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; subangular to rounded; yellowish brown (10YR 5/4); calcareous.	260	Gravel (G); granules to medium pebbles; well sorted; angular; black (2.5Y 2.5/1); calcareous; basalt.
130	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules; very poorly sorted; subrounded to rounded; brown (10YR 5/3); calcareous.	270	Gravel (G); granules to medium pebbles with trace medium sand; well sorted; angular; black (2.5Y 2.5/1); calcareous; basalt.
140	Gravelly sand (gS); fine to very coarse sand with granules to small pebbles; poorly sorted; subrounded to rounded; brown (10YR 5/3); calcareous.	280	Slightly gravelly sandy clay ((g)sM); clay with medium to coarse sand and granules to medium pebbles; very poorly sorted; light yellowish brown (10YR 6/4); calcareous.
		290	Clay (C); clay with trace medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
		300	Sandy clay (sC); clay with medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
		310	Sandy clay (sC); clay with fine to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.

**Table 4A.** Lithologic SHAKER log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)	Description	Depth (feet)	Description
320	Clayey silt (M); silt and clay with minor very fine sand; well sorted; light yellowish brown (10YR 6/4); calcareous.	490	Sandy clay (sC); clay with medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
330	Sandy clay (sC); clay with very fine to fine sand and trace very coarse sand; well sorted; light yellowish brown (10YR 6/4); calcareous.	500	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
340	Clay (C); clay with minor very fine to fine sand; very well sorted; yellowish brown (10YR 5/4); calcareous.	510	Clay (C); clay with trace medium to coarse sand; well sorted; brown (10YR 5/3); calcareous.
350	Clay (C); clay; very well sorted; yellowish brown (10YR 5/4); calcareous.	520	Sandy silty clay (sM); clay and silt with fine to very coarse sand; very poorly sorted; brown (10YR 5/3); calcareous.
360	Clay (C); clay with trace medium sand; very well sorted; yellowish brown (10YR 5/4); calcareous.	530	Sandy clay (sC); clay with fine to coarse sand and minor silt; poorly sorted; brown (10YR 5/3); calcareous.
370	Clay (C); clay with trace fine to medium sand; very well sorted; yellowish brown (10YR 5/4); calcareous.	540	Sandy clay (sC); clay with fine to very coarse sand and minor silt; very poorly sorted; dark grayish brown (10YR 4/2); calcareous.
380	Clay (C); clay with trace medium sand and trace granules to small pebbles; well sorted; yellowish brown (10YR 5/4); calcareous.	550	Silty clay (M); clay with silt and minor very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
383 1C shoe	Sandy silt (sZ); silt with very fine to medium sand; moderately sorted; yellowish brown (10YR 5/4); calcareous.	560	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
390	Clay (C); clay with trace granules to medium pebbles; well sorted; yellowish brown (10YR 5/4); calcareous.	570	Sandy clay (sC); clay with fine to very coarse sand and minor silt; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.
400	Silty clay (M); clay and silt with minor medium to coarse sand and trace granules to medium pebbles; moderately sorted; yellowish brown (10YR 5/4); calcareous.	580	Sandy clay (sC); clay with fine to medium sand and trace granules to small pebbles; moderately to poorly sorted; brown (10YR 5/3).
410	Silty clay (M); clay and silt with minor fine to medium sand; moderately to well sorted; yellowish brown (10YR 5/6); calcareous.	590	Sandy clay (sC); clay with fine to coarse sand and trace granules to small pebbles; poorly sorted; brown (10YR 4/3); calcareous.
420	Silty clay (M); clay and silt with minor fine to medium sand; moderately to well sorted; yellowish brown (10YR 5/4); calcareous.	600	Sandy silty clay (sM); clay and silt with very fine to coarse sand; very poorly to poorly sorted; brown (10YR 5/3); calcareous.
430	Clay (C); clay with trace fine to medium sand; very well sorted; yellowish brown (10YR 5/4); calcareous.	608 2C shoe	Silty clayey gravel (mG); granules to large pebbles with clay and silt; very poorly sorted; rounded; olive brown (2.5Y 4/3); calcareous; gravel-size gypsum (evaporite) fragments.
440	Silty clay (M); clay and silt with minor fine to medium sand; moderately to well sorted; yellowish brown (10YR 5/4); calcareous.	610	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; grayish brown (2.5Y 5/2); calcareous.
450	Sandy clay (sC); clay with fine to medium sand; moderately sorted; yellowish brown (10YR 5/4); calcareous.	620	Sandy clayey gravel (msG); granules to small pebbles with clay and fine to medium sand; very poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3); calcareous; gravel-size gypsum (evaporite) fragments.
460	Silty clay (M); clay and silt with minor fine to medium sand; moderately to well sorted; yellowish brown (10YR 5/4); calcareous.	630	Sandy clay (sC); clay with fine to very coarse sand with minor granules to small pebbles; very poorly sorted; yellowish brown (10YR 5/4); calcareous.
470	Sandy clay (sC); clay with fine to coarse sand and minor silt; poorly sorted; yellowish brown (10YR 5/4).		
480	Sandy clay (sC); clay with fine to medium sand; moderately sorted; yellowish brown (10YR 5/4); calcareous.		

**Table 4A.** Lithologic SHAKER log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)	Description	Depth (feet)	Description
640	Slightly gravelly sandy clay ((g)sM); clay with fine to coarse sand and granules to medium pebbles; very poorly sorted; brown (10YR 5/3); calcareous.	790	Sandy clay (sC); clay with fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
650	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); calcareous.	800	Sandy silty clay (sM); clay with silt, fine to medium sand, minor coarse sand and trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.
660	Slightly gravelly sandy clay ((g)sM); clay with fine to very coarse sand and granules to small pebbles; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.	810	Sandy silty clay (sM); clay with silt and fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
670	Slightly gravelly sandy silty clay ((g)sM); clay and silt with fine to very coarse sand and granules to small pebbles; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.	820	Sandy silty clay (sM); clay with silt and fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
680	Slightly gravelly sandy clay ((g)sM); clay with medium to coarse sand and granules to small pebbles; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.	830	Sandy clay (sC); clay with fine to medium and minor coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
690	Slightly gravelly sandy clay ((g)sM); clay with fine to very coarse sand and granules to small pebbles; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.	840	Sandy clay (sC); clay with fine to medium sand; moderately sorted; brown (10YR 5/3); slightly calcareous.
700	Sandy clay (sC); clay with fine to very coarse sand and minor silt; very poorly sorted; light olive brown (2.5Y 5/4); calcareous.	850	Sandy clay (sC); clay with fine to medium sand; moderately sorted; brown (10YR 5/3); slightly calcareous.
710	Sandy clay (sC); clay with fine to coarse sand and minor silt; poorly sorted; light yellowish brown (2.5Y 6/3); calcareous.	860	Sandy clay (sC); clay with fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
720	Sandy silty clay (sM); clay with silt and medium to coarse sand; poorly sorted; grayish brown (2.5Y 5/2); calcareous.	863	No Recovery.
730	Sandy silty clay (sM); clay with silt and fine to coarse sand with trace granules; poorly sorted; brown (10YR 5/3); calcareous.	3C shoe	
740	Slightly gravelly sandy clay ((g)sM); clay with fine to coarse sand and granules to small pebbles; very poorly sorted; brown (10YR 5/3); calcareous.	870	Sandy silty clay (sM); clay and silt with fine to coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.
750	Sandy silty clay (sM); clay with silt and fine to very coarse sand with trace granules; poorly sorted; grayish brown (10YR 5/2); calcareous.	880	Sandy clay (sC); clay with very fine to coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.
760	Sandy silty clay (sM); clay with silt and fine to coarse sand with trace granules; poorly sorted; grayish brown (10YR 5/2); slightly calcareous.	890	Slightly gravelly sandy clay ((g)sM); clay with very fine to medium sand and granules; poorly sorted; brown (10YR 5/3); calcareous.
770	Sandy silty clay (sM); clay with silt and fine to coarse sand with trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.	900	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
780	Sandy silty clay (sM); clay with silt and fine to coarse sand with trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.	910	Sandy clay (sC); clay with fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.
		920	Sandy clay (sC); clay with fine to medium and minor coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.
		930	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; grayish brown (10YR 5/2); calcareous.
		940	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
		950	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; grayish brown (10YR 5/2); calcareous.

**Table 4A.** Lithologic SHAKER log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)	Description	Depth (feet)	Description
960	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3); calcareous.	1,150	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; olive brown (2.5Y 4/3); calcareous.
970	Sandy clay (sC); clay with very fine to coarse sand and minor very coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.	1,160	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3); calcareous.
980	Sandy clay (sC); clay with very fine to coarse sand and trace granules to small pebbles; very poorly sorted; brown (10YR 5/3); calcareous.	1,170	Sandy clay (sC); clay with medium to coarse sand and trace granules; poorly sorted; olive brown (2.5Y 4/3); calcareous.
990	Sandy clay (sC); clay with very fine to coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.	1,180	Sandy clay (sC); clay with fine to medium sand; moderately to poorly sorted; olive brown (2.5Y 4/3); calcareous.
1,000	Clayey sand (cS); medium to coarse sand with clay and trace granules; poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); calcareous.	1,190	Sandy clay (sC); clay with fine to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.
1,010	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.	1,200	Sandy clay (sC); clay with very fine to coarse sand and minor silt; poorly sorted; brown (10YR 5/3); calcareous.
1,020	Sandy clay (sC); clay with fine to very coarse sand and trace granules; poorly sorted; grayish brown (10YR 5/2); calcareous.	1,210	Sandy clay (sC); clay with fine to coarse sand and minor silt; poorly sorted; brown (10YR 5/3); calcareous.
1,030	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3); calcareous.	1,220	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
1,040	Sandy clay (sC); clay with fine to very coarse sand; poorly sorted; light olive brown (2.5Y 5/3); calcareous.	1,230	Sandy clay (sC); clay with very fine to medium sand with trace granules to small pebbles; moderately to poorly sorted; brown (10YR 5/3); calcareous.
1,050	Sandy clay (sC); clay with very fine to very coarse sand and trace granules; poorly sorted; dark grayish brown (10YR 4/2); calcareous.	1,240	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
1,060	Sandy clay (sC); clay with very fine to very coarse sand and trace granules; poorly sorted; brown (10YR 5/3); calcareous.	1,250	Sandy clay (sC); clay with very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
1,070	Sandy clay (sC); clay with fine to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	1,260	Sandy clay (sC); clay with very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
1,080	Sandy clay (sC); clay with very fine to very coarse sand and trace granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.	1,270	Sandy clay (sC); clay with very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
1,090	Sandy clay (sC); clay with fine to very coarse sand with trace granules; very poorly sorted; light olive brown (2.5Y 5/3); calcareous.	1,280	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
1,100	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	1,290	Sandy clay (sC); clay with fine to medium sand; moderately to poorly sorted; grayish brown (10YR 5/2); calcareous.
1,110	Sandy clay (sC); clay with fine to coarse sand; poorly sorted; dark grayish brown (10YR 4/2); calcareous.	1,298	Sandy silty clay (sM); clay and silt with very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
1,120	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	1,301	Sandy silt (sZ); silt with very fine to medium sand; moderately to poorly sorted; dark grayish brown (2.5Y 4/2); calcareous
1,130	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	4C shoe	
1,140	Sandy clay (sC); clay with very fine to coarse sand and minor silt; poorly sorted; brown (10YR 5/3); calcareous.		

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**Table 4B.** Lithologic SIEVE log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Sandy gravel (sG); granules to large pebbles with very fine to very coarse sand; very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4); calcareous.	200	220	Clayey sand (cS); very fine to very coarse sand and clay with trace granules to medium pebbles; very poorly sorted; subrounded; yellowish brown (10YR 5/4); calcareous.
20	40	Silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	220	240	Clayey sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to rounded; very dark grayish brown (10YR 3/2); calcareous; basalt in interval.
40	60	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor silt; very poorly sorted; subrounded; yellowish brown (10YR 5/4); calcareous.	240	260	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles; poorly sorted; subangular; black (10YR 2/1); calcareous; basalt.
60	80	Sandy gravel (sG); granules to large pebbles with very fine to very coarse sand and minor silt; very poorly sorted; subrounded; yellowish brown (10YR 5/4); calcareous.	260	280	Clayey sand (cS); very fine to coarse sand with clay and trace granules to small pebbles; very poorly sorted; subrounded to subangular; brown (10YR 4/3); calcareous; basalt in interval.
80	100	Gravelly sand (gS); fine to very coarse sand with granules to small pebbles; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/4); calcareous.	280	300	Sandy clay (sC); clay with very fine to medium sand and trace granules to medium pebbles; moderately sorted; brown (10YR 4/3); calcareous; gravel-size gypsum (evaporite) fragments.
100	120	Gravelly sand (gS); fine to very coarse sand with granules to medium pebbles; very poorly sorted; subrounded to rounded; light olive brown (2.5Y 5/4); calcareous.	300	320	Clayey sand (cS); very fine to coarse sand with clay; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
120	140	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; very poorly sorted; subangular to rounded; brown (10YR 5/3); calcareous.	320	340	Sandy silty clay (sM); clay and silt with very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
140	160	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules to small pebbles; very poorly sorted; subrounded to rounded; brown (10YR 5/3); calcareous.	340	360	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
160	180	Slightly gravelly sand ((g)S); very fine to coarse sand with granules to small pebbles and minor clay; very poorly sorted; subangular to rounded; yellowish brown (10YR 5/4); calcareous.	360	380	Sandy silty clay (sM); clay with silt and very fine to medium sand with trace granules; moderately sorted; brown (10YR 5/3); calcareous.
180	200	Slightly gravelly clayey sand ((g)mS); very fine to very coarse sand with clay and granules to small pebbles; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.	380	400	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
			400	420	Sandy clay (sC); clay with very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
			420	440	Clayey sand (cS); very fine to coarse sand with clay; poorly sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.

**Table 4B.** Lithologic SIEVE log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
440	460	Clayey sand (cS); very fine to medium sand with minor coarse sand and clay; poorly sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.	660	680	Clayey silty sand (mS); very fine to coarse sand and silt with clay and trace granules to small pebbles; poorly sorted; subrounded to rounded; yellowish brown (10YR 5/4); calcareous.
460	480	Clayey sand (cS); very fine to coarse sand and clay with minor very coarse sand; poorly sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.	680	700	Clayey silty sand (mS); very fine to coarse sand and silt with minor clay and trace granules; poorly sorted; subrounded to well rounded; light olive brown (2.5Y 5/3); calcareous.
480	500	Clayey silty sand (mS); very fine to very coarse sand with silt and clay; poorly sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.	700	720	Silty sand (zS); very fine to medium sand with silt; moderately sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
500	520	Clayey silty sand (mS); very fine to very coarse sand with silt and clay; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.	720	740	Silty sand (zS); very fine to medium sand and silt with minor coarse sand; moderately sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
520	540	Clayey silty sand (mS); very fine to coarse sand with silt and clay; poorly sorted; subrounded to well rounded; olive brown (2.5Y 4/3); calcareous.	740	760	Silty sand (zS); very fine to coarse sand with silt; moderately to poorly sorted; rounded to well rounded; brown (10YR 5/3); calcareous.
540	560	Clayey silty sand (mS); very fine to coarse sand with silt and clay; poorly sorted; subrounded to well rounded; yellowish brown (10YR 5/4); calcareous.	760	780	Silty sand (zS); very fine to medium sand with silt; moderately sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
560	580	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.	780	800	Silty sand (zS); very fine to coarse sand with silt; moderately to poorly sorted; subrounded to rounded; brown (10YR 5/3); calcareous.
580	600	Clayey silty sand (mS); very fine to medium sand with silt, clay and minor coarse sand; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.	800	820	Silty sand (zS); very fine to coarse sand with silt; moderately to poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
600	620	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; brown (10YR 5/3); calcareous.	820	840	Clayey silty sand (mS); very fine to coarse sand with silt and clay; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
620	640	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.	840	860	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
640	660	Sandy silty clay (sM); clay and silt with very fine to coarse sand and minor very coarse sand; poorly sorted; light brownish gray (10YR 6/2); calcareous.	860	880	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.
			880	900	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.

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**Table 4B.** Lithologic SIEVE log for multiple-well monitoring site CRTH1 (13N/05E-28Q1S, -28Q2S, -28Q3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 1,577 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 10, 2011. Total depth drilled, 1,310 feet. Screened intervals, 1,240–1,260, 700–720, 235–255 and 175–195 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
900	920	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; subrounded to well rounded; grayish brown (10YR 5/2); calcareous.	1,120	1,140	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; subrounded to well rounded; olive brown (2.5Y 4/3); calcareous.
920	940	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; grayish brown (10YR 5/2); calcareous.	1,140	1,160	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; olive brown (2.5Y 4/3); calcareous.
940	960	Silty clayey sand (mS); very fine to coarse sand and clay with silt and trace granules to medium pebbles; poorly sorted; subrounded to well rounded; grayish brown (10YR 5/2); calcareous.	1,160	1,180	Silty clayey sand (mS); very fine to medium sand with clay and silt; moderately sorted; subrounded to well rounded; dark grayish brown (10YR 4/2); calcareous.
960	980	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; subrounded to well rounded; grayish brown (10YR 5/2); calcareous.	1,180	1,200	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; brown (10YR 5/3); calcareous.
980	1,000	Silty clayey sand (mS); very fine to coarse sand and clay with silt and trace granules; poorly sorted; subrounded to well rounded; grayish brown (10YR 5/2); calcareous.	1,200	1,220	Clayey silty sand (mS); very fine to medium sand and silt with clay and minor coarse sand; moderately to poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous.
1,000	1,020	Silty clayey sand (mS); very fine to very coarse sand with clay and silt; poorly sorted; subrounded to rounded; light olive brown (2.5Y 5/3); calcareous.	1,220	1,240	Clayey silty sand (mS); very fine to medium sand with silt and clay; moderately sorted; rounded to well rounded; grayish brown (2.5Y 5/2); calcareous.
1,020	1,040	Silty clayey sand (mS); fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; grayish brown (10YR 5/2); slightly calcareous.	1,240	1,260	Clayey silty sand (mS); very fine to coarse sand, silt and clay with trace granules to medium pebbles; poorly sorted; rounded to well rounded; brown (10YR 5/3); calcareous.
1,040	1,060	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; olive brown (2.5Y 4/3); slightly calcareous.	1,260	1,280	Clayey silty sand (mS); very fine to medium silt and clay with minor coarse sand; moderately sorted; rounded to well rounded; brown (10YR 5/3); calcareous.
1,060	1,080	Silty clayey sand (mS); very fine to coarse sand with clay and silt; poorly sorted; rounded to well rounded; olive brown (2.5Y 4/3); calcareous.	1,280	1,298	Clayey silty sand (mS); very fine to coarse sand with silt and clay; poorly sorted; subrounded to well rounded; brown (10YR 5/3); calcareous
1,080	1,100	Silty clayey sand (mS); very fine to medium sand with clay and silt; moderately sorted; rounded to well rounded; brown (10YR 5/3); calcareous.	1,298	1,301	No sample collected; cored interval.
1,100	1,120	Silty clayey sand (mS); very fine to medium sand with clay and silt; moderately sorted; subrounded to well rounded; olive brown (2.5Y 4/3); calcareous.			

**Table 5A.** Lithologic SHAKER log for multiple-well monitoring site GOLD2 (14N/01E-07R1S, -07R2S, -07R3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,107 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 9, 2012. Total depth drilled, 451 feet. Screened intervals, 420–440, 330–350, and 220–240 feet. Ream, sample was collected while enlarging the hole after coring or following a change in the drill bit size or type; Washed, sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description	
10	Sandy gravel (sG); granules to large pebbles and medium to very coarse sand; poorly sorted; subangular to angular; light olive brown (2.5Y 5/4); calcareous.	130	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).	
20	Sandy gravel (sG); granules to large pebbles and coarse to very coarse sand; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); calcareous.	140	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace clay; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	
30	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3); calcareous.	150	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace clay; poorly to very poorly sorted; angular to subangular; olive brown (2.5Y 4/3).	
40	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand and trace silt; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); calcareous.	160	Sandy clayey silt (sM); silt with clay, fine to coarse sand and trace granules; poorly sorted; light olive gray (5Y 6/2).	
50	Silty sandy gravel (msG); granules to large pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; brown (7.5YR 4/4).	170	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2).	
60	Silty sandy gravel (msG); granules to large pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; strong brown (7.5YR 4/6).	180	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace clay; poorly to very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2).	
70	Silty sandy gravel (msG); granules to large pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	190	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules to medium pebbles; poorly to very poorly sorted; light brownish gray (2.5Y 6/2).	
80	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	200	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; grayish brown (2.5Y 5/2).	
90	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	210	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules to small pebbles; poorly sorted; light brownish gray (2.5Y 6/2).	
100	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).	220	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand, granules to small pebbles, and trace clay; poorly to very poorly sorted; light brownish gray (2.5Y 6/2).	
102	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).	222	Sandy silt (sZ); silt with very fine to medium sand, trace clay, and trace coarse sand; moderately to poorly sorted; grayish brown (2.5Y 5/2).	
110	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	2C bottom	230	Slightly gravelly sandy silt ((g)sM); silt with fine to coarse sand and granules to large pebbles; poorly sorted; light yellowish brown (2.5Y 6/3)
120	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	240	Sandy clayey silt (sM); silt with clay and fine to coarse sand; moderately to poorly sorted; light gray (2.5Y 7/2).	

**Table 5A.** Lithologic SHAKER log for multiple-well monitoring site GOLD2 (14N/01E-07R1S, -07R2S, -07R3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,107 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 9, 2012. Total depth drilled, 451 feet. Screened intervals, 420–440, 330–350, and 220–240 feet. Ream, sample was collected while enlarging the hole after coring or following a change in the drill bit size or type; Washed, sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
250	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules; very poorly sorted; light yellowish brown (2.5Y 6/4); calcareous.	360	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; very well to well sorted; angular to very angular; multicolored; calcareous.
260	Slightly gravelly sandy silty clay ((g)sM); clay with silt, medium to very coarse sand and granules to small pebbles; very poorly sorted; light yellowish brown (10YR 6/4); slightly calcareous.	Washed	
270	Slightly gravelly sandy clay ((g)sM); clay with fine to coarse sand and granules to small pebbles; poorly to very poorly sorted; light yellowish brown (2.5Y 6/4); slightly calcareous.	370	Slightly gravelly sandy silty clay ((g)sM); clay with silt, medium to coarse sand and granules to small pebbles; very poorly sorted; light olive brown (2.5Y 5/4); calcareous.
280	Slightly gravelly sandy clay ((g)sM); clay with fine to coarse sand and granules to medium pebbles; poorly to very poorly sorted; light brownish gray (2.5Y 6/2); calcareous.	380	Sandy silty clay (sM); clay with silt, fine to medium sand and trace granules to small pebbles; poorly to very poorly sorted; light olive brown (2.5Y 5/4); calcareous.
290	Sandy silty clay (sM); clay with silt, very fine to medium sand and trace granules; poorly to very poorly sorted; light olive brown (2.5Y 5/4); slightly calcareous.	390	Sandy silty clay (sM); clay with silt, medium to very coarse sand and trace granules; poorly to very poorly sorted; olive (5Y 4/3); slightly calcareous.
300	Slightly gravelly sandy clay ((g)sM); clay with medium to very coarse sand, granules to small pebbles and trace silt; poorly to very poorly sorted; light yellowish brown (2.5Y 6/3).	400	Sandy silty clay (sM); clay with silt, very fine to medium sand and trace granules to small pebbles; poorly to very poorly sorted; olive gray (5Y 4/2).
310	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to small pebbles; very poorly sorted; pale yellow (2.5Y 7/3); calcareous.	400	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to large pebbles; very poorly sorted; olive (5Y 4/3); calcareous.
320	Sandy silty clay (sM); clay with silt, fine to coarse sand and trace granules; poorly to very poorly sorted; light olive brown (2.5Y 5/4); calcareous.	3C top	
330	Slightly gravelly sandy silty clay ((g)sM); clay with silt, medium to very coarse sand and granules to small pebbles; very poorly sorted; olive (5Y 5/3); calcareous.	403	Sandy silty clay (sM); clay with silt and fine to medium sand; moderately sorted; olive gray (5Y 4/2); slightly calcareous.
340	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to medium pebbles; very poorly sorted; pale olive (5Y 6/3); calcareous.	3C bottom	
340	Gravel (G); small to large pebbles; moderately to well sorted; angular to subangular; light olive gray (5Y 6/2); calcareous.	410	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to small pebbles; very poorly sorted; olive (5Y 4/3); calcareous.
Ream washed		420	Slightly gravelly sandy silty clay ((g)sM); clay with silt, medium to very coarse sand and granules; very poorly sorted; olive (5Y 4/3); calcareous.
350	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to small pebbles; very poorly sorted; light gray (5Y 7/2); calcareous.	430	Slightly gravelly sandy silty clay ((g)sM); clay with silt, fine to coarse sand and granules to small pebbles; very poorly sorted; olive (5Y 5/3); slightly calcareous.
360	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; poorly sorted; angular to very angular; olive gray (5Y 5/2); slightly calcareous.	440	Sandy silty clay (sM); clay with silt, very fine to medium sand and trace coarse to very coarse sand; moderately to poorly sorted; olive gray (5Y 4/2); slightly calcareous.
		450	Sandy silty clay (sM); clay with silt, medium to coarse sand and trace granules to small pebbles; poorly to very poorly sorted; dark gray (5Y 4/1); calcareous; basalt?
		451	Gravel (G); medium to very large pebbles; well sorted; angular; black (5Y 2.5/1); calcareous; basalt; aphanitic (boulder or flow?).
		4C bottom	

**Table 5B.** Lithologic SIEVE log for multiple-well monitoring site GOLD2 (14N/01E-07R1S, -07R2S, -07R3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,107 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 9, 2012. Total depth drilled, 451 feet. Screened intervals, 420–440, 330–350, and 220–240 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles; moderately sorted; subrounded to subangular; olive brown (2.5Y 4/3); calcareous.	240	260	Silty gravelly sand (gmS); very fine to medium sand with granules to small pebbles, silt, and trace clay; poorly to very poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/4); slightly calcareous.
20	40	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to large pebbles; poorly sorted; subrounded to subangular; olive brown (2.5Y 4/3); calcareous.	260	280	Silty gravelly sand (gmS); very fine to medium sand with granules to small pebbles, silt, and trace clay; poorly to very poorly sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3); calcareous.
40	60	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to large pebbles; poorly sorted; subrounded to subangular; brown (7.5YR 4/3); slightly calcareous.	280	300	Sandy silt (sZ); silt with very fine to medium sand, trace clay, and trace granules to small pebbles; moderately to poorly sorted; light olive brown (2.5Y 5/4); calcareous.
60	80	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles and trace silt; moderately to poorly sorted; rounded to subangular; brown (7.5YR 4/3); slightly calcareous.	300	320	Sandy silt (sZ); silt with very fine to medium sand and trace granules to small pebbles; moderately to poorly sorted; light olive brown (2.5Y 5/4); calcareous.
80	100	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles and trace silt; moderately to poorly sorted; rounded to subangular; dark brown (10YR 3/3); trace mica.	320	340	Slightly gravelly sandy silt ((g)sM); silt with fine to medium sand, granules to small pebbles, and trace clay; poorly to very poorly sorted; reddish brown (2.5YR 5/3); calcareous.
100	120	Silty gravelly sand (gmS); medium to very coarse sand with granules to medium pebbles and silt; poorly sorted; subrounded to subangular; olive brown (2.5Y 4/3).	340	360	Slightly gravelly sandy silt ((g)sM); silt with fine to coarse sand, granules to small pebbles, and trace clay; poorly to very poorly sorted; light olive gray (5Y 6/2); calcareous.
120	140	Silty gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and silt; poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/3).	360	380	Slightly gravelly sandy clayey silt ((g)sM); silt with clay, very fine to medium sand, and granules; very poorly sorted; light olive brown (2.5Y 5/4); slightly calcareous.
140	160	Silty gravelly sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; rounded to subangular; light olive brown (2.5Y 5/3).	380	400	Sandy clayey silt (sM); silt with clay, very fine to medium sand, and trace coarse sand; moderately sorted; olive gray (5Y 4/2); slightly calcareous.
160	180	Silty gravelly sand (gmS); medium to very coarse sand with granules to medium pebbles and silt; poorly sorted; subrounded to angular; light brownish gray (2.5Y 6/2); trace mica.	400	420	Sandy silt (sZ); silt with very fine to medium sand; very well to well sorted; olive gray (5Y 4/2); calcareous; micaceous.
180	200	Silty gravelly sand (gmS); fine to coarse sand with granules to medium pebbles and silt; poorly sorted; rounded to subangular; grayish brown (2.5Y 5/2); trace mica.	420	440	Sandy gravelly silt (gM); silt with very fine to medium sand, granules, and trace clay; poorly to very poorly sorted; olive gray (5Y 4/2); slightly calcareous; micaceous.
200	220	Silty gravelly sand (gmS); fine to coarse sand with granules to small pebbles, silt and trace clay; poorly to very poorly sorted; rounded to subangular; grayish brown (2.5Y 5/2); trace mica.	440	450	Sandy gravelly silt (gM); silt with very fine to medium sand, trace granules, and trace silt; poorly sorted; olive gray (5Y 4/2); calcareous; micaceous.
220	240	Silty gravelly sand (gmS); very fine to medium sand with silt and granules to small pebbles; poorly sorted; rounded to subangular; light olive brown (2.5Y 5/3).	450	451	No sample collected; cored interval.

**Table 6A.** Lithologic SHAKER log for multiple-well monitoring site BLA5 (14N/03E-26K1S, -26K2S, -26K3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,345 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 19, 2011. Total depth drilled, 370 feet. Screened intervals, 320–340, 190–210, and 190–210 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
5 1C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	110	Clay (C); clay with trace very fine to medium sand; well sorted; yellowish brown (10YR 5/4); calcareous.
10 2C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 4/4); calcareous.	120	Clay (C); clay with trace very fine to medium sand; well sorted; yellowish brown (10YR 5/4); calcareous.
15 3C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	130	Clay (C); clay with trace very fine to medium sand; well sorted; brown (7.5YR 4/4); slightly calcareous.
20 4C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	140	Silty clay (M); clay with silt and trace very fine to medium sand; moderately to well sorted; brown (7.5YR 4/4).
25 5C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	150	Clayey sandy silt (sM); silt with very fine to medium sand and clay; moderately sorted; yellowish brown (10YR 5/4); calcareous.
26.5 6C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	160	Clay (C); clay with trace very fine to fine sand; well sorted; yellowish brown (10YR 5/4).
30 7C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	170	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.
35 8C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4); calcareous.	180	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
40 9C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 4/4); calcareous.	190	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
45 10C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; brown (7.5YR 5/4).	200	Sandy silty clay (sM); clay with silt and fine sand with trace coarse sand; moderately sorted; dark yellowish brown (10YR 4/4); slightly calcareous.
50 11C shoe	Clay (C); clay with trace very fine to fine sand; well sorted; yellowish brown (10YR 5/4); extremely calcareous.	210	Sandy silty clay (sM); clay with silt and fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4).
55 12C shoe	Sandy silt (sZ); silt with very fine to fine sand; well sorted; brown (7.5YR 5/4); slightly calcareous.	220	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules with trace small to medium pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
60 13C shoe	Silt (Z); silt with trace very fine to fine sand and trace large pebbles; moderately to well sorted; brown (7.5Y 5/4); calcareous.		
70	Sandy clayey silt (sM); silt with clay, very fine to medium sand, and trace granules; moderately sorted; yellowish brown (10YR 5/4); calcareous.		
80	Clay (C); clay with trace very fine to fine sand; well sorted; yellowish brown (10YR 5/6); calcareous.		
90	Clay (C); clay with trace very fine to fine sand; well sorted; dark yellowish brown (10YR 4/4).		
100	Clay (C); clay with trace very fine to fine sand; well sorted; yellowish brown (10YR 5/4).		

**Table 6A.** Lithologic SHAKER log for multiple-well monitoring site BLA5 (14N/03E-26K1S, -26K2S, -26K3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,345 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 19, 2011. Total depth drilled, 370 feet. Screened intervals, 320–340, 190–210, and 190–210 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
230	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.	310 Washed	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; very angular to angular; yellowish brown (10YR 5/4); abundant microcrystalline quartz.
240	Silty sandy gravel (msG); granules to medium pebbles with silt and coarse to very coarse sand; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.	320	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; olive (5Y 5/3); slightly calcareous.
250	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly micaceous.	330	Silty clayey sand (mS); medium to very coarse sand with silt, clay, and trace granules to small pebbles; poorly sorted; angular to subangular; olive (5Y 4/3).
260	Silty clayey gravelly sand (gmS); medium to very coarse sand with granules to small pebbles, clay and silt; very poorly sorted; angular to subangular; brown (10YR 4/3).	340	Silty gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and silt; poorly sorted; angular to subangular; olive brown (2.5Y 4/3); slightly micaceous.
270	Clayey gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and clay; moderately to poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); calcareous.	350	Silty gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and silt; poorly sorted; angular to subrounded; olive brown (2.5Y 4/4); micaceous.
280	Silty clayey gravelly sand (gmS); medium to very coarse sand with granules, clay, and silt; very poorly sorted; angular to subangular; olive (5Y 4/3); slightly calcareous.	360	Silty gravelly sand (gmS); coarse to very coarse sand with granules to small pebbles and silt; poorly sorted; angular to subangular; olive brown (2.5Y 4/4); calcareous; micaceous.
290	Silty clayey gravelly sand (gmS); medium to very coarse sand with granules, clay, and silt; very poorly sorted; angular to subangular; olive (5Y 4/3); slightly calcareous.	370	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); abundant quartz.
300	Sandy gravelly clayey silt (gM); silt with clay, granules, medium to very coarse sand, and trace small pebbles; very poorly sorted; light olive brown (2.5Y 5/4); calcareous; slightly micaceous.	370 Washed	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; very angular to subangular; yellowish brown (10YR 5/4); slightly calcareous; abundant microcrystalline quartz.
310	Silty gravelly clayey sand (gmS); medium to very coarse sand with clay, granules, and silt; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/4); slightly calcareous; slightly micaceous.		

**60 Construction, Water-Level, and Water-Quality Data for Multiple-Well Monitoring Sites and Test Wells**

**Table 6B.** Lithologic SIEVE log for multiple-well monitoring site BLA5 (14N/03E-26K1S, -26K2S, -26K3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,345 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 19, 2011. Total depth drilled, 370 feet. Screened intervals, 320–340, 190–210, and 190–210 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	60	No sample collected; cored interval.	240	260	Slightly gravelly silty sand ((g)mS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3); calcareous.
60	80	Clay (C); clay with trace very fine to medium sand; well to moderately sorted; brown (7.5YR 5/4); calcareous.	260	280	Sand (S); medium to very coarse sand with trace granules, silt and trace fine sand; moderately to poorly sorted; subangular to subrounded; dark grayish brown (2.5Y 4/2); slightly calcareous; micaceous.
80	100	Clay (C); clay with trace very fine to medium sand; well to moderately sorted; brown (7.5YR 5/3); calcareous.	280	300	Silty sand (zS); medium to very coarse sand with silt, trace granules and trace fine sand; poorly sorted; subangular to subrounded; very dark grayish brown (2.5Y 3/2); micaceous.
100	120	Clay (C); clay with trace very fine to medium sand; well to moderately sorted; brown (7.5YR 5/3); slightly calcareous.	300	320	Silty sand (zS); fine to coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (2.5Y 3/2); micaceous.
120	140	Clay (C); clay with trace very fine to medium sand; well to moderately sorted; brown (7.5YR 5/4); slightly calcareous.	320	340	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; very dark grayish brown (2.5Y 3/2); calcareous; micaceous.
140	160	Clay (C); clay with trace very fine to medium sand; well to moderately sorted; brown (7.5YR 5/3); calcareous.	340	360	Slightly gravelly silty sand ((g)mS); medium to very coarse sand with silt and granules to medium pebbles; moderately to poorly sorted; angular to subangular; olive brown (2.5Y 4/3); calcareous; micaceous.
160	180	Silty sand (zS); very fine to medium sand with silt; well to moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous.	360	370	Slightly gravelly silty sand ((g)mS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; olive brown (2.5Y 4/3).
180	200	Slightly gravelly silty sand ((g)mS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.			
200	220	Clayey silty sand (mS); fine to coarse sand with silt and clay; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.			
220	240	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.			

**Table 7A.** Lithologic SHAKER log for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,058 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 30, 2011. Total depth drilled, 684 feet. Screened intervals, 650–670, 560–580, and 350–370 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); medium to very large pebbles with medium to very coarse sand; moderately sorted; very angular to angular; dark brown (10YR 3/3); slightly calcareous.	120	Gravelly silty sand (gmS); medium to very coarse sand with granules to medium pebbles and silt; poorly sorted; very angular to subangular; brown (7.5YR 4/4).
20	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; moderately sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous.	130	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; very angular to subangular; brown (7.5YR 5/3).
30	Silty sandy gravel (msG); granules to large pebbles with medium to very coarse sand and silt; poorly sorted; very angular to angular; dark yellowish brown (10YR 3/4).	140	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to medium pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 5/3).
40	Sandy gravel (sG); small to large pebbles with trace very large pebbles and cobbles and medium to very coarse sand; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 3/4).	150	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace large pebbles; poorly sorted; subangular to subrounded; brown (7.5YR 4/3).
50	Sandy gravel (sG); granules to medium pebbles with trace very large pebbles and medium to very coarse sand; moderately to poorly sorted; subangular to subrounded; very dark brown (10YR 2/2).	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).
60	Silty sandy gravel (msG); small to large pebbles and medium to very coarse sand with silt; moderately to poorly sorted; very angular to subangular; dark brown (10YR 3/3).	170	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to medium pebbles; poorly to very poorly sorted; angular to subangular; brown (7.5YR 5/3).
70	Silty gravelly sand (gmS); medium to very coarse sand and granules to medium pebbles with silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	180	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to medium pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 5/3).
80	Silty gravelly sand (gmS); medium to very coarse sand and granules to medium pebbles with silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/6).	190	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; brown (7.5YR 5/3).
90	Silty gravelly sand (gmS); medium to very coarse sand and granules to medium pebbles with silt; moderately to poorly sorted; angular to subrounded; brown (7.5YR 4/4).	200	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).
100	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace large pebbles; poorly sorted; subangular to subrounded; strong brown (7.5YR 4/6).	203	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).
110	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; brown (7.5YR 5/4).	1C bottom	
		210	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (7.5YR 4/3).
		220	Silty gravelly sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace medium pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).

**Table 7A.** Lithologic SHAKER log for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,058 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 30, 2011. Total depth drilled, 684 feet. Screened intervals, 650–670, 560–580, and 350–370 feet.]

Depth (feet)	Description	Depth (feet)	Description
230	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace medium pebbles; poorly sorted; subangular to subrounded; brown (7.5YR 4/2).	370	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark gray (7.5YR 4/1).
240	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/2).	380	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; grayish brown (10YR 5/2).
250	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules, and trace small pebbles; poorly sorted; very angular to subangular; brown (7.5YR 4/2).	390	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; very angular to angular; dark grayish brown (10YR 4/2).
260	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to angular; brown (7.5YR 4/2).	400	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).
270	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/2).	410	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; grayish brown (10YR 5/2).
280	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/2).	420	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).
290	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 5/2).	430	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).
300	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/2).	440	Gravelly silty sand (gmS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).
310	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/2).	450	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2).
320	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/2).	460	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules; very poorly sorted; angular to subangular; brown (10YR 5/3).
330	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/2).	470	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).
340	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark gray (7.5YR 4/1).	480	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; grayish brown (10YR 5/2).
350	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark gray (7.5YR 4/1).	490	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).
360	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; very angular to angular; brown (7.5YR 4/2).		

**Table 7A.** Lithologic SHAKER log for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,058 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 30, 2011. Total depth drilled, 684 feet. Screened intervals, 650–670, 560–580, and 350–370 feet.]

Depth (feet)	Description	Depth (feet)	Description
500	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).	600	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
503	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; subangular to subrounded; brown (10YR 4/3).	610	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately to well sorted; angular to very angular; very dark gray (7.5YR 3/1); basalt.
2C bottom		620	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately to well sorted; angular to very angular; dark brown (7.5YR 3/2); basalt.
510	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3).	630	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebbles; moderately to well sorted; angular to very angular; dark brown (10YR 3/3); basalt.
520	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	640	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; moderately to well sorted; very angular to angular; very dark gray (7.5YR 3/1); basalt.
530	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; poorly sorted; angular to subangular; brown (10YR 4/3).	650	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; moderately to poorly sorted; angular to very angular; dark brown (7.5YR 3/2); basalt.
540	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 4/3).	660	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to very angular; dark brown (7.5YR 3/2); basalt.
550	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules, and trace small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).	670	Sandy gravel (sG); granules to medium pebbles with trace large pebbles and coarse to very coarse sand; moderately to well sorted; angular to very angular; very dark gray (7.5YR 3/1); basalt.
560	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).	680	Sandy gravel (sG); granules to medium pebbles with trace large pebbles and very coarse sand; moderately to well sorted; very angular to angular; brown (7.5YR 4/3); basalt.
570	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).	680	Basalt; fractured aphanitic basalt; very dark gray (7.5YR 3/1).
580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).	3C top	
590	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4).	684	Basalt; fractured aphanitic basalt with minor vesicles; dark brown (7.5YR 3/2); heavily oxidized.
		3C bottom	

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**Table 7B.** Lithologic SIEVE log for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,058 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 30, 2011. Total depth drilled, 684 feet. Screened intervals, 650–670, 560–580, and 350–370 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly sand (gS); fine to coarse sand with granules to large pebbles; poorly sorted; angular to subrounded; dark yellowish brown (10YR 3/4); slightly calcareous.	160	180	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 3/4).
20	40	Gravelly sand (gS); fine to coarse sand with granules to large pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 3/4); slightly calcareous.	180	200	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace large pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
40	60	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 3/4).	200	220	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
60	80	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace large pebbles; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	220	240	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace large pebbles; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
80	100	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/4).	240	260	Gravelly sand (gS); fine to coarse sand with granules to medium pebbles and trace large pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).
100	120	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace large pebbles; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/4).	260	280	Gravelly sand (gS); fine to coarse sand with granules to small pebbles; poorly sorted; subangular to subrounded; dark brown (7.5YR 3/2).
120	140	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/3).	280	300	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/2).
140	160	Silty sand (zS); medium to very coarse sand with silt; moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	300	320	Sand (S); medium to very coarse sand with trace granules and trace fine sand; moderately to well sorted; subangular to subrounded; dark brown (7.5YR 3/2).
			320	340	Gravelly sand (gS); medium to very coarse sand with granules and trace small pebbles; moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).

**Table 7B.** Lithologic SIEVE log for multiple-well monitoring site GOLD1 (15N/01E-28R1S, -28R2S, -28R3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,058 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, June 30, 2011. Total depth drilled, 684 feet. Screened intervals, 650–670, 560–580, and 350–370 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
340	360	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).	520	540	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).
360	380	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace medium pebbles; moderately to poorly sorted; angular to subangular; very dark grayish brown (10YR 3/2).	540	560	Slightly gravelly sand ((g)S); medium to very coarse sand with minor granules and trace silt; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).
380	400	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately to poorly sorted; angular to subangular; very dark grayish brown (10YR 3/2).	560	580	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).
400	420	Sand (S); fine to coarse sand with trace granules; moderately to well sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	580	600	Gravelly sand (gS); fine to coarse sand with granules to small pebbles; moderately sorted; subangular to subrounded; brown (10YR 4/3).
420	440	Sand (S); fine to coarse sand with trace granules to small pebbles; moderately to well sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	600	620	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately sorted; subangular to subrounded; dark brown (7.5YR 3/2); basalt.
440	460	Sand (S); fine to coarse sand; well sorted; subangular to subrounded; dark brown (7.5YR 3/2).	620	640	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subangular to subrounded; dark reddish brown (5YR 3/2); basalt.
460	480	Sand (S); fine to coarse sand; well sorted; subangular to subrounded; dark grayish brown (10YR 4/2).	640	660	Sand (S); fine to coarse sand; well sorted; angular to subangular; dark brown (7.5YR 3/2); basalt.
480	500	Slightly gravelly sand ((g)S); fine to coarse sand with minor granules and trace silt; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).	660	680	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; very dark gray (10YR 3/1); basalt.
500	520	Slightly gravelly sand ((g)S); medium to very coarse sand and minor granules with trace silt; moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).	680	684	No sample collected; cored interval.

**Table 8A.** Lithologic SHAKER log for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,064 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 5, 2012. Total depth drilled, 700 feet. Screened intervals, 620–680, 300–420, and 260–280 feet. **Abbreviation:** mm, millimeter]

Depth (feet)	Description	Depth (feet)	Description
10	Gravel (G); granules to medium pebbles; moderately sorted; subangular to angular; dark brown (7.5YR 3/3).	160	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subangular to angular; brown (7.5YR 4/4).
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to angular; very dark brown (7.5YR 2.5/2).	170	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subrounded to subangular; brown (7.5YR 4/4).
30	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to angular; dark brown (7.5YR 3/3).	180	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subangular to angular; brown (7.5YR 4/4).
40	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; angular to subrounded; very dark brown (7.5YR 2.5/2).	190	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subangular to angular; dark brown (7.5YR 3/4).
50	Sandy gravel (sG); granules to medium pebbles with very coarse sand; moderately sorted; subrounded to angular; dark brown (7.5YR 3/3).	200	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to angular; dark brown (7.5YR 3/4).
60	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to subrounded; very dark brown (7.5YR 2.5/2).	210	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace very fine to fine sand; moderately to poorly sorted; subangular to angular; brown (7.5YR 4/3).
70	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; angular to subrounded; dark brown (7.5YR 3/3).	220	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace fine to very fine sand; moderately to poorly sorted; subangular to angular; brown (7.5YR 4/3).
80	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subrounded to angular; brown (7.5YR 4/4).	230	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace fine to very fine sand; moderately to poorly sorted; subrounded to angular; brown (7.5YR 5/3).
90	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subangular to angular; dark brown (7.5YR 3/3).	240	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace fine sand; moderately to poorly sorted; subangular to angular; brown (7.5YR 4/3).
100	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subangular to angular; brown (7.5YR 4/4).	250	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace fine to very fine sand; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/3); trace light yellow, 4–22 mm, brittle gravel with waxy luster.
110	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subrounded to angular; brown (7.5YR 4/4).	260	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; subrounded to angular; brown (7.5YR 4/2); trace light yellow, 3–8 mm, brittle gravel with waxy luster.
120	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subrounded to angular; dark brown (7.5YR 3/4).	270	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; subrounded to angular; brown (10YR 4/3).
130	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subrounded to angular; dark brown (7.5YR 3/4).		
140	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; subrounded to angular; brown (7.5YR 4/4).		
150	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subangular to angular; brown (7.5YR 4/4).		

**Table 8A.** Lithologic SHAKER log for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,064 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 5, 2012. Total depth drilled, 700 feet. Screened intervals, 620–680, 300–420, and 260–280 feet. **Abbreviation:** mm, millimeter]

Depth (feet)	Description	Depth (feet)	Description
280	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subrounded to subangular; dark yellowish brown (10YR 4/4); trace light yellow, 3–8 mm, brittle gravel with waxy luster.	380	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; moderately to poorly sorted; subangular to angular; brown (10YR 5/3).
290	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace light yellow, 1–3 mm, brittle gravel with waxy luster.	390	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; dark grayish brown (10YR 4/2).
300	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).	400	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace silt; moderately to poorly sorted; subangular to angular; very dark grayish brown (10YR 3/2).
310	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace silt; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace light yellow, 4–22 mm, brittle gravel with waxy luster.	410	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; subangular to angular; dark grayish brown (10YR 4/2).
320	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace light yellow, 3–7 mm, brittle gravel with waxy luster.	420	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to angular; reddish brown (5YR 4/4).
330	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	430	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace silt; moderately to poorly sorted; subrounded to subangular; dark grayish brown (10YR 4/2).
340	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; angular to subangular; dark brown (7.5YR 3/3).	440	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subrounded to angular; dark grayish brown (10YR 4/2).
345	Gravel (G); large pebbles; very well sorted; subangular to angular; dark reddish brown (5YR 3/4).	450	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; subrounded to angular; very dark grayish brown (10YR 3/2).
IC shoe		460	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately sorted; subrounded to subangular; dark grayish brown (10YR 4/2).
350	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; dark grayish brown (10YR 4/2).	470	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subrounded to subangular; dark grayish brown (10YR 4/2).
360	Gravelly silty sand (gmS); medium to very coarse sand with granules to medium pebbles and silt; moderately to poorly sorted; subangular to angular; brown (10YR 5/3).	480	Gravelly sand (gS); medium to very coarse sand and granules; moderately to well sorted; subrounded to subangular; dark grayish brown (10YR 4/2).
370	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subrounded to angular; dark grayish brown (10YR 4/2).	490	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; subangular to angular; dark grayish brown (10YR 4/2).

**Table 8A.** Lithologic SHAKER log for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,064 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 5, 2012. Total depth drilled, 700 feet. Screened intervals, 620–680, 300–420, and 260–280 feet. **Abbreviation:** mm, millimeter]

Depth (feet)	Description	Depth (feet)	Description
500	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subrounded to angular; brown (10YR 4/3).	610	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to well sorted; angular to very angular; dark brown (10YR 3/3); basalt.
510	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).	620	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to well sorted; angular to very angular; very dark brown (10YR 2/2); basalt.
520	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).	630	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to well sorted; angular to very angular; black (7.5YR 2.5/1); basalt.
530	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subangular to angular; brown (10YR 4/3).	640	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to well sorted; angular; very dark brown (10YR 2/2); basalt.
540	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).	650	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; angular to very angular; dark yellowish brown (10YR 3/4); basalt.
550	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	660	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; angular to very angular; dark yellowish brown (10YR 3/4); basalt.
560	Sandy silty gravel (mG); granules to small pebbles with silt and medium to very coarse sand; moderately to poorly sorted; subangular to angular; dark grayish brown (10YR 4/2).	670	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; angular to very angular; dark brown (10YR 3/3); basalt.
570	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; brown (10YR 4/3).	680	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; angular to very angular; very dark grayish brown (10YR 3/2); basalt.
580	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately sorted; subangular to angular; dark grayish brown (10YR 4/2).	690	Sandy silty gravel (mG); granules to medium pebbles with silt and medium to very coarse sand; moderately to poorly sorted; angular to very angular; dark yellowish brown (10YR 4/4); basalt.
590	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately sorted; angular to subangular; brown (10YR 4/3).	700	Sandy silty gravel (mG); granules to medium pebbles with silt and medium to very coarse sand; moderately to poorly sorted; angular to very angular; dark yellowish brown (10YR 3/4); basalt.
600	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately sorted; angular to subangular; brown (10YR 4/3).		

**Table 8B.** Lithologic SIEVE log for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,064 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 5, 2012. Total depth drilled, 700 feet. Screened intervals, 620–680, 300–420, and 260–280 feet. **Abbreviation:** mm, millimeter]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly sand (gS); very fine to medium sand with granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3); calcareous.	220	240	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).
20	40	Gravelly sand (gS); fine to very coarse sand with granules to medium pebbles; poorly sorted; very angular to subangular; brown (10YR 4/3); slightly calcareous.	240	260	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/2); waxy bentonite fragments (1–4 mm); altered ash?
40	60	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.	260	280	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).
60	80	Sand (S); very fine to medium sand with trace granules to small pebbles; moderately to well sorted; angular to subrounded; dark yellowish brown (10YR 4/4).	280	300	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); trace waxy bentonite (3–4 mm); altered ash?
80	100	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles; poorly sorted; subangular to rounded; brown (10YR 4/3).	300	320	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles and minor silt; very poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); slightly calcareous; minor waxy bentonite (1–20 mm); volcanic (dacite).
100	120	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; poorly sorted; subangular to rounded; brown (10YR 4/3).	320	340	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles; very poorly sorted; angular to subrounded; brown (7.5YR 4/2); volcanic (dacite).
120	140	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles; poorly sorted; angular to rounded; brown (10YR 4/3).	340	345	No sample collected; cored interval.
140	160	Gravelly sand (gS); fine to medium sand with granules to medium pebbles; poorly sorted; angular to subrounded; yellowish brown (10YR 5/4).	345	360	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles and minor silt; very poorly sorted; angular to subangular; black (7.5YR 2.5/1); volcanic (dacite).
160	180	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.	360	380	Gravelly sand (gS); very fine to coarse sand with granules to small pebbles and minor silt; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic (dacite).
180	200	Gravelly silty sand (gmS); very fine to coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).			
200	220	Gravelly sand (gS); very fine to coarse sand with granules to medium pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).			

**Table 8B.** Lithologic SIEVE log for test well GOLD1-T (15N/01E-28R4S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,064 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, March 5, 2012. Total depth drilled, 700 feet. Screened intervals, 620–680, 300–420, and 260–280 feet. **Abbreviation:** mm, millimeter]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
380	400	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and trace clay; very poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); minor biotite; volcanic (dacite).	560	580	Sand (S); very fine to medium sand with trace granules to small pebbles; moderately to well sorted; angular to subrounded; brown (10YR 4/3); slightly calcareous.
400	420	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand; very poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); slightly calcareous; minor biotite.	580	600	Gravelly sand (gS); fine to very coarse sand with granules to small pebbles; poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2).
420	440	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand; very poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); slightly calcareous; minor biotite.	600	620	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2); angular to subrounded basalt fragments; weathered mafic bedrock.
440	460	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles; very poorly sorted; angular to rounded; dark grayish brown (10YR 4/2); minor biotite.	620	640	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand; poorly sorted; very angular to subangular; black (10YR 2/1); angular basalt fragments; bedrock.
460	480	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules to medium pebbles; moderately to poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2).	640	660	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand; poorly sorted; very angular to angular; very dark grayish brown (10YR 3/2); angular basalt fragments; bedrock.
480	500	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules to small pebbles; moderately to poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2).	660	680	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand; very poorly sorted; very angular to angular; very dark grayish brown (10YR 3/2); angular basalt fragments; bedrock.
500	520	Gravelly sand (gS); fine to very coarse sand with granules to small pebbles; poorly sorted; subangular to rounded; brown (10YR 4/3).	680	700	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand; very poorly sorted; very angular to subangular; dark grayish brown (10YR 4/2); angular basalt fragments; bedrock.
520	540	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand; poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2).			
540	560	Slightly gravelly sand ((g)S); very fine to medium sand with minor coarse to very coarse sand and granules to medium pebbles; moderately to poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).			

**Table 9A.** Lithologic SHAKER log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Gravel (G); granules to large pebbles; poorly sorted; subangular to very angular; very dark brown (7.5YR 2.5/2); slightly calcareous.	140	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; brown (10YR 4/3).
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; subangular to angular; dark brown (7.5YR 3/2).	150	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand and trace silt; poorly sorted; subangular to angular; brown (10YR 4/3).
30	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; subangular to angular; dark grayish brown (10YR 4/2).	160	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly sorted; subangular to angular; yellowish brown (10YR 5/4).
40	Sandy gravel (sG); granules to medium pebbles with very coarse to medium sand and trace silt; poorly sorted; angular to subangular; brown (10YR 5/3).	170	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).
50	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).	180	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; brown (10YR 4/3).
60	Sandy gravel (sG); granules to medium pebbles with very coarse to coarse sand and trace silt; poorly sorted; subangular to angular; brown (10YR 5/3).	190	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).
70	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).	200	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).
80	Silty sandy gravel (msG); granules to small pebbles with very coarse to medium sand and silt; poorly to very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).	210	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).
90	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4).	220	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; brown (10YR 4/3).
100	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; angular to subangular; brown (10YR 5/3).	230	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
110	Sandy gravel (sG); small to large pebbles with coarse to very coarse sand; poorly sorted; subrounded to angular; brown (10YR 4/3).	240	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 4/3).
120	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand and trace silt; poorly sorted; subrounded to angular; brown (10YR 4/3).	250	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; subrounded to angular; yellowish brown (10YR 5/4).
130	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; subangular to angular; brown (10YR 4/3).		

**Table 9A.** Lithologic SHAKER log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)	Description	Depth (feet)	Description
260	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	370	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; brown (10YR 5/3).
270	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	380	Gravel (G); granules to medium pebbles; very well sorted; angular to very angular; very dark grayish brown (10YR 3/2).
280	Gravel (G); small to large pebbles; very well sorted; angular to very angular; very dark gray (10YR 3/1).	390	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly to very poorly sorted; angular to subangular; brown (10YR 5/3).
280	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand and trace clay; poorly sorted; angular to subangular; brown (10YR 5/3).	400	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
IC top		410	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
290	Clayey sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and clay; poorly to very poorly sorted; subangular to angular; brown (10YR 5/3).	420	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand, trace silt, and trace clay; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
300	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; poorly to very poorly sorted; subangular to angular; brown (10YR 5/3).	430	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
310	Clayey sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and clay; poorly to very poorly sorted; subangular to angular; brown (10YR 5/3).	440	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
320	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; subangular to angular; brown (10YR 5/3).	450	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
330	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; subangular to angular; brown (10YR 5/3).	460	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand, clay, and trace silt; very poorly sorted; angular to subangular; brown (10YR 5/3).
340	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; brown (10YR 5/3).	470	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand, clay, and trace silt; very poorly sorted; angular to subangular; brown (10YR 5/3).
350	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; brown (10YR 5/3).		
360	Gravelly silty sand (gmS); very coarse to medium sand with silt, granules to small pebbles, and trace clay; very poorly sorted; subangular to angular; brown (10YR 5/3).		

**Table 9A.** Lithologic SHAKER log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)	Description	Depth (feet)	Description
480	Gravelly clayey sand (gmS); medium to very coarse sand with clay, granules to small pebbles, and trace silt; very poorly sorted; angular to subangular; brown (7.5YR 5/3).	570	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand, silt, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
490	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	580	Silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and trace clay; very poorly sorted; subangular to angular; brown (10YR 5/3).
500	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 4/3).	590	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand and trace silt; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).
510	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	600	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand and trace clay; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
520	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 4/3).	610	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and silt; very poorly sorted; angular to subangular; brown (10YR 4/3).
530	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 4/3).	620	Clayey silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 4/3).
540	Clayey silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 4/3).	630	Clayey silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
550	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	640	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
560	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	650	Clayey silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
560 2C top	Sandy gravel (sG); medium to large pebbles with medium to very coarse sand; moderately to poorly sorted; subrounded to subangular; very dark grayish brown (10YR 3/2).	660	Clayey silty sandy gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
563 2C bottom	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to very angular; very dark gray (10YR 3/1).	670	Clayey silty sandy gravel (msG); granules to small pebbles with very coarse to medium sand, silt, and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).

**Table 9A.** Lithologic SHAKER log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)	Description	Depth (feet)	Description
680	Silty sandy clayey gravel (msG); granules to small pebbles with very coarse to coarse sand, clay, and silt; very poorly sorted; angular to subangular; brown (10YR 5/3).	810	Silty sandy clayey gravel (msG); granules to small pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; angular to subrounded; brown (10YR 4/3).
690	Silty clayey sandy gravel (msG); granules to small pebbles with coarse to very coarse sand, silt, and clay; very poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4).	820	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand, silt, and trace clay; very poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2).
700	Silty sandy clayey gravel (msG); granules to small pebbles with medium to very coarse sand, silt, and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).	830	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand, trace silt, and trace clay; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).
710	Silty sandy gravel (msG); granules with coarse to very coarse sand, silt and trace clay; poorly to very poorly sorted; angular to subangular; brown (10YR 5/3).	840	Silty sandy clayey gravel (msG); granules to medium pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; angular to subrounded; brown (10YR 4/3).
720	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	850	Silty sandy clayey gravel (msG); granules to medium pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; angular to subrounded; brown (10YR 4/3).
730	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	860	Silty sandy clayey gravel (msG); granules to medium pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; subrounded to angular; brown (10YR 4/3).
740	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	870	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand, trace silt, and trace clay; poorly sorted; subrounded to angular; brown (10YR 4/3).
750	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	880	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand, trace silt, and trace clay; poorly sorted; subrounded to angular; brown (10YR 4/3).
760	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	890	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand, trace silt, and trace clay; poorly sorted; subrounded to angular; dark grayish brown (10YR 4/2).
770	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subangular; brown (10YR 4/3).	900	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand, trace silt, and trace clay; poorly sorted; subangular to angular; brown (10YR 4/3).
780	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	900	Sandy clayey silt (sM); silt with clay, very fine to medium sand and trace granules; poorly sorted; brown (10YR 4/3); slough?
790	Silty sandy clayey gravel (msG); granules to small pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; subangular to subrounded; brown (10YR 4/3).	3C top	
800	Silty sandy clayey gravel (msG); granules to small pebbles with coarse to very coarse sand, clay, and silt; very poorly sorted; subrounded to angular; brown (10YR 4/3).	903	Silty clayey gravelly sand (gmS); very fine to medium sand with clay, silt, and granules to large pebbles; very poorly sorted; subrounded to angular; brown (10YR 4/3)
		3C bottom	

**Table 9B.** Lithologic SIEVE log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	19	Sandy gravel (sG); granules to large pebbles with very fine to very coarse sand; very poorly sorted; angular to subrounded; brown (7.5YR 4/3); calcareous; plus cobbles?	240	260	Clayey silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt with clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
19	40	Clayey sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4); calcareous; plus cobbles?	260	280	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
40	60	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to rounded; brown (10YR 5/3); calcareous.	280	300	Clayey silty sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and silt with clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
60	80	Clayey sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); plus cobbles?	300	320	Clayey silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt with clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
80	100	Clayey sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.	320	340	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
100	120	Clayey sandy gravel (msG); granules to large pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.	340	360	Sandy clayey gravel (mG); granules to medium pebbles with clay and very fine to very coarse sand; very poorly sorted; angular to subrounded; brown (10YR 5/3).
120	140	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); calcareous.	360	380	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3).
140	160	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules to medium pebbles; very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4); slightly calcareous.	380	400	Sandy gravel (sG); granules to large pebbles with very fine to very coarse sand; very poorly sorted; very angular to subangular; brown (10YR 4/3).
160	180	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); calcareous.	400	420	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).
180	200	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; very angular to subrounded; yellowish brown (10YR 5/4).	420	440	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor clay; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).
200	220	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 4/3).	440	460	Clayey silty sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and silt with clay; very poorly sorted; subangular to subrounded; brown (7.5YR 4/2).
220	240	Silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt; very poorly sorted; subangular to subrounded; brown (7.5YR 4/3).	460	480	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; very angular to subrounded; brown (7.5YR 4/2).

**Table 9B.** Lithologic SIEVE log for test well NELT6 (15N/02E-05N1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,139 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2012. Total depth drilled, 903 feet. Screened intervals, 760–840, 500–560, and 400–460 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
480	500	Silty sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and silt; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).	700	720	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; subangular to rounded; brown (10YR 4/3).
500	520	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).	720	740	Sandy gravel (sG); granules with very fine to very coarse sand and minor clay; poorly sorted; angular to rounded; brown (7.5YR 4/2).
520	540	Silty sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and silt; very poorly sorted; angular to subrounded; dark brown (7.5YR 3/2).	740	760	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor clay; very poorly sorted; very angular to subangular; dark grayish brown (10YR 4/2).
540	560	Silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt; very poorly sorted; very angular to subrounded; brown (7.5YR 4/2).	760	780	Slightly gravelly silty sand ((g)mS); very fine to very coarse sand with silt and granules; poorly to moderately sorted; very angular to subrounded; brown (10YR 4/3).
560	580	Silty sandy gravel (msG); granules to small pebbles with fine to very coarse sand and silt; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).	780	800	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor silt; very poorly sorted; angular to rounded; dark grayish brown (10YR 4/2).
580	600	Silty clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay with silt; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).	800	820	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles and minor clay; very poorly sorted; angular to subrounded; dark grayish brown (10YR 4/2).
600	620	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 4/3).	820	840	Gravelly sand (gS); very fine to very coarse sand with granules; poorly to moderately sorted; angular to subrounded; dark grayish brown (10YR 4/2).
620	640	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; very angular to subrounded; brown (10YR 4/3).	840	860	Sandy gravel (sG); granules with very fine to very coarse sand and minor clay; poorly to moderately sorted; angular to rounded; dark grayish brown (10YR 4/2).
640	660	Silty clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay with silt; very poorly sorted; angular to subrounded; brown (7.5YR 4/2).	860	880	Gravelly sand (gS); very fine to very coarse sand with granules and minor clay; poorly to moderately sorted; angular to rounded; very dark grayish brown (10YR 3/2).
660	680	Clayey silty sandy gravel (msG); granules to small pebbles with very fine to coarse sand and silt with clay; very poorly sorted; subangular to rounded; brown (10YR 4/3).	880	900	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor clay; very poorly sorted; angular to subrounded; very dark grayish brown (10YR 3/2); rounded mafic pebbles.
680	700	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; subangular to rounded; brown (10YR 4/3).	900	903	No sample collected; cored interval.

**Table 10A.** Lithologic SHAKER log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 3/4).	140	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; dark yellowish brown (10YR 3/4).	150	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).
30	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; dark yellowish brown (10YR 3/4).	160	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).
40	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace silt; moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	170	Gravelly sand (gS); granules to small pebbles with medium to very coarse sand and trace silt; moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).
50	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	180	Sandy gravelly silt (gM); silt with granules and medium to very coarse sand; poorly sorted; brown (10YR 5/3).
60	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand and trace silt; moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	190	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately sorted; subangular to subrounded; dark brown (10YR 3/3).
70	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	200	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).
80	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand; moderately sorted; subrounded to rounded; very dark grayish brown (10YR 3/2).	205	Silty sand (zS); very fine to medium sand with silt; moderately sorted; subangular to rounded; brown (10YR 4/3).
90	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).	1C shoe	
100	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).	210	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).
110	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 4/3).	220	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).
120	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; dark brown (10YR 3/3).	230	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules to small pebbles; poorly sorted; brown (10YR 4/3).
130	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2).	240	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well sorted; subangular to subrounded; very dark grayish brown (10YR 3/2).
		250	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
		260	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; angular to subangular; brown (10YR 4/3).

**Table 10A.** Lithologic SHAKER log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
270	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly to very poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	380	Slightly gravelly sandy silt ((g)sM); silt with very fine to coarse sand, granules to small pebbles, and trace clay; very poorly sorted; light brownish gray (2.5Y 6/2); pyroclastic.
280	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly to very poorly sorted; angular to subangular; dark yellowish brown (10YR 3/4).	390	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, fine to coarse sand, and granules to small pebbles; very poorly sorted; brown (10YR 5/3); pyroclastic.
290	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; brown (10YR 5/3).	400	Sandy clayey silt (sM); silt, clay, and fine to coarse sand with trace very coarse sand; moderately to poorly sorted; pale brown (10YR 6/3); slightly calcareous; pyroclastic.
300	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately sorted; subangular to subrounded; brown (10YR 4/3).	405	Sandy silt (sZ); silt with fine to coarse sand and trace very coarse sand; moderately to poorly sorted; light brownish gray (2.5Y 6/2); pyroclastic.
310	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); slightly calcareous.	2C shoe	
320	Gravelly clayey silty sand (gmS); medium to very coarse sand, silt, and clay with granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.	410	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, fine to coarse sand, and granules to small pebbles; very poorly sorted; light gray (2.5Y 7/2); calcareous; pyroclastic.
330	Gravelly silty sand (gmS); very fine to medium sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); calcareous.	420	Slightly gravelly sandy silt ((g)sM); silt with fine to coarse sand, granules to small pebbles, and trace clay and very coarse sand; very poorly sorted; pale brown (10YR 6/3); slightly calcareous; pyroclastic.
340	Sandy clayey silt (sM); silt with clay, very fine to medium sand, and trace granules to small pebbles; poorly sorted; brown (10YR 4/3); calcareous.	430	Sandy clayey silt (sM); silt with clay, fine to coarse sand, and trace granules; poorly to very poorly sorted; light brownish gray (10YR 6/2); calcareous; pyroclastic.
344	Sandy silt (sZ); silt with very fine to medium sand and trace granules to small pebbles; moderately to poorly sorted; pale brown (10YR 6/3); calcareous.	440	Gravelly silty sand (gmS); medium to very coarse sand and silt with granules to small pebbles and trace clay; very poorly sorted; angular to subangular; light gray (2.5Y 7/2); pyroclastic.
350	Sandy silt (sZ); silt with very fine to medium sand, trace granules, and trace clay; moderately to poorly sorted; dark grayish brown (10YR 4/2); slightly calcareous.	450	Sandy silt (sZ); silt with fine to coarse sand and trace granules; poorly sorted; pale brown (10YR 6/3); slightly calcareous; pyroclastic.
360	Sandy silt (sZ); silt with very fine to medium sand, trace granules, and trace clay; moderately to poorly sorted; brown (10YR 5/3); calcareous.	460	Sandy clayey silt (sM); silt with clay and very fine to medium sand and trace coarse sand; moderately to poorly sorted; light gray (2.5Y 7/2); pyroclastic.
361	Sandy silt (sZ); silt with very fine to medium sand, trace granules to small pebbles, and trace clay; moderately to poorly sorted; light gray (10YR 7/2); slightly calcareous; pyroclastic.	470	Sandy silt (sZ); silt with very fine to medium sand and trace granules to small pebbles; moderately sorted; light brownish gray (2.5Y 6/2); pyroclastic.
370	Gravelly silty sand (gmS); fine to coarse sand and silt with granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); calcareous; pyroclastic.	480	Silty sand (zS); very fine to medium sand with silt and trace coarse to very coarse sand; moderately sorted; subangular to subrounded; light gray (2.5Y 7/2); calcareous; pyroclastic.
		490	Sandy clayey silt (sM); silt with clay and fine to coarse sand; poorly sorted; light gray (2.5Y 7/2); calcareous.
		500	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, medium to very coarse sand, and granules to small pebbles; very poorly sorted; light brownish gray (2.5Y 6/2); pyroclastic.

**Table 10A.** Lithologic SHAKER log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
510	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, medium to very coarse sand, and granules to small pebbles; very poorly sorted; light gray (10YR 7/2); slightly calcareous; pyroclastic.	640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; brown (10YR 5/3); volcanic?
520	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; angular to subangular; light brownish gray (2.5Y 6/2); calcareous; pyroclastic.	650	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic?
530	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, medium to very coarse sand, and granules to small pebbles; very poorly sorted; light gray (10YR 7/2); slightly calcareous; pyroclastic.	660	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic?
540	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; light gray (10YR 7/2); calcareous; pyroclastic.	670	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic?
550	Sandy clayey silt (sM); silt with clay and fine to coarse sand; moderately to poorly sorted; light gray (2.5Y 7/2); slightly calcareous; pyroclastic.	680	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; grayish brown (10YR 5/2); volcanic?
560	Slightly gravelly sandy clayey silt ((g)sM): silt with clay, medium to very coarse sand, and granules; very poorly sorted; light gray (10YR 7/2); calcareous; pyroclastic.	690	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic?
570	Sandy clayey silt (sM); silt with clay, fine to coarse sand, and trace granules; poorly sorted; brown (10YR 5/3); calcareous; pyroclastic.	700	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; poorly sorted; angular to subangular; brown (10YR 5/3); volcanic?
580	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; light brownish gray (10YR 6/2); pyroclastic.	710	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; grayish brown (10YR 5/2); volcanic.
590	Sandy clayey silt (sM); silt with clay and fine to coarse sand; moderately to poorly sorted; light brownish gray (10YR 6/2); slightly calcareous; pyroclastic.	720	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; brown (10YR 5/3); volcanic.
600	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace clay; poorly to very poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	725	Crystal tuff; weakly chloritic siliceous crystal tuff with minor vugs and local hematitic alteration; dark grayish brown (10YR 4/2).
610	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); pyroclastic.	3C shoe	
620	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); slightly calcareous; volcanic?	730	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); volcanic.
630	Sandy clayey silt (sM); silt with clay, fine to medium sand, and trace granules; moderately to poorly sorted; grayish brown (10YR 5/2); pyroclastic.	740	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2); volcanic.
		750	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2); volcanic.

**Table 10A.** Lithologic SHAKER log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description
730–750 Washed	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; very angular to angular; very dark brown (10YR 2/2); volcanic.
760	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); pyroclastic.
770	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; poorly sorted; angular to subangular; brown (7.5YR 5/3); volcanic.
780	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/2); volcanic.
780 Washed	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/2); abundant hematitic alteration; volcanic.
790	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/2); volcanic.
800	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/2); volcanic.
810	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/3); volcanic.
820	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/2); volcanic.
830	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/2); volcanic.
830 Washed	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; very angular to angular; very dark brown (7.5YR 2.5/2); bedrock; volcanic.
840	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; very dark grayish brown (10YR 3/2); volcanic.

**Table 10B.** Lithologic SIEVE log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	18	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; moderately to poorly sorted; angular to subrounded; dark brown (7.5YR 3/3); slightly calcareous.	220	240	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; angular to subangular; dark brown (7.5YR 3/2).
18	40	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; moderately to poorly sorted; angular to subangular; dark brown (7.5YR 3/2); slightly calcareous.	240	260	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; angular to subangular; dark brown (7.5YR 3/2).
40	60	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; moderately to poorly sorted; angular to subangular; dark brown (7.5YR 3/2).	260	280	Silty clay (M); clay with silt and trace medium to coarse sand; moderately to well sorted; brown (7.5YR 4/3); calcareous.
60	80	Gravelly sand (gS); medium to very coarse sand with granules and trace small pebbles; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/4).	280	300	Sand (S); medium to very coarse sand with trace granules and silt; moderately sorted; subangular to subrounded; dark brown (7.5YR 3/2); slightly micaceous.
80	100	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subrounded; dark brown (7.5YR 3/3).	300	320	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark brown (7.5YR 3/2).
100	120	Gravelly sand (gS); medium to very coarse sand with granules; well to moderately sorted; subangular to subrounded; dark brown (7.5YR 3/2); slightly micaceous.	320	340	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules to small pebbles; poorly sorted; subrounded to rounded; brown (7.5YR 5/2); calcareous.
120	140	Gravelly sand (gS); medium to very coarse sand with granules; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/3).	340	360	Silty sand (zS); very fine to medium sand with silt, trace clay, and trace granules; moderately to poorly sorted; subrounded to rounded; brown (10YR 4/3); slightly calcareous.
140	160	Sand (S); medium to very coarse sand with trace granules; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/2).	360	380	Silty clayey sand (mS); medium to very coarse sand with clay and silt; moderately to poorly sorted; subrounded to rounded; brown (10YR 5/3); calcareous; white clay; pyroclastic.
160	180	Sand (S); medium to very coarse sand with trace granules to small pebbles; well to moderately sorted; angular to subrounded; dark brown (7.5YR 3/3).	380	400	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous; white clay; pyroclastic.
180	200	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; dark brown (7.5YR 3/2); slightly micaceous.	400	405	No sample collected; cored interval.
200	205	No sample collected; cored interval.	405	420	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; poorly sorted; subangular to subrounded; pale brown (10YR 6/3); calcareous; white clay; pyroclastic.
205	220	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; angular to subangular; dark brown (7.5YR 3/2).	420	440	Sandy silty clay (sM); clay with silt, fine to coarse sand, and trace granules; poorly sorted; light gray (10YR 7/2); calcareous; white clay; pyroclastic.

**Table 10B.** Lithologic SIEVE log for multiple-well monitoring site NELT2 (15N/03E-06L1S, -06L2S, -06L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,054 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, September 6, 2011. Total depth drilled, 840 feet. Screened intervals, 760–800, 510–530, and 280–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
440	460	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); slightly calcareous; pyroclastic.	660	680	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous; volcanic?
460	480	Sandy silty clay (sM); clay with silt, very fine to medium sand, and trace granules; moderately to poorly sorted; light yellowish brown (2.5Y 6/3); slightly calcareous; white clay; pyroclastic.	680	700	Sand (S); fine to medium sand; well sorted; subangular to subrounded; brown (7.5YR 4/3); calcareous; volcanic?
480	500	Sandy silty clay (sM); clay with silt and medium to very coarse sand; poorly sorted; light brownish gray (2.5Y 6/2); calcareous; pyroclastic.	700	705	No sample collected; cored interval.
500	520	Clayey silty sand (mS); fine to coarse sand with silt and clay; poorly sorted; subrounded to rounded; light brownish gray (2.5Y 6/2); calcareous; pyroclastic.	705	720	Sand (S); medium to very coarse sand; well sorted; subangular to angular; dark brown (7.5YR 3/2); slightly calcareous; volcanic?
520	540	Sandy silty clay (sM); clay with silt, medium to very coarse sand, and trace granules; poorly sorted; light gray (10YR 7/2); calcareous; pyroclastic.	720	725	No sample collected; cored interval.
540	560	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules; poorly to very poorly sorted; subangular to subrounded; light brownish gray (10YR 6/2); calcareous; pyroclastic.	725	740	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subangular to angular; dark brown (7.5YR 3/3); slightly calcareous; volcanic?
560	580	Clayey sand (cS); medium to very coarse sand with clay and trace granules to small pebbles; poorly sorted; subangular to subrounded; light gray (2.5Y 7/2); calcareous; pyroclastic.	740	760	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subrounded to angular; very dark gray (7.5YR 3/1); slightly calcareous; volcanic?
580	600	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; light yellowish brown (2.5Y 6/3); slightly calcareous; pyroclastic.	760	780	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; poorly sorted; subrounded to subangular; dark brown (7.5YR 3/4); pyroclastic.
600	620	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous; volcanic?	780	800	Sand (S); medium to very coarse sand with trace granules; moderately to well sorted; angular to very angular; dark brown (7.5YR 3/3); volcanic?
620	640	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3); slightly calcareous; volcanic?	800	820	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; poorly sorted; subangular to angular; dark reddish gray (5YR 4/2); volcanic?
640	660	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4); slightly calcareous; volcanic?	820	840	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; very angular; dark reddish brown (5YR 3/2); volcanic.

**Table 11A.** Lithologic SHAKER log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
10	Gravel (G); granules to medium pebbles with minor very fine to very coarse sand; poorly to moderately sorted; rounded to well rounded; brown (7.5YR 4/2); calcareous.	140	Sandy clayey silt (sM); silt with clay and very fine to very coarse sand; poorly sorted; grayish brown (10YR 5/2).
20	Sandy gravel (sG); granules to small pebbles with very fine to very coarse sand and minor clay; very poorly sorted; rounded to well rounded; brown (7.5YR 5/3); calcareous.	150	Gravelly silty clay (gM); clay with silt and granules to medium pebbles; very poorly sorted; light brown (7.5YR 6/3); slightly calcareous.
30	Sandy clayey gravel (mG); granules to large pebbles with clay and very fine to very coarse sand; very poorly sorted; angular to subrounded; light yellowish brown (10YR 6/4); calcareous.	160	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; pinkish gray (7.5YR 6/2); calcareous.
40	Silty gravelly clayey sand (gmS); very fine to very coarse sand and clay with granules to small pebbles and silt; very poorly sorted; subangular to subrounded; brown (7.5YR 5/3).	170	Sandy clay (sC); clay with very fine to coarse sand and trace granules to small pebbles; poorly sorted; brown (7.5YR 5/3); calcareous.
50	Slightly gravelly sandy clay ((g)sM); clay with very fine to very coarse sand and granules to medium pebbles; very poorly sorted; brown (7.5YR 5/3).	180	Gravelly sandy silty clay (gM); clay and silt with very fine to very coarse sand and granules to medium pebbles; very poorly sorted; light brown (7.5YR 6/3); calcareous.
60	Sandy gravelly clay (gM); clay with granules to small pebbles and very fine to very coarse sand; very poorly sorted; brown (7.5YR 5/2).	190	Sandy clay (sC); clay with very fine to coarse sand and minor silt with trace granules to small pebbles; poorly sorted; pale brown (10YR 6/3).
70	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and minor clay; very poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2).	200	Slightly gravelly clay ((g)M); clay with granules to small pebbles and minor very fine to medium sand; very poorly sorted; pale brown (10YR 6/3); calcareous; tephra (0.5–4 mm).
80	Sandy clayey gravel (mG); granules to small pebbles with clay and fine to very coarse sand; very poorly sorted; subangular to rounded; brown (10YR 5/3); calcareous.	205	Slightly gravelly silty sandy clay ((g)sM); clay with very fine to coarse sand and silt with granules; very poorly sorted; brown (10YR 5/3); slightly calcareous.
90	Clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subangular; brown (10YR 5/3); calcareous.	210	Clay (C); clay with minor very fine to coarse sand and trace granules to small pebbles; moderately to well sorted; brown (10YR 5/3).
100	Sandy gravelly clay (gM); clay, granules, and very fine to very coarse sand with trace silt; very poorly sorted; light brownish gray (10YR 6/2).	220	Sandy gravelly clay (gM); clay with granules to small pebbles and very fine to very coarse sand; very poorly sorted; light yellowish brown (10YR 6/4); calcareous.
110	Slightly gravelly sandy clay ((g)sM); clay with very fine to very coarse sand and granules to small pebbles with minor silt; very poorly sorted; brown (10YR 4/3).	230	Slightly gravelly sandy clay ((g)sM); clay with very fine to medium sand and granules to medium pebbles; very poorly sorted; pale brown (10YR 6/3); calcareous; tephra (2–9 mm).
120	Sandy clay (sC); clay with very fine to medium sand; moderately sorted; brown (10YR 5/3).	240	Sandy gravelly clay (gM); clay with granules to medium pebbles and very fine to very coarse sand; very poorly sorted; brown (10YR 5/3); calcareous; tephra (2–10 mm).
130	Silty clay (M); clay and silt with minor very fine to very coarse sand; poorly to well sorted; grayish brown (10YR 5/2).	250	Slightly gravelly sandy clay ((g)sM); clay with very fine to very coarse sand and granules to small pebbles with trace silt; very poorly sorted; pale brown (10YR 6/3); calcareous.

**Table 11A.** Lithologic SHAKER log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
260	Sandy silty clayey gravel (mG); granules to medium pebbles and clay with silt and very fine to very coarse sand; very poorly sorted; angular; pale brown (10YR 6/3); calcareous.	380	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor clay; very poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3); slightly calcareous.
270	Slightly gravelly sandy silty clay ((g)sM); clay and silt with very fine to coarse sand and granules to small pebbles; very poorly sorted; light brown (7.5YR 6/3); calcareous.	380 Washed	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand; very poorly sorted; angular to subrounded; dark grayish brown (2.5Y 4/2); slightly calcareous.
280	Slightly gravelly sandy silty clay ((g)sM); clay and silt with very fine to coarse sand and granules to small pebbles; very poorly sorted; pale brown (10YR 6/3); slightly calcareous.	390	Clayey sandy gravel (msG); granules with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.
290	Sandy clay (sC); clay with very fine to very coarse sand and trace granules; very poorly sorted; pale brown (10YR 6/3); calcareous.	400	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; grayish brown (2.5Y 5/2); calcareous.
300	Sandy clay (sC); clay with very fine to very coarse sand and trace granules; very poorly sorted; pale brown (10YR 6/3); calcareous.	410	Sandy clayey gravel (mG); granules to medium pebbles with clay and very fine to very coarse sand; very poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3); calcareous.
310	Slightly gravelly sandy clayey silt ((g)sM); silt and clay with very fine to very coarse sand and granules; very poorly sorted; light brownish gray (10YR 6/2); calcareous.	420	Sandy clayey silty gravel (mG); granules to medium pebbles with silt, clay, and very fine to very coarse sand; very poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3); slightly calcareous.
320	Slightly gravelly sandy clayey silt ((g)sM); silt and clay with very fine to very coarse sand and granules to small pebbles; very poorly sorted; light brownish gray (2.5Y 6/2); slightly calcareous.	430	Sandy clayey silty gravel (mG); granules to small pebbles with silt, clay, and very fine to very coarse sand; very poorly sorted; angular to subrounded; grayish brown (2.5Y 5/2); calcareous.
330	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3).	440	Clayey silty sandy gravel (msG); granules to small pebbles with very fine to very coarse sand, silt, and clay; very poorly sorted; subangular to rounded; grayish brown (2.5Y 5/2); calcareous.
340	Clayey sandy silt (sM); silt and very fine to very coarse sand with clay; very poorly sorted; light olive brown (2.5Y 5/3); slightly calcareous.	450	Sandy gravel (sG); granules to small pebbles with fine to very coarse sand and minor clay; very poorly sorted; subangular to rounded; grayish brown (2.5Y 5/2); calcareous.
350	Clayey sandy silt (sM); silt and very fine to very coarse sand with clay; very poorly sorted; olive brown (2.5Y 4/3); slightly calcareous.	460	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand and minor clay; very poorly sorted; subangular to rounded; dark grayish brown (2.5Y 4/2); calcareous.
360	Clayey silty sand (mS); very fine to very coarse sand with silt and clay and trace granules to small pebbles; very poorly sorted; subangular to rounded; grayish brown (10YR 5/2); slightly calcareous.	470	Sandy gravel (sG); granules to medium pebbles with fine to very coarse sand and minor clay; very poorly sorted; subangular to rounded; light brownish gray (2.5Y 6/2); calcareous.
360 Washed	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles and minor silt; very poorly sorted; very angular to subrounded; dark grayish brown (10YR 4/2).		
370	Silty gravelly clayey sand (gmS); very fine to very coarse sand and clay with granules and silt; very poorly sorted; subrounded; brown (10YR 5/3).		

**Table 11A.** Lithologic SHAKER log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
480	Sandy gravel (sG); granules to small pebbles with fine to very coarse sand and minor clay; very poorly sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous.	580	Clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay; very poorly sorted; subangular to rounded; olive gray (5Y 5/2); calcareous.
490	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous.	590	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
500	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous.	600	Clayey sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and clay; very poorly sorted; subrounded; olive gray (5Y 5/2); calcareous.
503	Gravel (G); granules to large pebbles with minor clay; poorly sorted; subrounded to rounded; olive gray (5Y 4/2); slightly calcareous.	610	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
2C bottom		620	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
510	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and minor clay; poorly sorted; angular to subrounded; grayish brown (2.5Y 5/2); calcareous.	630	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.
520	Sandy gravel (sG); granules to small pebbles with medium to very coarse sand and minor clay; poorly sorted; angular to subrounded; grayish brown (2.5Y 5/2); calcareous.	640	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 5/2); calcareous.
530	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand and minor clay; moderately to poorly sorted; subangular to subrounded; light brownish gray (2.5Y 6/2); calcareous.	650	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 5/2); slightly calcareous.
540	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and trace clay; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.	660	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 5/2); calcareous.
550	Clayey sandy gravel (msG); granules to small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.	670	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 4/2); calcareous.
560	Clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 4/2); calcareous.	680	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand and minor clay; poorly sorted; subangular to subrounded; olive gray (5Y 5/2); slightly calcareous.
570	Clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.		

**Table 11A.** Lithologic SHAKER log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. Washed—sample was washed to remove fine grained material and drilling mud]

Depth (feet)	Description	Depth (feet)	Description
690	Clayey sandy gravel (msG); granules with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; olive gray (5Y 5/2); calcareous.	800	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand; poorly sorted; very angular; salt and pepper; biotite-rich (heavily weathered bedrock).
700	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 5/2); calcareous.	Washed	
710	Clayey sandy gravel (msG); granules with fine to very coarse sand and clay; very poorly sorted; subangular to rounded; olive gray (5Y 5/2); slightly calcareous.	810	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; very angular; olive gray (5Y 5/2); biotite-rich (heavily weathered bedrock).
720	Clayey sandy gravel (msG); granules with fine to very coarse sand and clay; very poorly sorted; subangular to rounded; olive gray (5Y 5/2); calcareous.	820	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; very angular; olive gray (5Y 4/2); biotite-rich (moderately to heavily weathered bedrock).
730	Clayey sandy gravel (msG); granules with small pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to rounded; olive gray (5Y 5/2); calcareous.	830	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; very angular; light olive brown (2.5Y 5/3); biotite-rich (lightly to moderately weathered bedrock).
740	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to rounded; olive gray (5Y 5/2); calcareous.	840	Sandy gravel (sG); granules to large pebbles with fine to very coarse sand and minor clay; poorly sorted; very angular; light brownish gray (2.5Y 6/2); felsic (bedrock).
750	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; subangular to subrounded; gray (5Y 5/1); calcareous.	850	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; very angular; dark greenish gray (10Y 4/1); biotite-rich (bedrock).
760	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 5/2); calcareous.	860	Clayey sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and clay; very poorly sorted; very angular; dark greenish gray (10Y 4/1); biotite-rich (bedrock).
770	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; poorly to moderately sorted; very angular to subangular; olive gray (5Y 5/2); calcareous.	870	Sandy gravel (sG); granules to large pebbles with medium to very coarse sand and minor clay; poorly to moderately sorted; angular to subangular; salt and pepper; biotite-rich (bedrock).
780	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; very angular; olive gray (5Y 4/2); biotite-rich.	880	Clayey sandy gravel (msG); granules to large pebbles with medium to very coarse sand and clay; very poorly sorted; very angular to subangular; salt and pepper; biotite-rich (bedrock).
780	Gravel (G); granules to medium pebbles with minor very coarse sand; moderately to well sorted; very angular; salt and pepper; biotite-rich.	880	Granadiorite; medium to coarse crystalline granadiorite; weakly to moderately foliated; light gray (10YR 7/1); leucocratic; hematite stained fractures; band or dike?
Washed		3C top	
790	Gravel (G); granules to medium pebbles with minor medium to very coarse sand; moderately to well sorted; very angular; salt and pepper; biotite-rich.	885	Gneiss; fine to coarse crystalline intermediate gneiss; moderately to strongly foliated; salt and pepper; hematite stained fractures; proto-igneous?
800	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; very angular to subangular; olive gray (5Y 4/2); biotite-rich (heavily weathered bedrock).	3C bottom	

**Table 11B.** Lithologic SIEVE log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. **Abbreviation:** mm, millimeter]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles and trace clay; very poorly sorted; subrounded to rounded; yellowish brown (10YR 5/4); calcareous.	240	260	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.
20	40	Sand (S); very fine to very coarse sand with minor clay; moderately to poorly sorted; subrounded to rounded; dark yellowish brown (10YR 4/4); calcareous; caliche.	260	280	Slightly gravelly sandy clayey silt ((g)sM); silt with clay and very fine to coarse sand with granules to small pebbles; poorly sorted; pale brown (10YR 6/3); calcareous.
40	60	Slightly gravelly clayey sand ((g)mS); very fine to very coarse sand with clay and granules to small pebbles; very poorly sorted; subrounded; brown (10YR 5/3); slightly calcareous.	280	300	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
60	80	Clayey silty sand (mS); very fine to very coarse sand, silt and clay with trace granules; very poorly sorted; subrounded to rounded; brown (10YR 4/3).	300	320	Slightly gravelly sandy clayey silt ((g)sM); silt with clay and very fine to coarse sand with granules to small pebbles; poorly sorted; brown (10YR 5/3); slightly calcareous.
80	100	Slightly gravelly sandy silty clay ((g)sM); clay, silt, and very fine to very coarse sand with granules to small pebbles; very poorly sorted; brown (10YR 4/3).	320	340	Clayey silty sand (mS); very fine to medium sand with silt and clay with minor very coarse sand; poorly to moderately sorted; subrounded to rounded; grayish brown (10YR 5/2); slightly calcareous.
100	120	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; subrounded to rounded; brown (10YR 4/3).	340	360	Clayey silty sand (mS); very fine to coarse sand with silt and clay with trace granules to medium pebbles; poorly sorted; subrounded; brown (10YR 4/3); slightly calcareous.
120	140	Silty clay (M); clay with silt and minor very fine to very coarse sand; moderately to well sorted; pale brown (10YR 6/3); slightly calcareous.	360	380	Slightly gravelly silty sand ((g)mS); very fine to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2); calcareous.
140	160	Sandy silty clay (sM); clay with silt and very fine to medium sand with trace granules; moderately sorted; brown (10YR 5/3); slightly calcareous.	380	400	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles and minor silt; poorly to very poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2); calcareous.
160	180	Slightly gravelly sandy silty clay ((g)sM); clay with silt and very fine to coarse sand with granules to small pebbles; poorly sorted; brown (10YR 5/3); calcareous.	400	420	Gravelly sand (gS); very fine to very coarse sand with granules to medium pebbles and minor silt; very poorly sorted; subrounded to rounded; dark grayish brown (10YR 4/2); slightly calcareous.
180	200	Gravelly sandy clayey silt (gM); silt with clay and very fine to coarse sand with granules to small pebbles; very poorly sorted; light brownish gray (10YR 6/2); calcareous; minor very well indurated clayey silt (10–18 mm); light gray (10YR 7/2); highly calcareous (tephra?).	420	440	Sandy gravel (sG); granules to medium pebbles with very fine to very coarse sand and minor silt; very poorly sorted; subangular to rounded; dark grayish brown (10YR 4/2); slightly calcareous; minor mica.
200	205	No sample collected; cored interval.	440	460	Gravelly silty sand (gmS); very fine to very coarse sand and silt with granules to medium pebbles; very poorly sorted; subrounded to rounded; dark grayish brown (10YR 4/2); slightly calcareous; minor mica.
205	220	Sandy clayey silt (sM); silt and clay with very fine to coarse sand; poorly sorted; pale brown (10YR 6/3); calcareous.	460	480	Silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt; very poorly sorted; angular to rounded; dark grayish brown (10YR 4/2); slightly calcareous.
220	240	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately sorted; brown (10YR 5/3); slightly calcareous.			

**Table 11B.** Lithologic SIEVE log for test well NELT4 (15N/03E-08L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,990 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 885 feet. Screened intervals, 560–580, 500–520, and 320–480 feet. **Abbreviation:** mm, millimeter]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
480	500	Silty sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and silt; very poorly sorted; subangular to rounded; grayish brown (10YR 5/2); slightly calcareous; micaceous.	680	700	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous.
500	503	No sample collected; cored interval.	700	720	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules; poorly to moderately sorted; subangular to rounded; olive gray (5Y 5/2); slightly calcareous.
503	520	Sandy gravel (sG); granules to small pebbles with very fine to very coarse sand and minor silt; very poorly sorted; subangular to rounded; grayish brown (2.5Y 5/2); biotite-rich; mafic-rich.	720	740	Sand (S); very fine to very coarse sand with trace granules; moderately sorted; subrounded; olive gray (5Y 4/2); slightly calcareous; minor mica.
520	540	Sandy gravel (sG); granules to small pebbles with very fine to very coarse sand and minor silt; very poorly sorted; subrounded; grayish brown (2.5Y 5/2); slightly calcareous; biotite-rich; mafic-rich.	740	760	Slightly gravelly clayey sand ((g)mS); very fine to very coarse sand with clay and granules; very poorly sorted; subrounded; olive gray (5Y 4/2); calcareous.
540	560	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules; moderately to poorly sorted; subrounded; grayish brown (2.5Y 5/2); slightly calcareous; mafic-rich.	760	780	Clayey sand (cS); very fine to very coarse sand with clay and trace granules; poorly to very poorly sorted; subrounded; olive gray (5Y 5/2); calcareous.
560	580	Sand (S); very fine to very coarse sand with trace granules to small pebbles; moderately sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous; mafic-rich.	780	800	Clayey sand (cS); very fine to coarse sand with clay; poorly sorted; very angular to subrounded; olive gray (5Y 4/2); calcareous; micaceous; heavily weathered bedrock.
580	600	Sand (S); very fine to very coarse sand with trace granules; moderately sorted; subrounded; grayish brown (2.5Y 5/2); calcareous; minor mafics.	800	820	Clayey sandy gravel (msG); granules to small pebbles with very fine to very coarse sand and clay; very poorly sorted; angular to subrounded; olive gray (5Y 4/2); calcareous; biotite-rich; moderately to lightly weathered bedrock.
600	620	Slightly gravelly sand ((g)S); very fine to very coarse sand with granules to small pebbles; moderately sorted; subangular to rounded; grayish brown (2.5Y 5/2); calcareous; mafic-rich.	820	840	Sandy clayey gravel (mG); granules to medium pebbles with clay and very fine to very coarse sand; very poorly sorted; angular to rounded; olive gray (5Y 4/2); slightly calcareous; micaceous; lightly weathered bedrock.
620	640	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles; very poorly sorted; subangular to subrounded; grayish brown (2.5Y 5/2); calcareous; micaceous.	840	860	Clayey sand (cS); very fine to coarse sand with clay and trace granules; poorly sorted; angular to subrounded; dark gray (5Y 4/1); calcareous; micaceous; bedrock.
640	660	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles; very poorly sorted; subangular to rounded; grayish brown (2.5Y 5/2); calcareous; minor mica.	860	880	Clayey sandy gravel (msG); granules to medium pebbles with very fine to very coarse sand and clay; very poorly sorted; angular; dark gray (5Y 4/1); calcareous; micaceous; bedrock.
660	680	Gravelly sand (gS); very fine to very coarse sand with granules to small pebbles; very poorly sorted; subrounded; grayish brown (2.5Y 5/2); calcareous; trace mica.	880	885	No sample collected; cored interval.

**Table 12A.** Lithologic SHAKER log for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,688 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 8, 2011. Total depth drilled, 903 feet. Screened intervals, 875–895, 730–750, and 645–665 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).	150	Silty clayey sand (mS); medium to very coarse sand with clay and silt; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
20	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	160	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
30	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; well to moderately sorted; angular to subrounded; brown (10YR 4/3).	170	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; poorly to very poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
40	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	180	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (7.5YR 5/3); slightly calcareous.
50	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	190	Silty clayey sand (mS); fine to coarse sand with clay, silt, and trace granules; poorly to very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
60	Silty sandy gravel (msG); granules to medium pebbles and medium to very coarse sand with silt; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/6); calcareous.	200	Clayey sandy silt (sM); silt with medium to very coarse sand and clay; poorly sorted; brown (7.5YR 5/3); calcareous.
70	Silty gravelly sand (gmS); medium to very coarse sand and granules to small pebbles with silt; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous.	203	Sandy silt (sZ); silt with very fine to medium sand; well to moderately sorted; dark yellowish brown (10YR 4/4).
80	Silty gravelly sand (gmS); medium to very coarse sand and granules to medium pebbles with silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	1C bottom	
90	Clayey silty gravelly sand (gmS); medium to very coarse sand and granules to small pebbles with clay and silt; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4); calcareous.	210	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
100	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	220	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.
110	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; poorly to very poorly sorted; angular to subangular; brown (10YR 4/3).	230	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
120	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	240	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; brown (10YR 4/3).
130	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 4/3).	250	Clayey sandy silt (sM); silt with fine to coarse sand, clay, and trace granules to small pebbles; poorly to very poorly sorted; yellowish brown (10YR 5/4).
140	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); slightly calcareous.	260	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3).
		270	Silty clayey sand (mS); fine to coarse sand with silt and clay; moderately to poorly sorted; subangular to subrounded; pale brown (10YR 6/3); calcareous; white clay.
		280	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; brown (7.5YR 5/4); calcareous.
		290	Clayey sandy silt (sM); silt with fine to coarse sand and clay; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.

**Table 12A.** Lithologic SHAKER log for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,688 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 8, 2011. Total depth drilled, 903 feet. Screened intervals, 875–895, 730–750, and 645–665 feet.]

Depth (feet)	Description	Depth (feet)	Description
300	Clayey silty sand (mS); medium to very coarse sand with silt and clay; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	460	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
303	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).	470	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; grayish brown (10YR 5/2); calcareous.
310	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	480	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; light gray (10YR 7/2); calcareous; white clay.
320	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately to poorly sorted; very pale brown (10YR 8/2); calcareous; white clay.	490	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; grayish brown (10YR 5/2); calcareous.
330	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; light brownish gray (10YR 6/2); calcareous; white clay.	500	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
340	Sandy clayey silt (sM); silt with clay, medium to very coarse sand, and trace granules; poorly sorted; brown (10YR 5/3); slightly calcareous.	503	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); calcareous.
350	Clay (C); clay with trace medium to very coarse sand; well sorted; brown (10YR 5/3); slightly calcareous.	3C bottom	
360	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; light brownish gray (10YR 6/2); calcareous.	510	Sandy silty clay (sM); clay with silt and very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.
370	Sandy clayey silt (sM); silt with clay and fine to coarse sand; moderately to poorly sorted; grayish brown (10YR 5/2); slightly calcareous.	520	Sandy clayey silt (sM); silt, clay, and medium to very coarse sand with trace granules to small pebbles; poorly to very poorly sorted; pale brown (10YR 6/3); calcareous.
380	Sandy clayey silt (sM); silt with clay, fine to coarse sand, and trace very coarse sand; moderately to poorly sorted; brown (10YR 5/3); slightly calcareous.	530	Sandy clayey silt (sM); silt with clay, medium to very coarse sand, and trace granules; poorly to very poorly sorted; dark grayish brown (10YR 4/2); calcareous.
390	Sandy clay (sC); clay with medium to very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4); calcareous.	540	Sandy clayey silt (sM); silt and clay with fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
400	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3).	550	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
410	Sandy clayey silt (sM); silt with clay and fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	560	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular to angular; brown (10YR 5/3).
420	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.	570	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
430	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
440	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; light brownish gray (10YR 6/2).	590	Sandy silty clay (sM); clay with silt and very fine to very coarse sand; poorly sorted; brown (10YR 5/3); calcareous.
450	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	600	Sandy silty clay (sM); clay with silt, very fine to medium sand, and trace granules to small pebbles; moderately to poorly sorted; brown (10YR 5/3); calcareous.

**Table 12A.** Lithologic SHAKER log for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,688 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 8, 2011. Total depth drilled, 903 feet. Screened intervals, 875–895, 730–750, and 645–665 feet.]

Depth (feet)	Description	Depth (feet)	Description
610	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	780	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.
620	Sandy gravelly silty clay (gM); clay with silt, granules, and medium to very coarse sand; poorly to very poorly sorted; pale brown (10YR 6/3); calcareous.	790	Sandy clayey silt (sM); silt with clay and very fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.
630	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	800	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules to small pebbles; poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
640	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules; poorly sorted; brown (10YR 5/3); slightly calcareous.	810	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; pale brown (10YR 6/3); calcareous.
650	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).	820	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).	830	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly calcareous.
670	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately to poorly sorted; brown (10YR 5/3); calcareous.	840	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; brown (10YR 5/3); calcareous.
680	Sandy clayey silt (sM); silt, clay, and very fine to medium sand with trace granules; poorly sorted; brown (10YR 4/3); slightly calcareous.	850	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
690	Sandy clayey silt (sM); silt with clay and fine to coarse sand; poorly sorted; brown (10YR 5/3); slightly calcareous.	860	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
700	Sandy clayey silt (sM); silt with clay and fine to coarse sand; poorly sorted; brown (10YR 5/3); calcareous.	870	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 5/3).
710	Sandy silt (sZ); silt with medium to very coarse sand; poorly sorted; brown (10YR 5/3); slightly calcareous.	880	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; grayish brown (10YR 5/2).
720	Sandy clayey silt (sM); silt with clay and fine to coarse sand; poorly sorted; brown (10YR 5/3); slightly calcareous.	890	Silty clayey sand (mS); medium to very coarse sand with clay, silt, and trace granules; poorly sorted; angular to subangular; brown (10YR 5/3).
730	Silty sand (zS); very fine to coarse sand with silt; well to poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.	900	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
740	Silty sand (zS); very fine to coarse sand with silt and trace very coarse sand; poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.	903	Poor recovery; no sample available.
750	Gravelly clayey silty sand (gmS); very fine to very coarse sand with silt and clay and granules to small pebbles; very poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.	4C shoe	
760	Sandy clayey silt (sM); silt with clay and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4); calcareous.		
770	Sandy silt (sZ); silt with medium to very coarse sand; poorly sorted; brown (10YR 5/3); slightly calcareous.		

**Table 12B.** Lithologic SIEVE log for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S).

[Altitude of land surface, approximately 2,688 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 8, 2011. Total depth drilled, 903 feet. Screened intervals, 875–895, 730–750, and 645–665 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	19	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous; abundant quartz.	200	220	Silty clayey sand (mS); very fine to coarse sand with clay and silt; moderately to poorly sorted; subrounded to rounded; yellowish brown (10YR 5/4); slightly calcareous.
19	40	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4); calcareous.	220	240	Silty clayey sand (mS); very fine to medium sand with clay, silt, and trace coarse sand; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly micaceous.
40	60	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); calcareous; micaceous.	240	260	Silty clayey sand (mS); very fine to medium sand with clay, silt, and trace coarse sand; moderately to poorly sorted; subrounded to rounded; yellowish brown (10YR 5/4); calcareous.
60	80	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 3/4); calcareous.	260	280	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; yellowish brown (10YR 5/4); slightly calcareous.
80	100	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 3/4); calcareous.	280	300	Silty clayey sand (mS); very fine to fine sand with clay and silt; moderately to well sorted; subrounded to rounded; brown (10YR 5/3).
100	120	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); calcareous.	300	320	Silty clayey sand (mS); very fine to medium sand with clay and silt; moderately to poorly sorted; subrounded to rounded; brown (10YR 5/3); slightly calcareous.
120	140	Silty sandy gravel (msG); granules to medium pebbles and medium to very coarse sand with silt; poorly sorted; subrounded to rounded; dark yellowish brown (10YR 4/4); slightly calcareous.	320	340	Sandy clay (sC); clay with fine to coarse sand; moderately to poorly sorted; light gray (10YR 7/2); white clay.
140	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); slightly calcareous.	340	360	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately sorted; brown (10YR 5/3).
160	180	Silty clayey sand (mS); very fine to coarse sand with clay and silt; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	360	380	Clayey sandy silt (sM); silt with very fine to medium sand and clay; moderately sorted; brown (10YR 5/3).
180	200	Silty sand (zS); very fine to medium sand with silt and trace coarse sand; moderately to well sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	380	400	Silty clayey sand (mS); very fine to medium sand with clay and silt; moderately sorted; subrounded to rounded; brown (10YR 5/3); calcareous.
			400	420	Silty sand (zS); very fine to medium sand with silt; well to moderately sorted; subrounded to rounded; dark grayish brown (10YR 4/2).
			420	440	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately to poorly sorted; light olive brown (2.5Y 5/3); calcareous.

**Table 12B.** Lithologic SIEVE log for multiple-well monitoring site CCT1 (15N/03E-25L1S, -25L2S, -25L3S).—Continued

[Altitude of land surface, approximately 2,688 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, August 8, 2011. Total depth drilled, 903 feet. Screened intervals, 875–895, 730–750, and 645–665 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
440	460	Sandy silt (sZ); silt with very fine to fine sand; well sorted; grayish brown (10YR 5/2); slightly calcareous.	700	720	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); slightly calcareous.
460	480	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately sorted; brown (10YR 5/3).	720	740	Silty sand (zS); fine to coarse sand with silt and trace granules to small pebbles; poorly sorted; subangular to subrounded; grayish brown (10YR 5/2); slightly calcareous.
480	500	Clayey sandy silt (sM); silt with clay and very fine to medium sand; moderately sorted; grayish brown (10YR 5/2); calcareous.	740	760	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.
500	520	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately sorted; grayish brown (10YR 5/2); calcareous.	760	780	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.
520	540	Sandy clayey silt (sM); silt with clay and very fine to medium sand; moderately sorted; grayish brown (10YR 5/2); calcareous.	780	800	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); calcareous.
540	560	Silty sand (zS); very fine to medium sand with silt; well to moderately sorted; subrounded to rounded; brown (10YR 4/3).	800	820	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3); calcareous.
560	580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).	820	840	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
580	600	Sandy silt (sZ); silt with very fine to medium sand; well to moderately sorted; brown (10YR 5/3); calcareous.	840	860	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; brown (10YR 4/3); slightly calcareous.
600	620	Sandy silt (sZ); silt with very fine to medium sand; well to moderately sorted; brown (10YR 5/3); calcareous.	860	880	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
620	640	Sandy silt (sZ); silt with very fine to medium sand; well to moderately sorted; brown (10YR 5/3).	880	900	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3); slightly calcareous.
640	660	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark grayish brown (10YR 4/2).	900	903	No sample collected; cored interval.
660	680	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.			
680	700	Silty sand (zS); fine to coarse sand with silt and trace granules; poorly sorted; subangular to subrounded; brown (10YR 5/3); calcareous.			

**Table 13A.** Lithologic SHAKER log for test well RDPS (15N/06E-33L1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,102 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, April 23, 2009. Total depth drilled, 1,000 feet. Screened intervals, 520–700 and 420–440 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; moderately sorted; subrounded to subangular; brown (10YR 5/3).	190	Slightly gravelly silty sand ((g)mS); medium to very coarse sand, silt, and minor granules; moderately sorted; subrounded to subangular; brown (10YR 5/3).
20	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subrounded to subangular; brown (10YR 5/3).	200	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subrounded to subangular; brown (10YR 5/3).
30	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; moderately sorted; subrounded to subangular; brown (10YR 5/3).	210	Sandy clay (sC); clay and very coarse sand; moderately sorted; brown (10YR 5/3).
40	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subrounded to subangular; brown (10YR 5/3).	220	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 5/3).
50	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subrounded to subangular; brown (10YR 5/3).	230	Gravelly clay (gM); clay and granules; well sorted; brown (10YR 5/3).
60	Sandy silt (sZ); silt and very fine to very coarse sand; very poorly sorted; brown (10YR 5/3).	240	Clay (C); clay; very well sorted; brown (10YR 5/3).
70	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to subangular; brown (10YR 5/3).	250	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; brown (10YR 5/3).
80	Clay (C); clay; very well sorted; brown (10YR 5/3).	260	Silty sand (zS); medium to very coarse sand and silt; moderately sorted; subrounded to subangular; brown (10YR 5/3).
90	Sandy silt (sZ); silt and fine to coarse sand; poorly sorted; brown (10YR 5/3).	270	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
100	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subrounded to subangular; brown (10YR 5/3).	280	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
110	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to subangular; brown (10YR 5/3).	290	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
120	Gravelly sand (gS); medium to very coarse sand and granules; moderately sorted; subrounded to subangular; assorted colors.	300	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
130	Gravelly sand (gS); medium to very coarse sand and granules; moderately sorted; subrounded to subangular; assorted colors.	310	Sandy clay (sC); clay and coarse sand; moderately sorted; pale brown (10YR 6/3).
140	Gravelly sand (gS); medium to very coarse sand and granules; moderately sorted; subrounded to subangular; assorted colors.	320	Sandy clay (sC); clay and medium to very coarse sand; moderately to poorly sorted; pale brown (10YR 6/3).
150	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subrounded to subangular; brown (10YR 5/3).	330	Sandy clay (sC); clay and medium to very coarse sand; moderately to poorly sorted; pale brown (10YR 6/3).
160	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; brown (10YR 5/3).	340	Sandy clay (sC); clay and medium to very coarse sand; moderately to poorly sorted; pale brown (10YR 6/3).
170	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; brown (10YR 5/3).	350	Sandy clay (sC); clay and fine to coarse sand; moderately to poorly sorted; brown (10YR 5/3).
180	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; brown (10YR 5/3).	360	Silty sand (zS); fine to very coarse sand and silt; poorly sorted; subrounded to subangular; brown (10YR 5/3).
		370	Sandy silt (sZ); silt and medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3).
		380	Sandy silt (sZ); silt and medium to very coarse sand; moderately to poorly sorted; brown (10YR 5/3).
		390	Sandy clay (sC); clay and fine sand; well sorted; brown (10YR 5/3).
		400	Clay (C); clay; very well sorted; brown (10YR 5/3).
		410	Sandy clay (sC); clay and fine sand; well sorted; brown (10YR 5/3).
		420	Sandy clay (sC); clay and coarse sand; well sorted; brown (10YR 5/3).

**Table 13A.** Lithologic SHAKER log for test well RDPS (15N/06E-33L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,102 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, April 23, 2009. Total depth drilled, 1,000 feet. Screened intervals, 520–700 and 420–440 feet.]

Depth (feet)	Description	Depth (feet)	Description
430	Sandy clay (sC); clay and coarse sand; well sorted; brown (10YR 5/3).	720	Clay (C); clay; very well sorted; yellowish brown (10YR 5/4).
440	Sandy clay (sC); clay and coarse sand; well sorted; brown (10YR 5/3).	730	Silt (Z); silt; very well sorted; yellowish brown (10YR 5/4).
450	Sandy clay (sC); clay and very coarse sand; moderately sorted; brown (10YR 5/3).	740	Sandy clay (sC); clay and very coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4).
460	Silty clay (M); clay and silt; very well sorted; dark yellowish brown (10YR 4/6).	750	Clayey silt (M); silt and clay; well to very well sorted; yellowish brown (10YR 5/4).
470	Silty clay (M); clay and silt; very well sorted; dark yellowish brown (10YR 4/6).	760	Sandy clay (sC); clay and coarse sand; moderately sorted; yellowish brown (10YR 5/4).
480	Clay (C); clay; very well sorted; brown (10YR 5/3).	770	Sandy clay (sC); clay and coarse sand; moderately sorted; yellowish brown (10YR 5/4).
490	Clay (C); clay; very well sorted; brown (10YR 5/3).	780	Sandy clay (sC); clay and coarse to very coarse sand; moderately sorted; yellowish brown (10YR 5/4).
500	Clay (C); clay; very well sorted; brown (10YR 5/3).	790	Clay (C); clay; very well sorted; brown (10YR 5/3).
510	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).	800	Sandy silt (sZ); silt and coarse to very coarse sand; moderately sorted; brown (10YR 5/3).
520	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).	810	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
530	Clay (C); clay; very well sorted; brown (10YR 4/3).	820	Sandy clay (sC); clay and coarse sand; moderately sorted; brown (10YR 5/3).
540	Clay (C); clay; very well sorted; brown (10YR 4/3).	830	Clay (C); clay; very well sorted; brown (10YR 5/3).
550	Clay (C); clay; very well sorted; brown (10YR 5/3).	840	Silty clay (M); clay and silt; well to very well sorted; brown (10YR 5/3).
560	Sandy clay (sC); clay and medium to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4).	850	Sandy clay (sC); clay and fine to medium sand; moderately to well sorted; brown (10YR 5/3).
570	Sandy silt (sZ); silt and very fine to medium sand; moderately sorted; yellowish brown (10YR 5/4).	860	Clay (C); clay; very well sorted; brown (10YR 5/3).
580	Sandy silt (sZ); silt and very fine to coarse sand; poorly sorted; yellowish brown (10YR 5/4).	870	Clay (C); clay; very well sorted; brown (10YR 5/3).
590	Sandy clay (sC); clay and fine to coarse sand; moderately to poorly sorted; yellowish brown (10YR 5/4).	880	Clay (C); clay; very well sorted; brown (10YR 5/3).
600	Sandy clay (sC); clay and coarse sand; moderately sorted; yellowish brown (10YR 5/4).	890	Sandy clay (sC); clay and medium sand; moderately to well sorted; brown (10YR 5/3).
610	Sandy clay (sC); clay and coarse sand; moderately sorted; yellowish brown (10YR 5/4).	900	Sandy clay (sC); clay and medium sand; moderately to well sorted; brown (10YR 5/3).
620	Clay (C); clay; very well sorted; grayish brown (10YR 5/2).	910	Sandy clay (sC); clay and medium sand; moderately to well sorted; brown (10YR 5/3).
630	Clay (C); clay; very well sorted; grayish brown (10YR 5/2).	920	Sandy clay (sC); clay and medium sand; moderately to well sorted; brown (10YR 5/3).
640	Clay (C); clay; very well sorted; grayish brown (10YR 5/2).	930	Sandy clay (sC); clay and medium sand; moderately to well sorted; brown (10YR 5/3).
650	Clay (C); clay; very well sorted; grayish brown (10YR 5/2).	940	Sandy silt (sZ); silt and very fine to medium sand; moderately sorted; brown (10YR 5/3).
660	Clay (C); clay; very well sorted; brown (10YR 5/3).	950	Sandy silt (sZ); silt and very fine to medium sand; moderately sorted; brown (10YR 5/3).
670	Sandy silt (sZ); silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3).	960	Sandy silt (sZ); silt and very fine to medium sand; moderately sorted; brown (10YR 5/3).
680	Sandy silt (sZ); silt and very fine to coarse sand; poorly sorted; brown (10YR 5/3).	970	No sample collected.
690	Clay (C); clay; very well sorted; yellowish brown (10YR 5/4).	980	No sample collected.
700	Clay (C); clay; very well sorted; yellowish brown (10YR 5/4).	990	No sample collected.
710	Clay (C); clay; very well sorted; yellowish brown (10YR 5/4).	1,000	No sample collected.

**Table 13B.** Lithologic SIEVE log for test well RDPS (15N/06E-33L1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 2,102 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, April 23, 2009. Total depth drilled, 1,000 feet. Screened intervals, 520–700 and 420–440 feet. **Abbreviations:** mm, millimeter; <, less than]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Sand (S); fine to very coarse sand with minor granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	240	260	Sand (S); very fine to coarse sand and minor clay; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
20	40	Sand (S); fine to coarse sand with trace granules to pebbles <10 mm; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	260	280	Clayey sand (cS); fine to medium sand and clay; moderately sorted; subangular to subrounded; brown (10YR 5/3).
40	60	Sand (S); fine to coarse sand with trace granules to pebbles <12 mm; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	280	300	Sand (S); very fine to very coarse sand; poorly sorted; brown (10YR 5/3).
60	80	Silty sand (zS); very fine to very coarse sand, silt and trace granules to pebbles <7 mm; poorly sorted; subangular to subrounded; brown (7.5YR 5/4 to 4/4).	300	320	Clayey sand (cS); very fine to medium sand and clay; moderately to poorly sorted; subangular to subrounded; pale brown (10YR 6/3).
80	100	Silty sand (zS); very fine to very coarse sand and silt; poorly sorted; subangular to subrounded; brown (7.5YR 5/4 to 4/4).	320	340	Sand (S); very fine to coarse sand; moderately to poorly sorted; subangular to subrounded; pale brown (10YR 6/3).
100	120	Sand (S); very fine to very coarse sand and trace granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/9).	340	360	Sand (S); very fine to coarse sand; moderately to poorly sorted; subangular to subrounded; pale brown (10YR 6/3).
120	140	Sand (S); very fine to coarse sand and trace granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/9).	360	380	Clayey sand (cS); fine to coarse sand and clay; moderately sorted; subangular to subrounded; pale brown (10YR 6/3).
140	160	Sand (S); very fine to coarse sand and trace granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/9).	380	400	Clayey sand (cS); fine to coarse sand and clay; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 5/3).
160	180	Sand (S); very fine to coarse sand and trace granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/9).	400	420	Sand (S); fine to coarse sand; well to moderately sorted; subangular to subrounded; brown (7.5YR 5/3).
180	200	Clayey sand (cS); very fine to very coarse sand and clay; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/9).	420	440	Silty sand (zS); very fine to very coarse sand and silt; poorly sorted; subangular to subrounded; brown (7.5YR 5/3).
200	220	Clayey sand (cS); very fine to very coarse sand and clay; poorly sorted; subangular to subrounded; brown (10YR 5/3).	440	460	Clayey sand (cS); very fine to medium sand and clay; moderately sorted; subangular to subrounded; brown (7.5YR 5/3).
220	240	Clay (C); clay with minor very fine to fine sand; well sorted; brown (10YR 5/3).	460	480	Clayey sand (cS); very fine to medium sand and clay; moderately sorted; subangular to subrounded; brown (7.5YR 5/3).
			480	500	Clayey sand (cS); very fine to medium sand and clay; moderately sorted; subangular to subrounded; brown (7.5YR 5/3).

**Table 13B.** Lithologic SIEVE log for test well RDPS (15N/06E-33L1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 2,102 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, April 23, 2009. Total depth drilled, 1,000 feet. Screened intervals, 520–700 and 420–440 feet. **Abbreviation:** mm, millimeter; <, less than]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
500	520	Clay (C); clay with minor very fine to medium sand; well sorted; brown (7.5YR 5/3).	760	780	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (7.5YR 4/4).
520	540	Clayey sand (cS); very fine to medium sand and clay; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/3).	780	800	Clayey silty sand (mS); very fine to coarse sand, silt, and clay; poorly sorted; subangular to rounded; brown (7.5YR 4/3).
540	560	Clayey sand (cS); very fine to very coarse sand and clay; poorly sorted; subangular to subrounded; brown (7.5YR 5/3).	800	820	Clayey silty sand (mS); very fine to coarse sand, silt, and clay; poorly sorted; subangular to rounded; brown (7.5YR 4/3).
560	580	Silty sand (zS); very fine to very coarse sand, silt, and trace granules; poorly sorted; subangular to subrounded; brown (7.5YR 5/3).	820	840	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (10YR 5/3).
580	600	Sand (S); very fine to coarse sand; poorly sorted; subangular to subrounded; brown (7.5YR 5/3).	840	860	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (10YR 5/3).
600	620	Sand (S); very fine to coarse sand with minor clay; poorly to moderately sorted; subangular to subrounded; brown (10YR 5/3).	860	880	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (10YR 5/3).
620	640	Clayey sand (cS); very fine to very coarse sand and clay; poorly sorted; subangular to subrounded; brown (10YR 5/3).	880	900	Sand (S); very fine to fine sand and minor clay; well sorted; subangular to subrounded; brown (10YR 5/3).
640	660	Sand (S); fine to coarse sand with minor silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).	900	920	Sand (S); very fine to coarse sand and minor clay; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
660	680	Sand (S); very fine to very coarse sand and minor silt; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 5/3).	920	940	Sand (S); very fine to coarse sand and minor clay; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
680	700	Sand (S); very fine to fine sand and minor silt; well sorted; subangular to subrounded; brown (7.5YR 4/4).	940	960	Sand (S); fine to medium sand with minor clay; well sorted; subangular to subrounded; brown (10YR 5/3).
700	720	Clayey silty sand (mS); very fine to fine sand with silt and clay; moderately to well sorted; subangular to subrounded; brown (7.5YR 4/4).	960	980	Silty sand (zS); very fine to medium sand and silt; moderately sorted; subangular to subrounded; brown (10YR 5/3).
720	740	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (7.5YR 4/4).	980	1,000	Sand (S); very fine to coarse sand; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
740	760	Clayey sand (cS); very fine to fine sand and clay; moderately to well sorted; subangular to subrounded; brown (7.5YR 4/4).			

**Table 14A.** Lithologic SHAKER log for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,243 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 20, 2012. Total depth drilled, 905 feet. Screened intervals, 820–840, 640–780 and 480–520 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Gravel (G); granules to very large pebbles with trace very coarse sand; very poorly sorted; very angular to rounded; brown (10YR 4/3); calcareous.	170	Gravel (G); granules to large pebbles with minor medium to very coarse sand; very poorly sorted; angular to subangular; brown (7.5YR 4/2).
20	Gravel (G); granules to large pebbles with minor very coarse sand; very poorly sorted; very angular to rounded; brown (10YR 4/3); calcareous.	180	Gravel (G); granules to large pebbles with minor coarse to very coarse sand; very poorly sorted; very angular to subangular; brown (7.5YR 4/3).
30	Gravel (G); granules to large pebbles with minor medium to very coarse sand; very poorly sorted; very angular to subrounded; dark yellowish brown (10YR 4/4).	190	Gravel (G); granules to large pebbles with minor coarse to very coarse sand; very poorly sorted; angular; dark grayish brown (10YR 4/2).
40	Gravel (G); granules to very large pebbles with minor clay and medium to very coarse sand; very poorly sorted; very angular to subrounded; brown (7.5YR 5/3).	200	Gravel (G); granules to medium pebbles with minor medium to very coarse sand; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
50	Gravel (G); granules to large pebbles with minor very coarse sand; very poorly sorted; angular to subrounded; light brown (7.5YR 6/4).	210	Gravel (G); granules to large pebbles with trace very coarse sand; moderately to poorly sorted; angular; dark grayish brown (10YR 4/2).
60	Gravel (G); granules to very large pebbles with minor very coarse sand; very poorly sorted; angular to subrounded; very dark gray (7.5YR 3/1).	220	Gravel (G); granules to large pebbles with trace very coarse sand; very poorly sorted; angular to subangular; dark gray (10YR 4/1).
70	Gravel (G); granules to very large pebbles with minor coarse to very coarse sand; very poorly sorted; angular to rounded; dark grayish brown (10YR 4/2).	230	Gravel (G); granules to large pebbles with trace medium to very coarse sand; moderately to poorly sorted; angular to subrounded; grayish brown (10YR 5/2).
80	Gravel (G); granules to very large pebbles with minor coarse to very coarse sand; very poorly sorted; angular to rounded; yellowish brown (10YR 5/4).	240	Gravel (G); granules to large pebbles with trace medium to very coarse sand; moderately to poorly sorted; angular to subangular; brown (7.5YR 5/2).
90	Gravel (G); granules to very large pebbles with minor coarse to very coarse sand; very poorly sorted; angular to subrounded; brown (10YR 4/3).	250	Gravel (G); granules to large pebbles with trace medium to very coarse sand; poorly to very poorly sorted; angular to subrounded; brown (7.5YR 5/2).
100	Gravel (G); granules to large pebbles with minor very coarse sand; very poorly sorted; angular to rounded; dark brown (7.5YR 3/2).	260	Gravel (G); granules to large pebbles with trace clay and medium to very coarse sand; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
110	Gravel (G); granules to large pebbles with minor very coarse sand; very poorly sorted; angular to subrounded; brown (7.5YR 5/2).	270	Gravel (G); granules to large pebbles with minor clay and medium to very coarse sand; very poorly sorted; angular to subangular; brown (7.5YR 5/4).
120	Gravel (G); granules to large pebbles with minor very coarse sand; very poorly sorted; angular to subrounded; very dark gray (5YR 3/1).	280	Gravel (G); granules to medium pebbles with minor clay and trace medium to very coarse sand; very poorly sorted; angular to subrounded; brown (7.5YR 5/3).
130	Gravel (G); granules to large pebbles with minor coarse to very coarse sand; very poorly sorted; angular to subrounded; dark gray (10YR 4/1).	290	Gravel (G); granules to large pebbles with minor clay and medium to very coarse sand; poorly to very poorly sorted; angular to subangular; brown (7.5YR 5/3).
140	Gravel (G); granules to large pebbles with minor coarse to very coarse sand; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	300	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; brown (7.5YR 5/3).
150	Gravel (G); granules to large pebbles with trace medium to very coarse sand; very poorly sorted; very angular to subangular; dark grayish brown (10YR 4/2).	310	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular to subangular; brown (7.5YR 5/3).
160	Gravel (G); granules to large pebbles; very poorly sorted; angular to subrounded; dark reddish gray (5YR 4/2).	320	Gravel (G); granules to large pebbles with minor clay and fine to very coarse sand; very poorly sorted; very angular to angular; light brown (7.5YR 6/3).

**Table 14A.** Lithologic SHAKER log for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,243 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 20, 2012. Total depth drilled, 905 feet. Screened intervals, 820–840, 640–780 and 480–520 feet.]

Depth (feet)	Description	Depth (feet)	Description
330	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; very angular to subangular; brown (7.5YR 5/3).	480	Gravel (G); granules to very large pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular to subangular; brown (7.5YR 5/3).
340	Gravel (G); granules to large pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/3).	490	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; moderately to very poorly sorted; angular; brown (7.5YR 5/2).
350	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/3).	500	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; brown (7.5YR 5/3).
360	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/3).	510	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; brown (7.5YR 5/3).
370	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/3).	520	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; brown (7.5YR 5/2).
380	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/2).	530	Gravel (G); granules to small pebbles with minor fine to very coarse sand and clay; poorly to very poorly sorted; angular; grayish brown (10YR 5/2).
390	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/2).	540	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; brown (10YR 5/3).
400	Gravel (G); granules to large pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/2).	550	Gravel (G); granules to medium pebbles with minor very coarse sand; poorly to very poorly sorted; angular; dark grayish brown (10YR 4/2).
404 1C shoe	Gravel (G); very large pebbles to cobbles with boulders; very poorly sorted; rounded; dusky red (2.5YR 3/2); rhyo-dacite to andesite cobbles (aphanitic with subhedral to anhedral quartz).	560	Gravel (G); granules to medium pebbles with minor medium to very coarse sand and trace clay; poorly to very poorly sorted; angular; grayish brown (10YR 5/2).
410	Gravel (G); granules to medium pebbles with trace clay and very coarse sand; poorly sorted; angular; brown (7.5YR 5/3).	570	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular; grayish brown (10YR 5/2).
420	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/2).	580	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to coarse sand; very poorly sorted; angular; brown (10YR 5/3).
430	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular to subangular; pinkish gray (7.5YR 6/2).	590	Gravel (G); granules to small pebbles with minor medium to very coarse sand and trace clay; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
440	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; light brown (7.5YR 6/3).	600	Gravel (G); granules to small pebbles with minor fine to very coarse sand and clay; poorly to very poorly sorted; angular; grayish brown (10YR 5/2).
450	Clayey gravel (mG); granules to small pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; pinkish gray (7.5YR 6/2).	610	Sandy gravel (sG); granules with medium to very coarse sand and trace clay; poorly to very poorly sorted; angular; grayish brown (10YR 5/2).
460	Gravel (G); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular; brown (7.5YR 5/2).	620	Sandy gravel (sG); granules to small pebbles with fine to very coarse sand and minor clay; poorly sorted; angular; grayish brown (10YR 5/2).
470	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; moderately to very poorly sorted; angular; brown (7.5YR 5/2).	624 2C shoe	No recovery.

**Table 14A.** Lithologic SHAKER log for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,243 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 20, 2012. Total depth drilled, 905 feet. Screened intervals, 820–840, 640–780 and 480–520 feet.]

Depth (feet)	Description	Depth (feet)	Description
630	Gravel (G); granules to medium pebbles; moderately to poorly sorted; angular to subangular; dark gray (10YR 4/1).	770	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
640	Gravel (G); granules to very large pebbles with trace very coarse sand; poorly sorted; angular to subangular; grayish brown (10YR 5/2); cobble fragments.	780	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
650	Gravel (G); granules to very large pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	790	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
660	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular to subrounded; grayish brown (10YR 5/2).	800	Clayey sandy gravel (msG); granules with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
670	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	810	Clayey sandy gravel (msG); granules with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
680	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular to subangular; brown (10YR 5/3).	820	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules; very poorly sorted; subangular to rounded; grayish brown (10YR 5/2).
690	Gravel (G); granules to medium pebbles with minor clay and fine to very coarse sand; poorly to very poorly sorted; very angular to subangular; brown (10YR 5/3).	830	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules; very poorly sorted; angular to subangular; brown (10YR 5/3).
700	Clayey gravel (mG); granules to medium pebbles with clay and minor fine to very coarse sand; very poorly sorted; very angular to subangular; brown (10YR 5/3).	840	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules; very poorly sorted; angular to subangular; brown (10YR 5/3).
710	Clayey gravel (mG); granules to small pebbles with clay and minor fine to very coarse sand; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	850	Gravelly clayey sand (gmS); fine to very coarse sand with clay and granules; very poorly sorted; angular to subangular; brown (10YR 4/3).
720	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	860	Gravelly sand (gS); medium to very coarse sand with granules and minor clay; poorly sorted; angular to subangular; brown (10YR 5/3).
730	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	870	Slightly gravelly sand ((g)S); coarse to very coarse sand with granules and minor clay; moderately to well sorted; angular; grayish brown (10YR 5/2).
740	Clayey sandy gravel (msG); granules to medium pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; brown (10YR 5/3).	880	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; angular; grayish brown (10YR 5/2).
750	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	890	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebbles; moderately to well sorted; angular; grayish brown (10YR 5/2).
760	Clayey sandy gravel (msG); granules to small pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	900	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles and minor clay; moderately to well sorted; angular to rounded; grayish brown (10YR 5/2).
		905	No recovery.
		3C shoe	

**Table 14B.** Lithologic SIEVE log for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,243 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 20, 2012. Total depth drilled, 905 feet. Screened intervals, 820–840, 640–780 and 480–520 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; subangular to angular; brown (10YR 4/3); calcareous.	240	260	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; subrounded to angular; brown (10YR 4/3); trace mica.
20	40	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; subangular to angular; dark yellowish brown (10YR 4/4); trace mica.	260	280	Gravelly silty sand (gmS); fine to coarse sand with granules to medium pebbles and silt; poorly sorted; subrounded to angular; brown (10YR 4/3).
40	60	Gravelly silty sand (gmS); medium to very coarse sand with granules to large pebbles, silt, and trace clay; very poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4).	280	300	Silty sand (zS); very fine to medium sand with silt and trace granules to small pebbles; moderately to poorly sorted; rounded to subangular; brown (10YR 4/3); trace mica.
60	80	Gravelly silty sand (gmS); medium to very coarse sand with granules to large pebbles and silt; poorly sorted; subrounded to angular; brown (10YR 4/3).	300	320	Silty sand (zS); very fine to medium sand with silt and trace granules; moderately to poorly sorted; subrounded to subangular; brown (10YR 4/3).
80	100	Gravelly silty sand (gmS); medium to very coarse sand with granules to large pebbles and silt; poorly sorted; subangular to subrounded; brown (10YR 4/3).	320	340	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).
100	120	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles; moderately to poorly sorted; subrounded to angular; brown (10YR 4/3).	340	360	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; subrounded to angular; brown (10YR 4/3).
120	140	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately to poorly sorted; subrounded to angular; brown (10YR 4/3).	360	380	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subrounded to angular; brown (10YR 4/3).
140	160	Silty gravelly sand (gmS); fine to coarse sand with granules to medium pebbles and silt; poorly sorted; subrounded to subangular; brown (10YR 4/3); trace mica.	380	400	Gravelly silty clayey sand (gmS); fine to coarse sand, silt, and clay with granules; very poorly sorted; subrounded to angular; brown (10YR 5/3).
160	180	Silty gravelly sand (gmS); fine to coarse sand with granules and silt; moderately to poorly sorted; subrounded to subangular; brown (10YR 4/3); trace mica.	400	404	No sample collected; cored interval.
180	200	Silty gravelly sand (gmS); fine to coarse sand with granules to small pebbles and silt; poorly sorted; subrounded to subangular; brown (10YR 4/3); trace mica.	404	420	Silty sand (zS); fine to coarse sand with silt and trace clay; moderately sorted; angular to subrounded; brown (10YR 4/3).
200	220	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; subrounded to angular; brown (10YR 4/3).	420	440	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subangular to angular; dark grayish brown (10YR 4/2); trace mica.
220	240	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; rounded to subangular; dark brown (10YR 3/3).	440	460	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; well to moderately sorted; subangular to angular; dark grayish brown (10YR 4/2); trace mica.
			460	480	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace mica.

**Table 14B.** Lithologic SIEVE log for test well NELT5 (16N/01E-35P1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,243 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 20, 2012. Total depth drilled, 905 feet. Screened intervals, 820–840, 640–780 and 480–520 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
480	500	Gravelly sand (gS); fine to coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace mica.	700	720	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
500	520	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; subangular to angular; brown (10YR 4/3); trace mica.	720	740	Silty sand (zS); fine to coarse sand with silt; moderately sorted; angular to subangular; brown (10YR 4/3); micaceous.
520	540	Sand (S); medium to very coarse sand with trace granules and trace silt; well to moderately sorted; subangular to angular; dark grayish brown (10YR 4/2).	740	760	Silty sand (zS); fine to coarse sand with silt; moderately sorted; angular to subrounded; brown (10YR 4/3); micaceous.
540	560	Sand (S); medium to very coarse sand with trace granules and trace silt; well to moderately sorted; angular to subrounded; brown (10YR 4/3).	760	780	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately sorted; angular to subangular; brown (10YR 4/3); trace mica.
560	580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 4/3).	780	800	Sand (S); fine to coarse sand with trace very coarse sand and silt; moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
580	600	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); trace mica.	800	820	Silty sand (zS); fine to coarse sand with silt; moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
600	620	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2).	820	840	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3); micaceous.
620	624	No sample collected; cored interval.	840	860	Silty sand (zS); fine to coarse sand with silt; moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
624	640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).	860	880	Silty sand (zS); fine to medium sand with silt and trace very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
640	660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); trace mica.	880	900	Silty sand (zS); fine to medium sand with silt and trace very coarse sand; well to moderately sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.
660	680	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark grayish brown (10YR 4/2); micaceous.	900	905	No sample collected; cored interval.
680	700	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; subangular to angular; brown (10YR 4/3); micaceous.			

**Table 15A.** Lithologic SHAKER log for multiple-well monitoring site NELT7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,172 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 865 feet. Screened intervals, 780–800, 620–640, and 380–400 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to medium pebbles and coarse to very coarse sand with trace large to very large pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3); slightly calcareous.	140	Gravelly sand (gS); very fine to very coarse sand, granules to small pebbles, and trace silt; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
20	Sandy gravel (sG); granules to medium pebbles and medium to very coarse sand with trace large pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.	150	Silty sand (zS); fine to coarse sand with silt and trace clay; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
30	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; angular to very angular; dark yellowish brown (10YR 4/4); slightly calcareous.	160	Sand (S); fine to very coarse sand and trace granules; moderately sorted; subangular to rounded; brown (10YR 5/3).
40	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	170	Sand (S); fine to coarse sand with trace granules to small pebbles; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4).
50	Gravelly clayey sand (gmS); medium to very coarse sand with clay, granules to small pebbles, and trace silt; very poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4).	180	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace very fine to fine sand; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3); mafic gravel.
60	Clayey sandy gravel (msG); granules to large pebbles with fine to very coarse sand and clay; very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4); calcareous.	190	Sand (S); medium to very coarse sand with trace granules and silt; moderately to poorly sorted; angular to subrounded; brown (10YR 5/3).
70	Gravelly clayey sand (gmS); medium to very coarse sand with clay, granules to small pebbles, and trace silt; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	200	Sand (S); medium to very coarse sand with trace granules and silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
80	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles and trace silt and clay; very poorly sorted; angular to subrounded; brown (10YR 4/3).	210	Sand (S); fine to coarse sand with trace granules and silt; moderately to poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
90	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; poorly to very poorly sorted; angular to subrounded; brown (10YR 5/3); calcareous.	220	Gravelly sand (gS); fine to coarse sand with granules to small pebbles and trace silt; poorly sorted; angular to subangular; brown (10YR 5/3).
100	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly to very poorly sorted; angular to subrounded; yellowish brown (10YR 5/4).	230	Sand (S); fine to coarse sand with trace granules and silt; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
110	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; poorly sorted; angular to subangular; dark brown (10YR 3/3).	240	Gravelly silty sand (gmS); fine to coarse sand with silt, granules, and trace clay; poorly sorted; angular to subrounded; yellowish brown (10YR 5/4).
120	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace silt; poorly sorted; angular to subrounded; brown (10YR 4/3).	250	Gravelly silty sand (gmS); fine to coarse sand with silt, granules, and trace clay; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4); slightly micaceous.
130	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	260	Gravelly clayey sand (gmS); fine to coarse sand with clay, granules to small pebbles, and trace silt; poorly sorted; angular to subangular; brown (10YR 5/3).
		270	Gravelly clayey sand (gmS); fine to coarse sand with clay, granules, and trace silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly micaceous.
		280	Gravelly clayey sand (gmS); medium to very coarse sand with clay, granules, and trace silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly micaceous.

**Table 15A.** Lithologic SHAKER log for multiple-well monitoring site NELT7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,172 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 865 feet. Screened intervals, 780–800, 620–640, and 380–400 feet.]

Depth (feet)	Description	Depth (feet)	Description
283 1C bottom	Clayey silty sand (mS); very fine to medium sand with silt and clay; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); micaceous.	440	Silty sand (zS); very fine to medium sand with silt; well sorted; angular to subrounded; grayish brown (10YR 5/2).
290	Clayey silty gravelly sand (gmS); medium to coarse sand with granules to small pebbles, silt, and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	450	Silty sand (zS); very fine to medium sand with silt; well sorted; angular to subrounded; grayish brown (10YR 5/2).
300	Clayey silty gravelly sand (gmS); fine to coarse sand with granules, silt, and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly micaceous.	460	Sandy clayey silt (sM); silt and clay with very fine to medium sand; moderately to well sorted; light olive brown (2.5Y 5/3).
310	Clayey sand (cS); fine to coarse sand with clay and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	470	Sandy clay (sC); clay with very fine to medium sand; well sorted; yellowish brown (10YR 5/4).
320	Clayey sand (cS); fine to coarse sand with clay and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	480	Sandy clay (sC); clay with very fine to medium sand; well sorted; brown (10YR 5/3).
330	Silty clayey sand (mS); fine to coarse sand with clay and silt; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	490	Sandy clay (sC); clay with very fine to medium sand and trace coarse sand; well to moderately sorted; yellowish brown (10YR 5/4).
340	Silty sand (zS); medium to very coarse sand with silt; well to moderately sorted; angular to subangular; brown (10YR 5/3).	500	Sandy clay (sC); clay with fine to medium sand; well sorted; light olive brown (2.5Y 5/3); slightly calcareous.
350	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3).	510	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately sorted; brown (10YR 5/3).
360	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; angular to subrounded; brown (10YR 5/3).	520	Clayey silty sand (mS); very fine to medium sand with silt, clay, and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
370	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; subangular to subrounded; brown (10YR 5/3); white sand.	523 2C bottom	Sandy silty clay (sM); clay with silt and very fine to medium sand; moderately to well sorted; yellowish brown (10YR 5/4).
380	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; subangular to subrounded; brown (10YR 5/3).	530	Gravelly clayey silty sand (gmS); fine to coarse sand with silt, clay, and granules; poorly sorted; angular to subangular; brown (10YR 5/3).
390	Silty sand (zS); very fine to medium sand with silt; well sorted; angular to subrounded; brown (10YR 5/3).	540	Sandy clayey silt (sM); silt and clay with very fine to medium sand and trace coarse sand; moderately sorted; brown (10YR 5/3); micaceous.
400	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; subangular to subrounded; dark grayish brown (10YR 4/2).	550	Gravelly clayey silty sand (gmS); fine to coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; brown (10YR 5/3).
410	Silty sand (zS); very fine to medium sand with silt; well to moderately sorted; subangular to subrounded; brown (10YR 5/3).	560	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace clay; very poorly sorted; angular to subangular; brown (10YR 5/3).
420	Silty sand (zS); fine to coarse sand with silt; well to moderately sorted; angular to subrounded; brown (10YR 5/3).	570	Silty sand (zS); medium to very coarse sand with silt; poorly sorted; angular to subangular; brown (10YR 5/3).
430	Silty sand (zS); fine to medium sand with silt; well sorted; angular to subangular; dark grayish brown (10YR 4/2).	580	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).
		590	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); slightly calcareous.

**Table 15A.** Lithologic SHAKER log for multiple-well monitoring site NELT7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,172 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 865 feet. Screened intervals, 780–800, 620–640, and 380–400 feet.]

Depth (feet)	Description	Depth (feet)	Description
600	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	740	Silty sand (zS); very fine to medium sand with silt, trace clay, and granules; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
610	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	750	Silty sand (zS); very fine to medium sand with silt, trace clay, and granules; poorly to very poorly sorted; angular to subangular; grayish brown (10YR 5/2); slightly calcareous.
620	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	760	Gravelly silty sand (gmS); fine to very coarse sand, silt, granules, and trace clay; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).
630	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	770	Silty sand (zS); fine to coarse sand with silt and trace granules; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).
640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	780	Gravelly sand (gS); fine to coarse sand with granules and trace silt; poorly sorted; angular to subangular; grayish brown (10YR 5/2).
650	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	790	Silty gravelly sand (gmS); medium to very coarse sand with granules and silt; poorly to very poorly sorted; subangular to subrounded; grayish brown (2.5Y 5/2).
660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	800	Gravelly silty sand (gmS); fine to coarse sand with silt and granules; poorly to very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).
670	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly to very poorly sorted; angular to subangular; grayish brown (2.5Y 5/2).	810	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
680	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	820	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).
690	Clayey silty sand (mS); fine to coarse sand with silt, clay, and trace granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	830	Gravelly sand (gS); medium to very coarse sand with granules and trace silt; moderately to poorly sorted; angular to subrounded; grayish brown (10YR 5/2).
700	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; very poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).	840	Silty gravelly sand (gmS); medium to very coarse sand with granules and silt; poorly sorted; angular to subrounded; grayish brown (10YR 5/2).
710	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	850	Silty gravelly sand (gmS); medium to very coarse sand with granules and silt; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
720	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules; very poorly sorted; angular to subangular; grayish brown (10YR 5/2).	860	Silty gravelly sand (gmS); medium to very coarse sand with granules to small pebbles and silt; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).
730	Silty sand (zS); fine to coarse sand with silt and trace granules; poorly sorted; angular to subrounded; grayish brown (10YR 5/2); trace mica.	860 3C top	Sandy gravel (sG); granules to very large pebbles with coarse to very coarse sand; moderately to poorly sorted; angular to subangular; very dark grayish brown (10YR 3/2).
		865 3C bottom	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace very fine to fine sand; moderately to poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.

**Table 15B.** Lithologic SIEVE log for multiple-well monitoring site NELT-7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,172 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 865 feet. Screened intervals, 780–800, 620–640, and 380–400 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	18	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/4); calcareous.	200	220	Silty sand (zS); very fine to coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3); calcareous; slightly micaceous.
18	40	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; subangular to subrounded; brown (7.5YR 4/4); slightly calcareous.	220	240	Silty sand (zS); very fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).
40	60	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; angular to subangular; brown (7.5YR 4/4); slightly calcareous.	240	260	Clayey sand (cS); very fine to medium sand with clay and trace granules; moderately to poorly sorted; angular to subrounded; brown (10YR 5/3); slightly calcareous.
60	80	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly to very poorly sorted; angular to subangular; brown (7.5YR 4/4); slightly calcareous.	260	280	Silty sand (zS); very fine to medium sand with clay, trace silt, and trace granules; moderately to poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); slightly micaceous.
80	100	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subrounded; brown (7.5YR 4/4); slightly calcareous.	280	300	Silty sand (zS); very fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly micaceous.
100	120	Sand (S); very fine to medium sand with trace granules; moderately to well sorted; angular to subangular; brown (7.5YR 4/3); slightly calcareous.	300	320	Silty sand (zS); very fine to coarse sand with clay, trace silt, and trace granules; moderately to poorly sorted; angular to subrounded; yellowish brown (10YR 5/4).
120	140	Sand (S); very fine to medium sand with trace granules; moderately to well sorted; angular to subangular; brown (7.5YR 4/3).	320	340	Silty sand (zS); very fine to coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
140	160	Silty sand (zS); very fine to medium sand with silt and trace granules; moderately sorted; angular to subrounded; brown (7.5YR 4/3); slightly calcareous; trace mica.	340	360	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subrounded to rounded; brown (10YR 4/3); slightly micaceous.
160	180	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (7.5YR 4/3); mafic sands and gravels; trace mica.	360	380	Silty sand (zS); very fine to coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).
180	200	Gravelly sand (gS); medium to very coarse sand with granules; moderately sorted; angular to subangular; brown (10YR 4/3); trace mafic sand; trace mica.	380	400	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subangular to subrounded; brown (10YR 4/3).

**Table 15B.** Lithologic SIEVE log for multiple-well monitoring site NELT-7 (16N/02E-16P1S, -16P2S, -16P3S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,172 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 14, 2011. Total depth drilled, 865 feet. Screened intervals, 780–800, 620–640, and 380–400 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
400	420	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subangular to subrounded; brown (10YR 4/3).	640	660	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3); slightly micaceous.
420	440	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subangular to subrounded; brown (10YR 4/3).	660	680	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).
440	460	Silty sand (zS); very fine to medium sand with silt and trace clay; moderately to well sorted; angular to subangular; brown (10YR 4/3).	680	700	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; grayish brown (10YR 5/2); calcareous.
460	480	Silty sand (zS); very fine to medium sand with silt and trace clay; moderately to well sorted; angular to subangular; brown (10YR 4/3).	700	720	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; grayish brown (10YR 5/2); slightly micaceous.
480	500	Silty sand (zS); very fine to medium sand with silt and trace clay; moderately to well sorted; subangular to subrounded; brown (10YR 4/3).	720	740	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; grayish brown (10YR 5/2); slightly micaceous.
500	520	Silty sand (zS); very fine to medium sand with silt, trace clay, and trace very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3).	740	760	Sand (S); fine to very coarse sand with trace granules; moderately sorted; angular to subangular; grayish brown (10YR 5/2).
520	540	Silty sand (zS); very fine to medium sand with silt, trace clay, and trace very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3); slightly micaceous.	760	780	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; grayish brown (10YR 5/2); slightly micaceous.
540	560	Silty sand (zS); very fine to coarse sand with silt and trace granules; moderately to poorly sorted; subangular to rounded; brown (10YR 4/3).	780	800	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; grayish brown (10YR 5/2).
560	580	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3).	800	820	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subrounded to rounded; grayish brown (10YR 5/2).
580	600	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subrounded; brown (10YR 4/3); slightly micaceous.	820	840	Silty sand (zS); very fine to medium sand with silt and trace coarse sand; moderately to well sorted; subangular to rounded; brown (10YR 5/3).
600	620	Silty sand (zS); fine to coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).	840	860	Silty sand (zS); very fine to medium sand with silt; moderately to well sorted; subangular to rounded; brown (10YR 5/3).
620	640	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).	860	865	No sample collected; cored interval.

**Table 16A.** Lithologic SHAKER log for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,097 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 25, 2011. Total depth drilled, 800 feet. Screened intervals, 720–740, 540–580, 360–360 and 260–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 3/4); slightly calcareous; trace gypsum.	140	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).
20	Sandy gravel (sG); granules to large pebbles and coarse to very coarse sand; well to moderately sorted; angular to subangular; dark olive brown (2.5Y 3/3); slightly calcareous; trace gypsum.	150	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; brown (10YR 4/3).
30	Gravelly sand (gS); very coarse sand with granules to medium pebbles; well to moderately sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous; trace gypsum.	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark brown (10YR 3/3).
40	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; well to moderately sorted; angular to subangular; dark brown (10YR 3/3).	170	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.
50	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark brown (10YR 3/3).	180	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebbles and trace silt; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
60	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).	190	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 5/3); slightly calcareous.
70	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace medium pebbles; well to moderately sorted; subangular to subrounded; brown (10YR 4/3).	200	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
80	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	210	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
90	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; poorly to very poorly sorted; angular to subangular; brown (10YR 5/3).	220	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous.
100	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebbles; well to moderately sorted; very angular to angular; dark brown (10YR 3/3); slightly calcareous; trace gypsum.	230	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.
110	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	240	Gravelly silty sand (gmS); fine to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3).
120	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).	250	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.
130	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous; trace gypsum.	260	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
		270	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.

**Table 16A.** Lithologic SHAKER log for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,097 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 25, 2011. Total depth drilled, 800 feet. Screened intervals, 720–740, 540–580, 360–360 and 260–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
275 1C shoe	Gravelly silty sand (gmS); fine to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous; trace gypsum.	410	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; very angular to angular; dark yellowish brown (10YR 3/4); trace microcrystalline quartz.
280	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	420	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand and trace large pebbles; well to moderately sorted; very angular to angular; dark yellowish brown (10YR 4/4); trace microcrystalline quartz.
290	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	430	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
300	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3).	440	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
310	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; brown (10YR 5/3); calcareous.	450	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
320	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 5/3); trace microcrystalline quartz.	460	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
330	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	465	Silty sandy gravel (msG); granules to large pebbles and fine to coarse sand with silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
340	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	2C shoe 470	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
350	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	480	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
360	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4); slightly calcareous.	490	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
370	Sandy gravel (sG); granules to medium pebbles with very coarse sand; well sorted; very angular to angular; dark yellowish brown (10YR 4/4).	500	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles and trace silt; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
380	Silty sandy gravel (msG); granules to medium pebbles with silt and very coarse sand; poorly sorted; very angular to angular; dark yellowish brown (10YR 4/4); trace microcrystalline quartz.	510	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
390	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately to well sorted; angular to subangular; yellowish brown (10YR 5/4).	520	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
400	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand and trace large pebbles; well to moderately sorted; very angular to angular; dark yellowish brown (10YR 3/4); trace microcrystalline quartz.	530	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).

**Table 16A.** Lithologic SHAKER log for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,097 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 25, 2011. Total depth drilled, 800 feet. Screened intervals, 720–740, 540–580, 360–360 and 260–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
540	Sandy clayey silt (sM); silt with clay, medium to very coarse sand and trace granules; poorly sorted; yellowish brown (10YR 5/4).	670	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
550	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebbles; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	680	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
560	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	690	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
570	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles and trace medium pebbles; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).	700	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	710	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
590	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	720	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
600	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	730	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles and trace silt; moderately sorted; angular to subangular; brown (10YR 5/3); trace microcrystalline quartz.
610	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	740	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; well to moderately sorted; angular to subangular; brown (10YR 5/3).
620	Silty gravelly sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	750	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
630	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	760	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	770	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
650	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	780	Clayey silty sand (mS); coarse to very coarse sand with silt, clay, and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	790	Clayey silty sand (mS); coarse to very coarse sand with silt, clay, and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
665 3C shoe	Slightly gravelly sandy silt ((g)sM); silt with fine to medium sand and granules to medium pebbles; poorly sorted; yellowish brown (10YR 5/4).	800	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).

**Table 16B.** Lithologic SIEVE log for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,097 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 25, 2011. Total depth drilled, 800 feet. Screened intervals, 720–740, 540–580, 360–360, and 260–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	18	Gravelly sand (gS); medium to very coarse sand with granules to large pebbles and trace fine sand; poorly sorted; subangular to subrounded; dark brown (10YR 3/3); calcareous.	200	220	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; dark yellowish brown (10YR 4/4).
18	40	Gravelly silty sand (gmS); fine to coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; dark brown (10YR 3/3); slightly calcareous; trace gypsum.	220	240	Gravelly sand (gS); fine to coarse sand with granules to small pebbles; moderately to poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
40	60	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous.	240	260	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
60	80	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous.	260	280	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous; trace gypsum.
80	100	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; subangular to subrounded; dark brown (10YR 3/3); slightly calcareous; trace caliche.	280	300	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
100	120	Silty sand (zS); medium to very coarse sand with silt; moderately to poorly sorted; subangular to subrounded; dark brown (10YR 3/3).	300	320	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.
120	140	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; dark brown (10YR 3/3).	320	340	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3).
140	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; dark brown (10YR 3/3).	340	360	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).
160	180	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); slightly calcareous; trace gypsum.	360	380	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; moderately sorted; very angular to angular; brown (10YR 4/3); trace microcrystalline quartz.
180	200	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous.	380	400	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; dark brown (7.5YR 3/3).

**Table 16B.** Lithologic SIEVE log for test well NELT3 (16N/02E-31H1S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,097 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 25, 2011. Total depth drilled, 800 feet. Screened intervals, 720–740, 540–580, 360–360, and 260–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
400	420	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles and trace large pebbles; moderately to poorly sorted; angular to subangular; brown (10YR 4/3); microcrystalline quartz.	600	620	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).
420	440	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to small pebbles, and trace medium pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3); trace microcrystalline quartz.	620	640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); slightly micaceous.
440	460	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).	640	660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
460	480	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subangular to subrounded; brown (10YR 4/3); microcrystalline quartz.	660	680	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
480	500	Gravelly silty sand (gmS); medium to very coarse sand with silt, granules to medium pebbles, and trace large pebbles; poorly sorted; angular to subangular; brown (10YR 4/3); microcrystalline quartz.	680	700	Gravelly sand (gS); medium to very coarse sand with granules to small pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).
500	520	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to large pebbles; poorly sorted; very angular to angular; brown (10YR 4/3).	700	720	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3); slightly micaceous.
520	540	Gravelly sand (gS); medium to very coarse sand with trace fine sand and granules to medium pebbles; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).	720	740	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
540	560	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; angular to subangular; brown (10YR 4/3).	740	760	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (10YR 5/3).
560	580	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; moderately sorted; subangular to subrounded; brown (10YR 4/3).	760	780	Silty sand (zS); medium to very coarse sand with silt and trace granules; moderately to poorly sorted; subangular to subrounded; brown (10YR 4/3).
580	600	Sand (S); medium to very coarse sand with trace fine sand; well sorted; subangular to subrounded; brown (10YR 4/3).	780	800	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; brown (10YR 4/3).

**Table 17A.** Lithologic SHAKER log for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,074 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 10, 2011. Total depth drilled, 803 feet. Screened intervals, 740–760 and 280–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
10	Silty sand (zS); medium to very coarse sand and silt; poorly sorted; angular to subangular; brown (7.5YR 5/4).	160	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
20	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 4/3).	170	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
30	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); calcareous.	180	Silty sand (zS); medium to very coarse sand with silt and trace granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
40	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3); calcareous.	190	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; brown (7.5YR 5/4).
50	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; moderately to well sorted; angular to subangular; dark brown (10YR 3/3); slightly calcareous.	200	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; brown (7.5YR 5/4).
60	Gravelly silty sand (gmS); coarse to very coarse sand and silt with granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4); calcareous.	203	Sandy clayey silt (sM); silt with clay and coarse to very coarse sand; moderately to poorly sorted; brown (7.5YR 5/4).
70	Silty sand (zS); medium to very coarse sand with silt; poorly sorted; angular to subangular; brown (10YR 5/3); slightly calcareous.	1C bottom	
80	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; brown (10YR 4/3); slightly calcareous.	210	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/4).
90	Gravelly sand (gS); coarse to very coarse sand with granules to small pebbles; well to moderately sorted; angular to subangular; brown (10YR 5/3).	220	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
100	Gravelly sand (gS); medium to very coarse sand with granules to medium pebbles; well to moderately sorted; angular to subangular; brown (10YR 5/3).	230	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
110	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	240	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
120	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	250	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
130	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	260	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
140	Gravelly silty sand (gmS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	270	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
150	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	280	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
		290	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).

**Table 17A.** Lithologic SHAKER log for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,074 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 10, 2011. Total depth drilled, 803 feet. Screened intervals, 740–760 and 280–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
300	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/4).	430	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to trace small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).
310	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/4).	440	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subangular; brown (7.5YR 5/3).
320	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles with trace large pebbles; poorly to very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	450	Clayey silty sand (mS); medium to very coarse sand with silt and clay; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
330	Gravelly clayey silty sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; angular to subangular; brown (7.5YR 5/4).	460	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
340	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	470	Silty gravelly sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
350	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	480	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; brown (7.5YR 5/3).
360	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	490	Gravelly clayey sand (gmS); coarse to very coarse sand with clay and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
370	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	500	Gravelly clayey sand (gmS); medium to very coarse sand with clay and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
380	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	510	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
390	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to medium pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	520	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
400	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to medium pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	530	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
410	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	540	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
420	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	550	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
423	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles with minor clay; poorly to very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	560	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
2C bottom		570	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).

**Table 17A.** Lithologic SHAKER log for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,074 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 10, 2011. Total depth drilled, 803 feet. Screened intervals, 740–760 and 280–300 feet.]

Depth (feet)	Description	Depth (feet)	Description
580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	700	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; very poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
590	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt, clay, and granules to small pebbles; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	710	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
600	Gravelly silty clayey sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	720	Silty clayey sand (mS); medium to very coarse sand with silt, clay, and trace granules to small pebbles; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
610	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	730	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
620	Silty sand (zS); medium to very coarse sand with silt; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	740	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
630	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	750	Gravelly silty clayey sand (gmS); coarse to very coarse sand with clay, silt, and granules; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
640	Clayey silty sand (mS); medium to very coarse sand with silt, clay, and trace granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	760	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
650	Silty clayey sand (mS); medium to very coarse sand with silt and clay; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	770	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	780	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).
670	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	790	Sand (S); medium to very coarse sand with trace granules; well sorted; angular to subangular; dark yellowish brown (10YR 4/4).
680	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	800	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
690	Gravelly silty clayey sand (gmS); medium to very coarse sand with clay, silt, and granules to small pebbles; very poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).	803 3C bottom	Slightly gravelly sandy silt ((g)sM); silt with medium to very coarse sand and granules to medium pebbles; moderately to poorly sorted; dark yellowish brown (10YR 4/4).

**Table 17B.** Lithologic SIEVE log for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,074 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 10, 2011. Total depth drilled, 803 feet. Screened intervals, 740–760 and 280–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (7.5YR 4/3).	220	240	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
20	40	Silty sand (zS); fine to coarse sand with silt; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/3); slightly calcareous.	240	260	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to large pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
40	60	Silty sand (zS); fine to coarse sand with silt and trace very coarse sand; moderately to poorly sorted; subangular to subrounded; brown (7.5YR 4/3); calcareous.	260	280	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
60	80	Silty sand (zS); medium to very coarse sand with silt and trace granules; poorly sorted; angular to subrounded; brown (7.5YR 4/3); calcareous.	280	300	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
80	100	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3); slightly calcareous.	300	320	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; well to moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
100	120	Sandy gravel (sG); medium to very coarse sand with granules to medium pebbles; moderately to well sorted; angular to subangular; brown (10YR 4/3).	320	340	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to large pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
120	140	Silty sandy gravel (msG); granules to medium pebbles with coarse to very coarse sand and silt; poorly sorted; angular to subangular; dark yellowish brown (10YR 4/4).	340	360	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
140	160	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; well to moderately sorted; angular to subangular; brown (7.5YR 4/4).	360	380	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
160	180	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	380	400	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
180	200	Gravelly silty sand (gmS); medium to very coarse sand and silt with granules to medium pebbles; moderately to poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	400	420	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
200	203	No sample collected; cored interval.	420	423	No sample collected; cored interval.
203	220	Sandy gravel (sG); medium to very coarse sand with granules to large pebbles; moderately to well sorted; angular to subangular; brown (7.5YR 5/4).			

**Table 17B.** Lithologic SIEVE log for multiple-well monitoring site NELT1 (16N/02E-34Q1S, -34Q2S), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,074 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, July 10, 2011. Total depth drilled, 803 feet. Screened intervals, 740–760 and 280–300 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
423	440	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	620	640	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
440	460	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	640	660	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
460	480	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	660	680	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
480	500	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	680	700	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
500	520	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	700	720	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
520	540	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	720	740	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
540	560	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).	740	760	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
560	580	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	760	780	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to medium pebbles; poorly sorted; angular to subrounded; brown (10YR 4/3).
580	600	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	780	800	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; brown (10YR 4/3).
600	620	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).	800	803	No sample collected; cored interval.

**Table 18A.** Lithologic SHAKER log for test well SBTW (31S/46E-05B1M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,041 feet. Drilled by U.S Geological Survey using mud-rotary drilling method, December 7, 2009. Total depth drilled, 600 feet. Screened intervals, 220–400 and 140–200 feet. *Italics* indicate interpretation based on geologist’s field observations, geophysical logs, and examination of drill cuttings.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to medium pebbles and medium to very coarse sand; poorly sorted; subrounded to subangular; dark yellowish brown (10YR 4/4).	140	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to small pebbles; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
20	Sandy gravel (sG); granules to medium pebbles and medium to very coarse sand; poorly sorted; subrounded to subangular; dark yellowish brown (10YR 4/4).	150	Silty sandy gravel (msG); granules to small pebbles, medium to very coarse sand, and silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
30	Sandy gravel (sG); granules to medium pebbles and medium to very coarse sand; poorly sorted; subrounded to subangular; light yellowish brown (10YR 6/4).	160	Silty sandy gravel (msG); granules, very coarse sand and silt; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
40	Sandy gravel (sG); granules to medium pebbles and medium to very coarse sand; poorly sorted; subrounded to subangular; light yellowish brown (10YR 6/4).	170	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
50	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; moderately sorted; subrounded to subangular; dark yellowish brown (10YR 4/4).	180–200	Silty sandy gravel (msG); granules to small pebbles with coarse to very coarse sand and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
60	Silty sandy gravel (msG); granules to medium pebbles, fine to very coarse sand, and silt; very poorly sorted; subrounded to subangular; dark yellowish brown (10YR 4/4).	Interval sample	
70	Gravelly sand (gS); very coarse sand and granules to medium pebbles; moderately to well sorted; subrounded to subangular; brown (10YR 5/3).	210	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; poorly to very poorly sorted; subrounded to subangular; black (10YR 2/1); <i>potential basaltic lava flow</i> .
80	Sandy gravel (sG); granules to medium sand and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; brown (10YR 5/3).	220	Gravelly clayey sand (gmS); coarse to very coarse sand with clay and granules to large pebbles; very poorly sorted; subrounded to subangular; brown (10YR 4/3).
90	Sandy gravel (sG); granules to medium sand and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; brown (10YR 5/3).	230	Slightly gravelly sandy clay ((g)sM); clay and medium to very coarse sand with minor granules; very poorly sorted; brown (10YR 4/3).
100	Sandy gravel (sG); granules to medium sand and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; brown (10YR 5/3).	240	Slightly gravelly sandy clay ((g)sM); clay and coarse to very coarse sand and granules to small pebbles; very poorly sorted; brown (10YR 4/3).
110	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to small pebbles; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	250	Gravelly clayey sand (gmS); fine to very coarse sand and clay and granules to medium pebbles; very poorly sorted; subrounded to subangular; brown (10YR 4/3).
120	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	260	Gravelly clayey sand (gmS); fine to very coarse sand and clay and granules to medium pebbles; very poorly sorted; subrounded to subangular; brown (10YR 4/3).
130	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to small pebbles; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	270	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 4/3).
		280	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to small pebbles; poorly sorted; subrounded to subangular; brown (10YR 4/3).
		290	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to small pebbles; poorly sorted; subrounded to subangular; brown (10YR 4/3).

**Table 18A.** Lithologic SHAKER log for test well SBTW (31S/46E-05B1M), Fort Irwin National Training Center, California.—Continued

[Altitude of land surface, approximately 3,041 feet. Drilled by U.S Geological Survey using mud-rotary drilling method, December 7, 2009. Total depth drilled, 600 feet. Screened intervals, 220–400 and 140–200 feet. *Italics* indicate interpretation based on geologist's field observations, geophysical logs, and examination of drill cuttings.]

Depth (feet)	Description	Depth (feet)	Description
300	Silty sandy gravel (msG); granules to medium pebbles, coarse to very coarse sand, and silt; poorly sorted; subrounded to subangular; brown (10YR 4/3).	460	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 5/3).
310	Gravelly silty sand (gmS); very coarse sand, silt, and granules to small pebbles; poorly sorted; subrounded to subangular; brown (10YR 4/3).	470	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 5/3).
320	Gravelly silty sand (gmS); very coarse sand, silt, and granules to small pebbles; poorly sorted; subrounded to subangular; brown (10YR 4/3).	480	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 5/3).
330	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; poorly sorted; subrounded to subangular; brown (10YR 4/3).	490	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
340	Sandy gravel (sG); granules to small pebbles and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; assorted colors.	500	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; reddish brown (5YR 5/3).
350	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately to well sorted; subrounded to subangular; assorted colors.	510	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to small pebbles; poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
360	Sandy gravel (sG); granules to small pebbles and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; assorted colors.	520	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
370	Sandy gravel (sG); granules to medium pebbles and coarse to very coarse sand; moderately to well sorted; subrounded to subangular; assorted colors.	530	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
380	Gravelly sand (gS); coarse to very coarse sand and granules; well to very well sorted; subrounded to subangular; assorted colors.	540	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
390	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules; poorly to very poorly sorted; subrounded to subangular; light yellowish brown (10YR 6/4).	550	Clayey sand (cS); fine to very coarse sand and clay; poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
400	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to subangular; pale brown (10YR 6/3).	560	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; grayish brown (10YR 5/2).
410	Gravelly clayey sand (gmS); fine to very coarse sand, clay, and granules; very poorly sorted; subrounded to subangular; pale brown (10YR 6/3).	570	Gravelly clay (gM); clay with granules to small pebbles; moderately to poorly sorted; brown (10YR 5/3).
420	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subrounded to subangular; brown (10YR 5/3).	580	Clayey sand (cS); medium to very coarse sand and clay; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).
430	Clayey sand (cS); medium to very coarse sand and clay; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).	590	Clayey sand (cS); medium to very coarse sand and clay; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).
440	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).	600	Clayey sand (cS); medium to very coarse sand and clay; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).
450	Silty sand (zS); medium to very coarse sand and silt; moderately to poorly sorted; subrounded to subangular; brown (10YR 5/3).		

**Table 18B.** Lithologic SIEVE log for test well SBTW (31S/46E-05B1M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,041 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, December 7, 2009. Total depth drilled, 600 feet. Screened intervals, 220–400 and 140–200 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
20	40	Gravelly sand (gS); fine to coarse sand and small pebbles; poorly sorted; subrounded to subangular; brown (10YR 5/3).	300	320	Slightly gravelly sand ((g)S); fine to very coarse sand with minor granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
40	60	Slightly gravelly sand ((g)S); fine to very coarse sand with small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	320	340	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
60	80	Gravelly sand (gS); medium to very coarse sand and small pebbles; poorly sorted; subrounded to subangular; brown (10YR 5/3).	340	360	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
80	100	Sand (S); very fine to very coarse sand; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	360	380	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
100	120	Gravelly sand (gS); very fine to coarse sand and small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	380	400	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
120	140	Gravelly sand (gS); very fine to coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	400	420	Sand (S); fine to very coarse sand; moderately to poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
140	160	Slightly gravelly sand ((g)S); fine to coarse sand and minor small to large pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	420	440	Clayey sand (cS); very fine to very coarse sand and clay; very poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
160	180	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	440	460	Sand (S); fine to very coarse sand; moderately to poorly sorted; subrounded to subangular; light yellowish brown (10YR 6/4).
180	200	Gravelly sand (gS); fine to very coarse sand and granules to medium pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	460	480	Gravelly sand (gS); fine to very coarse sand and granules; very poorly to poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
200	220	Gravelly sand (gS); fine to coarse sand and granules to small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	480	500	Gravelly sand (gS); fine to very coarse sand and granules; very poorly to poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
220	240	Slightly gravelly sand ((g)S); medium to very coarse sand and minor small to medium pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	500	520	Gravelly sand (gS); fine to very coarse sand and granules; very poorly to poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
240	260	Slightly gravelly sand ((g)S); fine to very coarse sand and minor granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	520	540	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; pale brown (10YR 6/3).
260	280	Slightly gravelly sand ((g)S); fine to coarse sand with minor granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	540	560	Gravelly sand (gS); very fine to very coarse sand and granules; very poorly sorted; subrounded to subangular; brown (10YR 5/3).
280	300	Slightly gravelly sand ((g)S); fine to very coarse sand with minor granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	560	580	Sand (S); fine to coarse sand; moderately to well sorted; subrounded to subangular; light brownish gray (10YR 6/2).
			580	600	Silty sand (zS); fine to very coarse sand and silt; poorly sorted; subrounded to subangular; brown (10YR 5/3).

**Table 19A.** Lithologic SHAKER log for multiple-well monitoring site SBMW (31S/46E-05B2M, -05B3M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,044 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2010. Total depth drilled, 298 feet. Screened intervals, 270–290 and 130–150 feet. *Italics* indicate interpretation based on geologist's field observations, geophysical logs, and examination of drill cuttings.]

Depth (feet)	Description	Depth (feet)	Description
10	Sandy gravel (sG); granules to large pebbles and medium to very coarse sand; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/6).	160	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
20	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	165	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4); <i>weathered basalt</i> .
30	Silty sand (zS); coarse to very coarse sand and silt; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).	170	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
40	Silty sandy gravel (msG); granules to small pebbles, coarse to very coarse sand, and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	180	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
50	Silty sand (zS); very fine and very coarse sand with silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	190	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to medium pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
60	Sandy clay (sC); clay and coarse sand; moderately sorted; yellowish brown (10YR 5/4).	200	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
70	Gravelly clayey sand (gmS); coarse to very coarse sand, clay, and granules to very large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	210	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
80	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	220	Gravelly clay (gM); clay and granules to small pebbles; moderately to poorly sorted; yellowish brown (10YR 5/4).
90	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	230	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
100	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	240	Gravelly clay (gM); clay and granules; moderately to poorly sorted; yellowish brown (10YR 5/4).
110	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	250	Gravelly clay (gM); clay and granules; moderately to poorly sorted; yellowish brown (10YR 5/4).
120	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	260	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
130	Gravelly clayey sand (gmS); coarse to very coarse sand, clay, and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	270	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
140	Silty sandy gravel (msG); granules to small pebbles, medium to very coarse sand, and silt; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	280	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
150	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	290	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subangular to angular; yellowish brown (10YR 5/4).
		298	Clayey sand (cS); coarse to very coarse sand and clay; moderately sorted; subangular to angular; yellowish brown (10YR 5/4).

**Table 19B.** Lithologic SIEVE log for multiple-well monitoring site SBMW (31S/46E-05B2M, -05B3M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,044 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, February 23, 2010. Total depth drilled, 298 feet. Screened intervals, 270–290 and 130–150 feet.]

Depth (feet)		Description	Depth (feet)		Description
From	To		From	To	
0	20	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; moderately to poorly sorted; subrounded to subangular; brown (7.5YR 5/4).	160	178	Clayey sandy gravel (msG); granules to medium pebbles, fine to coarse sand, and clay; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
20	40	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; moderately to poorly sorted; subrounded to subangular; brown (7.5YR 5/4).	178	198	Clayey sandy gravel (msG); granules to large pebbles, fine to coarse sand, and clay; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
40	60	Sand (S); fine to coarse sand; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).	198	218	Clayey sandy gravel (msG); granules to medium pebbles, fine to coarse sand, and clay; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
60	80	Slightly gravelly sand ((g)S); fine to coarse sand and small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	218	238	Gravelly silty sand (gmS); very fine to coarse sand, silt, and granules; poorly to very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
80	100	Slightly gravelly sand ((g)S); fine to coarse sand and small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	238	258	Silty sand (zS); very fine to very coarse sand and silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
100	120	Gravelly sand (gS); fine to very coarse sand and granules to large pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	258	278	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
120	140	Gravelly sand (gS); fine to very coarse sand and granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	278	298	Gravelly sand (gS); very fine to very coarse sand and granules; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
140	160	Sandy gravel (sG); granules to large pebbles and medium to very coarse sand; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).			

**Table 20A.** Lithologic SHAKER log for single-well monitoring site SBMC (31S/46E-05D1M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,041 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, November 17, 2009. Total depth drilled, 280 feet. Screened interval, 180–200 feet. Washed—sample was washed to remove fine grained material and drilling mud. *Italics* indicate interpretation based on geologist’s field observations, geophysical logs, and examination of drill cuttings.]

Depth (feet)	Description	Depth (feet)	Description
10	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	170	Silty sandy gravel (msG); granules to medium pebbles, coarse to very coarse sand, and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
20	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	180	Silty sandy gravel (msG); granules to medium pebbles, coarse to very coarse sand, and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
30	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	190	Silty sandy gravel (msG); granules to large pebbles, medium to very coarse sand, and silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
40	Sandy gravel (sG); granules to small pebbles and medium to very coarse sand; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	200	Silty sandy gravel (msG); granules to large pebbles, medium to very coarse sand, and silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
50	Gravelly sand (gS); medium to very coarse sand and granules; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	210	Silty sandy gravel (msG); granules to large pebbles, medium to very coarse sand, and silt; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
60	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	220	Silty sandy gravel (msG); granules and medium to very coarse sand with silt; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).
70	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and small pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	230	Silty sandy gravel (msG); granules and medium to very coarse sand with silt; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4); <i>weathered basalt?</i>
80	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).	240	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; moderately sorted; subangular to angular; very dark grayish brown (10YR 3/2); <i>weathered basalt.</i>
90	Silty sand (zS); coarse to very coarse sand and silt; well sorted; rounded to subrounded; yellowish brown (10YR 5/4).	250	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subangular to angular; very dark grayish brown (10YR 3/2); <i>weathered basalt.</i>
100	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).	260	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subangular to angular; very dark grayish brown (10YR 3/2); <i>weathered basalt.</i>
110	Silty sand (zS); coarse to very coarse sand and silt; well sorted; rounded to subrounded; yellowish brown (10YR 5/4).	270	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subangular to angular; very dark grayish brown (10YR 3/2); <i>weathered basalt.</i>
120	Silty sand (zS); medium to very coarse sand and silt; moderately sorted; subrounded to subangular; yellowish brown (10YR 5/4).	280	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subangular to angular; very dark grayish brown (10YR 3/2); <i>weathered basalt.</i>
130	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to large pebbles; poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).	280	Basalt; aphanitic; very dark gray (10YR 3/1).
140	Silty sand (zS); medium to coarse sand and silt; moderately sorted; rounded to subrounded; yellowish brown (10YR 5/4).	Washed	
150	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).		
160	Silty sandy gravel (msG); granules to medium pebbles, coarse to very coarse sand, and silt; moderately to poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).		

**Table 20B.** Lithologic SIEVE log for single-well monitoring site SBMC (31S/46E-05D1M), Fort Irwin National Training Center, California.

[Altitude of land surface, approximately 3,041 feet. Drilled by U.S. Geological Survey using mud-rotary drilling method, November 17, 2009. Total depth drilled, 280 feet. Screened intervals, 180–200 feet. *Italics* indicate interpretation based on geologist's field observations, geophysical logs, and examination of drill cuttings.]

Depth (feet)		Description
From	To	
0	20	Sand (S); fine to coarse sand with minor granules; moderately to poorly sorted; subangular to subrounded; yellowish brown (10YR 5/6).
20	40	Slightly gravelly sand ((g)S); very fine to coarse sand and granules to small pebbles; poorly sorted; subangular to rounded; yellowish brown (10YR 5/4).
40	60	Sand (S); fine to coarse sand, trace very coarse sand, and granules; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).
60	80	Gravelly sand (gS); very fine to coarse sand and granules to small pebbles with trace clay; poorly sorted; subangular to rounded; yellowish brown (10YR 5/4).
80	100	Sand (S); very fine to coarse sand and trace granules; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).
100	120	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules to small pebbles; poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
120	140	Sandy gravel (sG); granules to small pebbles and very fine to very coarse sand with trace silt; very poorly sorted; angular to rounded; yellowish brown (10YR 5/4).
140	160	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles with trace clay; very poorly sorted; subangular to subrounded; yellowish brown (10YR 5/4).
160	180	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles with trace clay; very poorly sorted; subangular to subrounded; light yellowish brown (10YR 6/4).
180	200	Gravelly sand (gS); very fine to coarse sand and granules to small pebbles with trace clay; very poorly sorted; subangular to subrounded; brown (10YR 5/3).
200	220	Sandy gravel (sG); granules to small pebbles and very fine to very coarse sand; poorly sorted; subangular to subrounded; pale brown (10YR 6/3).
220	240	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles with trace clay; very poorly sorted; angular to subrounded; pale brown (10YR 6/3); <i>weathered basalt?</i>
240	260	Sandy gravel (sG); granules to medium pebbles and fine to very coarse sand; very poorly sorted; angular to subrounded; very dark gray (10YR 3/1); <i>medium pebble weathered basalt fragments.</i>
260	280	Sand (S); very fine to very coarse sand; poorly sorted; angular to subangular; very dark gray (10YR 3/1); <i>very coarse sand weathered basalt fragments.</i>

**Table 21.** Summary of water-level data from monitoring and test wells, Fort Irwin National Training Center, California, 2012.

[Altitudes were interpolated from a topographic map. Water levels are from the most recent complete set of static water levels for each site. All water-level data for each well may be accessed via NWISWeb links on the right side of the table. Status codes for water level measurements: Z, Other conditions existed that would affect the measured water level. **Abbreviations:** hh:mm, hour:minute; mm/dd/yyyy, month/day/year; NAVD 88, North American Vertical Datum of 1988; NWIS, U.S. Geological Survey National Water Information System; PDT, Pacific daylight time; PST, Pacific standard time; #, number]

Common name	State well number	Perforated interval (feet below land surface)	Altitude of land-surface datum (NAVD 88)	Water-level date (mm/dd/yyyy)	Water-level time (24 hour) (hh:mm)	Water-level time datum	Water-level (feet below land surface)	Link to water levels in NWIS
Site LL04								
LL04 #1	12N/03E-01M1S	950–970	2,410	02/14/2012	09:20	PST	295.28	<a href="#">X</a>
Site LL04B								
LL04B #1	12N/03E-01M4S	470–490	2,410	02/14/2012	09:25	PST	295.46	<a href="#">X</a>
LL04B #2	12N/03E-01M5S	330–350	2,410	02/14/2012	09:30	PST	295.50	<a href="#">X</a>
Site CRTH2								
CRTH2 #1	13N/05E-08B1S	920–940	1,432	03/4/2012	08:30	PST	56.68	<a href="#">X</a>
*CRTH2 #2	13N/05E-08B2S	270–290	1,432	03/4/2012	08:35	PST	60.55	<a href="#">X</a>
Site CRTH1								
CRTH1 #1	13N/05E-28Q1S	1,240–1,260	1,577	02/23/2012	17:30	PST	195.91	<a href="#">X</a>
CRTH1 #2	13N/05E-28Q2S	700–720	1,577	02/23/2012	17:37	PST	200.14	<a href="#">X</a>
CRTH1 #3	13N/05E-28Q3S	235–255 175–195	1,577	02/23/2012	17:41	PST	160.55	<a href="#">X</a>
Site GOLD2								
GOLD2 #1	14N/01E-07R1S	420–440	3,107	03/27/2012	09:55	PDT	247.29	<a href="#">X</a>
GOLD2 #2	14N/01E-07R2S	330–350	3,107	03/27/2012	10:00	PDT	247.34	<a href="#">X</a>
**GOLD2 #3	14N/01E-07R3S	220–240	3,107	03/27/2012	10:05	PDT	218.04	<a href="#">X</a>
Site BLA5								
BLA5 #1	14N/03E-26K1S	320–340	2,345	03/27/2012	16:45	PDT	187.01	<a href="#">X</a>
BLA5 #3	14N/03E-26K3S	190–210	2,345	03/27/2012	16:50	PDT	186.17	<a href="#">X</a>
Site BLA5B								
BLA5B #1	14N/03E-26K4S	250–270	2,345	03/27/2012	16:55	PDT	186.84	<a href="#">X</a>
Site GOLD1								
GOLD1 #1	15N/01E-28R1S	650–670	3,058	03/29/2012	16:47	PDT	171.10	<a href="#">X</a>
GOLD1 #2	15N/01E-28R2S	560–580	3,058	03/29/2012	16:44	PDT	171.01	<a href="#">X</a>
GOLD1 #3	15N/01E-28R3S	350–370	3,058	03/29/2012	16:42	PDT	171.05	<a href="#">X</a>
Site GOLD1-T								
GOLD1-T #1	15N/01E-28R4S	620–680 300–420 260–280	3,064	03/25/2012	11:33	PDT	171.96	<a href="#">X</a>

**Table 21.** Summary of water-level data from monitoring and test wells, Fort Irwin National Training Center, California, 2012.

—Continued

[Altitudes were interpolated from a topographic map. Water levels are from the most recent complete set of static water levels for each site. All water-level data for each well may be accessed via NWISWeb links on the right side of the table. Status codes for water level measurements: Z, Other conditions existed that would affect the measured water level. **Abbreviations:** hh:mm, hour:minute; mm/dd/yyyy, month/day/year; NAVD 88, North American Vertical Datum of 1988; NWIS, U.S. Geological Survey National Water Information System; PDT, Pacific daylight time; PST, Pacific standard time; #, number]

Common name	State well number	Perforated interval (feet below land surface)	Altitude of land-surface datum (NAVD 88)	Water-level date (mm/dd/yyyy)	Water-level time (24 hour) (hh:mm)	Water-level time datum	Water-level (feet below land surface)	Link to water levels in NWIS
Site NELT6								
NELT6 #1	15N/02E-05N1S	760–840 500–560 400–460	3,139	03/29/2012	14:25	PDT	300.87	<a href="#">X</a>
Site NELT2								
NELT2 #1	15N/03E-06L1S	760–800	3,054	02/11/2012	16:38	PST	216.59	<a href="#">X</a>
NELT2 #2	15N/03E-06L2S	510–530	3,054	02/11/2012	16:45	PST	216.89	<a href="#">X</a>
NELT2 #3	15N/03E-06L3S	280–300	3,054	02/11/2012	16:50	PST	216.08	<a href="#">X</a>
Site NELT4								
NELT4 #1	15N/03E-08L1S	560–580 500–520 320–480	2,990	02/11/2012	16:00	PST	159.45	<a href="#">X</a>
Site CCT1								
CCT1 #1	15N/03E-25L1S	875–895	2,688	03/24/2012	11:09	PDT	527.25	<a href="#">X</a>
CCT1 #2	15N/03E-25L2S	730–750	2,688	03/24/2012	11:15	PDT	527.11	<a href="#">X</a>
CCT1 #3	15N/03E-25L3S	645–665	2,688	03/24/2012	11:19	PDT	526.96	<a href="#">X</a>
Site RDPS								
RDPS #1	15N/06E-33L1S	520–700 420–440	2,102	02/12/2012	13:34	PST	422.28	<a href="#">X</a>
Site NELT5								
NELT5 #1	16N/01E-35P1S	820–840 640–780 480–520	3,243	02/29/2012	14:04	PDT	380.44	<a href="#">X</a>

**Table 21.** Summary of water-level data from monitoring and test wells, Fort Irwin National Training Center, California, 2012.  
—Continued

[Altitudes were interpolated from a topographic map. Water levels are from the most recent complete set of static water levels for each site. All water-level data for each well may be accessed via NWISWeb links on the right side of the table. Status codes for water level measurements: Z, Other conditions existed that would affect the measured water level. **Abbreviations:** hh:mm, hour:minute; mm/dd/yyyy, month/day/year; NAVD 88, North American Vertical Datum of 1988; NWIS, U.S. Geological Survey National Water Information System; PDT, Pacific daylight time; PST, Pacific standard time; #, number]

Common name	State well number	Perforated interval (feet below land surface)	Altitude of land-surface datum (NAVD 88)	Water-level date (mm/dd/yyyy)	Water-level time (24 hour) (hh:mm)	Water-level time datum	Water-level (feet below land surface)	Link to water levels in NWIS
Site NELT7								
NELT7 #1	16N/02E-16P1S	780–800	3,172	03/05/2012	07:05	PST	293.82	<a href="#">X</a>
NELT7 #2	16N/02E-16P2S	620–640	3,172	03/05/2012	07:12	PST	293.77	<a href="#">X</a>
NELT7 #3	16N/02E-16P3S	380–400	3,172	03/05/2012	07:20	PST	279.82	<a href="#">X</a>
Site NELT3								
NELT3 #1	16N/02E-31H1S	720–740 540–580 360–460 260–300	3,097	03/21/2012	14:34	PDT	208.17	<a href="#">X</a>
Site NELT1								
NELT1 #1	16N/02E-34Q1S	740–760	3,074	03/21/2012	13:20	PDT	207.39	<a href="#">X</a>
NELT1 #2	16N/02E-34Q2S	280–300	3,074	03/21/2012	13:25	PDT	203.00	<a href="#">X</a>
Site SBTW								
SBTW #1	31S/46E-05B1M	220–400 140–200	3,041	02/24/2012	11:54	PST	119.39	<a href="#">X</a>
Site SBMW								
SBMW #1	31S/46E-05B2M	270–290	3,044	02/24/2012	11:44	PST	120.04	<a href="#">X</a>
SBMW #2	31S/46E-05B3M	130–150	3,044	02/24/2012	11:51	PST	119.88	<a href="#">X</a>
Site SBMC								
SBMC #1	31S/46E-05D1M	180–200	3,041	02/27/2012	12:10	PST	119.31	<a href="#">X</a>

\*Status code Z: high salinity formational water affected the grout and it infiltrated the sand-pack, water level may not be representative.

\*\*Status code Z: well in a perched zone and was not able to be fully developed, water level may not be representative.

**Table 22.** Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking-water benchmark level and type. Values in the table that exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific conductance, chloride, sulfate, and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Dissolved oxygen (mg/L) (00300) [na]	pH, unfiltered field (standard units) (00400) [<6.5 or >8.5 SMCL-US]	Specific conductance, unfiltered (µS/cm at 25°C) (00095) [1,600 SMCL-CA]	Alkalinity, filtered, inflection point method, field (mg/L as CaCO <sub>3</sub> ) (39086) [na]	Bicarbonate, filtered, inflection point, field (mg/L) (00453) [na]	TDS and major ions		
											Dissolved solids, residue on evaporation at 180°C, filtered (mg/L) (70300) [1,000 SMCL-CA]	Calcium, filtered (mg/L) (00915) [na]	Magnesium, filtered (mg/L) (00925) [na]
LL04 #1	12N/03E-01M1S	970	08/02/2011 20:00	PDT	BD	0.7	<b>8.8</b>	<b>2,310</b>	—	—	<b>1,330</b>	26.9 d	0.550 d
LL04B #1	12N/03E-01M4S	490	05/11/2011 12:15	PDT	BD	0.6	8.5	<b>2,350</b>	36	42	<b>1,450</b>	38.9	1.66
LL04B #2	12N/03E-01M5S	350	12/08/2011 13:30	PST	BD	2.9	<b>8.7</b>	1,590	114	133	970	12.1	1.56
CRTH2 #1	13N/05E-08B1S	940	12/06/2011 16:00	PST	BD	0.1	8.2	1,320	103	123	840	34.4	10.5
CRTH2 #2	13N/05E-08B2S	290	02/08/2012 16:00	PST	BD	8.3	8.1	<b>E 20,000</b>	59	E 71	<b>17,600</b>	476 d	56.6 d
CRTH1 #1	13N/05E-28Q1S	1,260	03/03/2012 18:10	PST	BD	0.3	<b>8.8</b>	<b>2,750</b>	31	E 34	<b>1,760</b>	37.1 d	0.353 d
CRTH1 #3	13N/05E-28Q3S	255	03/01/2012 17:00	PST	BD	6.6	8.3	<b>2,150</b>	103	122	<b>1,320</b>	17.2 d	4.23 d
GOLD2 #1	14N/01E-07R1S	440	03/21/2012 17:23	PDT	BD	0.6	8.3	876	66	E 80	579	59.1	6.17
GOLD2 #2	14N/01E-07R2S	350	03/21/2012 19:13	PDT	BD	2.1	8.4	1,050	89	E 105	738	36.9	4.44
BLA5 #1	14N/03E-26K1S	360	05/12/2011 12:50	PDT	BD	4.4	8.5	837	—	—	551	5.62	1.46
BLA5 #3	14N/03E-26K3S	210	12/08/2011 16:30	PST	BD	3.1	<b>8.9</b>	969	248	E 276	657	2.54	0.344
BLA5B #1	14N/03E-26K4S	270	05/12/2011 14:20	PDT	BD	7.5	8.1	781	—	—	542	18.1	4.36
GOLD1 #1	15N/01E-28R1S	670	11/01/2011 14:10	PDT	BD	5.9	7.5	<b>3,500</b>	80	98	<b>2,230</b>	187 d	80.7 d
GOLD1 #2	15N/01E-28R2S	580	11/01/2011 15:20	PDT	BD	2.1	7.8	<b>3,210</b>	167	202	<b>2,020</b>	129 d	48.2 d
GOLD1 #3	15N/01E-28R3S	370	11/01/2011 11:45	PDT	BD	6.7	7.5	<b>3,630</b>	84	102	<b>2,370</b>	200 d	75.3 d
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 11:30	PDT	295	0.7	8.4	<b>3,480</b>	76	90	<b>2,300</b>	190 d	75.0 d
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 13:30	PDT	360	0.6	7.8	<b>3,440</b>	75	90	<b>2,300</b>	191 d	77.4 d
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 15:30	PDT	380	0.6	<b>8.7</b>	<b>3,440</b>	78	E 90	<b>2,330</b>	191 d	77.9 d
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 17:30	PDT	590	1.4	7.6	<b>3,390</b>	79	96	<b>2,280</b>	184 d	78.5 d
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 14:00	PDT	BD	6.4	7.4	<b>3,490</b>	79	96	<b>2,340</b>	195 d	77.2 d

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking-water benchmark level and type. Values in the table that exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific conductance, chloride, sulfate, and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Dissolved oxygen (mg/L) (00300) [na]	pH, unfiltered, field (standard units) (00400) [ <b>&lt;6.5 or &gt;8.5</b> SMCL-US]	Specific conductance, unfiltered (µS/cm at 25°C) (00095) [1,600 SMCL-CA]	Field parameters		TDS and major ions			
									Alkalinity, filtered, inflection point method, field (mg/L as CaCO <sub>3</sub> ) (39086) [na]	Bicarbonate, filtered, inflection point, field (mg/L) (00453) [na]	Alkalinity, filtered, inflection point method, field (mg/L as CaCO <sub>3</sub> ) (39086) [na]	Dissolved solids, residue on evaporation at 180°C, filtered (mg/L) (70300) [1,000 SMCL-CA]	Calcium, filtered (mg/L) (00915) [na]	Magnesium, filtered (mg/L) (00925) [na]
NELT6 #1	15N/02E-05N1S	840	3/27/12 14:30	PDT	3480	—	8.9	883	193	219	590	24.8 d	7.13 d	
NELT6 #1	15N/02E-05N1S	840	3/27/12 16:50	PDT	2498	—	8.9	695	171	195	512	25.9	7.12	
NELT6 #1	15N/02E-05N1S	840	3/27/12 19:00	PDT	2750	0.8	7.7	708	166	201	507	26.9	7.32	
NELT6 #1	15N/02E-05N1S	840	3/27/12 17:30	PDT	BD	4.2	8.0	698	169	204	538	26.5	7.26	
NELT2 #1	15N/03E-06L1S	800	11/03/2011 18:30	PDT	BD	5.3	8.0	782	120	144	531	18.4	3.59	
*NELT2 #2	15N/03E-06L2S	530	01/13/2012 19:00	PST	BD	—	<b>9.4</b>	1,040	294	264	**692	22.6	3.18	
NELT2 #3	15N/03E-06L3S	300	11/04/2011 13:30	PDT	BD	9.6	8.3	784	149	177	580	13.6	2.24	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 12:40	PST	2350	0.5	<b>8.9</b>	750	136	E 161	501	18.5	4.00	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 14:45	PST	2410	0.6	<b>8.9</b>	760	136	E 156	504	19.4	4.13	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 16:00	PST	2490	0.4	<b>8.8</b>	749	139	158	508	19.5	4.12	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 17:20	PST	2550	0.4	<b>8.9</b>	758	140	168	508	18.9	4.01	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 13:40	PST	BD	7.0	8.0	753	137	166	509	18.9	4.09	
CCT1 #1	15N/03E-25L1S	895	03/24/2012 19:15	PDT	BD	3.7	8.0	931	263	316	648	12.5	3.31	
CCT1 #2	15N/03E-25L2S	750	03/25/2012 16:15	PDT	BD	7.5	8.1	1,020	—	—	733	10.8	3.65	
RDPS #1	15N/06E-33L1S	740	06/10/2009 12:40	PDT	2520	—	8.1	1,160	—	—	657	21.4	7.32	
RDPS #1	15N/06E-33L1S	740	06/10/2009 16:00	PDT	2587	0.3	8.1	1,230	—	—	689	20.7	6.42	
RDPS #1	15N/06E-33L1S	740	06/11/2009 11:00	PDT	2620	—	<b>8.9</b>	1,070	—	—	674	19.8	5.83	
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:45	PDT	2650	0.3	<b>8.9</b>	1,110	—	—	705	19.2	5.67	
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:30	PDT	BD	4.1	8.1	958	—	—	613	17.8	6.04	

**Table 22.** Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking-water benchmark level and type. Values in the table that exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific conductance, chloride, sulfate, and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Dissolved oxygen (mg/L) (00300) [na]	pH, unfiltered, field (standard units) (00400) [ <b>&lt;6.5</b> or <b>&gt;8.5</b> SMCL-US]	Specific conductance, unfiltered (µS/cm at 25°C) (00095) [1,600 SMCL-CA]	Field parameters		TDS and major ions			
									Alkalinity, filtered, inflection point method, field (mg/L as CaCO <sub>3</sub> ) (39086) [na]	Bicarbonate, filtered, inflection point, field (mg/L) (00453) [na]	Dissolved solids, residue on evaporation at 180°C, filtered (mg/L) (70300) [1,000 SMCL-CA]	Calcium, filtered (mg/L) (00915) [na]	Magnesium, filtered (mg/L) (00925) [na]	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 14:00	PST	3530	1.2	<b>8.7</b>	790	140	161	579	26.2	5.85	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 18:00	PST	2620	0.9	<b>8.7</b>	670	140	E 165	504	29.1	4.22	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 19:30	PST	2710	0.6	<b>8.8</b>	672	138	166	519	31.4	4.42	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 20:30	PST	2800	1.0	8.5	675	144	173	510	29.2	4.44	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 17:30	PST	BD	6.1	7.9	685	139	168	512	29.8	4.28	
NELT7 #1	16N/02E-16P1S	800	01/12/2012 17:05	PST	BD	1.7	<b>9.1</b>	691	133	E 136	431	2.58	0.234	
NELT7 #2	16N/02E-16P2S	640	01/12/2012 16:40	PST	BD	0.2	<b>9.2</b>	484	125	123	336	2.10	0.219	
NELT7 #3	16N/02E-16P3S	400	01/12/2012 18:35	PST	BD	9.1	<b>8.9</b>	488	149	166	379	4.26	0.545	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 11:30	PDT	3300	7.9	7.9	702	—	—	506	21.3	3.02	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 03:00	PDT	3355	0.2	<b>8.8</b>	792	—	—	—	26.9	5.50	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 04:30	PDT	3535	0.2	<b>8.7</b>	754	—	—	—	28.0	7.12	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 05:30	PDT	2715	0.2	<b>8.7</b>	852	—	—	623	34.9	8.97	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 10:30	PDT	BD	4.4	7.8	808	—	—	588	28.4	5.70	
NELT1 #1	16N/02E-34Q1S	760	11/03/2011 15:30	PDT	BD	2.0	8.0	958	142	172	660	16.0	2.54	
NELT1 #2	16N/02E-34Q2S	300	11/03/2011 17:00	PDT	BD	7.1	8.2	616	134	161	442	4.92	0.946	
SBTW #1	31S/46E-05B1M	400	03/03/2010 10:00	PST	BD	2.9	7.8	367	—	—	289	17.2	2.81	
SBMW #1	31S/46E-05B2M	290	03/03/2010 14:10	PST	BD	4.1	7.9	442	112	135	321	16.2	3.12	
SBMW #2	31S/46E-05B3M	150	03/03/2010 17:30	PST	BD	7.3	8.0	525	107	129	396	16.8	4.78	
SBMC #1	31S/46E-05D1M	200	03/03/2010 16:55	PST	BD	—	8.2	594	115	139	415	13.1	4.07	

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	TDS and major ions—Continued										Trace elements			
						filtered (mg/L) (00935) [na]	Potassium, filtered (mg/L) (00930) [na]	Sodium, filtered (mg/L) (71870) [na]	Bromide, filtered (mg/L) [na]	Chloride, filtered (mg/L) (00940) [500 SMCL-CA]	Fluoride, filtered (mg/L) (00950) [2 MCL-CA]	Silica, filtered (mg/L) (00955) [na]	Sulfate, filtered (mg/L) (00945) [500 SMCL-CA]	Aluminum, filtered (µg/L) (01106) [1,000 MCL-CA]	Barium, filtered (µg/L) (01005) [1,000 MCL-CA]	Chromium, filtered (µg/L) (01030) [50 MCL-CA]			
LL04 #1	12N/03E-01M1S	970	08/02/2011 20:00	PDT	BD	3.21 d	435 d	1.76 d	439 d	3.54 d	16.1 d	377 d	42.6	16.0 d	—				
LL04B #1	12N/03E-01M4S	490	05/11/2011 12:15	PDT	BD	5.30	449 d	1.35 d	374 d	1.19	13.9 d	481 d	14.9	19.1	—				
LL04B #2	12N/03E-01M5S	350	12/08/2011 13:30	PST	BD	4.16	309	0.784 d	218	1.79	18.4 d	277	79.5 d	7.4	—				
CRTH2 #1	13N/05E-08B1S	940	12/06/2011 16:00	PST	BD	8.47	227	0.300	132	1.66	51.6 d	304 d	12.2 n,d	15.0	—				
CRTH2 #2	13N/05E-08B2S	290	02/08/2012 16:00	PST	BD	54.7 d	4,700 d	1.52 d	2,130 d	2.27 d	31.2 d	9,760 d	<22.0 d	21.4 d	—				
CRTH1 #1	13N/05E-28Q1S	1,260	03/03/2012 18:10	PST	BD	5.02 d	536 d	1.21 d	425 d	12.7 d	36.8 d	649 d	24.9 d	16.2 d	—				
CRTH1 #3	13N/05E-28Q3S	255	03/01/2012 17:00	PST	BD	5.70 d	444 d	0.993 d	350 d	3.64 d	42.7 d	369 d	10.0	9.7 d	—				
GOLD2 #1	14N/01E-07R1S	440	03/21/2012 17:23	PDT	BD	5.96	111	0.326	73.0	1.04	27.8 d	247	9.1	10.7	—				
GOLD2 #2	14N/01E-07R2S	350	03/21/2012 19:13	PDT	BD	5.38	168	0.442 d	96.6	1.10	28.3 d	265	276	31.3	—				
BLA5 #1	14N/03E-26K1S	360	05/12/2011 12:50	PDT	BD	6.48	166	0.328	67.4	2.97 d	68.3 d	117	28.4	2.9	—				
BLA5 #3	14N/03E-26K3S	210	12/08/2011 16:30	PST	BD	3.40	215	0.317	62.4	4.30 d	80.5 d	116	28.9	3.6	—				
BLA5B #1	14N/03E-26K4S	270	05/12/2011 14:20	PDT	BD	10.6	143	0.324	64.5	3.06 d	79.6 d	113	5.1	21.0	—				
GOLD1 #1	15N/01E-28R1S	670	11/01/2011 14:10	PDT	BD	33.8 d	381 d	1.69 d	880 d	0.40	83.9 d	418 d	<4.4 d	25.6 d	—				
GOLD1 #2	15N/01E-28R2S	580	11/01/2011 15:20	PDT	BD	27.8 d	416 d	1.37 d	691 d	0.87	74.0 d	433 d	<11.0 d	33.5 d	—				
GOLD1 #3	15N/01E-28R3S	370	11/01/2011 11:45	PDT	BD	35.8 d	403 d	1.72 d	915 d	0.45	88.0 d	433 d	<4.4 d	29.0 d	—				
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 11:30	PDT	295	33.9 d	382 d	1.72 d	866 d	0.46	84.4 d	415 d	5.6 n,d	26.0 d	—				
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 13:30	PDT	260	34.9 d	386 d	1.69 d	861 d	0.43	83.7 d	414 d	<11.0 d	25.5 d	—				
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 15:30	PDT	280	34.8 d	386 d	1.69 d	862 d	0.42	83.4 d	415 d	<4.4 d	25.4 d	—				
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 17:30	PDT	290	33.9 d	370 d	1.67 d	842 d	0.42	81.8 d	404 d	<11.0 d	23.5 d	—				

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	TDS and major ions—Continued										Trace elements		
						filtered (mg/L) (00935) [na]	filtered (mg/L) (00930) [na]	filtered (mg/L) (71870) [na]	SMCL-CA [500]	Chloride, filtered (mg/L) (00940) [500]	SMCL-CA [500]	Fluoride, filtered (mg/L) (00950) [2 MCL-CA]	SMCL-CA [na]	Silica, filtered (mg/L) (00955) [na]	SMCL-CA [500]	Sulfate, filtered (mg/L) (00945) [500]	SMCL-CA [1,000]	Aluminum, filtered (µg/L) (01106) [1,000]
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 14:00	PDT	BD	36.0 d	386 d	1.72 d	<b>863 d</b>	0.45	84.7 d	415 d	< 11.0 d	25.5 d	—	—	—	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 14:30	PDT	3480	16.1 d	142 d	0.368	—	—	71.6 d	—	44.3 d	31 d	—	—	—	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 16:50	PDT	2498	19.1	96.9	0.271	—	—	—	—	48.8	47.5	—	—	—	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 19:00	PDT	2750	21.0	105	0.273	64.3	<b>0.45</b>	89.6 d	78.4	19.3	42.0	—	—	—	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 17:30	PDT	BD	19.9	101	0.272	63.4	<b>0.44</b>	87.6 d	75.9	6.8	43.4	—	—	—	—
NELT2 #1	15N/03E-06L1S	800	11/03/2011 18:30	PDT	BD	14.6	137	0.373	78.1	<b>3.40 d</b>	82.8 d	97.3	45.4 d	34.3	—	—	—	—
*NELT2 #2	15N/03E-06L2S	530	01/13/2012 19:00	PST	BD	7.42	219	0.359	74.6	<b>4.58</b>	82.5 d	149	<b>3,580 d</b>	65.8	6.6	—	—	—
NELT2 #3	15N/03E-06L3S	300	11/04/2011 13:30	PDT	BD	8.08	149	0.295	47.6	<b>3.76 d</b>	96.4 d	105	94.4 d	15.2	—	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 12:40	PST	2350	16.5	114 d	0.399	77.6	<b>3.07 d</b>	76.7 d	90.4	8.1	34.6	—	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 14:45	PST	2410	16.6	116 d	0.380	78.0	<b>3.08 d</b>	76.9 d	90.5	3.5 n	32.8	—	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 16:00	PST	2490	16.4	113 d	0.381	77.6	<b>3.06 d</b>	75.3 d	90.5	2.7 n	46.2	—	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 17:20	PST	2550	17.2	118 d	0.381	78.0	<b>3.07 d</b>	71.8 d	90.5	2.7 n	29.6	—	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 13:40	PST	BD	16.1	127 d	0.377	77.2	<b>3.11 d</b>	77.6 d	90.1	10.4	39.3	—	—	—	—
CCT1 #1	15N/03E-25L1S	895	03/24/2012 19:15	PDT	BD	12.3	186	0.288	60.2	<b>4.31 d</b>	81.8 d	94.3	51.1 d	42.4	—	—	—	—
CCT1 #2	15N/03E-25L2S	750	03/25/2012 16:15	PDT	BD	12.7	198	0.291 d	63.1	<b>3.96 d</b>	78.2 d	94.1	61.8	34.5	—	—	—	—
RDPS #1	15N/06E-33L1S	740	06/10/2009 12:40	PDT	2520	6.61	173	0.378	110	<b>3.73 d</b>	60.3 d	125	29.1	44.8	4.2	—	—	—
RDPS #1	15N/06E-33L1S	740	06/10/2009 16:00	PDT	2587	6.81	196	0.394	124	<b>3.88 d</b>	59.1 d	133	15.6	43.9	7.7	—	—	—
RDPS #1	15N/06E-33L1S	740	06/11/2009 11:00	PDT	2620	6.59	202	0.397	126	<b>4.88 d</b>	54.9 d	130	E 2.8 n	38.7	8.4	—	—	—
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:45	PDT	2650	6.24	201	0.397	130	<b>4.76 d</b>	54.3 d	133	E 3.6 n	34.5	9.0	—	—	—

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	TDS and major ions—Continued										Trace elements			
						filtered (mg/L) (00935) [na]	filtered (mg/L) (00930) [na]	filtered (mg/L) (71870) [na]	filtered (mg/L) (00940) [500 SMCL-CA]	fluoride filtered (mg/L) (00950) [2 MCL-CA]	silica filtered (mg/L) (00955) [na]	sulfate filtered (mg/L) (00945) [500 SMCL-CA]	aluminum filtered (µg/L) (01106) [1,000 MCL-CA]	barium filtered (µg/L) (01005) [1,000 MCL-CA]	chromium filtered (µg/L) (01030) [50 MCL-CA]				
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:30	PDT	BD	6.02	163	0.344	94.9	<b>3.96 d</b>	61.0 d	113	E 2.4 n	39.2	5.0				
NELT5 #1	16N/01E-35P1S	840	03/06/2012 14:00	PST	3530	17.3	133	0.367	63.5	0.75	78.3 d	110	< 6.6 d	24.4	—				
NELT5 #1	16N/01E-35P1S	840	03/06/2012 18:00	PST	3620	20.0	100	0.342	54.6	0.82	95.4 d	92.1	3.5 n	36.4	—				
NELT5 #1	16N/01E-35P1S	840	03/06/2012 19:30	PST	3710	21.9	107	0.342	53.9	0.79	96.5 d	92.4	< 6.6 d	44.0	—				
NELT5 #1	16N/01E-35P1S	840	03/06/2012 20:30	PST	3800	20.1	100	0.343	55.5	0.77	97.5 d	92.0	< 6.6 d	35.6	—				
NELT5 #1	16N/01E-35P1S	840	03/06/2012 17:30	PST	BD	20.2	102	0.335	53.8	0.82	95.8 d	92.4	8.1 n,d	36.1	—				
NELT7 #1	16N/02E-16P1S	800	01/12/2012 17:05	PST	BD	2.39	142	0.306	52.7	<b>14.6 d</b>	39.9 d	75.0	174	3.2	—				
NELT7 #2	16N/02E-16P2S	640	01/12/2012 16:40	PST	BD	1.98	102	0.165	23.8	<b>11.9 d</b>	40.3 d	36.5	201	2.0	—				
NELT7 #3	16N/02E-16P3S	400	01/12/2012 18:35	PST	BD	5.03	103	0.139	18.6	<b>9.26 d</b>	86.3 d	34.4	720	6.7	—				
NELT3 #1	16N/02E-31H1S	740	08/04/2011 11:30	PDT	3300	13.1	115	0.368	60.9	1.18	83.1 d	71.0	6.8	30.0	—				
NELT3 #1	16N/02E-31H1S	740	08/04/2011 03:00	PDT	3355	12.8	115	0.457 d	70.0	0.81	83.3 d	74.9	2.6 n	35.5	—				
NELT3 #1	16N/02E-31H1S	740	08/04/2011 04:30	PDT	3535	13.8	107	0.420 d	62.2	0.65	88.4 d	68.3	5.0	46.9	—				
NELT3 #1	16N/02E-31H1S	740	08/04/2011 05:30	PDT	3715	17.4	116	0.503 d	81.8	0.58	90.2 d	93.5	4.7	34.8	—				
NELT3 #1	16N/02E-31H1S	740	08/04/2011 10:30	PDT	BD	13.5	125	0.457 d	70.2	0.78	82.5 d	75.8	3.2 n	43.0	—				
NELT1 #1	16N/02E-34Q1S	760	11/03/2011 15:30	PDT	BD	8.94	187	0.214	33.5	<b>4.56 d</b>	80.4 d	215	14.7 d	17.9	—				
NELT1 #2	16N/02E-34Q2S	300	11/03/2011 17:00	PDT	BD	7.91	129	0.217	31.4	<b>4.88 d</b>	75.9 d	63.5	97.7 d	11.8	—				
SBTW #1	31S/46E-05B1M	400	03/03/2010 10:00	PST	BD	8.29	47.5	0.122	20.5	0.60	71.5	35.9	< 3.4	58.9	1.6				
SBMW #1	31S/46E-05B2M	290	03/03/2010 14:10	PST	BD	8.19	67.7	0.135	25.6	0.54	65.3 d	49.4	18.3	27.2	2.1				
SBMW #2	31S/46E-05B3M	150	03/03/2010 17:30	PST	BD	9.05	77.2	0.165	38.2	0.71	84.1 d	67.1	28.6	27.0	1.7				
SBMC #1	31S/46E-05D1M	200	03/03/2010 16:55	PST	BD	7.46	96.5	0.166	29.8	0.64	77.3 d	96.5	32.0	9.4	2.1				

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Iron, filtered (µg/L) (01046) [300 SMCL-CA]	Lithium, filtered (µg/L) (01130) [na]	Manganese, filtered (µg/L) (01056) [50 SMCL-CA]	Strontium, filtered (µg/L) (01080) [4,000 HAL-US]	Arsenic, filtered (µg/L) (01000) [10 MCL-US]	Boron, filtered (µg/L) (01020) [1,000 NL-CA]	Iodide, filtered (mg/L) (71865) [na]	Stable isotopes		
													Deuterium, unfiltered (per mil) (82082) [na]	Oxygen-18, unfiltered (per mil) (82085) [na]	Carbon-13, unfiltered (per mil) (82081) [na]
LL04 #1	12N/03E-01M1S	970	08/02/2011 20:00	PDT	BD	14.7 d	77.3 d	21.0 d	772 d	2.4	205 d	0.137 d	-89.70	-10.45	-8.70
LL04B #1	12N/03E-01M4S	490	05/11/2011 12:15	PDT	BD	< 3.2	62.1	29.9	1,340	6.3	<b>1,840 d</b>	0.103 d	-92.80	-10.60	-9.70
LL04B #2	12N/03E-01M5S	350	12/08/2011 13:30	PST	BD	14.9	66.4	1.81	397	<b>36.3 d</b>	<b>2,550 d</b>	0.070 d	-96.20	-11.47	-8.73
CRTH2 #1	13N/05E-08B1S	940	12/06/2011 16:00	PST	BD	< 3.2	145	10.3	1,530	<b>36.9 d</b>	<b>1,510 d</b>	0.148 d	-89.40	-11.07	-8.78
CRTH2 #2	13N/05E-08B2S	290	02/08/2012 16:00	PST	BD	44.7 n,d	6,500 d	<b>171 d</b>	<b>9,240 d</b>	<b>71.4 d</b>	<b>9,780 d</b>	2.34 d	—	—	—
CRTH1 #1	13N/05E-28Q1S	1,260	03/03/2012 18:10	PST	BD	26.4 d	E 650 d	5.48 d	1,200 d	<b>148 d</b>	<b>4,490 d</b>	0.321 d	-89.70	-10.48	-7.41
CRTH1 #3	13N/05E-28Q3S	255	03/01/2012 17:00	PST	BD	11.0 n,d	E 64.0 d	1.15 d	773 d	<b>19.4</b>	<b>2,070 d</b>	0.011 d	-96.20	-11.34	-5.69
GOLD2 #1	14N/01E-07R1S	440	03/21/2012 17:23	PDT	BD	7.3	E 11.2	22.1	673	1.1	590 d	0.079 d	-97.70	-12.45	-9.34
GOLD2 #2	14N/01E-07R2S	350	03/21/2012 19:13	PDT	BD	146	E 13.7	48.1	460	1.7	578 d	0.069 d	-99.80	-12.55	-10.21
BLA5 #1	14N/03E-26K1S	360	05/12/2011 12:50	PDT	BD	11.8	18.4	0.73	94.2	<b>33.3</b>	999 d	0.008	-95.10	-12.00	-8.12
BLA5 #3	14N/03E-26K3S	210	12/08/2011 16:30	PST	BD	18.5	14.8	0.62	45.4	<b>51.9</b>	967 d	0.010	-94.70	-11.87	-7.11
BLA5B #1	14N/03E-26K4S	270	05/12/2011 14:20	PDT	BD	4.7 n	33.9	0.81	306	<b>14.5</b>	995 d	0.005	-95.00	-12.02	-8.30
GOLD1 #1	15N/01E-28R1S	670	11/01/2011 14:10	PDT	BD	< 6.4 d	140 d	1.28 d	1,890 d	5.2 d	<b>1,010 d</b>	0.013 d	-95.80	-11.74	-7.35
GOLD1 #2	15N/01E-28R2S	580	11/01/2011 15:20	PDT	BD	< 6.4 d	124 d	29.3 d	1,220 d	9.3 d	977 d	0.068 d	-95.40	-11.68	-7.47
GOLD1 #3	15N/01E-28R3S	370	11/01/2011 11:45	PDT	BD	< 6.4 d	150 d	3.37 d	1,840 d	7.3 d	<b>1,120 d</b>	0.017 d	-95.40	-11.89	-7.68
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 11:30	PDT	<sup>2</sup> 95	12.5 n,d	E 77.4 d	2.10 d	1,710 d	4.8 d	<b>1,070 d</b>	—	-95.70	-11.77	—
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 13:30	PDT	<sup>3</sup> 60	9.3 n,d	E 73.4 d	1.56 d	1,750 d	4.7 d	<b>1,080 d</b>	—	-95.80	-11.73	-5.42
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 15:30	PDT	<sup>3</sup> 80	15.6 d	E 75.3 d	1.27 d	1,760 d	4.8 d	<b>1,080 d</b>	—	-94.60	-11.74	-6.30
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 17:30	PDT	<sup>2</sup> 90	7.0 n,d	E 74.9 d	1.38 d	1,730 d	4.1 d	<b>1,030 d</b>	—	-95.50	-11.77	-7.35

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

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Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Iron, filtered (µg/L) (01046) [300 SMCL-CA]	Lithium, filtered (µg/L) (01130) [na]	Manganese, filtered (µg/L) (01056) [50 SMCL-CA]	Strontium, filtered (µg/L) (01080) [4,000 HAL-US]	Arsenic, filtered (µg/L) (01000) [10 MCL-US]	Boron, filtered (µg/L) (01020) [1,000 NL-CA]	Iodide, filtered (mg/L) (71865) [na]	Stable isotopes		
													Deuterium, unfiltered (per mil) (82082) [na]	Oxygen-18, unfiltered (per mil) (82085) [na]	Carbon-13, unfiltered (per mil) (82081) [na]
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 14:00	PDT	BD	111 d	E 73.9 d	1.82 d	1,800 d	4.6 d	<b>1,090 d</b>	—	-95.30	-11.75	-7.36
NELT6 #1	15N/02E-05N1S	840	3/27/12 14:30	PDT	3480	127 d	E 39.6 d	6.17 d	279 d	<b>13.6 d</b>	<b>850 d</b>	< 0.001	-102	-13.04	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 16:50	PDT	2498	87.5	E 40.4	4.99	285	<b>18.1</b>	<b>818 d</b>	< 0.001	-105	-13.45	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 19:00	PDT	2750	12.9	E 41.6	0.95	299	<b>17.5 d</b>	<b>829 d</b>	0.008	-104	-13.48	—
NELT6 #1	15N/02E-05N1S	840	3/27/12 17:30	PDT	BD	83.0	E 41.8	10.8	296	<b>15.3</b>	<b>837 d</b>	0.015	-106	-13.52	—
NELT2 #1	15N/03E-06L1S	800	11/03/2011 18:30	PDT	BD	22.2	82.7	6.64	359	<b>45.2 d</b>	<b>1,250 d</b>	0.010	-101	-12.73	-8.05
*NELT2 #2	15N/03E-06L2S	530	01/13/2012 19:00	PST	BD	<b>2,330</b>	32.5	118	136	<b>69.0</b>	<b>1,830 d</b>	—	-103	-12.85	-9.52
NELT2 #3	15N/03E-06L3S	300	11/04/2011 13:30	PDT	BD	53.2	110	4.68	223	<b>26.3 d</b>	<b>1,300 d</b>	0.007	-99.90	-12.94	-8.19
NELT4 #1	15N/03E-08L1S	580	02/10/2012 12:40	PST	2350	8.8	76.5	1.64	357	<b>38.4</b>	<b>1,160 d</b>	0.004	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 14:45	PST	2410	4.1 n	76.2	0.85	367	<b>38.7</b>	<b>1,160 d</b>	0.004	—	—	—
NELT4 #1	15N/03E-08L1S	580	02/10/2012 16:00	PST	2490	< 3.2	77.0	1.26	374	<b>38.7</b>	<b>1,160 d</b>	0.004	—	—	-7.35
NELT4 #1	15N/03E-08L1S	580	02/10/2012 17:20	PST	2550	4.4 n	77.8	0.85	373	<b>37.6</b>	<b>1,160 d</b>	0.004	—	—	-6.97
NELT4 #1	15N/03E-08L1S	580	02/10/2012 13:40	PST	BD	37.2	77.2	1.79	360	<b>38.2</b>	<b>1,150 d</b>	0.004	—	—	-7.61
CCT1 #1	15N/03E-25L1S	895	03/24/2012 19:15	PDT	BD	23.3	E 50.9	122	193	<b>25.9 d</b>	<b>1,360 d</b>	0.063 d	-97.90	-12.32	-6.66
CCT1 #2	15N/03E-25L2S	750	03/25/2012 16:15	PDT	BD	47.9	E 48.6	<b>64.0</b>	165	<b>29.6</b>	<b>1,390 d</b>	0.122 d	-94.70	-12.10	-9.86
RDPS #1	15N/06E-33L1S	740	06/10/2009 12:40	PDT	2520	84.7	122	13.0	792	<b>50.9</b>	<b>1,320 d</b>	0.058 d	-95.00	-12.06	—
RDPS #1	15N/06E-33L1S	740	06/10/2009 16:00	PDT	2587	39.4	135	11.3	776	<b>68.1</b>	<b>1,380 d</b>	0.063 d	-95.60	-12.08	—
RDPS #1	15N/06E-33L1S	740	06/11/2009 11:00	PDT	2620	5.9	142	12.1	824	<b>63.4</b>	<b>1,340 d</b>	0.049 d	-95.50	-12.17	—
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:45	PDT	2650	10.4	143	9.06	795	<b>72.1</b>	<b>1,440 d</b>	0.050 d	-94.70	-12.10	-6.13

**Table 22.** Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbis, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbis datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbis) (00003)	Iron, filtered (µg/L) (01046) [300 SMCL-CA]	Lithium, filtered (µg/L) (01130) [na]	Manganese, filtered (µg/L) (01056) [50 SMCL-CA]	Strontium, filtered (µg/L) (01080) HAL-US	Arsenic, filtered (µg/L) (01000) [10 MCL-US]	Boron, filtered (µg/L) (01020) [1,000 NL-CA]	Iodide, filtered (mg/L) (71865) [na]	Stable isotopes		
													Deuterium, unfiltered (per mil) (82082) [na]	Oxygen-18, unfiltered (per mil) (82085) [na]	Carbon-13, unfiltered (per mil) (82081) [na]
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:30	PDT	BD	235	118	15.0	670	58.7	1,280 d	0.038 d	-95.60	-12.14	-7.22
NELT5 #1	16N/01E-35P1S	840	03/06/2012 14:00	PST	3530	300	E 44.1	18.2	361	21.0	1,040 d	0.050 d	-100	-12.50	—
NELT5 #1	16N/01E-35P1S	840	03/06/2012 18:00	PST	2620	5.4 n	E 48.1	4.41	428	43.4	1,120 d	0.004	-104	-12.79	—
NELT5 #1	16N/01E-35P1S	840	03/06/2012 19:30	PST	2710	5.5 n	E 49.9	4.50	465	41.4	1,050 d	0.003	-104	-12.93	—
NELT5 #1	16N/01E-35P1S	840	03/06/2012 20:30	PST	2800	5.6 n	E 48.8	1.86	436	41.4	1,090 d	0.004	-104	-12.90	-7.59
NELT5 #1	16N/01E-35P1S	840	03/06/2012 17:30	PST	BD	422	E 48.8	8.94	433	40.7	1,100 d	0.005	-104	-12.80	-7.80
NELT7 #1	16N/02E-16P1S	800	01/12/2012 17:05	PST	BD	71.8	274 d	4.02	27.5	150	1,110 d	0.048 d	-102	-13.11	-7.75
NELT7 #2	16N/02E-16P2S	640	01/12/2012 16:40	PST	BD	88.7	206	5.23	23.4	179	1,260 d	0.061 d	-102	-13.38	-8.27
NELT7 #3	16N/02E-16P3S	400	01/12/2012 18:35	PST	BD	306	109	11.1	87.0	44.2	696 d	0.002 n	-105	-13.66	-9.26
NELT3 #1	16N/02E-31H1S	740	08/04/2011 11:30	PDT	3300	14.2	95.6	1.32	389	51.0	1,280 d	0.004	-104	-12.93	-7.06
NELT3 #1	16N/02E-31H1S	740	08/04/2011 03:00	PDT	3355	9.5	93.3	10.3	412	31.0	964 d	0.002	-102	-12.80	—
NELT3 #1	16N/02E-31H1S	740	08/04/2011 04:30	PDT	2535	9.1	85.3	1.98	353	31.0	919 d	0.003	-103	-13.01	-7.69
NELT3 #1	16N/02E-31H1S	740	08/04/2011 05:30	PDT	2715	20.2	105	12.2	427	27.7	1,080 d	0.005	-103	-12.74	-6.47
NELT3 #1	16N/02E-31H1S	740	08/04/2011 10:30	PDT	BD	57.2	101	1.11	440	34.5	1,000 d	0.002	-102	-12.88	-8.13
NELT1 #1	16N/02E-34Q1S	760	11/03/2011 15:30	PDT	BD	4.7 n	61.0	0.91	181	59.0 d	1,690 d	0.020	-104	-12.77	-8.12
NELT1 #2	16N/02E-34Q2S	300	11/03/2011 17:00	PDT	BD	33.8	56.6	0.75	63.4	70.8 d	1,110 d	0.009	-103	-13.00	-6.92
SBTW #1	31S/46E-05B1M	400	03/03/2010 10:00	PST	BD	16.3	15.0	1.61	186	15.0	309	E 0.002 n	-98.30	-12.72	-9.48
SBMW #1	31S/46E-05B2M	290	03/03/2010 14:10	PST	BD	6.1	25.6	3.44	175	13.5	355	0.014	-97.80	-12.46	-9.08
SBMW #2	31S/46E-05B3M	150	03/03/2010 17:30	PST	BD	12.3	27.7	3.74	178	14.8	355	0.005	-94.40	-12.15	-6.19
SBMC #1	31S/46E-05D1M	200	03/03/2010 16:55	PST	BD	10.3	22.9	2.54	140	23.4	345	0.019	-96.60	-12.41	-7.15

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbis, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific day/light time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; †, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbis datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbis) (00003)	Radioisotopes				Nutrients				
						Carbon-14, filtered (percent modern) (49933) [na]	Tritium, unfiltered (pCi/L) (07000)	Ammonia, filtered (mg/L as N) (00608)	Nitrate + nitrite, filtered (mg/L as N) (00631)	Nitrite, filtered (mg/L as N) (00613)	NWIS water-quality link			
LI04 #1	12N/03E-01M1S	970	08/02/2011 20:00	PDT	BD	53.46	< 0.4	—	—	—	—	—	—	X
LI04B #1	12N/03E-01M4S	490	05/11/2011 12:15	PDT	BD	12.00	< 0.3	0.092	<b>12.7 d</b>	0.251 d	—	—	—	X
LI04B #2	12N/03E-01M5S	350	12/08/2011 13:30	PST	BD	20.06	< 0.5	0.046	8.49 d	0.007	—	—	—	X
CRTH2 #1	13N/05E-08B1S	940	12/06/2011 16:00	PST	BD	9.87	< 0.5	0.017 n	5.64 d	0.015	—	—	—	X
CRTH2 #2	13N/05E-08B2S	290	02/08/2012 16:00	PST	BD	—	—	0.351	0.384	0.185	—	—	—	X
CRTH1 #1	13N/05E-28Q1S	1,260	03/03/2012 18:10	PST	BD	11.06	< 0.4	0.054	< 0.040	0.003	—	—	—	X
CRTH1 #3	13N/05E-28Q3S	255	03/01/2012 17:00	PST	BD	4.95	< 0.5	< 0.010	4.64	< 0.001	—	—	—	X
GOLD2 #1	14N/01E-07R1S	440	03/21/2012 17:23	PDT	BD	8.37	—	< 0.010	< 0.040	< 0.001	—	—	—	X
GOLD2 #2	14N/01E-07R2S	350	03/21/2012 19:13	PDT	BD	18.37	—	< 0.010	0.062 n	0.033	—	—	—	X
BLA5 #1	14N/03E-26K1S	360	05/12/2011 12:50	PDT	BD	10.83	< 0.3	< 0.010	4.64	0.004	—	—	—	X
BLA5 #3	14N/03E-26K3S	210	12/08/2011 16:30	PST	BD	6.92	< 0.4	< 0.010	5.26 d	0.002	—	—	—	X
BLA5B #1	14N/03E-26K4S	270	05/12/2011 14:20	PDT	BD	11.29	< 0.3	< 0.010	4.67	0.003	—	—	—	X
GOLD1 #1	15N/01E-28R1S	670	11/01/2011 14:10	PDT	BD	22.26	< 0.4	0.016 n	5.23 d	0.002	—	—	—	X
GOLD1 #2	15N/01E-28R2S	580	11/01/2011 15:20	PDT	BD	18.71	< 0.4	0.044	3.30	0.272 d	—	—	—	X
GOLD1 #3	15N/01E-28R3S	370	11/01/2011 11:45	PDT	BD	22.87	—	0.017 n	5.09 d	0.004	—	—	—	X
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 11:30	PDT	295	—	—	< 0.010	5.58 d	< 0.001	—	—	—	X
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 13:30	PDT	360	22.49	—	< 0.010	5.54 d	< 0.001	—	—	—	X
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 15:30	PDT	380	22.22	—	< 0.010	5.59 d	< 0.001	—	—	—	X
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 17:30	PDT	390	22.51	—	< 0.010	5.62 d	< 0.001	—	—	—	X
GOLD1-T #1	15N/01E-28R4S	680	03/23/2012 14:00	PDT	BD	21.82	—	< 0.010	5.59 d	< 0.001	—	—	—	X
NELT6 #1	15N/02E-05N1S	840	3/27/12 14:30	PDT	3480	—	—	< 0.010	1.97	0.032	—	—	—	X
NELT6 #1	15N/02E-05N1S	840	3/27/12 16:50	PDT	3498	—	—	< 0.010	1.73	0.002 n	—	—	—	X

**Table 22.** Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mg/L as N, milligram per liter as nitrogen; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Radioisotopes				Nutrients			
						Carbon-14, filtered (percent modern) (49933) [na]	Tritium, unfiltered (pCi/L) (07000) [20,000 MCL-CA]	Ammonia, filtered (mg/L as N) (00608) [30 HAL-US]	Nitrate + nitrite, filtered (mg/L as N) (00631) [10 MCL-US]	Nitrite, filtered (mg/L as N) (00613) [1 MCL-US]	NWIS water-quality link		
NELT6 #1	15N/02E-05N1S	840	3/27/12 19:00	PDT	750	—	—	<0.010	1.79	0.002		X	
NELT6 #1	15N/02E-05N1S	840	3/27/12 17:30	PDT	BD	—	—	<0.010	1.74	0.003		X	
NELT2 #1	15N/03E-06L1S	800	11/03/2011 18:30	PDT	BD	12.26	—	0.018 n	2.69	0.006		X	
*NELT2 #2	15N/03E-06L2S	530	01/13/2012 19:00	PST	BD	4.46	—	—	—	—		X	
NELT2 #3	15N/03E-06L3S	300	11/04/2011 13:30	PDT	BD	12.49	—	0.013 n	4.55	0.009		X	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 12:40	PST	350	—	—	<0.010	2.99	<0.001		X	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 14:45	PST	410	—	—	<0.010	2.97	<0.001		X	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 16:00	PST	490	19.80	<0.3	<0.010	3.00	<0.001		X	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 17:20	PST	550	20.50	<0.3	<0.010	2.93	0.001 n		X	
NELT4 #1	15N/03E-08L1S	580	02/10/2012 13:40	PST	BD	18.77	0.5	<0.010	2.98	<0.001		X	
CCT1 #1	15N/03E-25L1S	895	03/24/2012 19:15	PDT	BD	16.92	—	0.028	0.452	0.011		X	
CCT1 #2	15N/03E-25L2S	750	03/25/2012 16:15	PDT	BD	27.44	—	0.029	0.586	0.013		X	
RDPS #1	15N/06E-33L1S	740	06/10/2009 12:40	PDT	520	—	—	<0.020	5.63 d	0.032		X	
RDPS #1	15N/06E-33L1S	740	06/10/2009 16:00	PDT	587	—	—	<0.020	6.07 d	0.042		X	
RDPS #1	15N/06E-33L1S	740	06/11/2009 11:00	PDT	620	—	—	E 0.010 n	6.43 d	0.059		X	
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:45	PDT	650	12.24	—	E 0.010 n	6.48 d	0.064		X	
RDPS #1	15N/06E-33L1S	740	06/11/2009 12:30	PDT	BD	12.83	<0.3	<0.020	5.48 d	0.019		X	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 14:00	PST	530	—	—	0.034	3.82	0.191		X	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 18:00	PST	620	—	—	<0.010	3.77	<0.001		X	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 19:30	PST	710	—	—	<0.010	3.54	<0.001		X	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 20:30	PST	800	9.67	<0.3	0.012 n	3.19	<0.001		X	
NELT5 #1	16N/01E-35P1S	840	03/06/2012 17:30	PST	BD	9.24	<0.3	0.016 n	3.80	0.004		X	

**Table 22. Summary of water-quality data from monitoring and test wells at the Fort Irwin National Training Center, San Bernardino County, California, 2009–12.—Continued**

[Wells are listed in order by state well number. The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. The information below the parameter code in brackets is the drinking water benchmark level and type. Values in the table which exceed the benchmark level are in **bold**. Maximum contaminant level (MCL) benchmarks are listed as MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. The upper secondary MCL was used for specific-conductance, chloride, sulfate and total dissolved solids. **Abbreviations:** b, value extrapolated at low end; BD, bulk discharge; d, sample was diluted before analysis; E, estimated or having a higher degree of uncertainty; fbls, feet below land surface; HAL-US, U.S. Environmental Protection Agency (USEPA) lifetime health advisory level; MCL-CA, California Department of Public Health (CDPH) MCL; MCL-US, USEPA MCL; mg/L, milligram per liter; mm/dd/yyyy hh:mm, month/day/year hour:minute; n, result was below the laboratory reporting level but above the long-term method detection limit; na, not available; NL-CA, CDPH notification level; NWIS, U.S. Geological Survey National Water Information System; pCi/L, picocurie per liter; PDT, Pacific daylight time; PST, Pacific standard time; SMCL-CA, CDPH secondary MCL; SMCL-US, USEPA secondary MCL; TDS, total dissolved solids; °C, degrees Celsius; —, not analyzed; #, number; <, less than; >, greater than; +, plus; µg/L, microgram per liter; µS/cm, microSiemen per centimeter; δ, delta; \*, analytical values may be unrepresentatively high due to a filter break during sampling; \*\*, value is calculated using linear regression based on the other measured values for the same analysis from this sample set]

Common name	State well number	Well depth (fbls datum)	Date and time (mm/dd/yyyy hh:mm)	Time datum	Sampling depth <sup>1</sup> (fbls) (00003)	Radioisotopes				Nutrients			
						Carbon-14, filtered (percent modern) (49933) [na]	Tritium, unfiltered (pCi/L) (07000) [20,000 MCL-CA]	Ammonia, filtered (mg/L as N) (00608) [30 HAL-US]	Nitrate + nitrite, filtered (mg/L as N) (00631) [10 MCL-US]	Nitrite, filtered (mg/L as N) (00613) [1 MCL-US]	NWIS water-quality link		
NELT7 #1	16N/02E-16P1S	800	01/12/2012 17:05	PST	BD	2.90	<0.3	0.036	2.30	0.041		X	
NELT7 #2	16N/02E-16P2S	640	01/12/2012 16:40	PST	BD	1.27	<0.3	—	—	—		X	
NELT7 #3	16N/02E-16P3S	400	01/12/2012 18:35	PST	BD	3.77	<0.3	0.017 n	2.47	0.015		X	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 11:30	PDT	3300	7.28	<0.5	<0.010	7.20 d	0.005		X	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 03:00	PDT	3355	—	—	<0.010	<b>21.2 d</b>	0.001 b,n		X	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 04:30	PDT	3535	7.55	<0.4	<0.010	<b>21.2 d</b>	0.003		X	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 05:30	PDT	3715	2.64	<0.5	<0.010	<b>21.3 d</b>	0.003		X	
NELT3 #1	16N/02E-31H1S	740	08/04/2011 10:30	PDT	BD	10.91	<0.4	<0.010	<b>21.2 d</b>	0.002 b,n		X	
NELT1 #1	16N/02E-34Q1S	760	11/03/2011 15:30	PDT	BD	11.30	—	0.028	3.86	0.010		X	
NELT1 #2	16N/02E-34Q2S	300	11/03/2011 17:00	PDT	BD	14.03	—	<0.010	4.33	<0.001		X	
SBTW #1	31S/46E-05B1M	400	03/03/2010 10:00	PST	BD	—	<0.4	<0.020	2.48	0.004		X	
SBMW #1	31S/46E-05B2M	290	03/03/2010 14:10	PST	BD	23.39	<0.3	0.026	3.05	0.240 d		X	
SBMW #2	31S/46E-05B3M	150	03/03/2010 17:30	PST	BD	43.94	0.4	E 0.018 n	3.12	0.148		X	
SBMC #1	31S/46E-05D1M	200	03/03/2010 16:55	PST	BD	36.05	0.3	0.044	2.92	0.173		X	

<sup>1</sup> The depth-dependent samples represent a composite of all flow entering the perforated interval below the sample point if the pump intake of the test well was above the sample point or a composite of all flow entering the perforated interval above the sample point if the pump intake was below the sample point.

<sup>2</sup> Pump intake was above the sample depth. Water-quality samples collected at each depth are a composite sample and represent water quality from the sampled depth to the bottom of the screened interval, under pumping conditions using a small-diameter pump as described by Izbiccki (2004).

<sup>3</sup> Pump intake was below sample depth. Water-quality samples collected at each depth are a composite sample and represent water quality from the sampled depth to the top of the screened interval, under pumping conditions using a small-diameter pump as described by Izbiccki (2004).

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