

Prepared in cooperation with the San Bernardino Valley Municipal Water District

## Geohydrologic and Water-Quality Data in the Vicinity of the Rialto-Colton Fault, San Bernardino, California



Data Series 813

**Cover.** The Rialto-Colton area looking northwest towards the San Gabriel Mountains. (Photograph by Anthony Brown, U.S. Geological Survey)

# **Geohydrologic and Water-Quality Data in the Vicinity of the Rialto-Colton Fault, San Bernardino, California**

By Nick Teague, Anthony A. Brown, and Linda R. Woolfenden

Prepared in cooperation with the San Bernardino Valley Municipal Water District  
West Valley Water District

Data Series 813

**U.S. Department of the Interior  
U.S. Geological Survey**

**U.S. Department of the Interior**  
SALLY JEWELL, Secretary

**U.S. Geological Survey**  
Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2014

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment, visit <http://www.usgs.gov> or call 1–888–ASK–USGS.

For an overview of USGS information products, including maps, imagery, and publications, visit <http://www.usgs.gov/pubprod>

To order this and other USGS information products, visit <http://store.usgs.gov>

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this information product, for the most part, is in the public domain, it also may contain copyrighted materials as noted in the text. Permission to reproduce copyrighted items must be secured from the copyright owner.

Suggested citation:

Teague, Nick, Brown, A..A., and Woolfenden, L.R., 2014, Geohydrologic and water-quality data in the vicinity of the Rialto-Colton Fault, San Bernardino, California: U.S. Geological Survey Data Series 813, 76 p., <http://dx.doi.org/10.3133/ds813>.

ISSN 2327-638X (online)

## 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	0.004047	square kilometer (km <sup>2</sup> )
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>Volume</b>		
ounce, fluid (fl. oz)	29.57	milliliter (mL)
ounce, fluid (fl. oz)	0.02957	liter (L)

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

$$^{\circ}\text{F}=(1.8\times^{\circ}\text{C})+32$$

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

Altitude, as used in this report, refers to distance above the vertical datum.

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

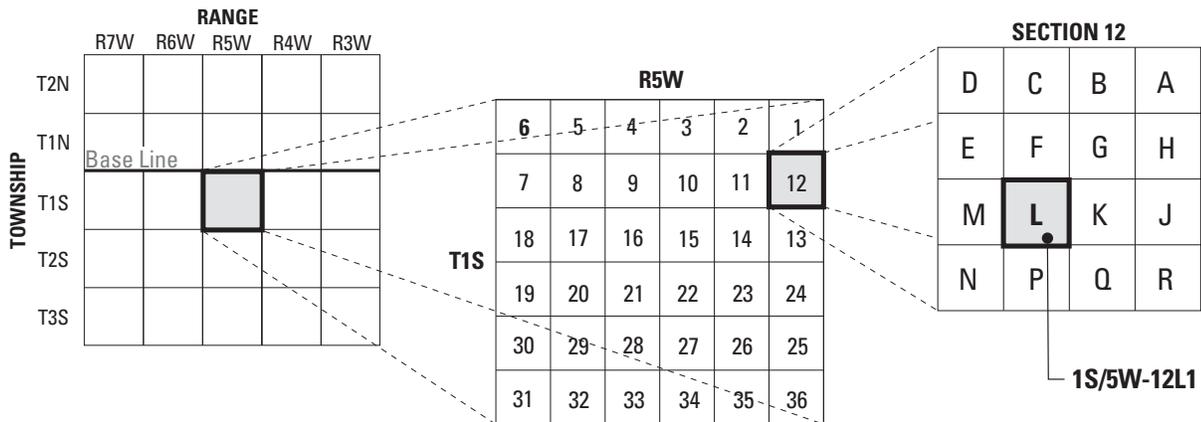
Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter ( $\mu\text{g}/\text{L}$ ).

## Abbreviations

CA DWR	California Department of Water Resources
CAWSC	California Water Science Center
EM	electromagnetic
$\mu\text{m}$	micrometer
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
PVC	polyvinyl chloride
SP	spontaneous potential
VOC	volatile organic compound
‰	per mil – part per thousand
$\delta\text{D}$	isotopic ratio of deuterium [ $^2\text{H}$ ] to protium [ $^1\text{H}$ ] relative to the ratio in a standard reference material, in per mil
$\delta^{18}\text{O}$	isotopic ratio of oxygen-18 [ $^{18}\text{O}$ ] to oxygen-16 [ $^{16}\text{O}$ ] relative to the ratio in a standard reference material, in per mil

# System Well-Numbering

Wells and springs are identified and numbered by the State of California according to their location in the rectangular system for the subdivision of public lands. Identification consists 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, wells are sequentially numbered in the order they are inventoried. The final letter refers to the base line and meridian. In California, there are three base lines and meridians—Humbolt (H), Mount Diablo (M), and San Bernardino (S). Because all wells in the study areas of this report are referenced to the San Bernardino base line and meridian, the final letter "S" will be omitted. Well numbers consist of 15 characters and follow the format 001S005W-12L001S. Multiple-well sites are numbered from deepest to shallowest. In this report, well numbers are abbreviated and written as 1S/5W-12L1, or wells are referred to by their common name. The following diagram of the well-numbering system shows how well number 1S/5W-12L1 is derived.



## Acknowledgments

The U.S. Geological Survey would like to acknowledge the staffs of the San Bernardino Valley Municipal Water District and the West Valley Water District for continued support of this study. Raymond Brown, formerly of the San Bernardino Valley Municipal Water District, and Anthony Araiza and Kenneth Sikorski, West Valley Water District, are acknowledged for their logistical contributions.

Rhett Everett of the U.S. Geological Survey and Joseph Montrella, formerly of the U.S. Geological Survey, are acknowledged for help with fieldwork, including but not limited to drilling, geophysical logging, and well development. High-resolution temperature logs were done by Frederick Grubb and Colin Williams of the U.S. Geological Survey. Water levels were measured by Gregg Lobdell and James Nelson, formerly of the U.S. Geological Survey. Anthony Poiriez and Matt Fontanesi, formerly of the USGS, also assisted with the data collection and well development. The U.S. Geological Survey Western Research Drilling Operation is acknowledged for borehole drilling and construction.

# Contents

Abstract.....	1
Introduction.....	1
Purpose and Scope .....	1
Description of Study Area .....	1
Methods of Study.....	2
Well Drilling and Construction.....	2
Geologic Data Collection.....	2
Lithologic Logging.....	3
Borehole-Geophysical Logging .....	3
Water-Level Measurements and Water-Quality Sample Collection .....	4
Sample Collection Methods.....	4
Analytical Methods .....	5
Quality Assurance.....	5
Results .....	6
Lithologic Descriptions .....	6
Borehole-Geophysical Logs.....	6
Water Levels.....	7
Water-Quality Results .....	7
References Cited.....	7
Figures .....	10
Tables .....	35

## Figures

1. Map showing location of study area and geologic and other features, San Bernardino County, California.....	11
2. Map showing locations of multiple-well monitoring sites, San Bernardino County, California.....	12
3. Figure showing typical multiple-well monitoring site completion and construction .....	13
4. Graphs showing geophysical logs, well-construction diagrams, and generalized lithologic descriptions for multiple-well monitoring sites, San Bernardino County, Calif. <i>A</i> , RCZ6; <i>B</i> , RCNE; <i>C</i> , RCSW; <i>D</i> , CRCR; <i>E</i> , RHSV; <i>F</i> , FOG1; <i>G</i> , FOG2.....	14
5. Diagrams showing grain-size classification chart.....	21
6. Graphs showing water-level elevation in multiple-well monitoring site RCZ6, San Bernardino County, California.....	22
7. Graph showing water-level elevation in multiple-well monitoring site RCNE, San Bernardino County, California.....	23
8. Graph showing water-level elevation in multiple-well monitoring site RCSW, San Bernardino County, California.....	23
9. Graphs showing water-level elevation in multiple-well monitoring site CRCR, San Bernardino County, California.....	24
10. Graphs showing water-level elevation in multiple-well monitoring site RHSV, San Bernardino County, California.....	25
11. Graph showing water-level elevation in multiple-well monitoring site FOG1, San Bernardino County, California.....	26
12. Graph showing water-level elevation in multiple-well monitoring site FOG2, San Bernardino County, California.....	26
13. Diagrams showing major-ion chemistry of water from multiple-well monitoring site RCZ6, San Bernardino County, California, 2011.....	27
14. Diagrams showing major-ion chemistry of water from multiple-well monitoring site CRCR, San Bernardino County, California, 2007 .....	28
15. Diagrams showing major-ion chemistry of water from multiple-well monitoring site RHSV, San Bernardino County, California, 2007 .....	29
16. Diagrams showing major-ion chemistry of water from multiple-well monitoring site FOG1, San Bernardino County, California, 2007.....	30
17. Diagrams showing major-ion chemistry of water from multiple-well monitoring site FOG2, San Bernardino County, California, 2007.....	31
18. Graph showing delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site RCZ6, San Bernardino County, California, 2011 .....	32
19. Graph showing delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site CRCR, San Bernardino County, California, 2007 .....	32
20. Graph showing delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site RHSV, San Bernardino County, California, 2007 .....	33
21. Graph showing delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site FOG1, San Bernardino County, California, 2007 .....	33
22. Graph showing delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site FOG2, San Bernardino County, California, 2007 .....	34

## Tables

1. Well-identification and construction information for multiple-well monitoring sites, San Bernardino County, California .....	36
2. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCZ6, San Bernardino County, California .....	37
3. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCZ6, San Bernardino County, California .....	39
4. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCNE, San Bernardino County, California .....	43
5. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCNE, San Bernardino County, California .....	45
6. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCSW, San Bernardino County, California .....	49
7. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCSW, San Bernardino County, California .....	50
8. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site CRCR, San Bernardino County, California .....	54
9. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site CRCR, San Bernardino County, California .....	56
10. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RHSW, San Bernardino County, California .....	60
11. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RHSW, San Bernardino County, California .....	62
12. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site FOG1, San Bernardino County, California .....	66
13. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG1, San Bernardino County, California .....	67
14. Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site FOG2, San Bernardino County, California .....	69
15. Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG2, San Bernardino County, California .....	70
16. Date range of available water-level data, count of water-level measurements, and maximum and minimum water-level elevations for select wells, San Bernardino County, California.....	72
17. Field measurement, major-ion, nutrient, and selected trace-element data in groundwater samples from selected monitoring sites, San Bernardino County, California .....	73
18. Deuterium, oxygen-18, and tritium data in groundwater samples from selected monitoring sites, San Bernardino County, California .....	76

# Geohydrologic and Water-Quality Data in the Vicinity of the Rialto-Colton Fault, San Bernardino, California

By Nick Teague, Anthony A. Brown, and Linda R. Woolfenden

## Abstract

The Rialto-Colton Basin is in western San Bernardino County, about 60 miles east of Los Angeles, California. The basin is bounded by faults on the northeast and southwest sides and contains multiple barriers to groundwater flow. The structural geology of the basin leads to complex hydrology. Between 2001 and 2008, in an effort to better understand the complex hydrologic system of the Rialto-Colton Basin, seven multiple-well monitoring sites were constructed. Two to six observation wells were installed in the borehole at each site; a total of 32 observation wells were installed. This report presents geologic, hydrologic, and water-quality data collected from these seven multiple-well monitoring sites.

Descriptions of the collected drill cuttings were compiled into lithologic logs for each monitoring site. The lithologic logs are summarized along with the geophysical logs, including gamma-ray, spontaneous potential, resistivity, and electromagnetic induction tool logs. At selected sites, sonic tool logs also were recorded. Periodic water-level measurements are reported, and water-level data are displayed on hydrographs. Water levels at multiple-well monitoring sites in the northern part of the study area differed between the shallow and deep observation wells; in the remaining multiple-well monitoring sites, water levels differed little with depth. Along the southern trace of the Rialto-Colton Fault, water levels are slightly higher east of the fault than west of the fault. Selected water-quality data for 21 of the observation wells show water from wells in the northern and central parts of the study area is calcium-carbonate water. In the southern part of the study area, water from wells screened above 400 feet below land surface is of mixed type or is calcium-carbonate water. Water from wells screened greater than 400 feet below land surface in the southern part of the study area is sodium-carbonate or sodium-mixed anion water. Water from most wells in the study area plots above the Global Meteoric Water Line along an apparent local meteoric water line, indicating the water has not experienced substantial evaporation before infiltration. A few samples from shallow wells in the study area plot slightly to the right of the Global Meteoric Water Line, possibly indicating the water experienced some evaporation before recharge.

## Introduction

The Rialto-Colton Basin is in western San Bernardino County, about 60 miles (mi) east of Los Angeles, California (fig. 1). The basin is bounded on two sides by faults, the Rialto-Colton Fault in the southwest and the San Jacinto Fault in the northeast, and contains multiple barriers to groundwater flow. While movement of water within the basin generally is northwest to southeast, uncertainty exists regarding hydrologic conditions adjacent to the faults and barriers. The U.S. Geological Survey (USGS) was asked by the San Bernardino Valley Municipal Water District and the West Valley Water District to collect geologic, water-level, and water-quality data in areas of hydrologic uncertainty to improve understanding of the overall basin hydrology. This project is being done by the USGS in cooperation with both water districts.

## Purpose and Scope

The purpose of this work was to establish new multiple-well monitoring sites within the Rialto-Colton Basin and in the adjacent Chino Basin. The scope of the work included drilling and installing seven multiple-well monitoring sites within the Rialto-Colton and Chino Basins, describing the lithology through well cuttings and borehole geophysics, monitoring water levels, and water-quality sampling and analysis. At each site, two to six observation wells were installed at isolated depths in the boreholes. Wells were drilled for the purpose of collecting data to be used in future investigative reports. This report includes site-location, well-construction, geologic, hydrologic, and water-quality data collected from the observation wells during 2001–11.

## Description of Study Area

The Rialto-Colton Basin is a northwest-southeast trending alluvial basin in the upper Santa Ana River watershed. As defined by the California Department of Water Resources (CA DWR), the 47-square miles (mi<sup>2</sup>) Rialto-Colton Basin

## 2 Geohydrologic and Water-Quality Data in the Vicinity of the Rialto-Colton Fault, San Bernardino, California

is bounded on the northeast by the Barrier E and San Jacinto Faults and on the southwest by the Rialto-Colton Fault and the Chino Basin (California Department of Water Resources, 2003) (fig. 1). The San Gabriel Mountains form the northwestern boundary, and the Badlands and Box Spring Mountains form the southeastern boundary. The Santa Ana River traverses the southeastern part of the basin. Warm, San Timoteo, and Lytle Creeks join the Santa Ana River near the southeastern boundary of the basin (fig. 1). An unnamed fault trends northwest to southeast, subparallel to the San Jacinto Fault, dissecting the Rialto-Colton Basin. In the northwestern part of the basin, Barrier J trends southwest to northeast. The unnamed fault and Barrier J act as barriers to groundwater flow; however, groundwater may flow in the unfaulted parts of the alluvium (Woolfenden and Kadhim, 1997) (fig. 1). Groundwater moves predominantly southeastward from Barrier J toward the city of Colton and then westward to southwestward in the southern end of the basin; groundwater eventually drains into the adjacent Chino Basin (Dutcher and Garrett, 1963).

### Methods of Study

Seven multiple-well monitoring sites were installed to collect geologic, hydrologic, and water-quality data. Lithologic and borehole-geophysical data were collected from test holes drilled for this study, water levels were measured from wells installed in these test holes, and water-quality samples were collected and analyzed for selected constituents. The lithology of each test hole was described in brief from the drill cuttings during drilling and in more detail after samples of the cuttings were collected. Borehole-geophysical surveys were conducted after the drilling of each test hole was completed. The depth and perforated interval of the observation wells installed in the test holes were determined on the basis of the lithologic and borehole-geophysical data and existing data from nearby wells. Water levels were measured and water-quality samples for selected constituents were collected periodically after construction and development of each well was completed.

### Well Drilling and Construction

During 2001–08, four multiple-well monitoring sites were installed in the Rialto-Colton Basin, and three multiple-well monitoring sites were installed in the Chino Basin, adjacent to the Rialto-Colton Fault (fig. 2, table 1). Monitoring site RCNE (1N/6W-26A) is in the Chino Basin but lies east of the Rialto-Colton Fault as described by Anderson and others (2004). The locations of the multiple-well monitoring sites were chosen where depth-dependent lithologic, borehole-geophysical, water-level, and water-quality data were

not available. Consideration also was given to locating the multiple-well monitoring sites on public property having easy access that would allow subsequent water-level monitoring. Sites RCNE (1N/6W-26A), RCSW (1N/6W-26K), FOG1 (1S/4W-29H), and FOG2 (1S/4W-29K) were specifically selected to collect geologic data on each side of the Rialto-Colton Fault and to establish monitoring sites that could provide key data leading to a better understanding of the movement of groundwater across this barrier. RCNE (1N/6W-26A) and RCSW (1N/6W-26K) were sited on either side of the northwestern part of the Rialto-Colton Fault to determine if flow occurs across a portion of the fault in this area; FOG1 (1S/4W-29H) and FOG2 (1S/4W-29K) were sited near the Santa Ana River where most groundwater flow is believed to cross the Rialto-Colton Fault. A diagram showing the well construction of a typical installation of a multiple-well monitoring site is shown in figure 3.

The multiple-well monitoring sites were drilled by the USGS Western Region Research Drilling Operation using a mud-rotary method. The diameters of the test holes decreased with depth and ranged from 6 to 12.25 inches (in.). After total hole depth was attained, borehole-geophysical logs were recorded for each test hole before observation wells were completed. Two to six observation wells were installed in each hole. The monitoring wells were constructed by using flush-threaded, 2-in.-diameter, schedule 80 polyvinyl chloride (PVC) casing. The screened interval for each monitoring well typically consisted of a 20-ft section of slotted PVC (slot size is 0.020 in.) at the bottom. At sites RCZ6 (1N/5W-17L), RCNE (1N/5W-26A), RCSW (1N/6W-26K), and FOG1 (1S/4W-29H), a sump was added to the well below the screen.

Once casing was installed to the desired depth for the deepest observation well, bentonite grout was tremied around the casing below the screened interval (fig. 3). Next, a filter pack of No. 3 Monterey sand was tremied around the screened interval. Bentonite grout was then tremied in place, above the filter pack, to seal the borehole and effectively isolate the screened interval of the monitoring well. The process was repeated for each successive well. Finally, a traffic-rated vault was installed at land surface to secure the completed wells. Diagrams of the well construction for the multiple-well monitoring sites are shown in figures 4A–G, and the well-construction data are given in table 1.

After installation was completed, the wells were developed by evacuating residual drilling fluid using compressed air. Extensive airlifting and a surging technique with compressed air were employed to further develop the filter pack surrounding the well. Specific conductance, pH, temperature, apparent color, and turbidity, along with the discharge rate and total volume, were monitored during this process. Development was continuous until no discernible drilling mud was present in the lifted water and field measurements of pH and specific conductance had stabilized.

## Geologic Data Collection

The geologic data collected for each of the seven multiple-well sites include information assembled from various lithologic logging techniques and borehole-geophysical logging tools. The methods used in collecting lithologic and geophysical data are presented separately below.

### Lithologic Logging

Generalized lithologic logs (figs. 4A–G) were compiled from field descriptions and subsequent laboratory microscope examination of drill cuttings, notes on drilling rates and action, and geophysical logs at the seven multiple-well monitoring sites (fig. 2, table 1). Drill cuttings were obtained in two ways: collection from the return drilling fluid throughout each 20-ft interval by using a number 120 (125 micrometers;  $\mu\text{m}$ ) U.S.A. Standard Testing Sieve and grab sampling every 10 ft from the number 60 (250  $\mu\text{m}$ ) shaker screen through which return drilling fluid passes. The sieved samples represent a composite of sand-sized, silt-sized, and finer-textured materials (which tend to form balls of clay) from each 20-foot (ft) drilling interval. Grab samples collected from the shaker screen represent texture fractions typically coarser than the sieve samples. Laboratory microscope examination of drill cuttings helped to more accurately define the field description with respect to sediment type, percent fine-textured and coarse-textured sediment, sorting, roundness, and color (Folk, 1954). Texture descriptions of sieve and shaker cuttings were described by using standardized grain-size classification (fig. 5; Lane, 1947). For samples containing gravel, the terms “silt” and (or) “clay” are used in lieu of “mud.” Color, determined on moist samples, follows the numerical color designations in Munsell Soil Color Charts (Munsell Color, 1994). Lithologic descriptions of sieve and shaker samples are provided separately in this report (tables 2–15). Sieve and shaker samples used to compile generalized lithologic descriptions for each monitoring site are shown on figures 4A–G. The depths of contacts between lithologic units were refined by comparison to geophysical logs.

### Borehole-Geophysical Logging

Borehole-geophysical logs were used in conjunction with the lithologic descriptions to select screened intervals during construction of observation wells (figs. 4A–G) at the seven multiple-well monitoring sites (fig. 2, table 1). Borehole-geophysical logs were collected in the uncased, mud-filled open hole before wells were installed. The logs provide additional information about the lithologic material and chemical properties of the groundwater. Borehole-geophysical logs collected include caliper, temperature and temperature gradient,

natural gamma and spontaneous potential (SP), normal resistivity (16- and 64-in.), lateral resistivity and conductivity, and sonic data. Sonic logs were obtained at all sites except RCSW (1N/6W-26K) because the tool was unavailable when that site was logged. The geophysical tools were calibrated as specified by the manufacturer, except for the caliper tool that was calibrated onsite according to the diameters of the drill bits used to drill the borehole.

Down-hole caliper logging tools are designed to measure the inside diameter of the open borehole. This allows for the detection of any “wash-out zones” where unconsolidated sand has been washed away by the drilling process. The caliper tool also can aid in identifying zones in which a clay unit has expanded owing to a decrease in down-hole pressure. In addition, the caliper tool is used to determine the quantity of sand and grout needed to fill the annular space during the construction of the observation wells.

High-resolution borehole temperature logs were collected in the deepest well at each multiple-well monitoring site, except RCZ6 (1N/5W-17L). When well RCZ6 (1N/5W-17L) was drilled, the high-resolution temperature log tool was not available for logging in the area; therefore, the electrical tool was used to log groundwater temperature at well RCZ6 (1N/5W-17L). To ensure the water temperature was characteristic of ambient groundwater conditions, logging was performed several months after the site had been constructed, developed, and sampled for water quality to allow sufficient time for the water column in the well to equilibrate with the surrounding material. Generally, groundwater temperature increases with depth, and the global average is about 25° degrees Celsius (°C) per kilometer (km). The geothermal gradient in sedimentary basins generally exceeds this average because of the relatively low thermal conductivity of sedimentary materials (Ingebritsen and Sanford, 1998). Perturbations in the geothermal gradient in temperature logs can provide information about geologic formations as well as horizontal and vertical patterns of groundwater flow. Groundwater temperature is related to lithology (which affects thermal conductance), depth, recharge source, and residence time within the aquifer (Keys and MacCary, 1971; Beck, 1976; Michalski, 1989; Williams and others, 1994). Measured temperature logs, when expressed as a measured vertical temperature gradient and compared with the geothermal gradient, can be used to identify potential zones of relatively greater groundwater flow. Depth intervals where the temperature gradient is rightward convex upward, or decreases in the temperature gradient, are consistent with the cooling influence of groundwater flow through relatively permeable units. Depth intervals exhibiting greater temperature perturbations can be interpreted as zones of greater flow.

The natural gamma tool measures the intensity of gamma-ray emissions resulting from the decay of naturally occurring radioactive isotopes, including

potassium-40, uranium-238, uranium-235, and thorium-232 (Schlumberger, 1972). Natural gamma logs are used to correlate lithology between wells and define aquifer thickness. Clay-rich deposits and feldspar-rich gravels generally emit higher intensity gamma rays than silts or sands.

SP, normal resistivity (16- and 64-in.), and lateral resistivity are electric logs that measure the electrical properties of the formation around the borehole and the fluid in the formation. These logs are used to distinguish fine-grained silt and clay from coarser sand and gravel. The SP tool measures voltage differences that exist between different layers, which aids in determining bed thickness, clay content, and lithology. On SP logs, lithologic contacts are located at the point of curve inflection. Differences in salinity of the drilling fluid and formation water affect SP logs. When the drilling fluid is less saline than the formation water, maximum positive (to the right) deflections represent intervals of fine-grained material, mostly clay; negative deflections represent coarser sediments (Schlumberger, 1972). When the drilling fluid is more saline than the formation water, the signal is reversed, as generally was the case in this study.

Normal and lateral electrical resistivity tools measure the apparent resistivity of a volume of rock under the direct application of an electric current (Keys and MacCary, 1971). These logs are used to determine formation and fluid resistivity and to estimate formation porosity. Low resistivity generally indicates water higher in dissolved solids or fine-grained deposits such as silt, clay, and shale, or both. High resistivity indicates water lower in dissolved solids or coarser material such as sand or gravel, or both. Two types of normal resistivity were measured, 16-in. (referred to as short) and 64-in. (referred to as long). The difference between the short- and long-normal logs is the separation distance between the electrodes in the tool. As the separation distance increases, the volume of aquifer material measured by the tool increases. Comparison of short- and long-normal resistivity values can provide an estimate of the extent to which drilling fluid has entered aquifer deposits, an indication of the permeability of the aquifer deposits. Lateral resistivity logs are made using a tool similar to the normal resistivity tool, only the spacing between the electrodes is longer. The longer spacing between the electrodes is designed to measure resistivity further beyond the borehole than normal resistivity tools.

The electromagnetic (EM) tool measures the conductivity of a volume of rock under an induced electromagnetic field, shown as conductivity logs on figures 4A–G. Conductivity logs yield information on lithology of a formation and on chemical characteristics of pore water (McNeill, 1986). In alluvial aquifers, high conductivity generally indicates water higher in dissolved solids or fine-grained deposits such as silt, clay, and shale, or both. Low conductivity indicates water lower in dissolved solids or coarse-grained material such as sand or gravel, or both. Conductivity logs produced using the EM induction tool can help identify water-bearing units to determine optimum depths for the placement of monitoring well screens.

Sonic tools measure the velocity of an acoustic pulse between a transmitter and a receiver. The sonic tool used has two receivers, near and far, that record the arrival time of the compressional sound wave sent by the transmitter. Sonic logs display the difference in arrival times between the receivers,  $\Delta t$ , which can be related to the physical properties of the adjacent material. The sonic log gives an indication of the degree of consolidation of the formation, as well as an approximate location of the water table. Increasing consolidation and the location of the water table are indicated by decreased  $\Delta t$ .

## **Water-Level Measurements and Water-Quality Sample Collection**

Water levels were measured periodically (typically monthly) at the monitoring sites and also prior to collection of the water-quality sample. Water levels were measured and recorded to within 0.01 ft using a calibrated electric tape.

A total of 53 water-quality samples were collected from 22 of the 32 observation wells from 2002 to 2011. Some wells could not be sampled because the wells were dry or the yields were too small to produce a sufficient volume of water for sampling. Water samples from well RCNE-2 (1N/6W-26A2) had high concentrations of phosphate, indicating the well was not adequately developed and drilling mud was still entrapped within the formation; therefore, water-quality data from the sample collected at well RCNE-2 (1N/6W-26A2) are not presented in this report. A total of 41 water-quality samples were collected for analysis of major ions, trace elements, and nutrients; 21 for analysis of stable isotopes of water (oxygen-18 and deuterium); 23 for analysis of carbon 13/12 isotopic ratios and carbon-14 isotope; 46 for analysis of tritium; and 18 for analysis of volatile organic compounds (VOCs).

The field parameters—specific conductance, pH, temperature, dissolved oxygen, and alkalinity—were measured during the collection of the water-quality sample.

## **Sample Collection Methods**

Groundwater samples at 22 wells were collected in accordance with the protocols established by the USGS National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, 2006). A minimum of three casing volumes were purged from each well before sampling using a portable submersible pump. Prior to purging and sample collection, sampling equipment, including pumps, were cleaned in accordance with the USGS National Field Manual for the Collection of Water-Quality Data (Wilde, 2004). The field parameters—specific conductance, pH, and temperature—were monitored during purging. Water-quality samples were collected only after monitored field parameters had stabilized. Stability was attained when three successive measurements at intervals of 5 minutes or more differed by less than 5 percent for specific conductance, 0.1 units of pH, and 0.2°C for water

temperature. Instruments used for the measurements of specific conductance and pH were calibrated in the field during the initial purging process and prior to sampling. Water temperature was measured using the built-in thermistor on the pH probe (plus or minus 0.1°C). The thermistor was frequently checked against a National Institute of Standards and Technology certified mercury thermometer and conformed to within 0.5°C. Measurements of dissolved oxygen were determined by using the Alsterberg-Azide modified Winkler titration method and the membrane electrode method, as described in the USGS National Field Manual for the Collection of Water-Quality Data (Lewis, 2006). Measurements of dissolved oxygen were processed in the field immediately preceding sampling. Alkalinity was determined in the field by incrementally titrating filtered samples with dilute sulfuric acid, using a digital titration system, as described in the USGS National Field Manual for the Collection of Water-Quality Data (Rounds, 2006). Concentrations of bicarbonate and carbonate were computed using a speciation model available at <http://or.water.usgs.gov/alk/> (U.S. Geological Survey, variously dated).

During sample collection, purge water from the pump was diverted through a Teflon tube into a sample-collection chamber that minimized atmospheric exposure. All sampling and filter apparatuses were rinsed thoroughly with sample water prior to sample collection. Water samples intended for analyses of major ions, nutrients, trace elements, and alkalinity were filtered in the field through a polyethersulfone membrane capsule filter with a pore size of 0.45 µm. Sample bottles were rinsed three times with sample water prior to filling. Samples for nutrient analysis were collected in opaque polyethylene bottles and preserved on ice to inhibit bacterial growth. Samples for the determination of cations and selected trace elements were collected in acid-rinsed polyethylene bottles and then acidified with ultrex-grade nitric acid to a pH less than 2. Samples for anion determination were collected in a polyethylene bottle and did not require preservation.

Unfiltered samples for the analysis of the stable isotopes of water (deuterium, oxygen-18/16) and tritium were collected in 60-milliliter (mL) glass and 1-liter (L) polyethylene bottles, respectively, and sealed with black phenolic caps with conical-shaped polyethylene liners to minimize exchange with the atmosphere. Samples for the analysis of carbon-13/12 and carbon-14 isotopes were collected by bottom filling and overflowing a 1-L plastic-coated, amber glass bottle with several volumes of filtered water. Samples were sealed with either poly-seal polyethylene caps or special Teflon-septa caps with no air space in the bottle and held on ice. VOCs were collected as unfiltered water in 40-mL amber glass bottles at selected wells using sampling and preservation protocols of the USGS National Field Manual for the Collection of Water-Quality Data (Wilde and others, 2004).

## Analytical Methods

Samples were shipped to the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, for analysis of inorganic substances following standard methods outlined by Fishman and Friedman (1989), analysis of organic substances following standard methods outlined by Fishman (1993), analysis of metals following standard methods outlined by Faires (1993), analysis of total phosphorus following standard methods outlined by Patton and Truitt (1992) and Jones and Garbarino (1999), and analysis of arsenic and selenium following standard methods outlined by Struzeski and others (1996).

Samples for the analysis of stable isotopes were shipped to the USGS Stable Isotope Laboratory in Reston, Virginia, to be analyzed using methods described by Coplen and others (1991) and Epstein and Mayeda (1953). Tritium samples were analyzed at the University of Miami Rosenstiel School of Marine and Atmospheric Science (RSMAS) Tritium Laboratory in Miami, Florida, using methods described by Thatcher and others (1977).

Samples for carbon-13/12 and carbon-14 isotopes were analyzed by the University of Waterloo Environmental Isotope Laboratory in Ontario, Canada, or the National Ocean Sciences Accelerator Mass Spectrometry Facility (NOSAMS) in Woods Hole, Massachusetts, using methods described by Gleason and others (1969), Stuiver and Polach (1977), and Beukens (1992).

VOC samples were analyzed at the NWQL in Denver, Colo., by gas chromatography/mass spectrometry methods described by Connor and others (1998).

## Quality Assurance

Several methods were used to analyze the quality of the sample data within this report, including collection and interpretation of quality-control (QC) samples, calculation of major-ion charge balances, and analysis of trends in constituent proportionality for samples collected from the same wells on different dates.

QC samples were collected to quantify bias and estimate potential variability associated with the sample collection, processing, and laboratory analysis. Samples include a source solution blank, two equipment blanks, two field blanks, and a sequential field replicate; these QC samples were collected following procedures outlined by the USGS National Field Manual for the Collection of Water-Quality Data (U.S. Geological Survey, 2006). The equipment blanks were collected at the California Water Science Center (CAWSC) office under controlled conditions; all other QC samples were collected in the field. Blanks were analyzed to identify contamination

of routine groundwater samples by field personnel, sampling equipment, sample bottles, or any other source of contamination during transportation of field equipment, during shipment to the laboratory, or during analysis at the laboratory. Blank samples were analyzed for VOCs and gasoline oxygenates only under a custom schedule having slightly lower reporting limits for many analytes than the analyses used for groundwater samples. VOCs and gasoline oxygenates were not detected in any blank samples, indicating no bias in VOC results caused by sample collection. A replicate was collected to assess variability of the sample-collection process and analysis for VOCs. Samples with a relative error less than 15 percent are generally considered acceptable. The relative error was less than 1 percent for the replicate sample collected for all analytes. Precision of the stable isotopes deuterium and oxygen-18 are better than  $\pm 2.0$  and 0.2 per mil, respectively.

Major-ion charge balances between positively (cations) and negatively (anions) charged ions were calculated for each sample. An imbalance less than or equal to 5 percent was considered to be within an acceptable limit. Of the 44 samples, 20 percent have a charge imbalance greater than the acceptable limit. Of those samples that exceed the acceptable limit, only one sample had a charge imbalance greater than 10 percent. Only samples that have charge imbalances below the acceptable limit are displayed in this report, excluding the samples from wells RCZ6-5 (1N/5W-17L5) and RCZ6-6 (1N/5W-17L6). The samples from wells RCZ6-5 (1N/5W-17L5) and RCZ6-6 (1N/5W-17L6) had charge balances slightly greater than the acceptable limit, 7.72 and 7.36 percent, respectively, but were the only samples available for those wells.

For wells sampled more than once, trends in constituent proportionality, including sodium/chloride, potassium/fluoride, sum of cations/specific conductance, and sum of anions/specific conductance, were evaluated. Use of constituent proportionalities to evaluate the variability of sampling results has some uncertainties because groundwater chemistry can change over time as is evident over multiple decades in the Rialto-Colton and adjacent basins (Kent and Landon, 2013). The variability is expressed in relative percent difference (RPD) between the replicate analyses of the same environmental sample as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100 \text{ percent}, \quad (1)$$

where

- $C_1$  is the concentration in the first sample, and
- $C_2$  is the concentration in the second sample of the replicate pair.

Samples with a RPD less than 20 percent were considered as evidence of reasonable reproducibility. RPDs greater than 20 percent were calculated for sodium/chloride in 32 percent of the wells and for potassium/fluoride in 32 percent of the wells; for these ratios in particular, the differences over time may be influenced by actual changes in groundwater

chemistry. However, the RPDs were less than 20 percent for calculations of sum of cations/specific conductance in all the wells and for sum of anions/specific conductance in 95 percent of the wells; these measures are more unlikely to change over time, and the results suggest measured sample results generally showed reasonable reproducibility over time.

## Results

Users of the data presented in this report are encouraged to access information through the National Water Information System NWISWeb at <http://water.usgs.gov/nwis>. NWISWeb serves as an interface to a database network of site information, real-time, groundwater, surface-water, and water-quality data collected from locations throughout the 50 states and elsewhere. Data are updated in NWISWeb from the database network on a regularly scheduled basis. For electronic versions of this report, NWISWeb water-quality data for each multiple-well monitoring site can be accessed through the respective web address hyperlinks located in table 16, and NWISWeb water-level data can be accessed through the web address hyperlinks embedded in the respective hydrographs. Data presented in this report include lithologic descriptions, borehole-geophysical data, water-level data, and water-quality data.

## Lithologic Descriptions

Lithologic descriptions of sieve and shaker samples are provided separately in this report (tables 2–15). Sieve and shaker sample lithologic descriptions were used in compiling the generalized lithology for each multiple-well monitoring site shown on figures 4A–G. Lithologic logs indicate subsurface materials are largely heterogeneous alluvium. Grain size ranged from clay to gravel. Sites FOG1 (1S/4W-29H) and FOG2 (1S/4W-29K) were drilled through alluvium into bedrock. Most sites show a coarsening upward. Site RCZ6 (1N/5W-17L) had the greatest amount of fines with thick clay layers interspersed throughout the depth profile. Other than at site RCZ6 (1N/5W-17L), grain size in the northern part of the study area was coarser than in the south.

## Borehole-Geophysical Logs

Geophysical logs for each multiple-well monitoring site are shown in figures 4A–G. The SP log is presented with the natural gamma log, and the conductivity log is presented with the lateral resistivity log. The geophysical logs varied by location, including across the Rialto-Colton Fault, because of differences in lithology. In general, data from the gamma log, the electric logs, and the conductivity log were consistent with the results from the lithologic data. Additionally, well-defined signals in the temperature gradient, as well as in the sonic logs, were coincident with water levels measured within the wells.

## Water Levels

The range of dates for which water levels are available, as well as the number of water-level measurements and the maximum and minimum water-level elevations, are presented in table 16 for each well. Water-level data for the multiple-well monitoring sites are presented in figures 6–12. NWISWeb water-level data can be accessed through the web address hyperlinks embedded in the respective hydrographs.

Hydrographs are used to show water levels through time and may also give some insight into the presence of perched aquifers. Water levels at multiple-well monitoring sites in the northern part of the study area differed between the shallow and deep observation wells. Two sets of sites were situated so that the multiple-well sites were on either side of the Rialto-Colton Fault—RCNE (1N/6W-26A) and RCSW (1N/6W-26K) in the north and FOG1 (1S/4W-29H) and FOG2 (1S/4W-29K) in the south. Along the northern trace of the Rialto-Colton Fault, water levels are higher west of the fault [RCSW (1N/6W-26W)] than east of the fault [RCNE (1N/6W-26A)]. Along the southern trace of the Rialto-Colton Fault, water levels are slightly higher east of the fault [FOG1 (1S/4W-29H)] than west of the fault [FOG2 (1S/4W-29K)].

## Water-Quality Results

Water-quality data from 21 of the 22 samples collected from the 32 observation wells from 2002 to 2011 are presented in this report. Nine wells could not be sampled because the wells were dry or the yields were too small to produce a sufficient volume of water for sampling. The sample from well RCNE-2 (1N/6W-26A2) had an anomalously high concentration of phosphate, which indicates the well was not adequately developed and drilling mud was still entrapped within the formation; therefore, water-quality data from the sample collected at well RCNE-2 (1N/6W-26A2) are not presented in this report. Four of the 22 samples had VOC detections at levels that would be difficult to interpret; therefore, VOCs are not presented or discussed further in this report. Field measurements, major-ions, nutrients, and selected trace-element data are presented in table 17. Isotope data are presented in table 18. Isotope data presented in this report represent the dates on which samples for stable isotopes of water, tritium, and carbon-13/12 and carbon-14 isotopes were collected concurrently. Graphical representations of the water-quality data are shown at the back of this report (figs. 13–17).

Trilinear diagrams (figs. 13–17) display water composition with respect to major cations and anions. Water-quality data from wells in the northern and central parts of the study area, RCZ6 (1N/5W-17L), CRCR (1S/5W-03A), and RHSV (1S/5W-13B), plot near the left corner of the central diamond as calcium-carbonate water. In the southern part of the study area, wells screened above 400 ft below land surface [FOG1-4 (1S/4W-29H4), FOG1-5 (1S/4W-29H5), FOG2-2 (1S/4W-29K2), FOG2-3 (1S/4W-29K3), FOG2-4

(1S/4W-29K4), and FOG2-5 (1S/4W-29K5)] have water-quality data that plot in the center or slightly left of the center of the central diamond and are mixed cation-carbonate or mixed cation-mixed anion waters. Water-quality data from wells in the southern part of the study area screened greater than 400 ft below land surface [FOG1-1 (1S/4W-29H1), FOG1-2 (1S/4W-29H2), FOG1-3 (1S/4W-29H3), and FOG2-1 (1S/4W-29K1)] plot down and to the right of the center of the central diamond as sodium-carbonate or sodium-mixed anion waters.

Plots of the ratio of stable isotopes of oxygen ( $\delta^{18}\text{O}$ ) and deuterium ( $\delta\text{D}$ ) provide insight into the hydrologic history of the groundwater (figs. 18–22). The isotope ratios are expressed in delta notation ( $\delta$ ) as per mil (‰) differences relative to a standard known as Vienna Standard Mean Ocean Water (VSMOW) (Gonfiantini, 1978). Craig (1961) found that a linear relation exists between  $\delta\text{D}$  and  $\delta^{18}\text{O}$  in meteoric waters throughout the world; this relation is referred to as the Global Meteoric Water Line. Variations in  $\delta^{18}\text{O}$  and  $\delta\text{D}$  reflect the elevation, temperature, season, or source region of groundwater recharge and the degree of evaporation prior to recharge. Water that has not undergone substantial evaporation will plot near and sub-parallel to the Global Meteoric Water Line. Most water from wells in the study area plot slightly above the Global Meteoric Water Line, along a local meteoric water line. Water plotting to the right of the meteoric water line may have experienced some degree of evaporation before recharging the aquifer.

NWISWeb water-quality data for each multiple-well monitoring site can be accessed through the respective web address hyperlinks in table 17. Following publication, any updates to data presented in this report will be made to the USGS NWIS database. Additional geophysical logs, sample collection notes, and other information not contained in NWIS are kept on file at the USGS CAWSC office in San Diego, Calif. Formal requests for specific data should be directed to the USGS CAWSC office, in Sacramento, California.

## References Cited

- Anderson, M.L., Roberts, C.W., and Jachens, R.C., 2000, Principal facts for gravity stations in the vicinity of San Bernardino, southern California: U.S. Geological Survey Open-File Report 00–193, p. 23, <http://pubs.usgs.gov/of/2000/0193/>.
- Anderson, Megan, Matti, Jonathan, and Jachens, Robert, 2004, Structural model of the San Bernardino basin, California, from analysis of gravity, aeromagnetic, and seismicity data: *Journal of Geophysical Research, Solid Earth*, v. 109, no. 4, <http://dx.doi.org/10.1029/2003JB002544>.
- Beck, A.E., 1976, The use of thermal resistivity logs in stratigraphic correlation: *Geophysics*, v. 41, no. 2, p. 300–309.

- Beukens, R.P., 1992, Radiocarbon accelerator mass spectrometry—Background, precision and accuracy, *in* Taylor, R.E., Long, A., and Kra, R.S., eds., *Radiocarbon after four decades—An interdisciplinary perspective*: New York, Springer-Verlag, p. 230–239.
- California Department of Water Resources, 2003, California's groundwater—Upper Santa Ana Valley groundwater basin, Rialto-Colton subbasin: California Department of Water Resources Bulletin 118—Update 2003, [http://www.water.ca.gov/pubs/groundwater/bulletin\\_118/basindescriptions/8-2.04.pdf](http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.04.pdf).
- Connor, B.F., Rose, D.L., Noriega, M.C., Murtaugh, L.K., and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of 86 volatile organic compounds in water by gas chromatography/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97–829, 78 p.
- 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>.
- Craig, Harmon, 1961, Isotopic variations in meteoric waters: *Science*, v. 133, no. 3465, p. 1702–1703, <http://dx.doi.org/10.1126/science.133.3465.1702>.
- Dutcher, L.C., and Garrett, A.A., 1963, Geologic and hydrologic features of the San Bernardino area, California—With special reference to underflow across the San Jacinto Fault: U.S. Geological Survey Water-Supply Paper 1419, 114 p.
- Epstein, S., and Mayeda, T., 1953, Variations of O<sup>18</sup> 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).
- Faires, L.M., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of metals in water by inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 92–634, 28 p.
- 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., <http://pubs.er.usgs.gov/usgpsubs/ofr/ofr93125>.
- Fishman, M.J., and Friedman, L.C., eds., 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 rocks: *Journal of Geology*, v. 62, no. 4, p. 344–359.
- Gleason, J.D., Friedman, I., and Hanshaw, B.B., 1969, Extraction of dissolved carbonate species from natural water for carbon-isotope analysis: U.S. Geological Survey Professional Paper 650–D, p. 248–250.
- Gonfiantini, R., 1978, Standards for stable isotope measurements in natural compounds: *Nature*, v. 271, p. 534–536, <http://dx.doi.org/10.1038/271534a0>.
- Ingebritsen, S.E., and Sanford, W.E., 1998, *Groundwater in geologic processes*: New York, N.Y., Cambridge University Press, 341 p.
- Jones, S.R., and Garbarino, J.R., 1999, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of arsenic and selenium in water and sediment by graphite furnace atomic absorption spectrometry: U.S. Geological Survey Open-File Report 98–639, 39 p.
- Kent, Robert, and Landon, M.K., 2013, Trends in concentrations of nitrate and total dissolved solids in public supply wells of the Bunker Hill, Lytle, Rialto, and Colton groundwater subbasins, San Bernadino County, California—Influence of legacy land use: *Science of the Total Environment*, v. 452–453, p. 125–136, <http://dx.doi.org/10.1016/j.scitotenv.2013.02.042>.
- Keys, W.S., and MacCary, L.M., 1971, Application of borehole geophysics to water-resources investigations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 2, chap. E1, 126 p., <http://pubs.water.usgs.gov/twri2e1>.
- Lane, E.W., 1947, Report of the subcommittee on sediment terminology: Washington, D.C., American Geophysical Union Transactions, v. 28, no. 6, p. 936–938.
- Lewis, M.E., 2006, Dissolved oxygen (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.2, June 2006, accessed March 3, 2010 from <http://pubs.water.usgs.gov/twri9A6/>.
- McNeill, J.D., 1986, Geonics EM39 borehole conductivity meter—Theory of operation: Mississauga, Ontario, Geonics Limited, Technical Note 20, 11 p.
- Michalski, Andrew, 1989, Application of temperature and electrical-conductivity logging in ground water monitoring: *Groundwater Monitoring & Remediation*, v. 9, no. 3, p. 112–118, <http://dx.doi.org/10.1111/j.1745-6592.1989.tb01158.x>.
- Munsell Color, 1994, *Munsell soil color charts*: Baltimore, Md., Munsell Color, Inc.

- Patton, C.J., and Truitt, E.P., 1992, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of total phosphorus by a Kjeldahl digestion method and an automated colorimetric finish that includes dialysis: U.S. Geological Survey Open-File Report 92-146, 39 p.
- Rounds, S.A., 2006, Alkalinity and acid neutralizing capacity (ver. 3.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6., sec. 6.6, July 2006, accessed March 3, 2010 from <http://pubs.water.usgs.gov/twri9A6/>.
- Schlumberger, 1972, Log interpretation, volume I—Principles: New York, Schlumberger Limited, 112 p.
- Struzeski, T.M., DeGiacomo, W.J., and Zayhowski, E.J., 1996, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of dissolved aluminum and boron in water by inductively coupled plasma-atomic emission spectrometry: U.S. Geological Survey Open-File Report 96-149, 17 p.
- Stuiver, M., and Polach, H.A., 1977, Discussion—Reporting of <sup>14</sup>C data: Radiocarbon, v. 19, no. 3, p. 355–363.
- 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, book 5, chap. A5, 95 p., <http://pubs.water.usgs.gov/twri5a5>.
- U.S. Geological Survey, 2006, Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, September 2006, accessed March 3, 2010, at <http://pubs.water.usgs.gov/twri9A4/>.
- Wilde, F.D., ed., 2004, Cleaning of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, April 2004, accessed March 3, 2010, at <http://pubs.water.usgs.gov/twri9A3/>.
- Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., 2004 with updates through 2009, Processing of water samples (ver. 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, April 2004, accessed March 3, 2010, at <http://pubs.water.usgs.gov/twri9A5/>.
- Williams, C.F., Galanis, S.P., Jr., Grubb, F.V., and Moses, T.H., Jr., Filippelli, G.M., Delaney, M.L., 1994, The thermal regime of Santa Maria Province, California—Phosphorus geochemistry, diagenesis, and mass balances of the Miocene Monterey Formation at Shell Beach, California: U.S. Geological Survey Bulletin 1995-F,G, 26 p.
- Woolfenden, L.R., and Kadhim, Dina, 1997, Geohydrology and water chemistry in the Rialto-Colton Basin, San Bernardino County, California: U.S. Geological Survey Water-Resources Investigations Report 97-4012, 101 p.

## Figures

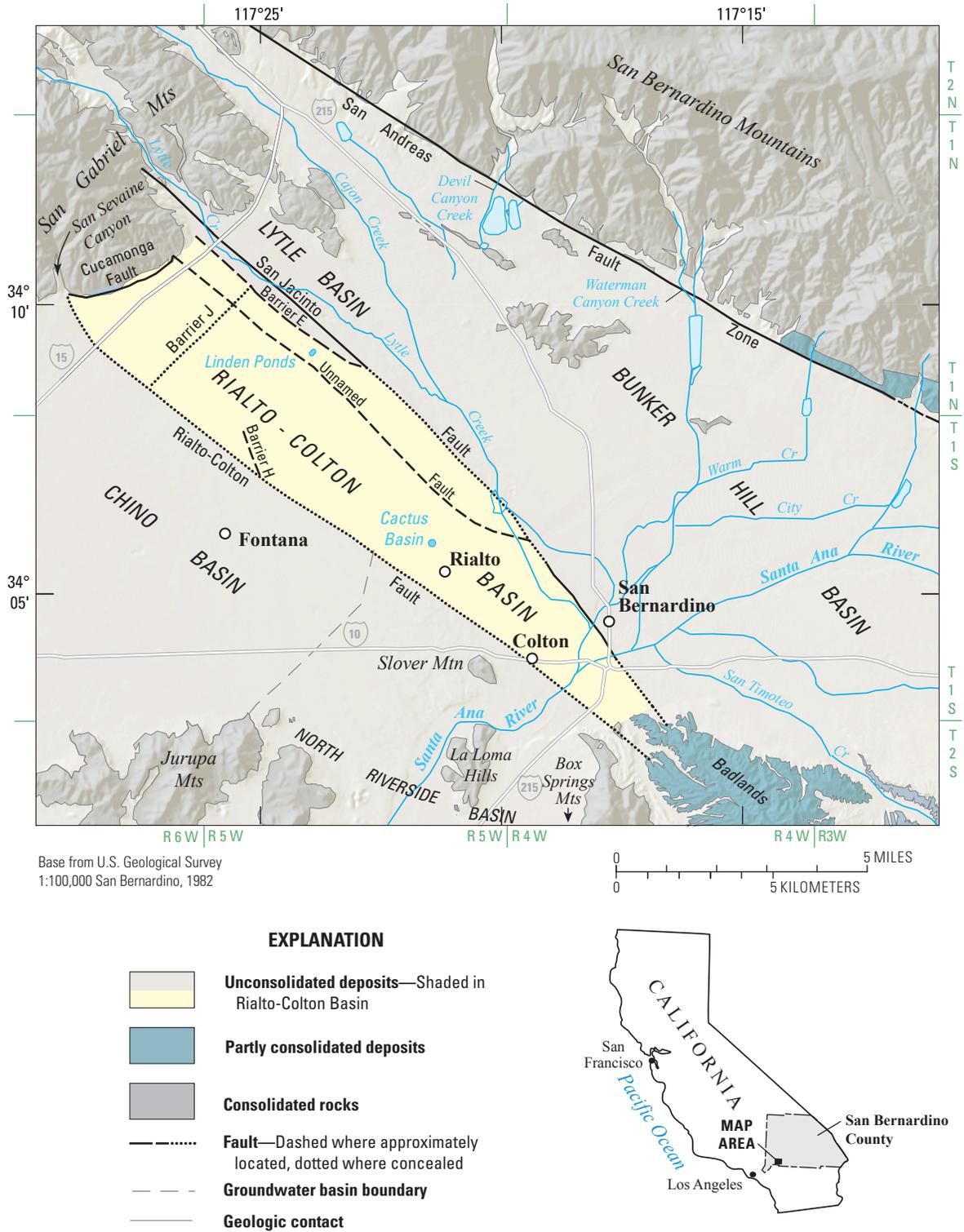


Figure 1. Location of study area and geologic and other features, San Bernardino County, California.

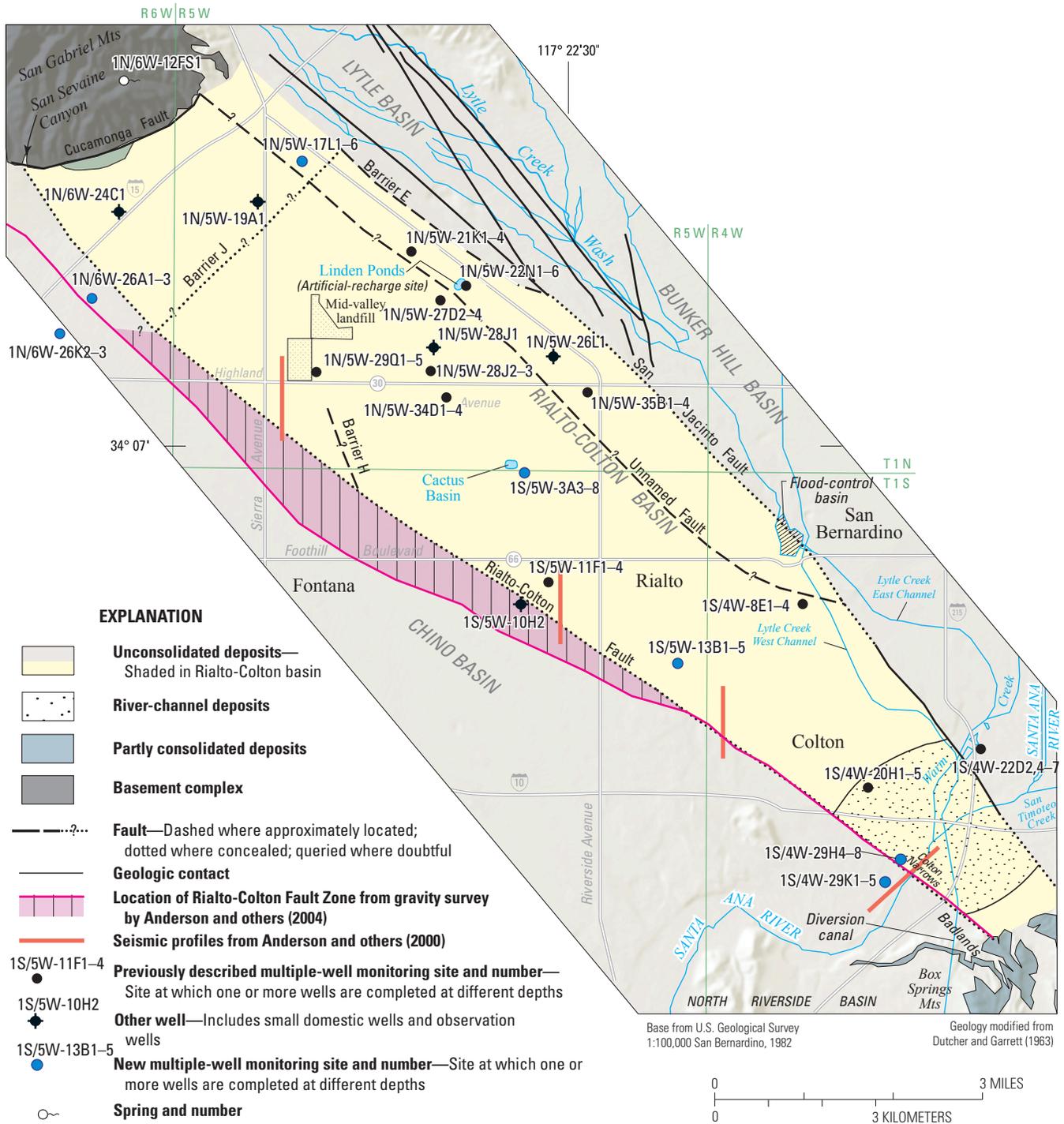


Figure 2. Locations of multiple-well monitoring sites, San Bernardino County, California.

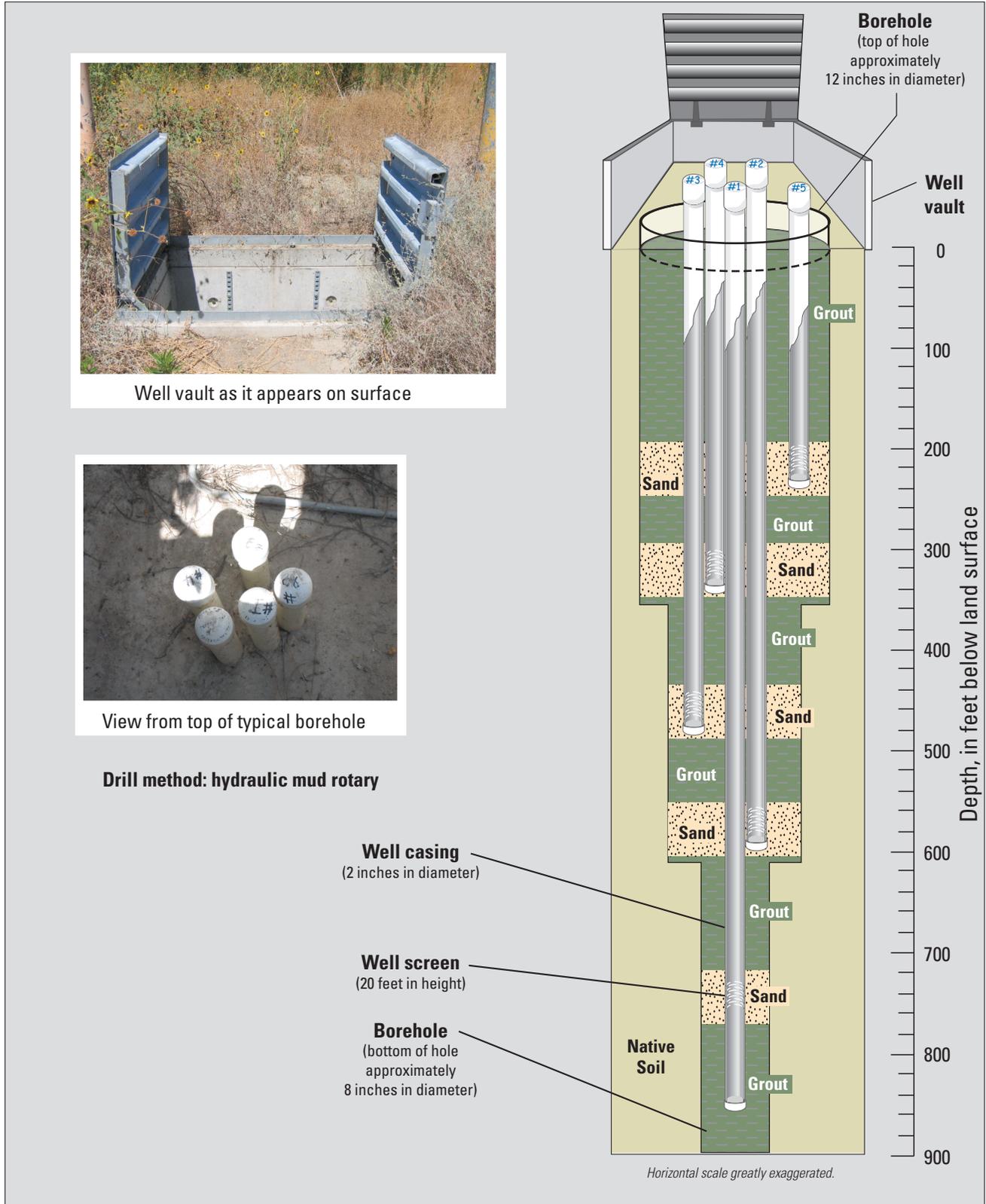
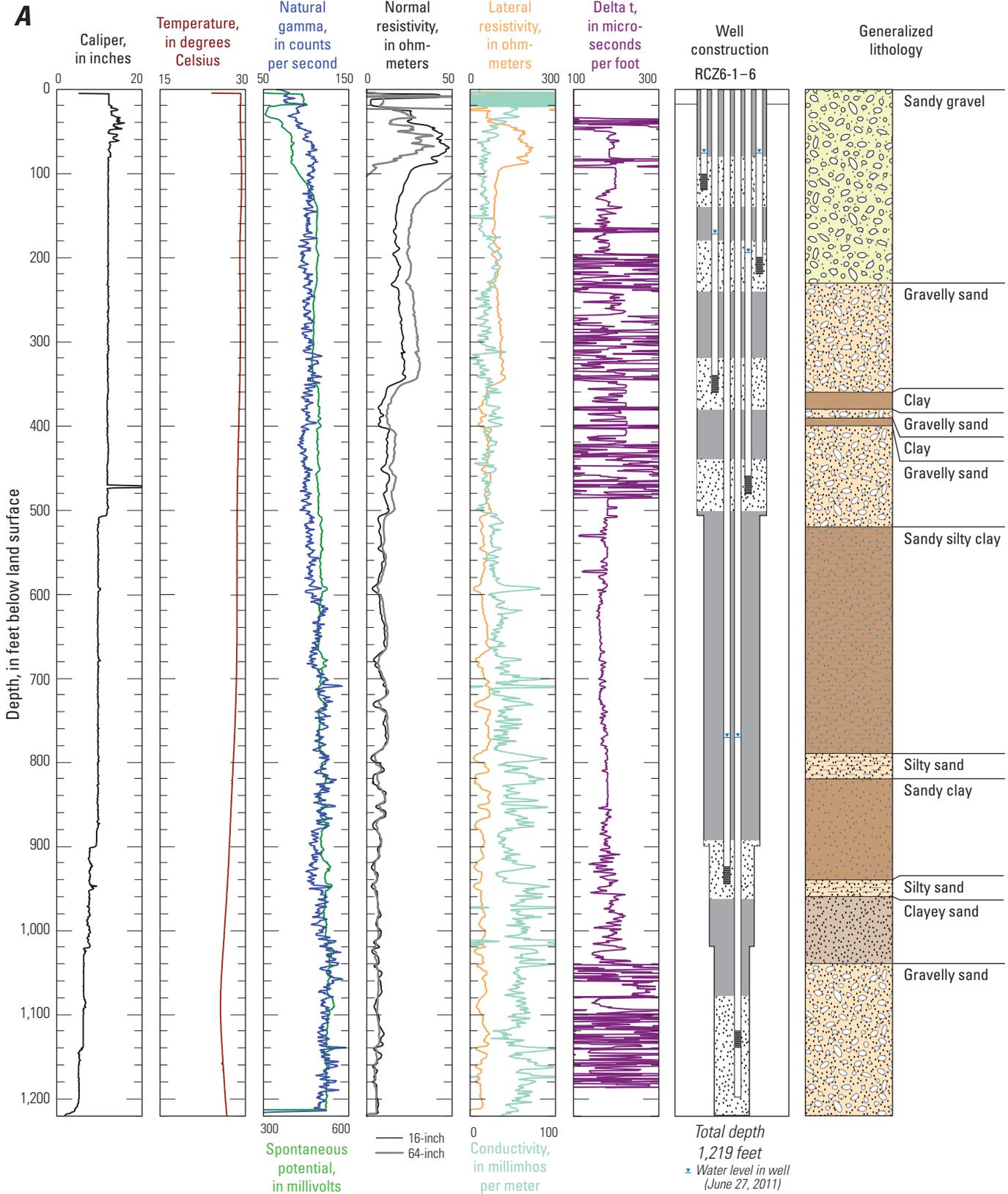


Figure 3. Typical multiple-well monitoring site completion and construction.



**Figure 4.** Geophysical logs, well-construction diagrams, and generalized lithologic descriptions for multiple-well monitoring sites, San Bernardino County, Calif.; A, RCZ6 (1N/5W-17L1-6); B, RCNE (1N/6W-26A1-3); C, RCSW (1N/6W-26K2-3); D, CRCR (1S/5W-03A3-8); E, RHSW (1S/5W-13B1-5); F, FOG1 (1S/4W-29H4-8); G, FOG2 (1S/4W-29K1-5).

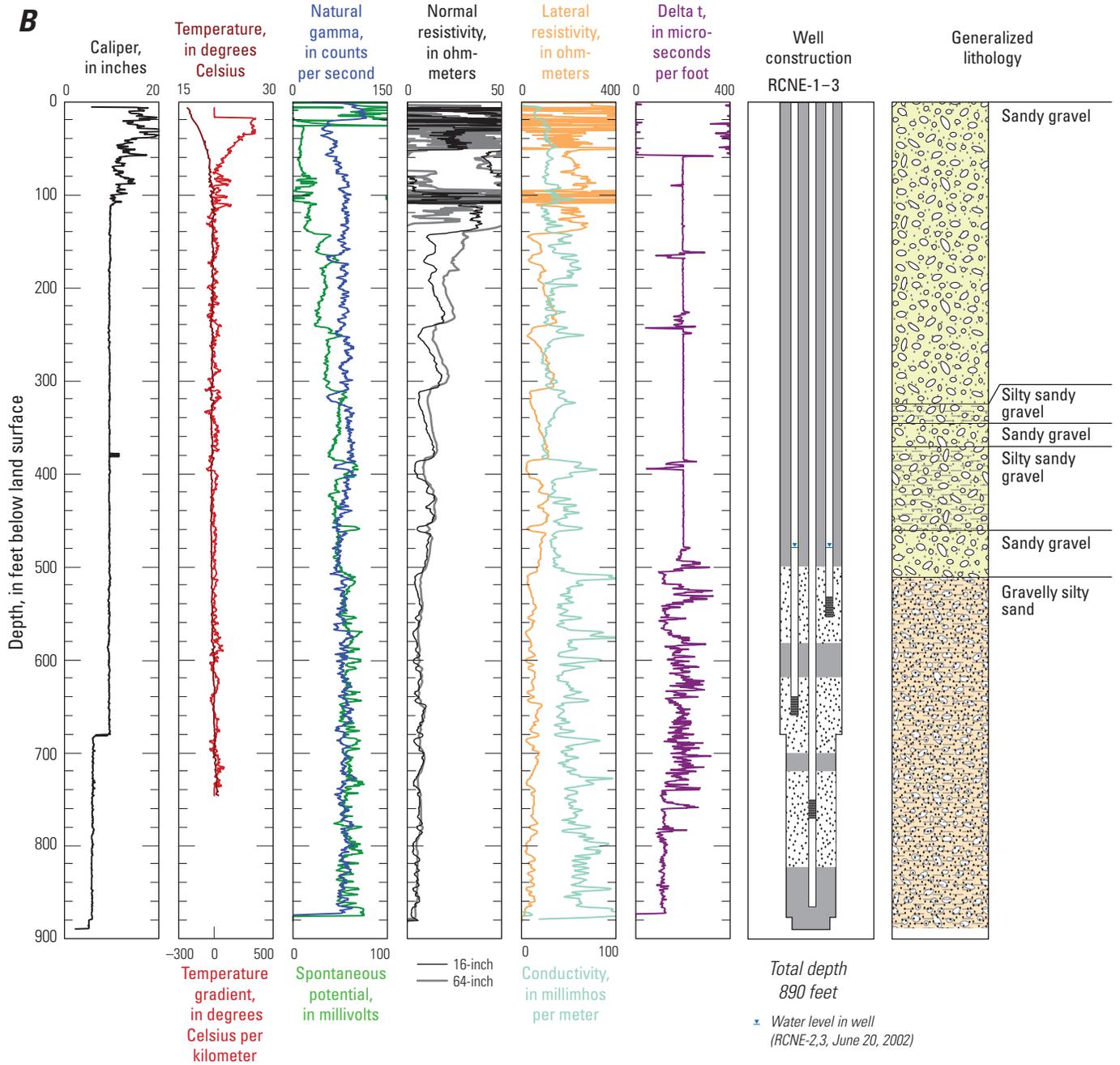


Figure 4. —Continued

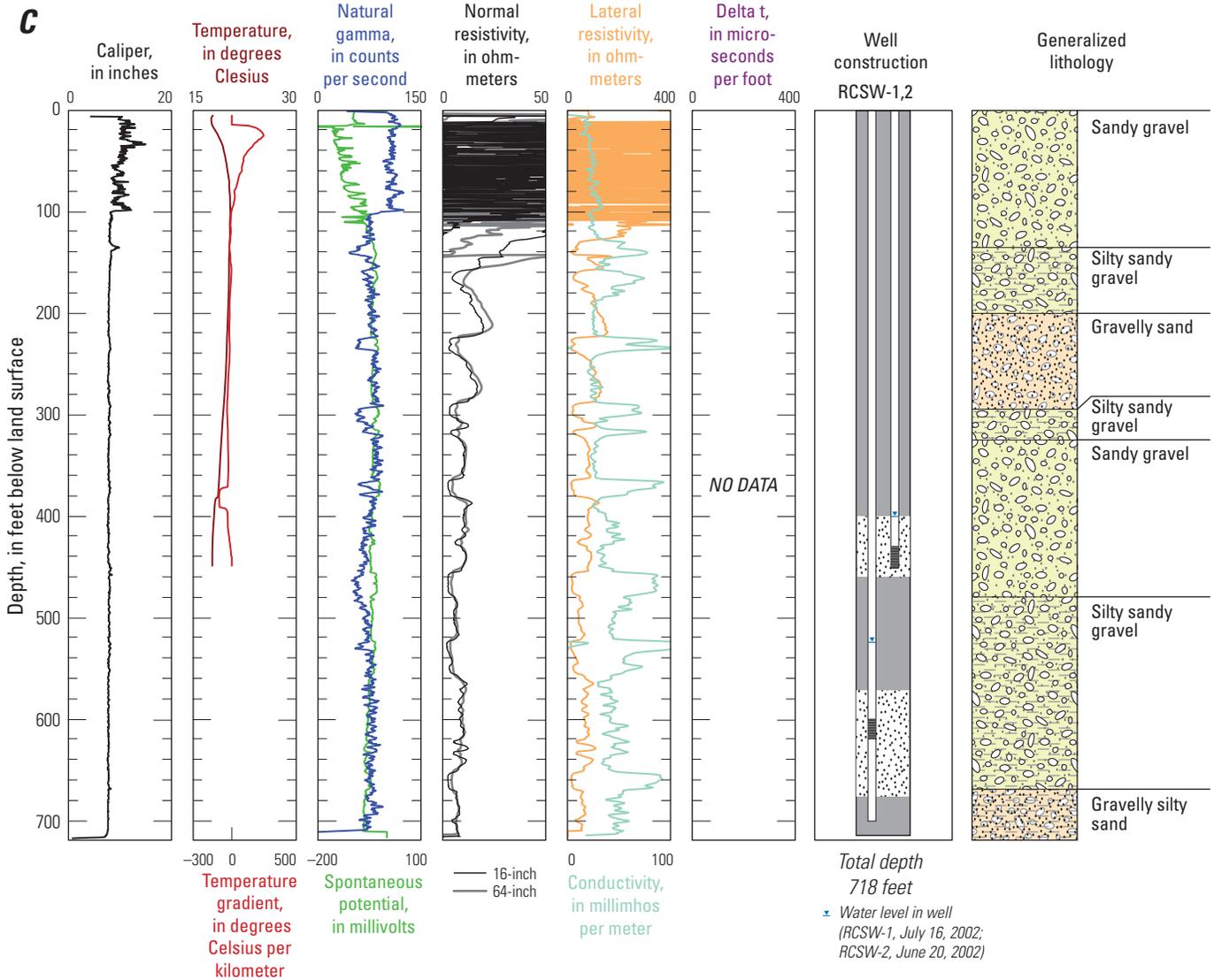


Figure 4. —Continued

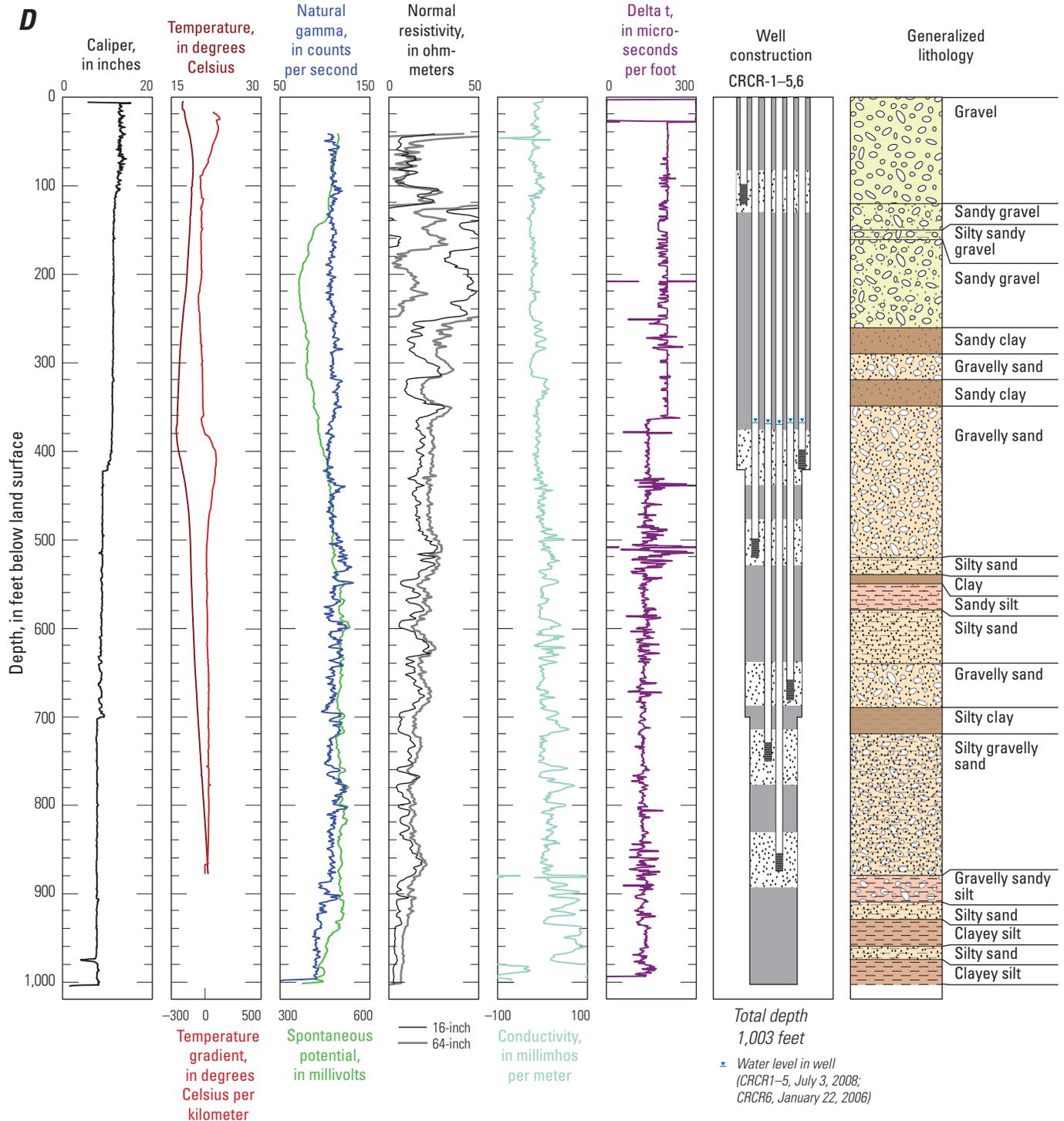


Figure 4. —Continued

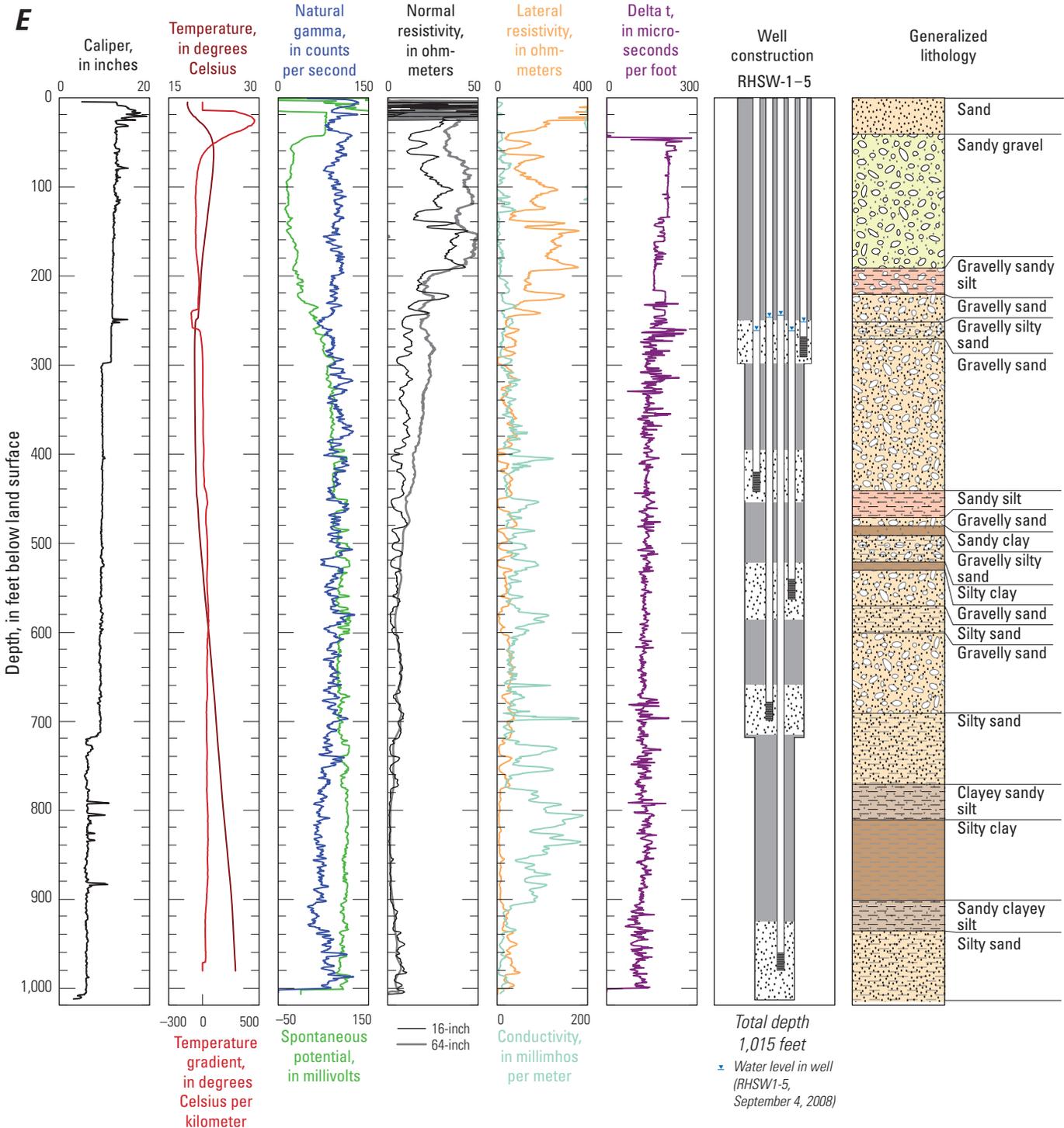


Figure 4. —Continued

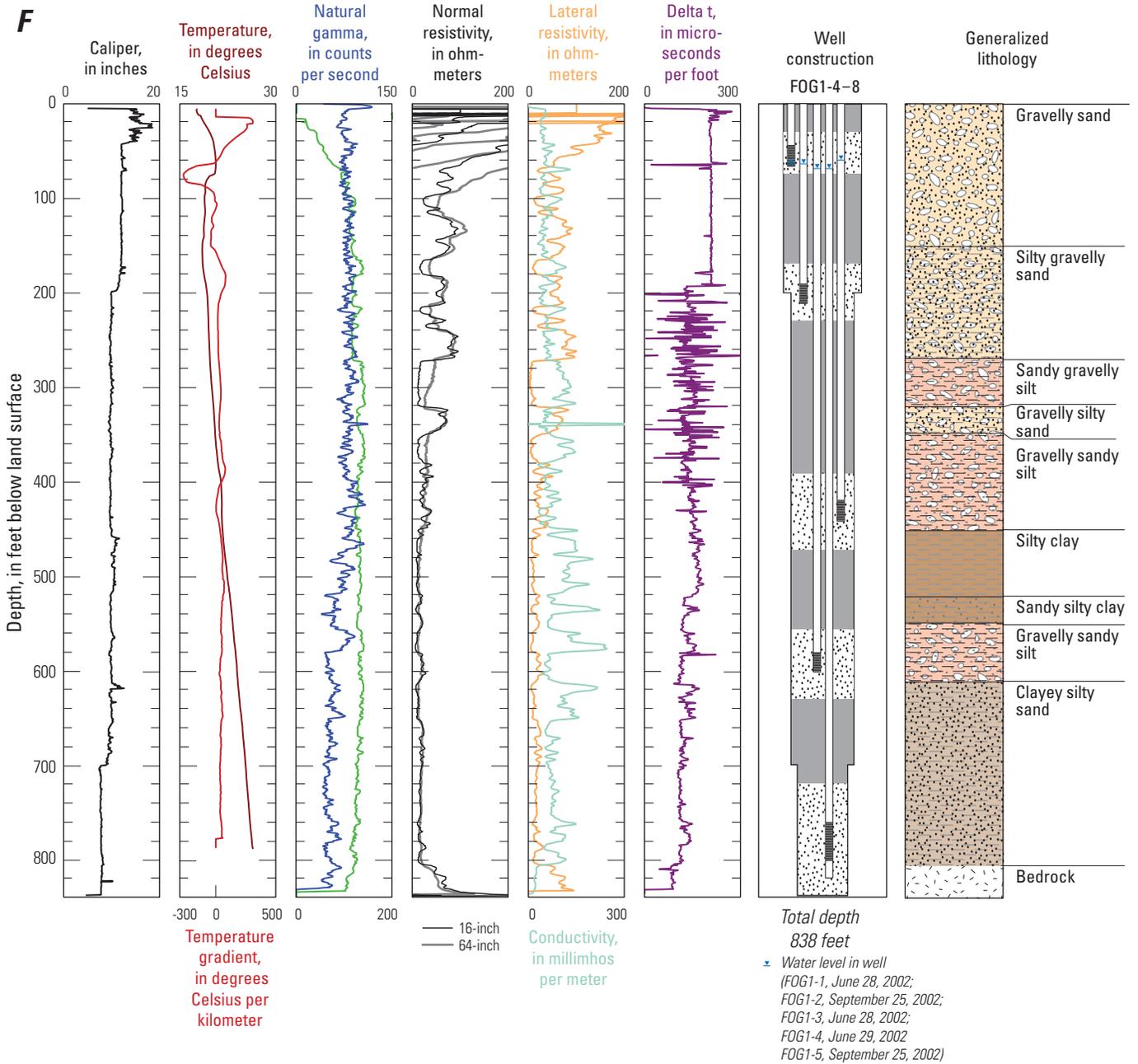


Figure 4. —Continued

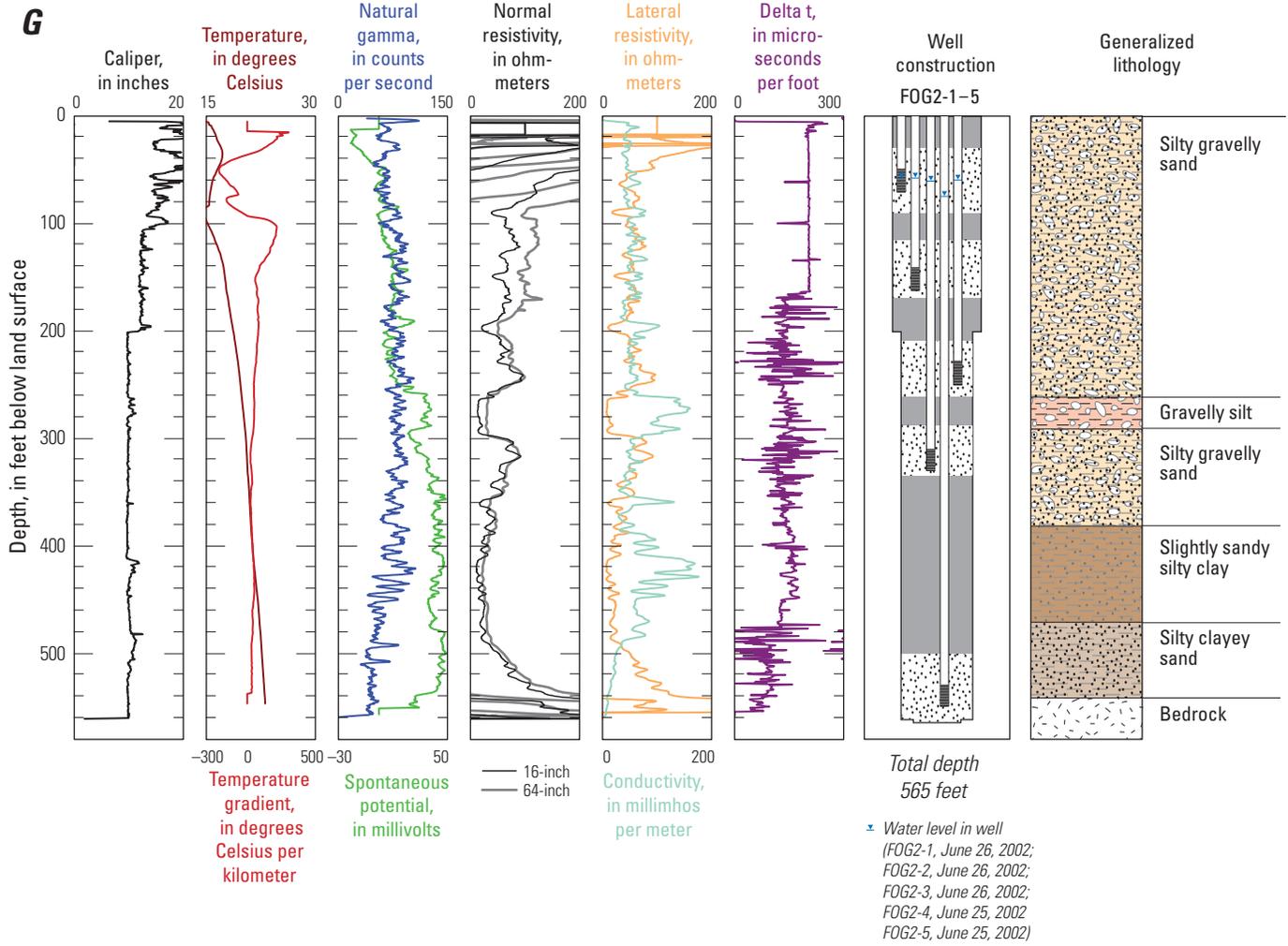
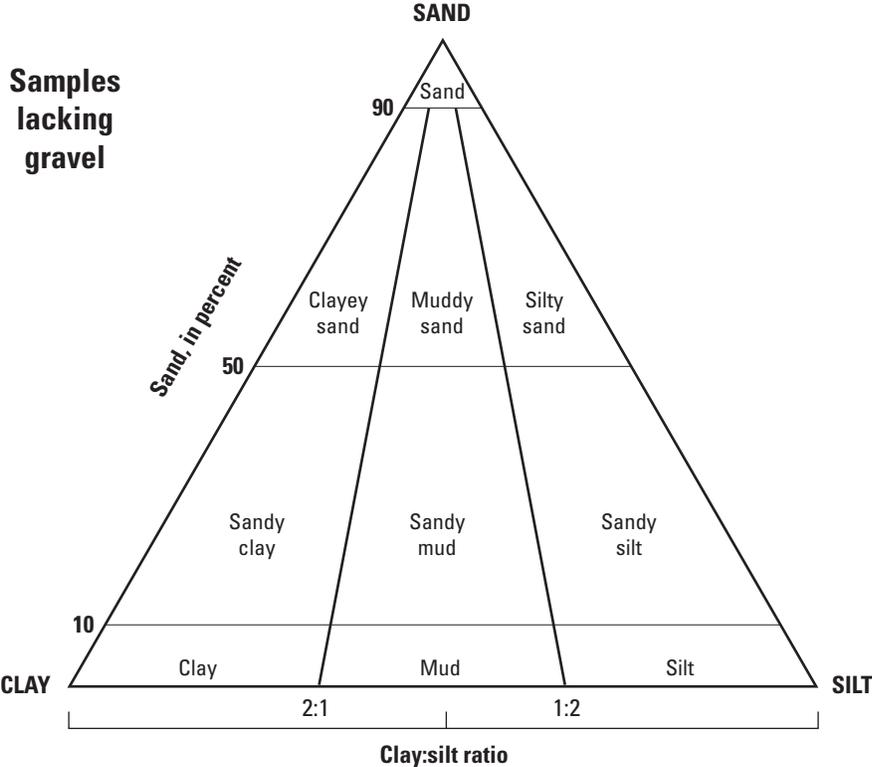
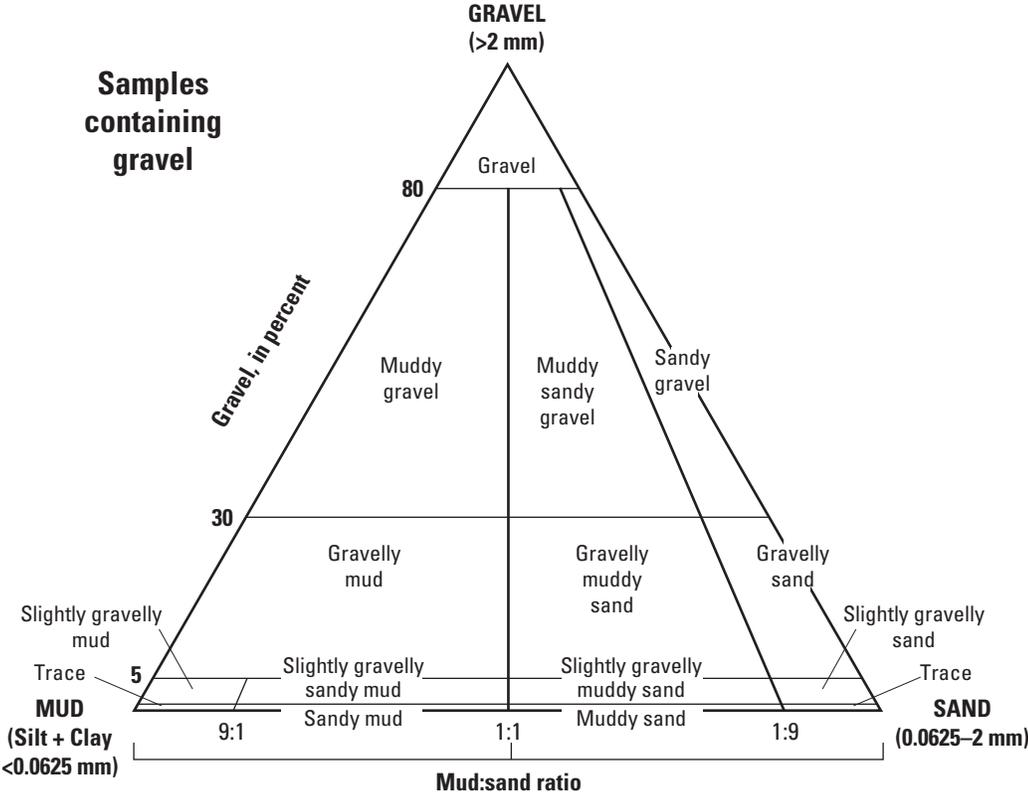


Figure 4. —Continued



>, greater than; <, less than; mm, millimeters

Modified from Lane, 1947

Figure 5. Grain-size classification chart.

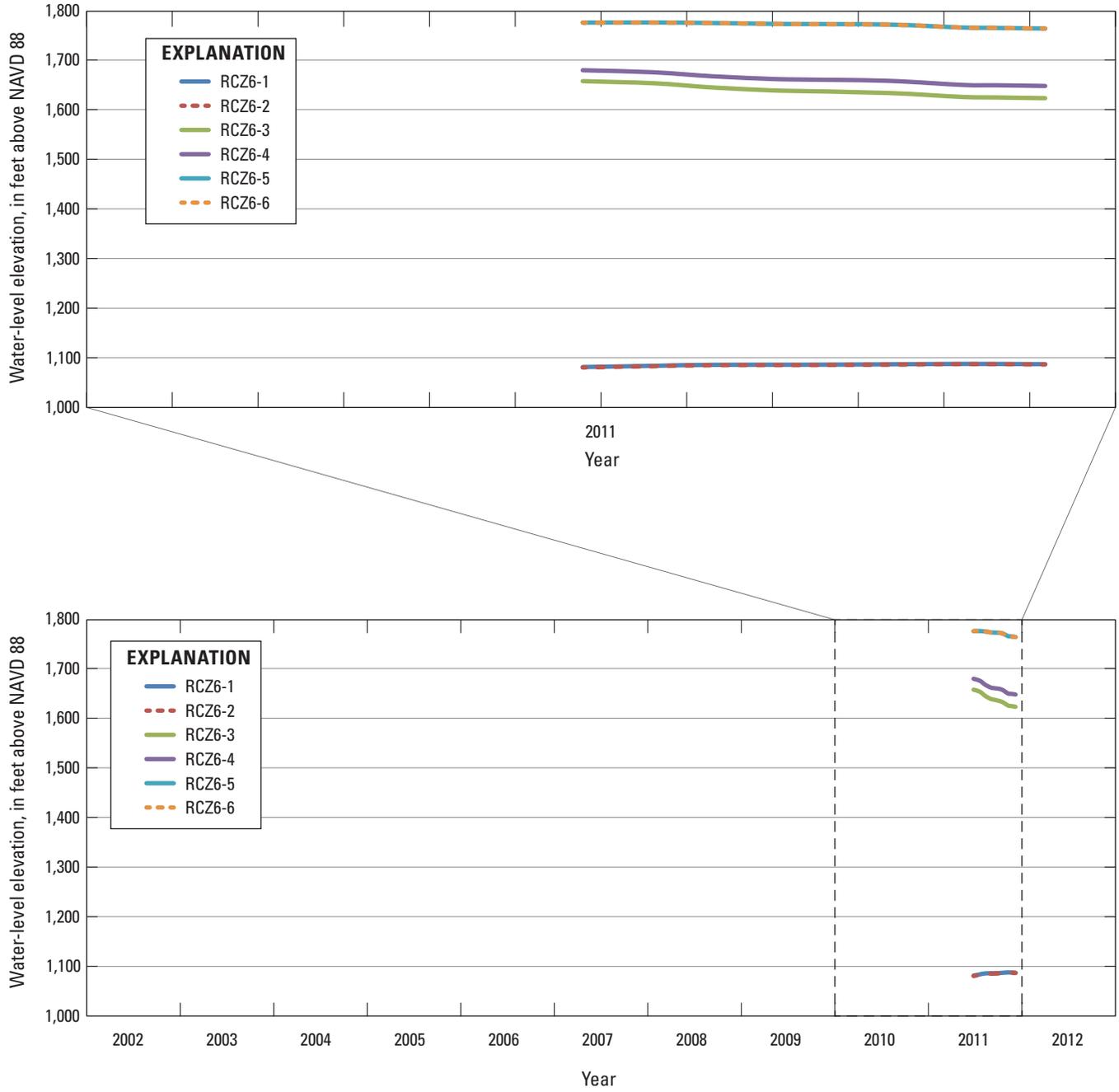


Figure 6. Water-level elevation in multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.

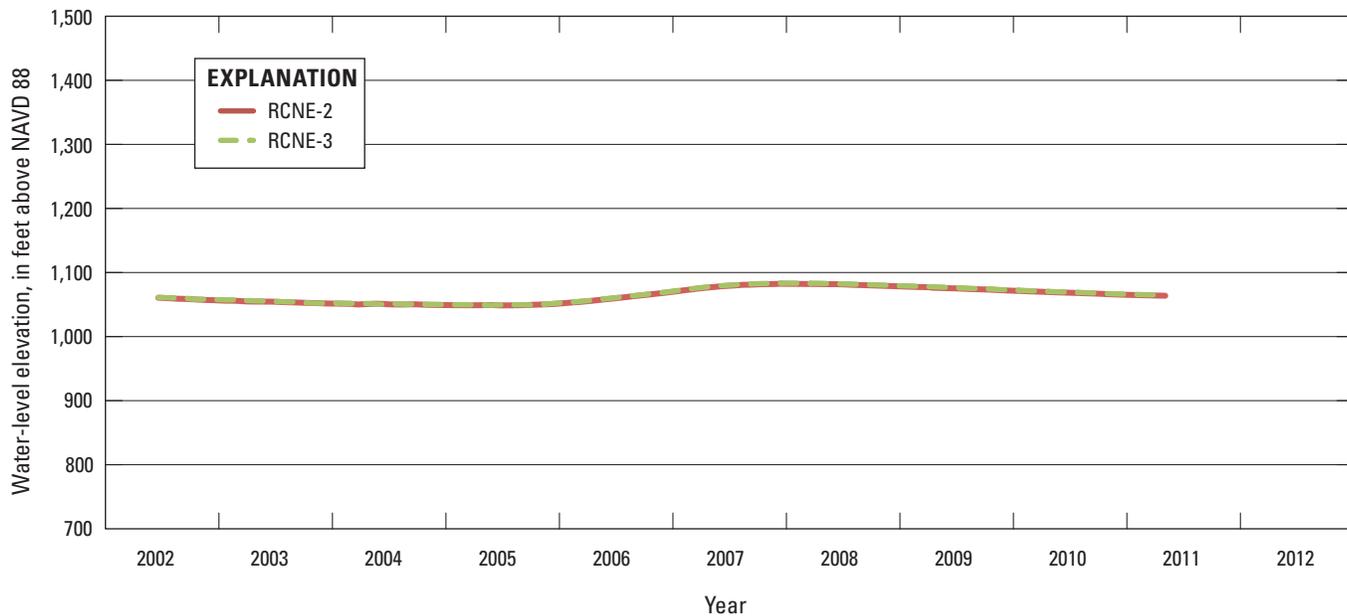


Figure 7. Water-level elevation in multiple-well monitoring site RCNE (1N/6W-26A2-3), San Bernardino County, California.

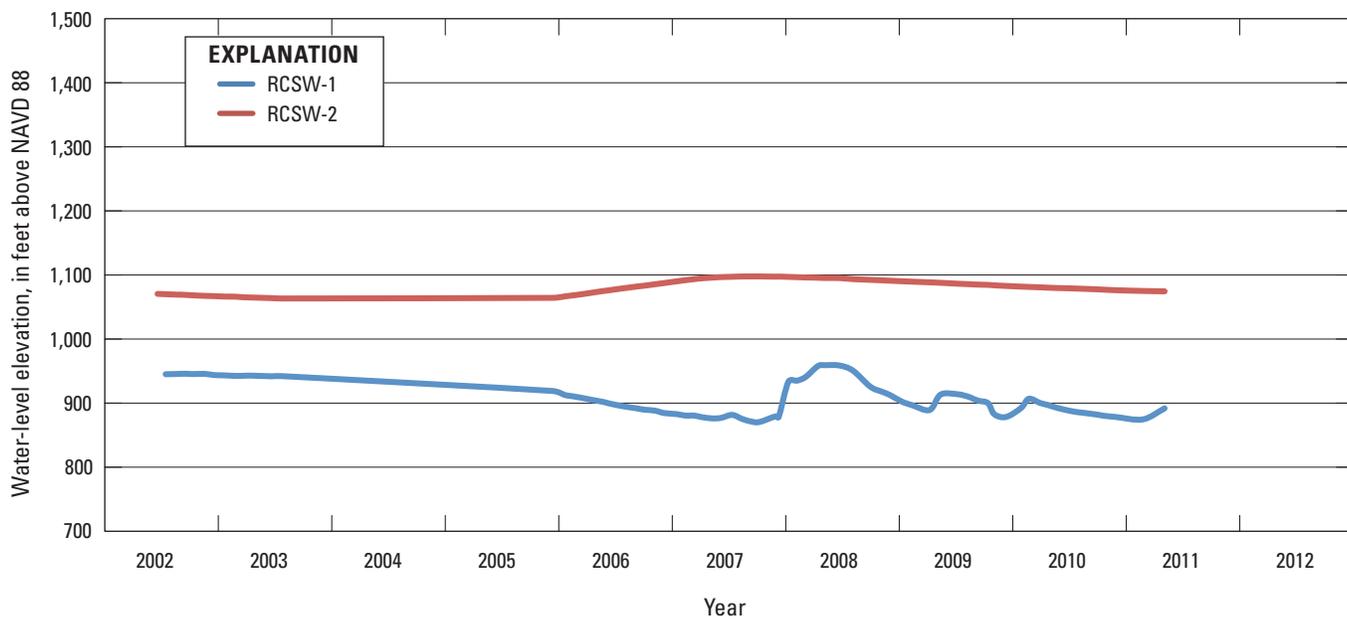


Figure 8. Water-level elevation in multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.

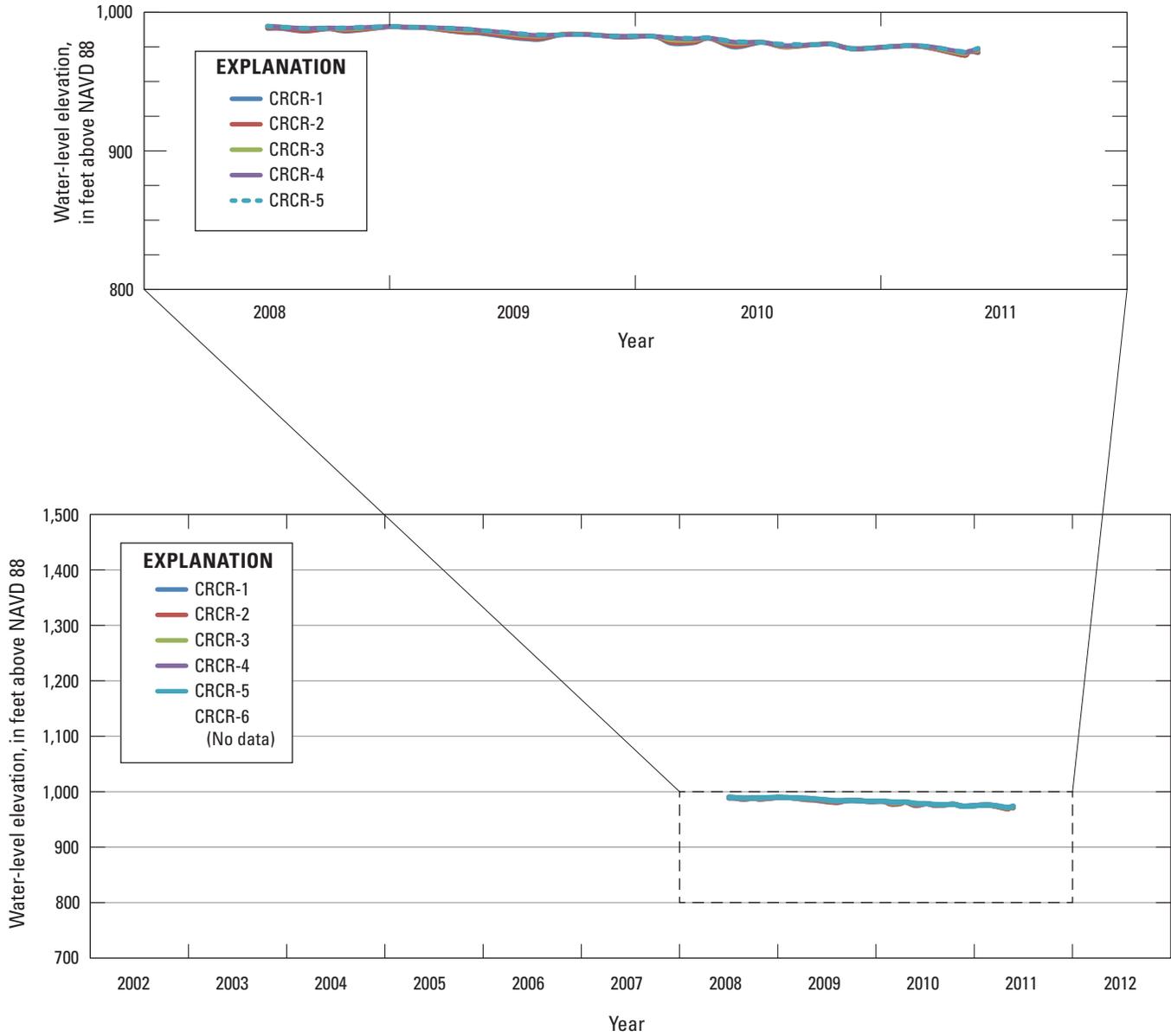


Figure 9. Water-level elevation in multiple-well monitoring site *CRCR (1S/5W-03A3-8)*, San Bernardino County, California.

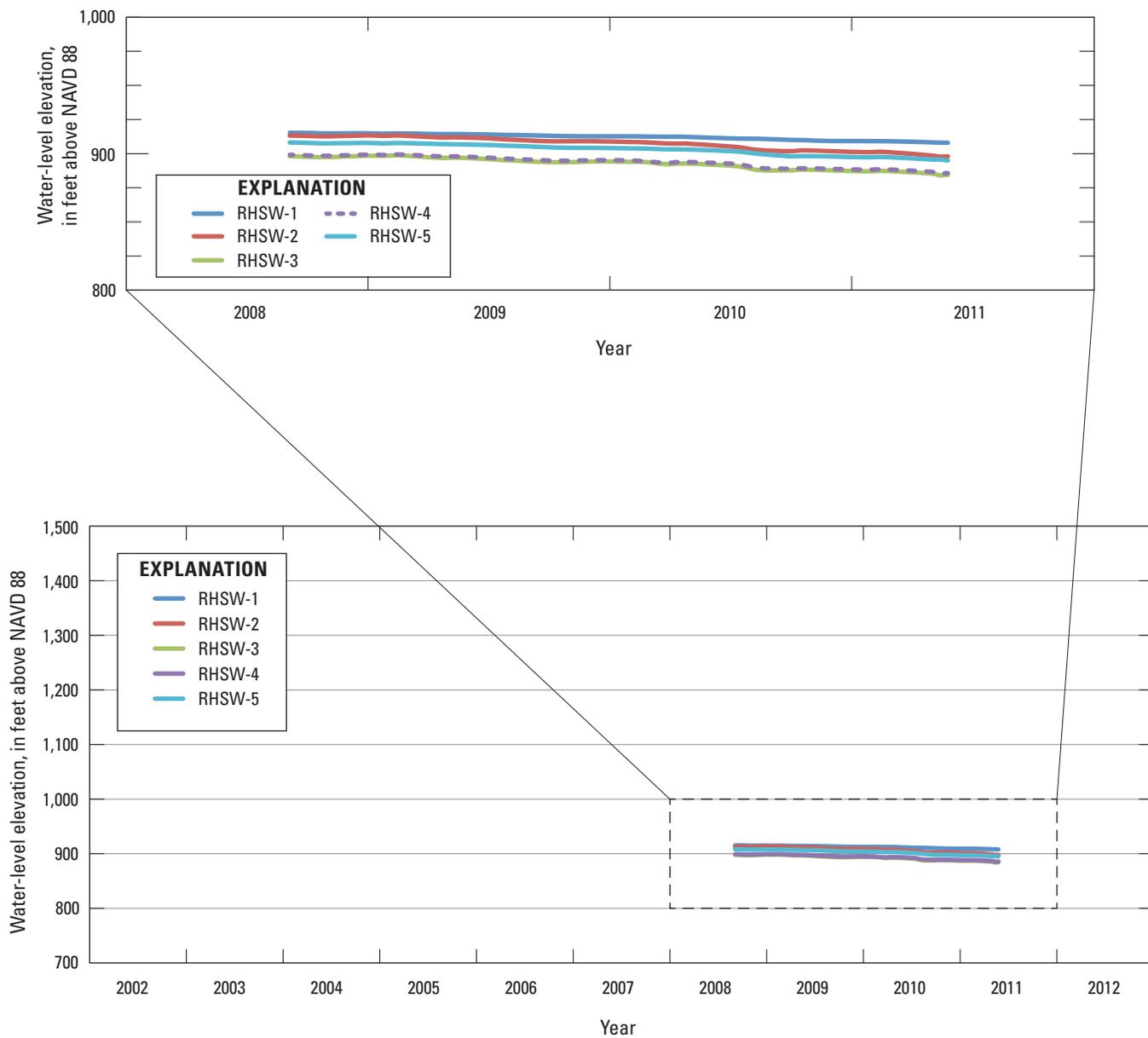


Figure 10. Water-level elevation in multiple-well monitoring site *RHSW (1S/5W-13B1-5)*, San Bernardino County, California.

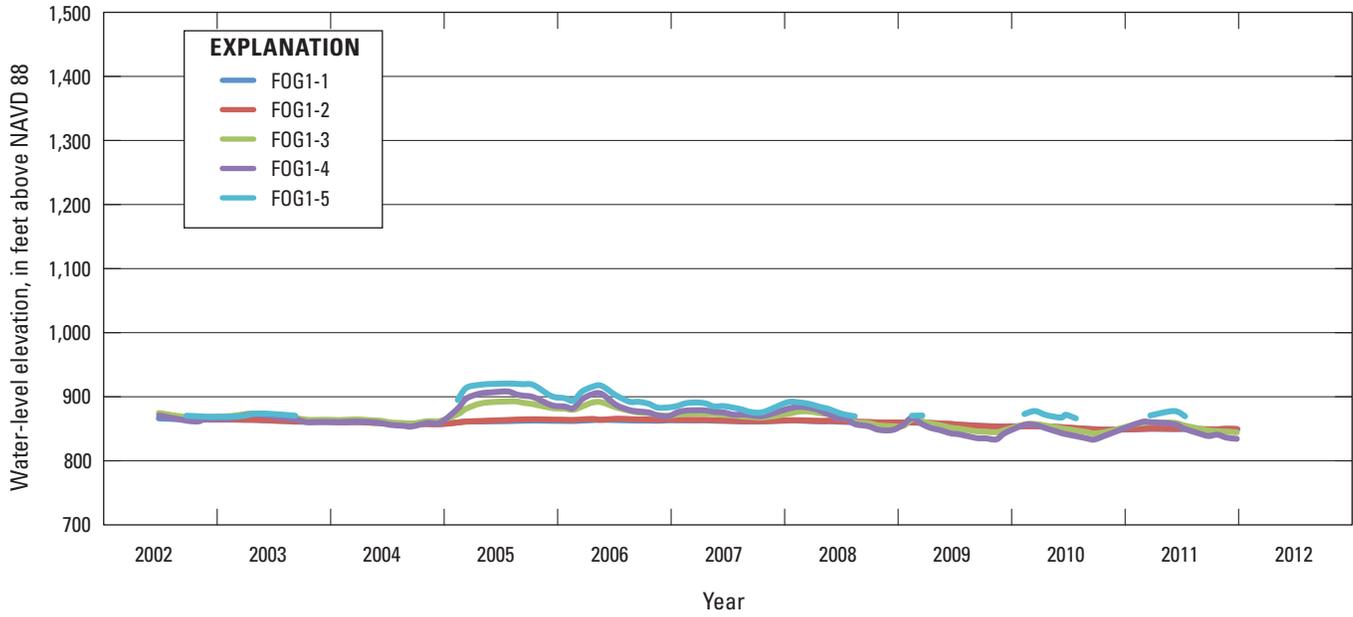


Figure 11. Water-level elevation in multiple-well monitoring site *FOG1 (1S/4W-29H4-8)*, San Bernardino County, California.

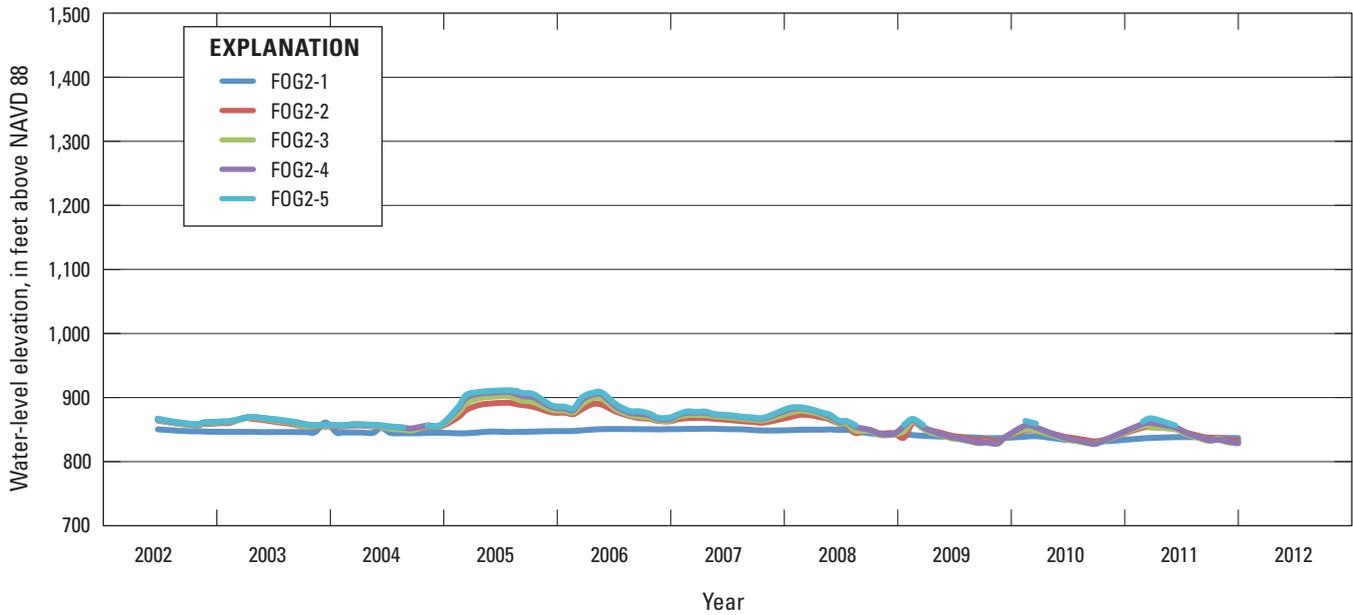
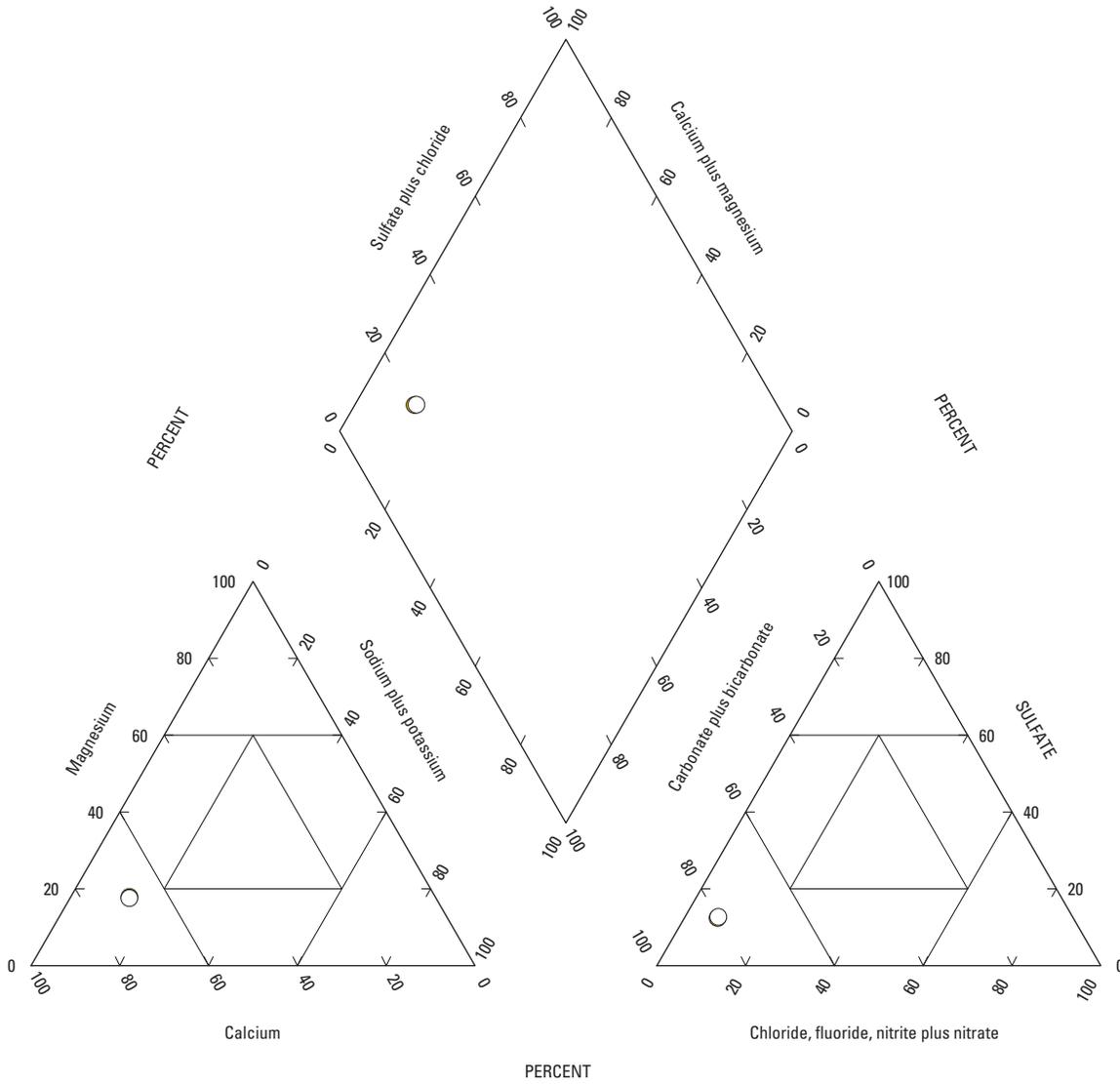


Figure 12. Water-level elevation in multiple-well monitoring site *FOG2 (1S/4W-29K1-5)*, San Bernardino County, California.

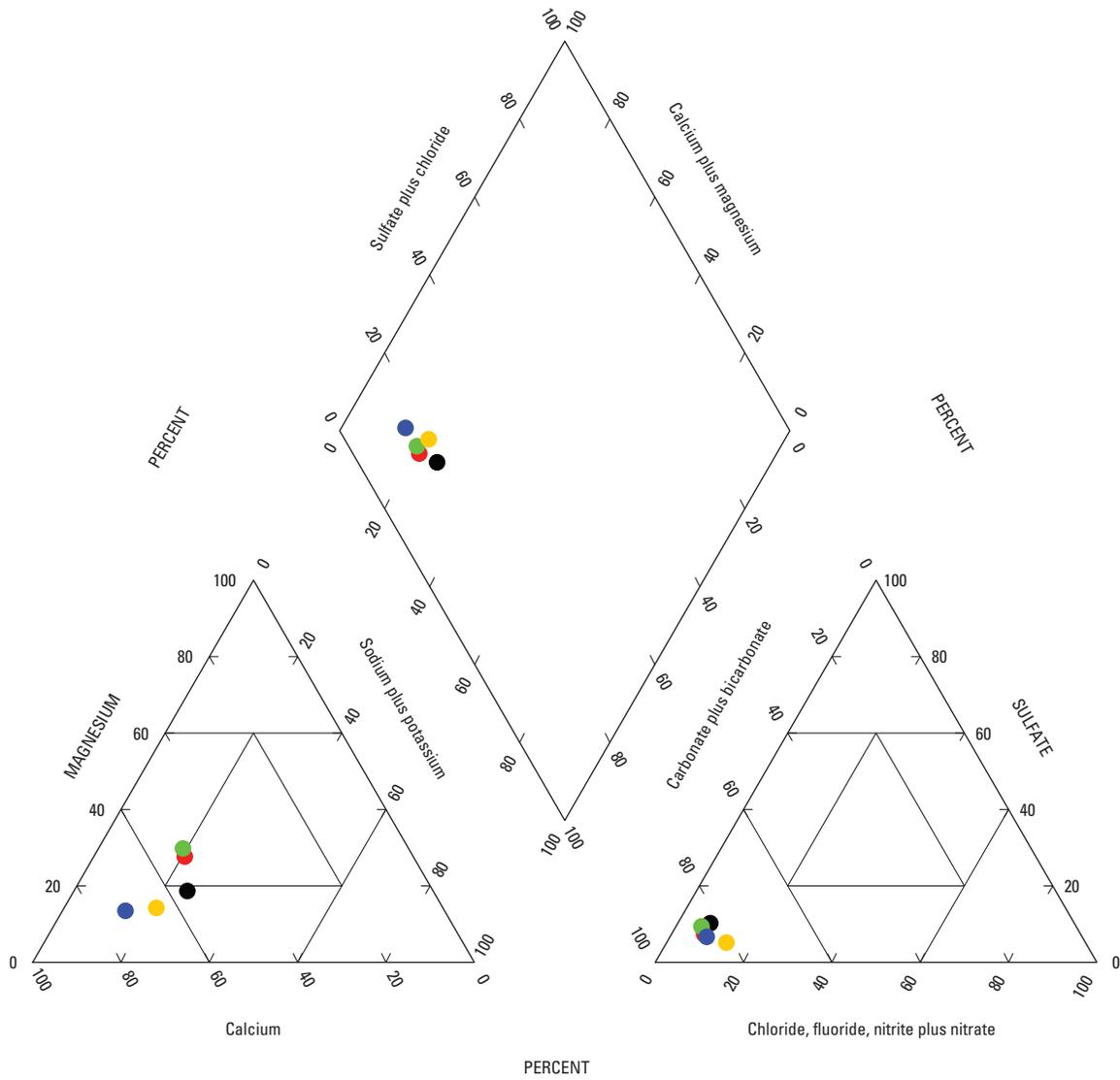


**EXPLANATION**

**Site and well number**

- RCZ6-6
- RCZ6-5

**Figure 13.** Major-ion chemistry of water from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California, 2011.

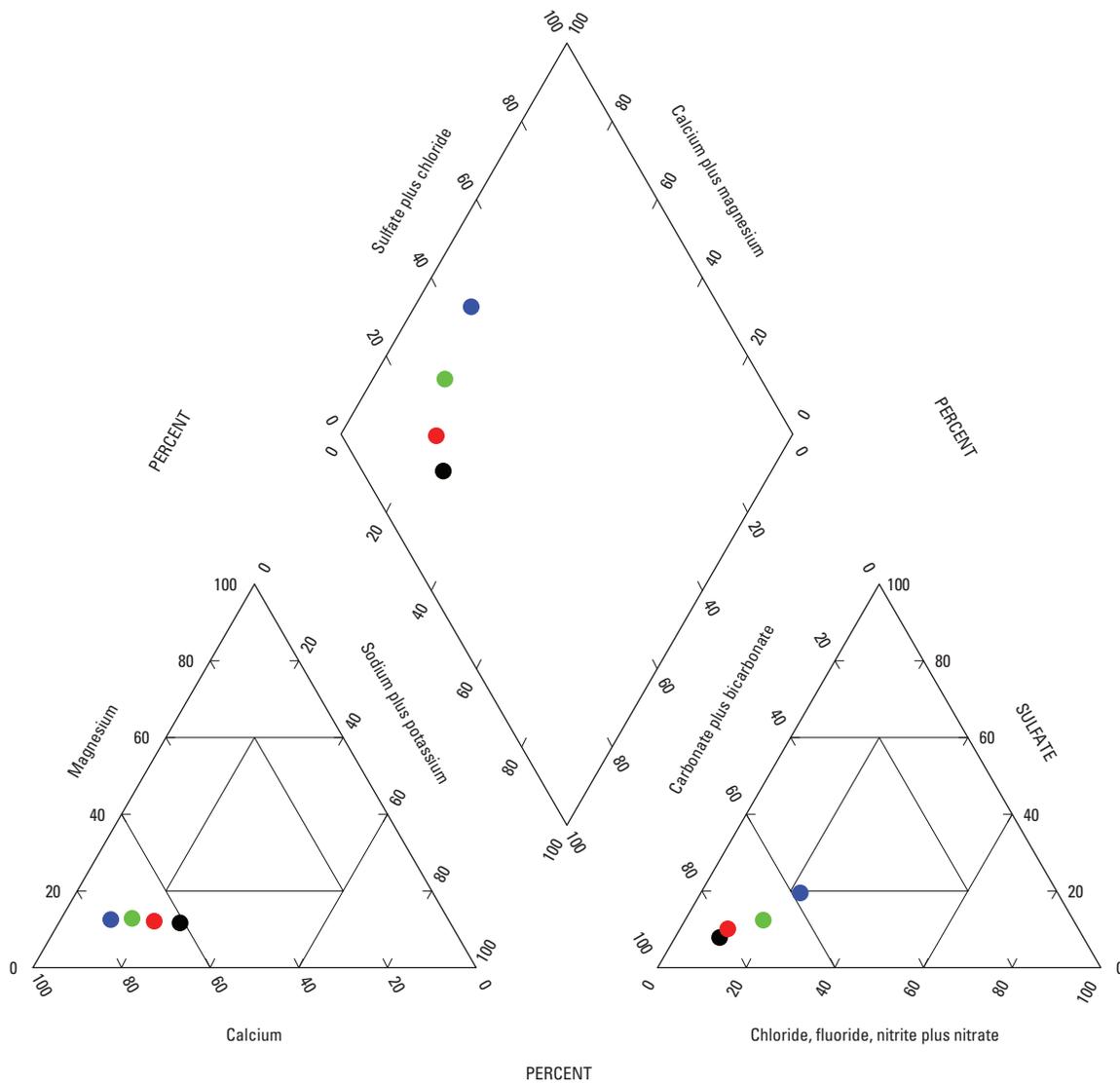


**EXPLANATION**

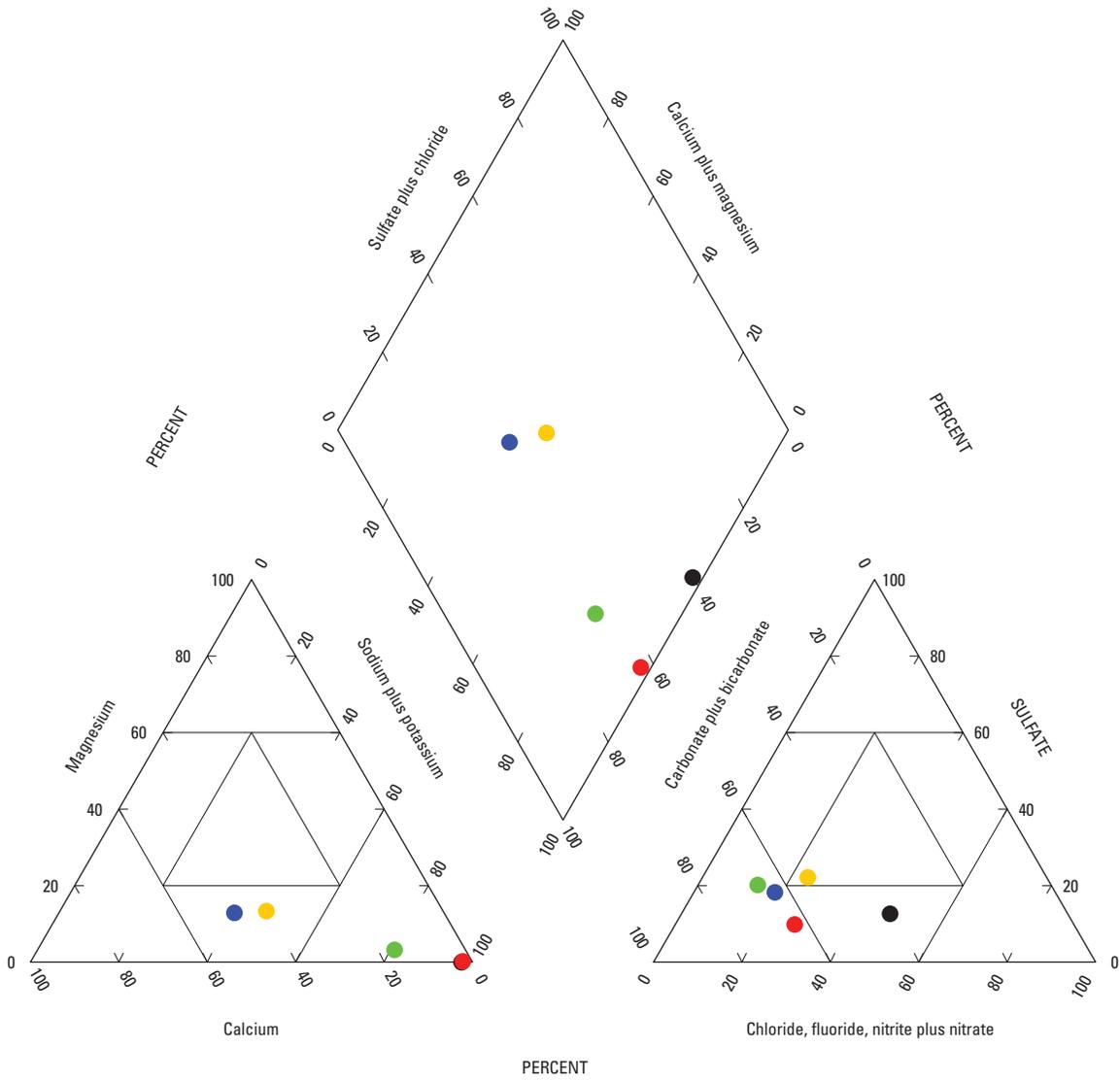
**Site and well number**

- CRCR-5
- CRCR-4
- CRCR-3
- CRCR-2
- CRCR-1

**Figure 14.** Major-ion chemistry of water from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California, 2007.



**Figure 15.** Major-ion chemistry of water from multiple-well monitoring site RHW (1S/5W-13B1-5), San Bernardino County, California, 2007.

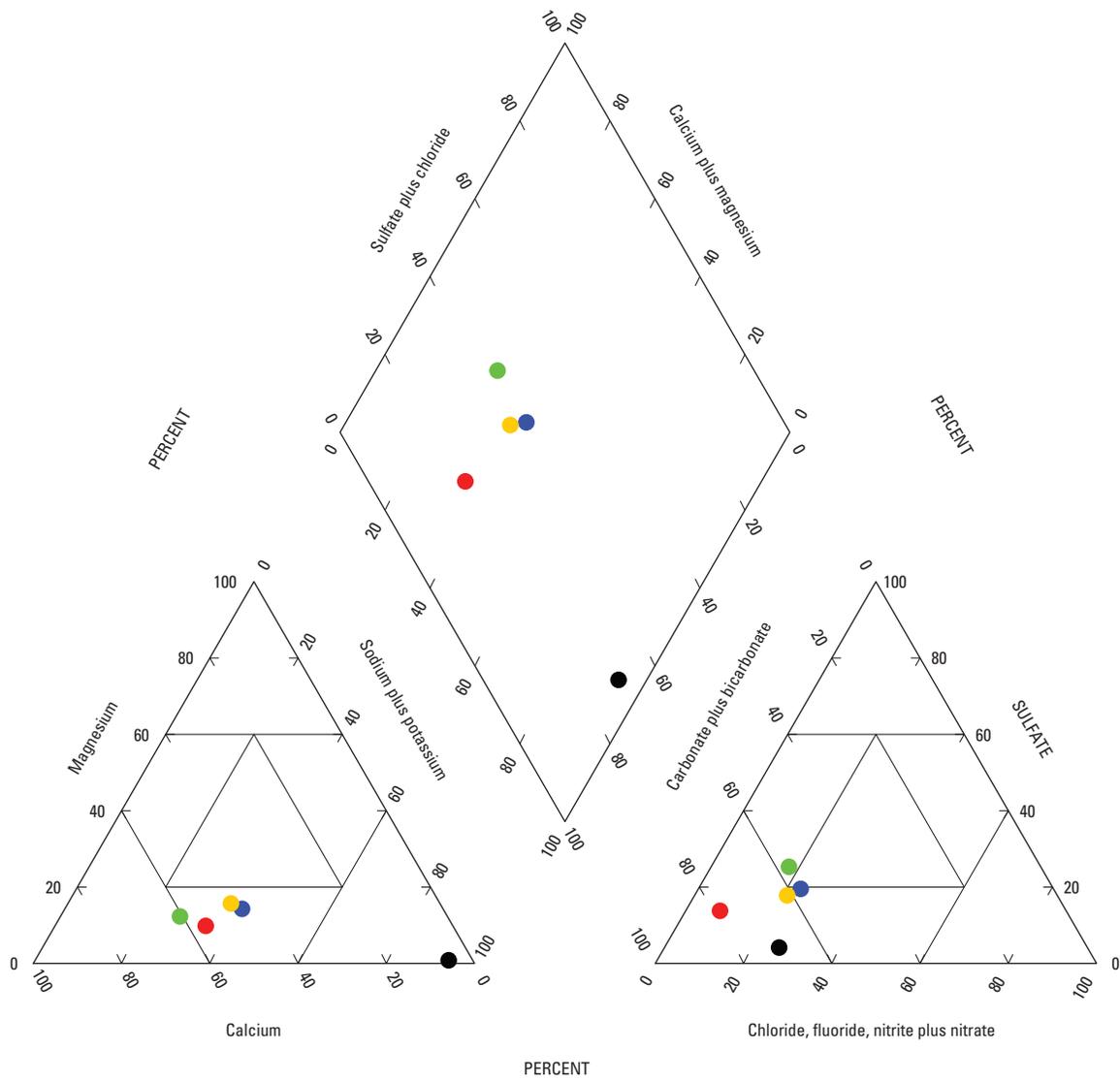


**EXPLANATION**

**Site and well number**

- FOG1-5
- FOG1-4
- FOG1-3
- FOG1-2
- FOG1-1

**Figure 16.** Major-ion chemistry of water from multiple-well monitoring site FOG1 (1S/4W-29H4-8), San Bernardino County, California, 2007.

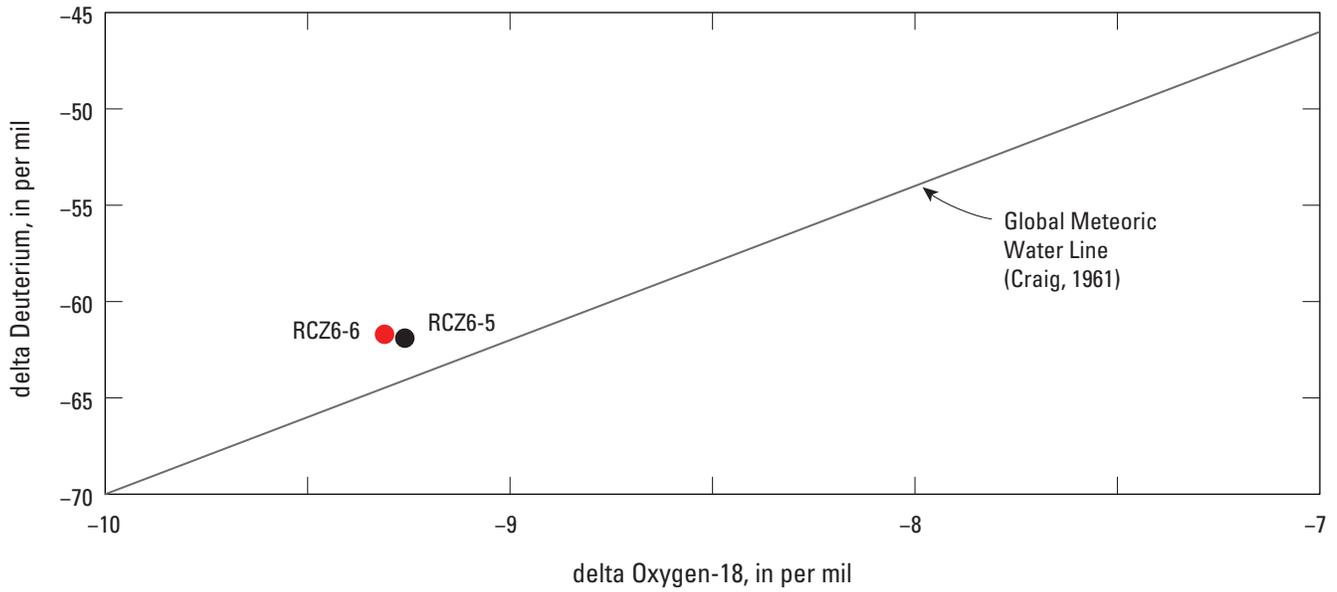


**EXPLANATION**

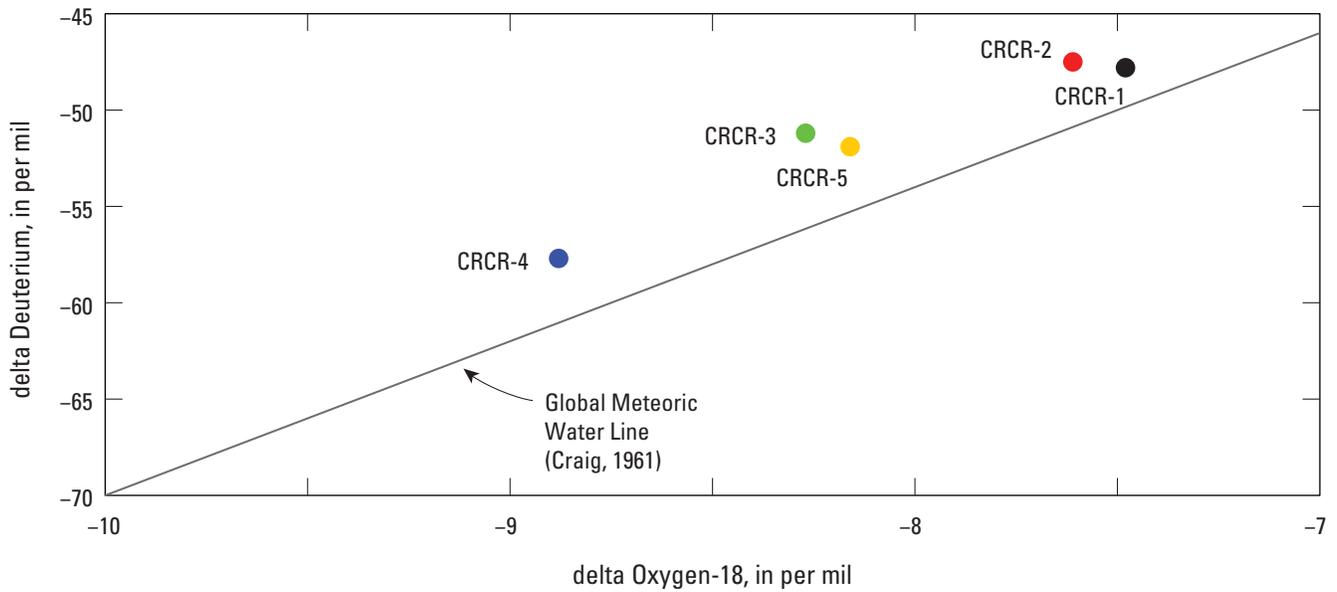
**Site and well number**

- FOG2-5
- FOG2-4
- FOG2-3
- FOG2-2
- FOG2-1

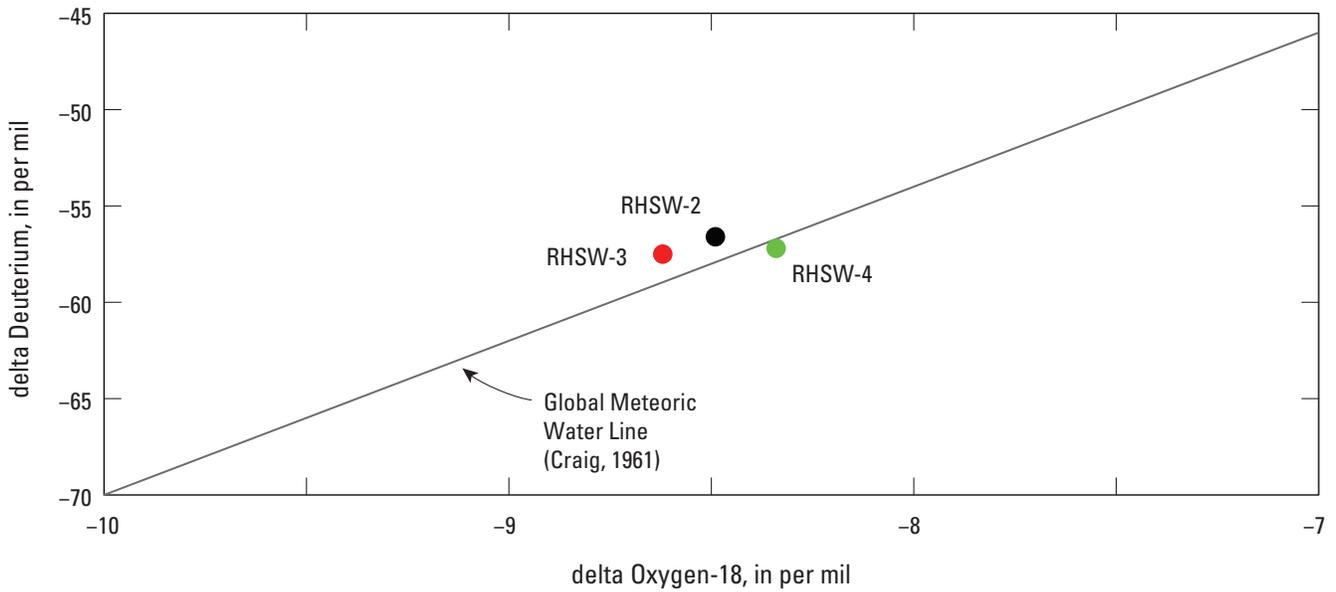
**Figure 17.** Major-ion chemistry of water from multiple-well monitoring site FOG2 (1S/4W-29K1-5), San Bernardino County, California, 2007.



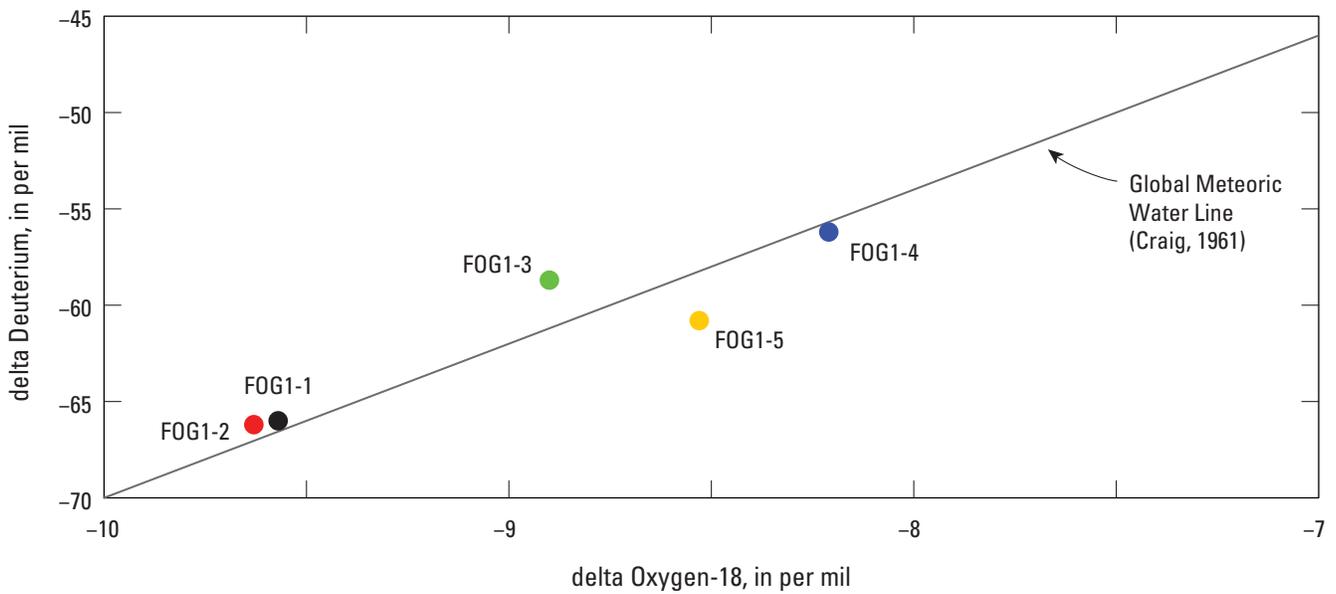
**Figure 18.** Delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California, 2011.



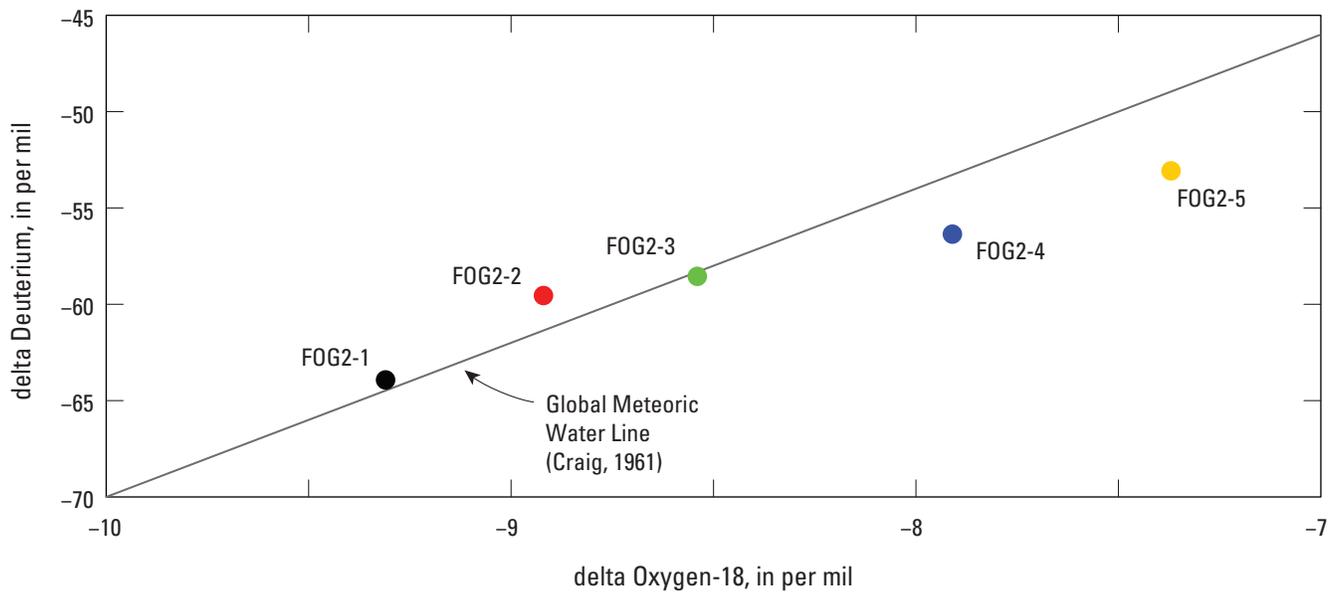
**Figure 19.** Delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California, 2007.



**Figure 20.** Delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California, 2007.



**Figure 21.** Delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site FOG1 (1S/4W-29H4-8), San Bernardino County, California, 2007.



**Figure 22.** Delta oxygen-18 and delta deuterium composition of water from multiple-well monitoring site FOG2 (1S/4W-29K1-5), San Bernardino County, California, 2007.

## Tables

**Table 1.** Well-identification and construction information for multiple-well monitoring sites, San Bernardino County, California.

[Site locations by common name are shown in figure 1. State well number, see "Well-Numbering System" section preceding text. U.S. Geological Survey (USGS) site identification number is the unique number for each site in the USGS National Water Information System (NWIS) database. **Abbreviations:** ft, feet; ft blsd, feet below land surface datum; in., inch; mm/dd/yyyy, month/day/year; NAVD 88, North American Vertical Datum of 1988]

State well number	USGS site identification number	Common name	Date of construction (mm/dd/yyyy)	Elevation of land surface (ft above NAVD 88)	Depth drilled (ft blsd)	Depth to bottom of casing (ft blsd)	Diameter of casing (in.)	Depth to top perforation (ft blsd)	Depth to bottom perforation (ft blsd)
IN/5W-17L1	341013117253901	RCZ6-1	07/21/2008	1,851	1,222	1,200	2	1,120	1,140
IN/5W-17L2	341013117253902	RCZ6-2	07/21/2008	1,851	1,222	945	2	925	945
IN/5W-17L3	341013117253903	RCZ6-3	07/21/2008	1,851	1,222	480	2	460	480
IN/5W-17L4	341013117253904	RCZ6-4	07/21/2008	1,851	1,222	360	2	340	360
IN/5W-17L5	341013117253905	RCZ6-5	07/21/2008	1,851	1,222	220	2	200	220
IN/5W-17L6	341013117253906	RCZ6-6	07/21/2008	1,851	1,222	120	2	100	120
IN/6W-26A1	340851117281901	RCNE-1	08/20/2001	1,540	889	870	2	750	770
IN/6W-26A2	340851117281902	RCNE-2	08/20/2001	1,540	889	660	2	640	660
IN/6W-26A3	340851117281903	RCNE-3	08/20/2001	1,540	889	550	2	530	550
IN/6W-26K2	340829117284301	RCSW-1	08/05/2001	1,470	718	700	2	600	620
IN/6W-26K3	340829117284302	RCSW-2	08/05/2001	1,470	718	450	2	430	450
IS/5W-03A3	340716117230601	CRCR-1	07/30/2005	1,358	1,003	875	2	855	875
IS/5W-03A4	340716117230602	CRCR-2	07/30/2005	1,358	1,003	750	2	730	750
IS/5W-03A5	340716117230603	CRCR-3	07/30/2005	1,358	1,003	680	2	660	680
IS/5W-03A6	340716117230604	CRCR-4	07/30/2005	1,358	1,003	520	2	500	520
IS/5W-03A7	340716117230605	CRCR-5	07/30/2005	1,358	1,003	420	2	400	420
IS/5W-03A8	340716117230606	CRCR-6	07/30/2005	1,358	1,003	120	2	100	120
IS/5W-13B1	340521117212001	RHSW-1	01/03/2005	1,160	1,013	980	2	960	980
IS/5W-13B2	340521117212002	RHSW-2	01/03/2005	1,160	1,013	695	2	675	695
IS/5W-13B3	340521117212003	RHSW-3	01/03/2005	1,160	1,013	560	2	540	560
IS/5W-13B4	340521117212004	RHSW-4	01/03/2005	1,160	1,013	440	2	420	440
IS/5W-13B5	340521117212005	RHSW-5	01/03/2005	1,160	1,013	290	2	270	290
IS/4W-29H4	340326117185301	FOG1-1	02/04/2002	935	839	820	2	760	800
IS/4W-29H5	340326117185302	FOG1-2	02/04/2002	935	839	600	2	580	600
IS/4W-29H6	340326117185303	FOG1-3	02/04/2002	935	839	440	2	420	440
IS/4W-29H7	340326117185304	FOG1-4	02/04/2002	935	839	210	2	190	210
IS/4W-29H8	340326117185305	FOG1-5	02/04/2002	935	839	65	2	45	65
IS/4W-29K1	340317117190401	FOG2-1	02/16/2002	925	563	550	2	530	550
IS/4W-29K2	340317117190402	FOG2-2	02/16/2002	925	563	330	2	310	330
IS/4W-29K3	340317117190403	FOG2-3	02/16/2002	925	563	250	2	230	250
IS/4W-29K4	340317117190404	FOG2-4	02/16/2002	925	563	160	2	140	160
IS/4W-29K5	340317117190405	FOG2-5	02/16/2002	925	563	70	2	50	70

**Table 2.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	20	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular; dark grayish brown (2.5Y 4/2).
20	40	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; olive gray (5Y 4/2).
40	60	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; dark olive gray (5Y 3/2).
60	80	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; dark olive gray (5Y 3/2).
80	100	Gravelly sand (gS); very fine to very coarse sand with granule- to large pebble-size gravel; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
100	120	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/4).
120	140	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
140	160	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subangular; dark grayish brown (2.5Y 4/2).
160	175	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
175	180	No sample collected.
180	200	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
200	220	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; angular to subrounded; dark grayish brown (2.5Y 4/2).
220	240	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
240	260	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
260	280	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; very poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
280	300	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; angular to subrounded; dark grayish brown (2.5Y 4/2).
300	320	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; angular to subrounded; dark grayish brown (2.5Y 4/2).
320	340	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; angular to subrounded; olive gray (5Y 4/2).
340	360	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; angular to subrounded; olive brown (2.5Y 4/3).
360	380	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
380	400	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
400	420	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
420	440	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
440	460	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
460	480	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3).
480	500	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
500	507	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; olive brown (2.5Y 4/3).
507	512	No sample collected.
512	519	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).

**Table 2.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
519	529	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granule- to small pebble-size gravel; poorly sorted; subangular; light olive brown (2.5Y 5/4).
529	534	No sample collected.
534	540	Sand (S); fine sand with very fine to very coarse sand; well sorted; subangular to rounded; light olive brown (2.5Y 5/4).
540	560	Sand (S); very fine to medium sand; very well sorted; subangular to rounded; light olive brown (2.5Y 5/4).
560	580	Silty sand (zS); very fine to medium sand with silt; well sorted; subangular to rounded; light olive brown (2.5Y 5/4).
580	600	Sand (S); very fine to medium sand; very well sorted; subangular to rounded; yellowish brown (10YR 5/4).
600	620	Sand (S); very fine to medium sand; very well sorted; subangular to rounded; light olive brown (2.5Y 5/4).
620	640	Silty sand (zS); very fine to very coarse sand with silt; moderately sorted; subangular to rounded; light olive brown (2.5Y 5/4).
640	660	Silty sand (zS); very fine to medium sand with silt; well sorted; subangular to rounded; light olive brown (2.5Y 5/4).
660	680	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
680	700	Silty sand (zS); very fine to medium sand with silt; well sorted; subangular to subrounded; light yellowish brown (2.5Y 6/3).
700	720	Silty sand (zS); very fine to medium sand with silt; well sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
720	740	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
740	760	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
760	780	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
780	800	Clayey silty sand (mS); very fine to medium sand with silt and clay; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
800	820	No sample collected.
820	840	Clayey silty sand (mS); very fine to medium sand with silt and clay; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
840	860	Clayey silty sand (mS); very fine to medium sand with silt and clay; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
860	880	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
880	900	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
900	920	Clayey silty sand (mS); very fine to medium sand with silt and clay; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
920	940	Silty sand (zS); very fine to coarse sand with silt; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
940	960	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
960	980	Clayey silty sand (mS); very fine to medium sand with silt and clay; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/3).
980	1,000	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,000	1,020	Sand (S); very fine to medium sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,020	1,037	Silty sand (zS); very fine to medium sand with silt; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,037	1,057	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,057	1,077	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,077	1,097	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,097	1,117	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,117	1,137	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,137	1,157	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,157	1,177	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,177	1,197	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
1,197	1,217	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/3).

**Table 3.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
10	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; very poorly sorted; very angular to subangular; assorted colors.
20	Sandy gravel (sG); granules to medium pebbles with medium to very coarse sand; very poorly sorted; very angular to subrounded; assorted colors.
30	Sandy gravel (sG); granules to small pebbles with coarse to very coarse sand; poorly sorted; very angular to subrounded; dark olive gray (5Y 3/2).
40	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; very angular to subrounded; dark olive gray (5Y 3/2).
50	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; very angular to subangular; dark greenish gray (5GY 3/1).
60	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; very angular to subangular; dark greenish gray (5GY 3/1).
70	Sandy gravel (sG); granule to medium pebbles with coarse to very coarse sand; poorly sorted; very angular to subrounded; dark greenish gray (5GY 3/1).
80	Sandy gravel (sG); granules to large pebbles with very coarse sand; moderately sorted; angular to subrounded; dark greenish gray (5GY 3/1).
90	Sandy gravel (sG); granules to large pebbles with coarse to very coarse sand; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
100	Gravelly sand (gS); medium to very coarse sand with granules to small pebble-size gravel; moderately sorted; angular to subrounded; light olive brown (2.5Y 5/3).
110	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; moderately sorted; angular to subrounded; light olive brown (2.5Y 5/3).
120	Gravelly sand (gS); coarse to very coarse sand with granules to medium pebble-size gravel; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
130	Gravelly sand (gS); medium to very coarse sand with granules to medium pebble-size gravel; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
140	Sandy gravel (sG); granules to medium pebbles with coarse to very coarse sand; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/3).
150	Silty sandy gravel (msG); granules to medium pebbles with medium to very coarse sand and silt; very poorly sorted; subangular to rounded; olive (5Y 5/3).
160	Sandy gravel (sG); granules to large pebbles and fine to very coarse sand; very poorly sorted; subrounded to angular; light yellowish brown (10YR 6/4).
170	Sandy gravel (sG); granules to large pebbles and very fine to very coarse sand; very poorly sorted; subrounded to angular; light yellowish brown (10YR 6/4).
175	Slightly gravelly sandy clay ((g)sM); clay and fine to medium sand with minor granules; moderately sorted; light olive brown (2.5Y 5/3).
1C shoe	
180	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; well-rounded to subrounded; light olive brown (2.5Y 5/4).
2C shoe	
190	Sandy gravel (sG); granules to medium pebbles and fine to very coarse sand; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
200	Silty sandy gravel (msG); granules to small pebbles, medium to very coarse sand and silt; poorly sorted; rounded to subangular; light olive brown (2.5Y 5/4).
210	Silty sandy gravel (msG); granules to small pebbles, medium to very coarse sand and silt; poorly sorted; rounded to subangular; light olive brown (2.5Y 5/4).
220	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
230	Silty sandy gravel (msG); granules to medium pebbles, very fine to very coarse sand and silt; very poorly sorted; subangular to very angular; light olive brown (2.5Y 5/4).
240	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/4).
250	Silty sandy gravel (msG); granules to medium pebbles, very fine to very coarse sand and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
260	Slightly gravelly sandy clay ((g)sM); clay, medium to very coarse sand, and minor small pebbles; poorly sorted; light olive brown (2.5Y 5/3).

**Table 3.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
270	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
280	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
290	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
300	Silty sandy gravel (msG); granules to medium pebbles, medium to very coarse sand, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
310	Silty sandy gravel (msG); granules to medium pebbles, medium to very coarse sand, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/4).
320	Silty sandy gravel (msG); granules to small pebbles, very fine to very coarse sand, and silt; very poorly sorted; subrounded to very angular; light olive brown (2.5Y 5/4).
330	Silty sandy gravel (msG); granules to small pebbles, very fine to very coarse sand, and silt; very poorly sorted; subrounded to very angular; light olive brown (2.5Y 5/4).
340	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to small pebbles; poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
350	Gravelly silty sand (gmS); medium to very coarse sand, silt, and granules to small pebbles; poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
360	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
370	Sandy clay (sC); clay and coarse to very coarse sand; well sorted; light olive brown (2.5Y 5/4).
380	Sandy silty clay (sM); clay, silt, and coarse to very coarse sand; well sorted; light olive brown (2.5Y 5/4).
390	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
400	Sandy silty clay (sM); clay, silt, and coarse to very coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
410	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
420	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
430	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
440	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
450	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; rounded to subrounded; light olive brown (2.5Y 5/4).
460	Gravelly silty sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
470	Gravelly silty sand (gmS); medium to very coarse sand, clay, and granules; poorly sorted; subrounded to subangular; reddish brown (2.5YR 5/3).
480	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
490	Gravelly silty sand (gmS); fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
497 washed	Gravelly sand (gS); medium to very coarse sand and granules; moderately sorted; subrounded to angular; assorted colors; mica-rich.
500	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; rounded to subangular; light olive brown (2.5Y 5/4).
512 3C shoe	Gravelly clayey sand (gmS); very fine to very coarse sand, clay, and granules to medium pebbles; very poorly sorted; subrounded to subangular; yellowish brown (10YR 5/4).
520	Silty sandy gravel (msG); granules to small pebbles and very fine to very coarse sand and silt; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
534 4C shoe	Slightly gravelly silty sand ((g)mS); very fine to very coarse sand, silt, and minor medium pebbles; very poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/4).

**Table 3.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
540	Gravelly clay (gM); clay and granules to small pebbles; well sorted; light olive brown (2.5Y 5/4).
550	Gravelly clay (gM); clay and granules to small pebbles; well sorted; light olive brown (2.5Y 5/4).
560	Sandy clay (sC); clay and very coarse sand; well sorted; light olive brown (2.5Y 5/3).
570	Sandy silty clay (sM); clay, silt, and medium to coarse sand; moderately sorted; light olive brown (2.5Y 5/3).
580	Silty sand (zS); medium to very coarse sand and silt; moderately sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
590	Silty sand (zS); medium to very coarse sand and silt; moderately sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
600	Sandy clay (sC); clay and fine to coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
610	Sandy clay (sC); clay and fine to coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
617	Gravelly sand (gS); fine to very coarse sand and granules; poorly sorted; subangular to angular; light gray (2.5Y 7/2).
washed	
620	Sandy clay (sC); clay and fine to very coarse sand; poorly sorted; light olive brown (2.5Y 5/4).
630	Sandy silty clay (sM); clay, silt, and fine to coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
640	Sandy clay (sC); clay and medium to coarse sand; well sorted; light olive brown (2.5Y 5/4).
650	Sandy clay (sC); clay and medium to coarse sand; well sorted; light olive brown (2.5Y 5/4).
660	Slightly gravelly sandy clay ((g)sM); clay, very fine to fine sand, and minor granules; moderately sorted; light olive brown (2.5Y 5/4).
670	Sandy clay (sC); clay and medium to coarse sand; well sorted; light olive brown (2.5Y 5/4).
680	Sandy clay (sC); clay and medium to coarse sand; well sorted; light olive brown (2.5Y 5/4).
690	Sandy clay (sC); clay and medium to very coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
700	Sandy silty clay (sM); clay, silt, and medium to very coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
710	Sandy clay (sC); clay and medium to very coarse sand; moderately sorted; grayish brown (2.5Y 5/2).
720	Sandy silty clay (sM); clay, silt, and medium to very coarse sand; moderately sorted; light olive brown (2.5Y 5/4).
730	Sandy clay (sC); clay and very coarse sand; well sorted; light olive brown (2.5Y 5/4).
740	Slightly gravelly sandy clay ((g)sM); clay, fine to very coarse sand, and minor granules; poorly sorted; light olive brown (2.5Y 5/4).
750	Slightly gravelly sandy clay ((g)sM); clay, fine to very coarse sand, and minor granules; poorly sorted; light olive brown (2.5Y 5/4).
760	Sandy silty clay (sM); clay, silt, and fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/4).
770	Sandy silty clay (sM); clay, silt, and fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/4).
780	Sandy silty clay (sM); clay, silt, and fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/4).
790	Silty clayey sand (mS); very fine to very coarse sand, clay, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
800	Silty clayey sand (mS); very fine to very coarse sand, clay, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
810	Silty clayey sand (mS); very fine to very coarse sand, clay, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
820	Silty sand (zS); coarse to very coarse sand and silt; well sorted; rounded to subrounded; light olive brown (2.5Y 5/3).
830	Sandy silty clay (sM); clay, silt, and fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
840	Slightly gravelly sandy clay ((g)sM); clay, medium to very coarse sand, and minor granules; poorly sorted; light olive brown (2.5Y 5/3).
850	Slightly gravelly sandy clay ((g)sM); clay, medium to very coarse sand, and minor granules; poorly sorted; light olive brown (2.5Y 5/3).
860	Sandy silt (sZ); silt and fine to coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
870	Sandy silty clay (sM); clay, silt, and medium to very coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
880	Silty clayey sand (mS); medium to very coarse sand, clay, and silt; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
890	Sandy silty clay (sM); clay, silt, and coarse to very coarse sand; moderately sorted; light olive brown (2.5Y 5/3).
900	Silty sand (zS); medium to coarse sand and silt; well sorted; subangular to angular; light olive brown (2.5Y 5/3).
910	Sandy silt (sZ); silt and medium to very coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
920	Sandy silt (sZ); silt and medium to very coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
930	Sandy silt (sZ); silt and medium to very coarse sand; poorly sorted; light olive brown (2.5Y 5/3).

**Table 3.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCZ6 (1N/5W-17L1-6), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
940	Silty clayey sand (mS); very fine to coarse sand, clay, and silt; very poorly sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
950	Silty sand (zS); very fine to coarse sand and silt; poorly sorted; subrounded to angular; yellowish brown (10YR 5/4).
960	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subangular to very angular; light yellowish brown (2.5Y 6/3).
970	Sandy clay (sC); clay and medium to coarse sand; well sorted; light olive brown (2.5Y 5/3).
980	Clayey silty sand (mS); very fine to very coarse sand, silt, and clay; very poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/3).
990	Clayey silty sand (mS); very fine to very coarse sand, silt, and clay; very poorly sorted; subrounded to subangular; light olive brown (2.5Y 5/3).
1,000	Clayey sand (cS); medium to very coarse sand and clay; moderately sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3).
1,010	Clayey sand (cS); medium to very coarse sand and clay; moderately sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3).
1,020	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; rounded to angular; light yellowish brown (2.5Y 6/3).
1,030	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; rounded to angular; light yellowish brown (2.5Y 6/3).
1,040	Sandy silty clay (sM); clay, silt, and medium to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3).
1,050	Sand (S); very fine to very coarse sand; poorly sorted; rounded to angular; light yellowish brown (2.5Y 6/3).
1,060	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; rounded to subangular; light brownish gray (2.5Y 6/2).
1,070	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; rounded to subangular; light brownish gray (2.5Y 6/2).
1,080	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; rounded to subangular; light brownish gray (2.5Y 6/2).
1,090	Clayey silty sand (mS); very fine to very coarse sand, silt, and clay; very poorly sorted; subrounded to very angular; light brownish gray (2.5Y 6/2).
1,100	Gravelly sand (gS); fine to very coarse sand and granules; poorly sorted; rounded to subangular; light brownish gray (2.5Y 6/2).
1,110	Gravelly sand (gS); fine to very coarse sand and granules; poorly sorted; rounded to subangular; light brownish gray (2.5Y 6/2).
1,120	Sand (S); very fine to very coarse sand; poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,130	Sand (S); very fine to very coarse sand; poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,140	Silty sand (zS); very fine to coarse sand; poorly sorted; rounded to subangular; yellowish brown (10YR 5/4).
1,150	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,160	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,170	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,180	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,190	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,200	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
1,210	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).

**Table 4.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	18	Gravelly sand (gS); medium sand to granules; moderately sorted; angular to subangular; olive (5Y 5/3).
18	38	Gravelly sand (gS); medium sand to granules; moderately sorted; angular to subangular; olive gray (5Y 5/2).
38	58	Gravelly sand (gS); medium sand to pebbles; moderately sorted; subangular; olive gray (5Y 5/2); pebbles are <8 mm in diameter.
58	78	Gravelly sand (gS); medium sand to pebbles; moderately sorted; subangular; olive gray (5Y 5/2); pebbles are <8 mm in diameter.
78	98	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; olive gray (5Y 5/2); pebbles are <12 mm in diameter.
98	118	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; olive gray (5Y 5/2); pebbles are <25 mm in diameter.
118	138	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; olive gray (5Y 5/2); pebbles are <12 mm in diameter.
138	148	Gravelly sand (gS); fine to very coarse sand with occasional granules and pebbles; poorly sorted; subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
148	160	No sample collected.
160	170	Gravelly sand (gS); very fine sand to granules; poorly sorted; angular to subangular; yellowish brown (10YR 5/4).
170	190	Gravelly sand (gS); fine sand to pebbles; poorly sorted; angular to subangular; light yellowish brown (10YR 6/4); pebbles are <10 mm in diameter.
190	210	Gravelly sand (gS); medium sand to pebbles; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <8 mm in diameter.
210	230	Gravelly sand (gS); fine sand to pebbles; poorly sorted; angular to subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
230	250	Gravelly sand (gS); fine sand to pebbles; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3); pebbles are <8 mm in diameter.
250	270	Slightly gravelly silty clayey sand ((g)mS); very fine to very coarse sand with silt and clay and occasional granules; very poorly sorted; subangular; yellowish brown (10YR 5/4).
270	290	Gravelly sand (gS); fine sand to granules; moderately sorted; subangular; light olive brown (2.5Y 5/4).
290	310	Gravelly sand (gS); medium sand to pebbles; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <15 mm in diameter.
310	318	Gravelly sand (gS); fine sand to granules; moderately sorted; subangular; yellowish brown (10YR 5/4).
318	338	Gravelly silty sand (gmS); fine sand to granules with silt; poorly sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
338	358	Sand (S); very fine to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
358	378	Gravelly sand (gS); very fine sand to granules; poorly sorted; subangular; light yellowish brown (2.5Y 6/4).
378	398	Sand (S); very fine to very coarse sand; moderately sorted; subangular; yellowish brown (10YR 5/4).
398	418	Sand (S); very fine to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
418	438	Sand (S); very fine to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
438	458	Sand (S); very fine to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
458	498	No sample collected.
498	518	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/4).
518	538	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
538	558	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
558	578	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
578	598	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
598	618	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
618	638	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
638	658	Sand (S); fine to coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/4).
658	670	No sample collected.
670	690	Sand (S); fine to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/4).
690	710	Sand (S); fine to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/4).
710	730	Sand (S); fine to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
730	750	Sand (S); very fine to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).

**Table 4.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
750	770	Sand (S); fine to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/4).
770	786	Sand (S); medium to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
786	797	Silty clayey sand (mS); medium to coarse sand with silt and clay; moderately sorted; subangular; light olive brown (2.5Y 5/4).
797	817	Silty clayey sand (mS); medium to coarse sand with silt and clay; moderately sorted; subangular; light olive brown (2.5Y 5/4).
817	837	Silty clayey sand (mS); medium to coarse sand with some silt and clay; moderately sorted; subangular; light olive brown (2.5Y 5/4).

**Table 5.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
20	Gravel (G); pebbles to granules; well sorted; subrounded; light yellowish brown (2.5Y 6/4); pebbles are <20 mm in diameter.
30	Gravel (G); pebbles to granules; well sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <20 mm in diameter.
40	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; gray (2.5Y 6/1); pebbles are <20 mm in diameter.
50	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; gray (2.5Y 6/1); pebbles are <20 mm in diameter.
60	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; gray (2.5Y 6/1); pebbles are <10 mm in diameter.
70	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; gray (2.5Y 6/1); pebbles are <15 mm in diameter.
80	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; gray (2.5Y 6/1); pebbles are <12 mm in diameter.
90	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; dark gray (2.5Y 4/1); pebbles are <15 mm in diameter.
100	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to angular; dark gray (2.5Y 4/1); pebbles are <20 mm in diameter.
110	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark gray (2.5Y 4/1); pebbles are <10 mm in diameter.
120	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; gray (2.5Y 5/1).
130	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; gray (2.5Y 6/1); pebbles are <10 mm in diameter.
140	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark grayish brown (2.5Y 4/2); pebbles are <15 mm in diameter.
145	Silty clayey sandy gravel (msG); pebbles to very coarse sand with silt and clay; moderately sorted; subrounded to subangular; strong brown (7.5YR 4/6); pebbles are <10 mm in diameter.
170	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
175	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
180	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
185	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.
190	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
195	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
200	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
205	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
210	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
215	Gravel (G); pebbles and granules; well sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <20 mm in diameter.
220	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <8 mm in diameter.
225	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3); pebbles are <15 mm in diameter.
230	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.

**Table 5.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
240	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3); pebbles are <10 mm in diameter.
250	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; light yellowish brown (10YR 6/4); pebbles are <10 mm in diameter.
255	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; light yellowish brown (10YR 6/4); pebbles are <15 mm in diameter.
260	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <15 mm in diameter.
265	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular; yellowish brown (10YR 5/6); pebbles are <10 mm in diameter.
270	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
280	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
290	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
295	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; very angular to subangular; light olive brown (2.5Y 5/3); pebbles are <15 mm in diameter.
300	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular; light olive brown (2.5Y 5/3); pebbles are <10 mm in diameter.
305	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3); pebbles are <15 mm in diameter.
310	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/3); pebbles are <10 mm in diameter.
320	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; light olive brown (2.5Y 5/3); pebbles are <15 mm in diameter.
325	Gravelly silty sand (gmS); coarse sand to pebbles with silt to very fine sand; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4); pebbles are <15 mm in diameter.
330	Gravelly silty sand (gmS); coarse sand to pebbles with silt to very fine sand; poorly sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
335	Gravelly silty sand (gmS); coarse sand to pebbles with silt to very fine sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
340	Gravelly silty sand (gmS); coarse sand to pebbles with silt to very fine sand; poorly sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4); pebbles are <15 mm in diameter.
345	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
350	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
355	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
365	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
370	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; olive brown (2.5Y 4/4).
380	Gravelly silty sand (gmS); very coarse sand to granules with some silt; moderately sorted; subangular; olive brown (2.5Y 4/4).
390	Gravelly clayey silty sand (gmS); very coarse sand to granules with silt and clay; moderately sorted; subangular; dark yellowish brown (10YR 4/4).
395	Silty clayey sand (mS); coarse to very coarse sand with silt and clay; moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
400	Gravelly silty sand (gmS); very coarse sand to pebbles with silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
405	Gravelly silty clayey sand (gmS); very coarse sand to pebbles with silt and clay; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
410	Silty sand (zS); coarse to very coarse sand with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).

**Table 5.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
415	Gravelly silty sand (gmS); very coarse sand and granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
420	Gravelly silty sand (gmS); very coarse sand and granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
435	Gravelly silty sand (gmS); very coarse sand and granules with silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
445	Silty sand (zS); coarse to very coarse sand with some silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
450	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
455	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
460	Gravelly sand (gS); very coarse sand to granules; well sorted; subangular to subrounded; brown (10YR 4/3).
480	Gravelly sand (gS); very coarse sand to granules with occasional pebbles; moderately sorted; subangular to subrounded; brown (10YR 4/3).
490	Gravelly sand (gS); very coarse sand to granules; well sorted; subangular to subrounded; brown (10YR 4/3).
500	Gravelly sand (gS); very coarse sand to granules; well sorted; subangular to subrounded; brown (10YR 4/3).
510	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subrounded to subangular; dark yellowish brown (10YR 4/4).
520	Gravelly sand (gS); coarse sand to granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
530	Gravelly sand (gS); coarse sand to granules with occasional pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
540	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <15 mm in diameter.
550	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
560	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
570	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
580	Gravelly sand (gS); coarse sand to granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
600	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4).
620	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4).
630	Gravelly silty sand (gmS); coarse sand to granules with occasional silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
640	Gravelly sand (gS); coarse sand to granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
650	Gravelly silty sand (gmS); coarse sand to granules with occasional silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
670	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
680	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
690	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
700	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
710	Gravelly silty sand (gmS); coarse sand to pebbles with occasional silt; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
720	Gravelly silty sand (gmS); coarse sand to granules with some silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
730	Gravelly silty sand (gmS); very coarse sand to pebbles with silt; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
740	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).

**Table 5.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCNE (1N/6W-26A1-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
750	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4); pebbles are <10 mm in diameter.
760	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
770	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
780	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
790	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
800	Gravelly silty sand (gmS); coarse sand to pebbles with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
810	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
820	Gravelly silty sand (gmS); coarse sand to granules with silt; moderately sorted; subangular; light olive brown (2.5Y 5/4).
830	Gravelly silty clayey sand (gmS); coarse sand to granules with silt and clay; moderately sorted; subangular; light olive brown (2.5Y 5/4).

**Table 6.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	10	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; olive (5Y 5/3).
10	30	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; olive gray (5Y 5/2).
30	50	Gravelly sand (gS); medium sand to pebbles; moderately sorted; subangular; olive (5Y 5/3); pebbles are <8 mm in diameter.
50	70	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; olive (5Y 5/3); pebbles are <12 mm in diameter.
70	80	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular; olive (5Y 5/3); pebbles are <8 mm in diameter.
80	97	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular; olive (5Y 5/3); pebbles are <8 mm in diameter.
97	117	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular; light olive brown (2.5Y 5/4); pebbles are <8 mm in diameter.
117	137	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular; light olive brown (2.5Y 5/4); pebbles are <8 mm in diameter.
137	155	No sample collected.
155	170	Sand (S); very fine sand to very coarse sand; moderately sorted; subangular; yellowish brown (10YR 5/6).
170	190	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
190	210	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
210	230	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; light olive brown (2.5Y 5/4).
230	250	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/6).
250	270	Gravelly sand (gS); medium sand to granules; moderately sorted; subangular to subrounded; brown (10YR 4/3).
270	290	Sand (S); medium to very coarse sand; moderately sorted; subangular to subrounded; brown (10YR 4/3).
290	310	Sand (S); medium to coarse sand; well sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
310	330	Sand (S); medium to very coarse sand; moderately sorted; subangular to subrounded; brown (10YR 4/3).
330	350	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/6).
350	370	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3).
370	390	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
390	400	No sample collected.
400	410	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/4).
410	430	Gravelly sand (gS); medium sand to granules; moderately sorted; subangular; light olive brown (2.5Y 5/4).
430	450	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; light olive brown (2.5Y 5/4); pebbles are <8 mm in diameter.
450	458	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
458	478	No sample collected.
478	490	Gravelly sand (gS); fine sand to granules; moderately sorted; subangular; light olive brown (2.5Y 5/4).
490	510	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
510	530	Gravelly sand (gS); medium sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
530	550	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
550	570	Sand (S); medium to very coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
570	590	Gravelly sand (gS); medium sand to granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
590	610	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
610	630	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
630	650	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
650	665	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
665	670	No sample collected.
670	678	Sand (S); fine to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).

**Table 7.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
10	Sandy gravel (sG); pebbles with some granules and very coarse sand; moderately sorted; subrounded to subangular; light olive gray (5Y 6/2); pebbles are <20 mm in diameter.
20	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive gray (5Y 6/2); pebbles are <25mm in diameter.
30	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive gray (5Y 6/2); pebbles are <25mm in diameter.
40	Sandy gravel (sG); pebbles with some very coarse sand to granules; moderately sorted; angular to subangular; light olive gray (5Y 6/2); pebbles are <20 mm in diameter.
45	Sandy gravel (sG); granules to pebbles with occasional very coarse sand; moderately sorted; angular; light olive gray (5Y 6/2); pebbles are <25 mm in diameter.
50	Sandy gravel (sG); granules to pebbles with occasional very coarse sand; moderately sorted; angular; gray (5Y 6/1); pebbles are <20 mm in diameter.
55	Sandy gravel (sG); granules to pebbles with occasional very coarse sand; moderately sorted; angular; dark gray (5Y 4/1); pebbles are <20 mm in diameter.
60	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; subangular to subrounded; dark gray (5Y 4/1); pebbles are <15 mm in diameter.
65	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subangular to subrounded; dark gray (5Y 4/1); pebbles are <20 mm in diameter.
70	Gravelly sand (gS); coarse sand to pebbles; moderately sorted; subrounded to subangular; dark gray (5Y 4/1); pebbles are <30 mm in diameter.
75	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <10 mm in diameter.
80	Sandy gravel (sG); pebbles with very coarse sand to granules; moderately sorted; angular; light olive gray (5Y 6/2); pebbles are <25 mm in diameter.
85	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <15 mm in diameter.
90	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <20 mm in diameter.
95	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; dark gray (5Y 4/1); pebbles are <15 mm in diameter.
100	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <20 mm in diameter.
105	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subrounded; dark gray (5Y 4/1); pebbles are <12 mm in diameter.
110	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular; gray (5Y 6/1); pebbles are <25 mm in diameter.
115	Sandy gravel (sG); pebbles to granules with occasional very coarse sand; moderately sorted; angular; gray (5Y 6/1); pebbles are <25 mm in diameter.
120	Sandy gravel (sG); pebbles to granules with some very coarse sand; moderately sorted; angular to subangular; gray (5Y 6/1); pebbles are <25 mm in diameter.
125	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <10 mm in diameter.
130	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subangular; dark gray (5Y 4/1); pebbles are <10 mm in diameter.
135	Gravelly silty sand (gmS); very coarse sand to pebbles with silt; poorly sorted; angular to subangular; brown (7.5YR 4/4); pebbles are <8 mm in diameter.
155	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; angular to subangular; light olive brown (2.5Y 5/4); pebbles are <8 mm in diameter.
160	Gravelly sand (gS); very coarse sand and granules; well sorted; angular to subangular; yellowish brown (10YR 5/4).
170	Gravelly silty sand (gmS); very coarse sand and granules with silt; moderately sorted; subangular; brown (7.5YR 4/4).
180	Gravelly silty sand (gmS); very coarse sand and granules with some silt; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4).
190	Gravelly silty sand (gmS); very coarse sand to pebbles with occasional silt; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4); pebbles are <8 mm in diameter.

**Table 7.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
200	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <15 mm in diameter.
210	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; brown (10YR 5/3); pebbles are <20 mm in diameter.
215	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; very angular to subangular; dark grayish brown (2.5Y 4/2); pebbles are <8 mm in diameter.
220	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; very angular to subangular; dark grayish brown (2.5Y 4/2); pebbles are <8 mm in diameter.
225	Sandy gravel (sG); granules and very coarse sand with some pebbles; moderately sorted; angular to subrounded; dark grayish brown (2.5Y 4/2).
230	Sandy gravel (sG); granules and very coarse sand with occasional pebbles; moderately sorted; angular to subrounded; light olive brown (2.5Y 5/4).
235	Silty sandy gravel (msG); granules and very coarse sand with occasional pebbles and silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
240	Silty sandy gravel (msG); granules and very coarse sand with occasional silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/6).
245	Silty sandy gravel (msG); granules and very coarse sand with occasional silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/6).
250	Silty sandy gravel (msG); granules and very coarse sand with occasional pebbles and silt; moderately sorted; subangular; yellowish brown (10YR 5/4).
255	Silty sandy gravel (msG); granules and very coarse sand with occasional pebbles and silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4).
260	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
265	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <8 mm in diameter.
270	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <8 mm in diameter.
275	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3); pebbles are <8 mm in diameter.
280	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3); pebbles are <8 mm in diameter.
285	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; brown (10YR 4/3); pebbles are <8 mm in diameter.
290	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular to subrounded; brown (10YR 4/3).
295	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; angular to subangular; brown (7.5YR 4/4); pebbles are <8 mm in diameter.
300	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; angular to subangular; yellowish brown (10YR 5/4); pebbles are <8 mm in diameter.
305	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
310	Gravelly sand (gS); very coarse sand and granules; well sorted; angular to subangular; dark yellowish brown (10YR 4/4).
315	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; angular to subangular; dark yellowish brown (10YR 4/4).
320	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <8 mm in diameter.
325	Gravelly sand (gS); very coarse sand and granules; well sorted; angular to subangular; dark yellowish brown (10YR 4/4).
330	Gravelly sand (gS); very coarse sand and granules; well sorted; angular to subangular; dark yellowish brown (10YR 4/4).
335	Silty gravelly sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
340	Silty gravelly sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4).
345	Silty gravelly sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4).

**Table 7.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
350	Silty gravelly sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subangular; dark yellowish brown (10YR 4/4).
355	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
360	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
370	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
375	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
380	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
385	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
390	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
410	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
415	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
420	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; subangular; dark yellowish brown (10YR 4/4); pebbles are <10 mm in diameter.
425	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
430	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
435	Gravelly sand (gS); pebbles to very coarse sand; moderately sorted; angular to subangular; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
440	Sandy gravel (sG); granules and very coarse sand; well sorted; subangular; dark yellowish brown (10YR 4/4).
445	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; angular to subangular; olive brown (2.5Y 4/3).
450	Gravelly sand (gS); very coarse sand to pebbles; moderately sorted; subangular; olive brown (2.5Y 4/3); pebbles are <10 mm in diameter.
475	Gravelly sand (gS); very coarse sand and granules; well sorted; subangular; dark yellowish brown (10YR 4/4).
480	Gravelly silty sand (gmS); very coarse sand and granules with occasional silt and pebbles; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
490	Gravelly silty sand (gmS); very coarse sand and granules with some silt and pebbles; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).
495	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
500	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
505	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
510	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
520	Gravelly silty sand (gmS); very coarse sand and granules with some silt; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
530	Gravelly silty sand (gmS); very coarse sand and granules with some silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
540	Silty sandy gravel (msG); pebbles to very coarse sand with occasional silt; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
545	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
550	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
555	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
560	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
570	Silty sandy gravel (msG); pebbles to very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.
575	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; yellowish brown (10YR 5/4); pebbles are <10 mm in diameter.

**Table 7.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RCSW (1N/6W-26K2-3), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)	Description
580	Sandy gravel (sG); granules and very coarse sand; well sorted; angular to subangular; light olive brown (2.5Y 5/4).
585	Sandy gravel (sG); granules and very coarse sand; well sorted; subangular; light olive brown (2.5Y 5/4).
590	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
600	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
610	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
615	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
620	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
625	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
630	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
635	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
640	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
645	Sandy gravel (sG); granules and very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
650	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
655	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are <10 mm in diameter.
670	Silty sandy gravel (msG); granules and very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).
680	Silty sandy gravel (msG); granules and very coarse sand with some silt; moderately sorted; subangular to subrounded; yellowish brown (10YR 5/4).
690	Gravelly silty sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subrounded; yellowish brown (10YR 5/4).
700	Sandy gravel (sG); pebbles to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.

**Table 8.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	17	Gravelly sand (gS); very fine to very coarse sand with granule- to large pebble-size gravel; very poorly sorted; subangular; light olive brown (2.5Y 5/3).
17	37	Gravelly sand (gS); very fine to very coarse sand with granule- to very large pebble-size gravel; very poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
37	57	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; very poorly sorted; subangular to subrounded; various colors.
57	77	Sandy gravel (sG); granule- to medium pebble-size gravel with very fine to very coarse sand; poorly sorted; subangular to subrounded; various colors.
77	97	Sandy gravel (sG); granule- to large pebble-size gravel with very fine to very coarse sand; poorly sorted; subangular to subrounded; olive gray (5Y 4/2).
97	117	Gravelly sand (gS); very fine to very coarse sand with granule- to large pebble-size gravel; poorly sorted; subangular to subrounded; olive gray (5Y 4/2).
117	137	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
137	157	Sandy gravel (sG); granule- to large pebble-size gravel with very fine to very coarse sand; very poorly sorted; subangular to subrounded; olive brown (2.5Y 4/3).
157	177	Sandy gravel (sG); granule- to large pebble-size gravel with very fine to very coarse sand; very poorly sorted; subangular to subrounded; olive brown (2.5Y 4/3).
177	197	Gravelly sand (gS); very fine to very coarse sand with granule- to medium pebble-size gravel; poorly sorted; angular to subrounded; olive brown (2.5Y 4/3).
197	217	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; angular to subrounded; olive brown (2.5Y 4/3).
217	237	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular; olive brown (2.5Y 4/3).
237	257	Sand (S); very fine to coarse sand; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3).
257	277	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3).
277	297	No sample collected.
297	317	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
317	330	No sample collected.
330	340	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
340	360	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
360	380	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
380	400	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
400	420	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
420	440	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
440	460	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; angular to subrounded; light olive brown (2.5Y 5/4).
460	480	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
480	490	No sample collected.
490	500	Gravelly sand (gS); very fine to very coarse sand with granules; moderately sorted; angular to subrounded; light olive brown (2.5Y 5/4).
500	520	Sand (S); very fine to very coarse sand; well sorted; angular to subrounded; light olive brown (2.5Y 5/4).
520	521	No sample collected.
521	541	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
541	561	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
561	581	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
581	601	Sand (S); very fine to very coarse sand; well sorted; subangular to rounded; light yellowish brown (2.5Y 6/4).

**Table 8.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
601	621	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular to subrounded; light yellowish brown (2.5Y 6/4).
621	641	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
641	660	No sample collected.
660	680	Sand (S); very fine to very coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
680	700	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
700	720	No sample collected.
720	740	Sand (S); very fine to coarse sand; well sorted; subrounded; light olive brown (2.5Y 5/4).
740	760	Sand (S); very fine to coarse sand; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
760	780	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
780	800	Sand (S); very fine to medium sand; well sorted; subrounded; light olive brown (2.5Y 5/4).
800	820	No sample collected.
820	840	Gravelly sand (gS); very fine to medium sand with some small pebble-size gravel; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
840	860	Sand (S); very fine to medium sand; well sorted; subrounded; light olive brown (2.5Y 5/4).
860	880	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
880	881	No sample collected.
881	901	Sand (S); very fine to medium sand; well sorted; subrounded; light olive brown (2.5Y 5/3).
901	921	Sand (S); very fine to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
921	941	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granule- to small pebble-size gravel; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
941	961	Gravelly sand (gS); very fine to very coarse sand with some granules; poorly sorted; subrounded; light olive brown (2.5Y 5/3).
961	981	Silty sand (zS); very fine to medium sand with silt; well sorted; subrounded; light olive brown (2.5Y 5/3).

**Table 9.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
10	Gravelly sand (gS); coarse to very coarse sand with granule- to large pebble-size gravel; well sorted; angular to subangular; various colors.
20	Gravelly sand (gS); coarse to very coarse sand with granule- to large pebble-size gravel; poorly sorted; angular; various colors.
30	Gravelly sand (gS); coarse to very coarse sand with granule- to large pebble-size gravel; moderately sorted; angular to subangular; various colors.
40	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; moderately sorted; angular to subangular; various colors.
50	Sandy gravel (sG); granule- to very large pebble-size gravel with coarse to very coarse sand; very poorly sorted; angular to subangular; various colors.
60	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; poorly sorted; angular; various colors.
70	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; moderately sorted; angular; various colors.
80	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; poorly sorted; angular; various colors.
90	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; poorly sorted; angular; various colors.
100	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; poorly sorted; angular; various colors.
110	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; poorly sorted; angular; various colors.
120	Sandy gravel (sG); granule- to very large pebble-size gravel with coarse to very coarse sand; very poorly sorted; angular; various colors.
130	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; poorly sorted; angular to subangular; light olive brown (2.5Y 5/3).
140	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; very poorly sorted; angular; various colors.
150	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; moderately sorted; subangular; various colors.
160	Silty sandy gravel (msG); granule- to small pebble-size gravel with coarse to very coarse sand and silt; poorly sorted; subangular to subrounded; dark yellowish brown (10YR 4/4).
170	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; moderately sorted; angular; various colors.
180	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; moderately sorted; angular; various colors.
190	Sandy gravel (sG); granule- to medium pebble-size gravel with coarse to very coarse sand; poorly sorted; angular to subangular; various colors.
200	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; well sorted; angular; various colors.
210	Gravelly sand (gS); coarse to very coarse sand with granule-size gravel; well sorted; angular to subangular; light olive brown (2.5Y 5/4).
220	Gravelly sand (gS); coarse to very coarse sand with granule-size gravel; well sorted; angular to subangular; olive (5Y 5/3).
230	Gravelly sand (gS); fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular to subrounded; olive brown (2.5Y 4/3).
240	Silty gravelly sand (gmS); very fine to very coarse sand with granule- to medium pebble-size gravel and silt; very poorly sorted; angular to subangular; olive gray (5Y 5/2).
250	Gravelly sand (gS); medium to very coarse sand with granules; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3).

**Table 9.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
260	Gravelly sand (gS); medium to very coarse sand with granule- to small pebble-size gravel; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3).
270	Gravelly silty sand (gmS); very fine to very coarse sand with silt and some granules; poorly sorted; angular to subrounded; brown (10YR 4/3).
280	Gravelly silty sand (gmS); very fine to very coarse sand with silt and some granules; poorly sorted; angular to subrounded; brown (10YR 4/3).
290	Gravelly silty sand (gmS); very fine to very coarse sand with silt and some granules; poorly sorted; angular to subangular; light olive brown (2.5Y 5/4).
300	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
310	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
320	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/3).
325	Gravelly sand (gS); fine to very coarse sand with granules; well sorted; subrounded; yellowish brown (10YR 5/8).
330	Sandy gravel (sG); granule- to small pebble-size gravel with fine to very coarse sand; poorly sorted; subangular; dark yellowish brown (10YR 4/6).
340	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
350	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
360	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
370	Gravelly sand (gS); coarse to very coarse sand with granule- to small pebble-size gravel; well sorted; subangular; light olive brown (2.5Y 5/3).
380	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
390	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
400	Gravelly sand (gS); coarse to very coarse sand with granule- to small pebble-size gravel; well sorted; subangular; light olive brown (2.5Y 5/3).
410	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
420	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
430	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
440	Gravelly sand (gS); coarse to very coarse sand with granule- to small pebble-size gravel; well sorted; subangular; light olive brown (2.5Y 5/3).
450	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
460	Sandy gravel (sG); granule- to small pebble-size gravel with coarse to very coarse sand; well sorted; subangular; light olive brown (2.5Y 5/3).
470	Gravelly sand (gS); coarse to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/3).
480	Sandy gravel (sG); granules with coarse to very coarse sand; well sorted; subangular; light olive brown (2.5Y 5/3).
485	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; poorly sorted; subangular to subrounded; various colors.
490	Sandy gravel (sG); granule- to large pebble-size gravel with coarse to very coarse sand; poorly sorted; subangular to subrounded; various colors.
500	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/4).
510	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/4).
520	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/4).
530	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; olive gray (5Y 5/2).
540	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; olive gray (5Y 5/2).
550	Silty sand (zS); very fine to fine sand and silt; well sorted; subangular; dark yellowish brown (10YR 4/4).
560	Sandy silty clay (sM); clay with silt and very fine to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3).
570	Sandy silt (sZ); silt with very fine to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3).
580	Sandy silt (sZ); silt with very fine to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3).
590	Sand (S); very fine to fine sand; well sorted; subangular; light olive brown (2.5Y 5/3).

**Table 9.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
600	Sand (S); very fine to fine sand with some medium to very coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/3).
610	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
620	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
630	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
640	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
646	Sandy gravel (sG); granule- to large pebble-size gravel with medium to very coarse sand; poorly sorted; subangular to subrounded; various colors.
651	Sand (S); very fine to medium sand; well sorted; subangular; various colors.
660	Gravelly sand (gS); very fine to very coarse sand with granules; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
670	Gravelly sand (gS); fine to very coarse sand with granules; poorly sorted; subangular; light olive brown (2.5Y 5/3).
680	Gravelly sand (gS); medium to very coarse sand with granules; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3).
690	Gravelly sand (gS); medium to very coarse sand with granule- to small pebble-size gravel; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3).
700	Sandy silt (sZ); silt with very fine to very coarse sand; poorly sorted; brown (10YR 4/3).
705	Gravelly sand (gS); very fine to very coarse sand with granule- to small pebble-size gravel; poorly sorted; subangular; brown (10YR 5/3).
710	Sand (S); very fine to fine sand; well sorted; subangular; light olive brown (2.5Y 5/4).
720	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
730	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subangular; light olive brown (2.5Y 5/4).
740	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subangular; light olive brown (2.5Y 5/4).
750	Gravelly silty sand (gmS); medium to very coarse sand with silt and granules; poorly sorted; subrounded; light olive brown (2.5Y 5/4).
760	Silty sand (zS); medium to very coarse sand with silt; moderately sorted; subrounded; light olive brown (2.5Y 5/3).
770	Gravelly sand (gS); medium to very coarse sand with granules; well sorted; subrounded; light olive brown (2.5Y 5/4).
780	Gravelly sand (gS); very fine to very coarse sand with granules; poorly sorted; subrounded; light yellowish brown (2.5Y 6/4).
790	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subrounded; light yellowish brown (2.5Y 6/4).
800	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subrounded; light olive brown (2.5Y 5/4).
805	Gravel (G); small to large pebble-size gravel; well sorted; angular; various colors.
810	Gravel (G); granule- to very large pebble-size gravel; moderately sorted; angular to rounded; various colors.
820	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subangular; light olive brown (2.5Y 5/3).
830	Gravelly silty sand (gmS); fine to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
840	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
850	Silty sand (zS); medium to very coarse sand with silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
860	Gravelly sand (gS); fine to very coarse sand with granules; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
870	Gravelly sand (gS); medium to very coarse sand with granule- to small pebble-size gravel; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
880	Gravelly sand (gS); fine to very coarse sand with granule- to small pebble-size gravel; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
890	Silty sand (zS); very fine to fine sand with silt; well sorted; subrounded; light olive brown (2.5Y 5/4).

**Table 9.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site CRCR (1S/5W-03A3-8), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
900	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
910	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subangular to subrounded; light olive brown (2.5Y 5/3).
920	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subrounded; light olive brown (2.5Y 5/4).
930	Gravelly silty sand (gmS); very fine to very coarse sand with silt and granules; poorly sorted; subrounded; light olive brown (2.5Y 5/4).
940	Sand (S); very fine to medium sand; well sorted; subrounded; light olive brown (2.5Y 5/4).
950	Sand (S); very fine to medium sand; well sorted; subrounded; light olive brown (2.5Y 5/4).
960	Silty sand (zS); very fine to fine sand with silt; well sorted; subrounded; light olive brown (2.5Y 5/4).
970	Silty sand (zS); very fine to very coarse sand with silt; poorly sorted; subrounded; light olive brown (2.5Y 5/4).
975	Sandy gravel (sG); granule- to large pebble-size gravel with medium to very coarse sand; poorly sorted; subangular to subrounded; various colors.
980	Sand (S); very fine to fine sand; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
985	Silty sand (zS); very fine to fine sand with silt; very well sorted; subangular to subrounded; yellowish brown (10YR 5/4).
990	Silty sand (zS); very fine to fine sand with silt; very well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
995	Silty sand (zS); very fine to fine sand with silt; very well sorted; subangular to subrounded; grayish brown (2.5Y 5/2).
1,000	Silty sand (zS); very fine to fine sand with silt; very well sorted; subangular to subrounded; grayish brown (2.5Y 5/2).

**Table 10.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	10	No sample collected.
10	30	Sand (S); fine to coarse sand; moderately sorted; subangular to angular; grayish brown (2.5Y 5/2).
30	50	Sand (S); fine to coarse sand; moderately sorted; subangular to angular; brown (10YR 5/3).
50	70	Gravelly sand (gS); very fine to coarse sand and small to medium pebbles; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/3).
70	90	Gravelly sand (gS); very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/3).
90	110	Gravelly sand (gS); fine to very coarse sand and granules to large pebbles; very poorly sorted; subangular to very angular; light yellowish brown (2.5Y 6/3).
110	130	Sandy gravel (sG); granules to large pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; light brownish gray (2.5Y 6/2).
130	153	No sample collected.
153	170	Sandy gravel (sG); granules to large pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; light brownish gray (2.5Y 6/2).
170	190	Sandy gravel (sG); gravel to medium pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; dark gray (2.5Y 4/1).
190	210	Gravelly sand (gS); fine to coarse sand and small to large pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
210	230	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules to medium pebbles; very poorly sorted; subangular to very angular; light olive brown (2.5Y 5/3).
230	245	Gravelly clayey sand (gmS); very fine to very coarse sand, clay, and granules to medium pebbles; very poorly sorted; subangular to very angular; brown (7.5Y 5/4).
245	251	No sample collected.
251	270	Gravelly sand (gS); fine to medium sand and small to medium pebbles; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/4).
270	290	Sandy gravel (sG); granules to medium pebbles and fine to very coarse sand; very poorly sorted; subangular to very angular; grayish brown (2.5Y 5/2).
290	295	No sample collected.
295	310	Gravelly sand (gS); very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/3).
310	330	Gravelly sand (gS); very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/4).
330	350	Sandy gravel (sG); granules to medium pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
350	355	No sample collected.
355	370	Sand (S); very fine to coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
370	390	Sand (S); very fine to coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
390	410	Sand (S); very fine to coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
410	420	Gravelly sand (gS); very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/4).
420	440	Sand (S); very fine to coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
440	445	No sample collected.
445	460	Sand (S); very fine to coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
460	480	No sample collected.
480	500	Slightly gravelly sand ((g)S); very fine to coarse sand and medium pebbles; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
500	520	Sand (S); very fine to very coarse sand; poorly sorted; subangular to very angular; light yellowish brown (2.5Y 6/3).
520	540	Slightly gravelly sand ((g)S); very fine to very coarse sand and small pebbles and minor clay; very poorly sorted; subrounded to angular; light yellowish brown (10YR 6/4).
540	560	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; subrounded to very angular; light yellowish brown (2.5Y 6/3).
560	565	No sample collected.

**Table 10.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
565	580	Slightly gravelly sand ((g)S); very fine to coarse sand and medium pebbles; poorly sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
580	600	Sand (S); very fine to coarse sand; poorly sorted; angular; light yellowish brown (2.5Y 6/3).
600	620	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
620	640	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
640	660	Slightly gravelly sand ((g)S); very fine to very coarse sand and small pebbles; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
660	663	No sample collected.
663	680	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
680	700	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
700	720	Gravelly sand (gS); very fine to very coarse sand and granules; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
720	740	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
740	760	Slightly gravelly sand ((g)S); very fine to very coarse sand and granules; very poorly sorted; subangular to very angular; light yellowish brown (2.5Y 6/3).
760	780	Sand (S); very fine to very coarse sand; poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
780	800	Sand (S); very fine to medium sand; well to moderately sorted; subangular to angular; light yellowish brown (2.5Y 6/4).
800	820	Sand (S); very fine to medium sand; well to moderately sorted; subangular to angular; light yellowish brown (2.5Y 6/4).
820	840	Sand (S); very fine to medium sand; well to moderately sorted; subangular to angular; light yellowish brown (2.5Y 6/4).
840	878	No sample collected.
878	898	Sand (S); very fine to medium sand and minor silt; moderately sorted; subangular to angular; light olive brown (2.5Y 5/3).
898	918	Sand (S); very fine to medium sand; well sorted; subangular to angular; brown (7.5YR 5/4).
918	938	Sand (S); very fine to medium sand; well sorted; subangular to angular; light olive brown (2.5Y 5/6).
938	958	Sand (S); very fine to medium sand and trace granules; moderately sorted; subangular to angular; brown (10YR 5/3).
958	978	Sand (S); very fine to medium sand; well to moderately sorted; subangular to angular; pale brown (10YR 6/3).
978	998	Sand (S); very fine to medium sand; well to moderately sorted; subangular to angular; pale brown (10YR 6/3).

**Table 11.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description	
10	Sand (S); very coarse sand; very well sorted; rounded to subrounded; assorted colors; wood fragments.	
20	Sand (S); very coarse sand; very well sorted; rounded to angular; assorted colors.	
30	Gravelly sand (gS); very coarse sand and granules; well sorted; subrounded to angular; assorted colors.	
40	Gravelly sand (gS); fine to very coarse sand and granules to small pebbles; very poorly sorted; rounded to angular; assorted colors; wood fragments.	
50	Sandy gravel (sG); granules to medium pebbles and very fine to very coarse sand; very poorly sorted; subrounded to angular; assorted colors.	
60	Sandy gravel (sG); granules to large pebbles and fine to very coarse sand; very poorly sorted; subangular to very angular; assorted colors.	
70	Gravelly sand (gS); coarse to very coarse sand and granules to large pebbles; very poorly sorted; subangular to angular; assorted colors.	
80	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; poorly sorted; subrounded to angular; assorted colors.	
90	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; poorly sorted; subrounded to angular; assorted colors.	
100	Gravelly sand (gS); coarse to very coarse sand and granules to large pebbles; very poorly sorted; subrounded to angular; assorted colors.	
110	Gravelly sand (gS); medium to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; assorted colors.	
120	Gravelly sand (gS); coarse to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; assorted colors.	
130	Sandy gravel (sG); granules to very coarse pebbles and very fine to very coarse sand; very poorly sorted; subangular to very angular; light olive brown (2.5Y 5/3).	
140	Gravelly sand (gS); very fine to very coarse sand and granules to medium pebbles; very poorly sorted; subrounded to angular; light brownish gray (2.5Y 6/2).	
148	Gravelly sand (gS); very fine to very coarse sand and granules to medium pebbles; very poorly sorted; subrounded to angular; light brownish gray (2.5Y 6/2).	
C1 shoe	153	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/3).
C2 shoe	160	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subrounded to angular; assorted colors.
170	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; poorly sorted; subrounded to subangular; assorted colors.	
180	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; poorly sorted; subrounded to subangular; assorted colors.	
190	Gravelly sand (gS); coarse to very coarse sand and granules to medium pebbles; poorly sorted; subrounded to subangular; assorted colors.	
200	Silty sandy gravel (msG); granules to medium pebbles, very fine to very coarse sand and silt; very poorly sorted; subangular to angular; light brownish gray (2.5Y 6/2).	
210	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; brown (10YR 5/3).	
220	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; brown (10YR 5/3).	
230	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; brown (10YR 5/3).	
240	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).	
241	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to medium pebbles; very poorly sorted; subrounded to subangular; brown (10YR 5/3).	
C3 shoe	245	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; very dark grayish brown (10YR 3/2).
C4 shoe	250	Gravelly sand (gS); very fine to very coarse sand and granules with trace silt and clay; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).

**Table 11.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
251	Silty sand (zS); very fine to medium sand and silt; moderately sorted; subangular to angular; light olive brown (2.5Y 5/4).
C5 shoe	
260	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subangular to angular; light olive brown (2.5Y 5/4).
270	Gravelly sand (gS); very fine to very coarse sand and granules; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/4).
280	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
290	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
295	Slightly gravelly sandy clay ((g)sM); clay, medium to very coarse sand, and granules; poorly sorted; light yellowish brown (2.5Y 6/3).
C6 shoe	
300	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; yellowish brown (10YR 5/6).
310	Silty sandy gravel (msG); granules to small pebbles, very fine to very coarse sand, and silt; very poorly sorted; subrounded to angular; yellowish brown (10YR 5/6).
320	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).
330	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).
340	Gravelly sand (gS); very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).
350	Gravelly sand (gS); very fine to very coarse sand and granules; very poorly sorted; subangular to angular; yellowish brown (10YR 5/4).
355	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).
C7 shoe	
360	Gravelly sand (gS); very fine to very coarse sand to granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4).
370	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; angular to very angular; light brownish gray (2.5Y 6/2).
380	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; poorly sorted; angular to very angular; light brownish gray (2.5Y 6/2).
390	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; poorly sorted; angular to very angular; light brownish gray (2.5Y 6/2).
400	Gravelly sand (gS); coarse to very coarse sand and granules to small pebbles; moderately sorted; subangular to angular; light olive brown (2.5Y 5/3).
410	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
420	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
430	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
440	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
445	Slightly gravelly silty sand ((g)mS); very fine to very coarse sand, silt, and granules to medium sand; very poorly sorted; angular to very angular; light yellowish brown (2.5Y 6/3).
C8 shoe	
450	Slightly gravelly sandy clayey silt ((g)sM); silt, clay, very coarse sand, and granules to small pebbles; moderately sorted; light olive brown (2.5Y 5/4).
460	Gravelly clayey silt (gM); silt, clay, and granules; poorly sorted; light olive brown (2.5Y 5/4).
465	No recovery.
C9 shoe	
470	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules to small pebbles; very poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
C10 shoe	

**Table 11.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
480	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subrounded to angular; light yellowish brown (2.5Y 6/4).
490	Gravelly clay (gM); clay and granules to small pebbles; well sorted; light olive brown (2.5Y 5/4).
500	Clayey gravel (mG); granules to small pebbles and clay; well sorted; subrounded to subangular; light olive brown (2.5Y 5/3).
510	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3).
520	Silty sandy gravel (msG); granules to small pebbles, very fine to very coarse sand, and silt; very poorly sorted; subrounded to angular; light olive brown (2.5Y 5/3).
530	Gravelly clay (gM); clay and granules; well sorted; yellowish brown (10YR 5/4).
540	Gravelly sand (gS); very coarse sand and granules; well sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
550	Gravelly sand (gS); very coarse sand and granules; well sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
560	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subangular to angular; light olive brown (2.5Y 5/4).
565	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
C11 shoe	
570	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
580	Gravelly clayey sand (gmS); very fine to very coarse sand, clay, and granules; very poorly sorted; subangular to very angular; light olive brown (2.5Y 5/4).
590	Sandy clay (sC); clay and very coarse sand; well sorted; light olive brown (2.5Y 5/4).
600	Gravelly clayey sand (gmS); medium to very coarse sand, clay, and granules to small pebbles; very poorly sorted; subangular to very angular; light olive brown (2.5Y 5/4).
610	Gravelly sand (gS); very coarse sand and granules; well sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3).
620	Gravelly sand (gS); very coarse sand and granules; well sorted; subrounded to subangular; light yellowish brown (2.5Y 6/3).
630	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
640	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
650	Gravelly sand (gS); very coarse sand and granules to small pebbles; well sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
660	Gravelly sand (gS); very coarse sand and granules to small pebbles; well sorted; subangular to angular; light yellowish brown (2.5Y 6/3).
663	Gravelly sand (gS); very fine to very coarse sand and granules to large pebbles; very poorly sorted; subangular to very angular; light yellowish brown (2.5Y 6/3).
C12 shoe	
670	Gravelly sand (gS); coarse to very coarse sand and granules; well sorted; subrounded to subangular; light yellowish brown (2.5Y 6/4).
680	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
690	Gravelly sand (gS); medium to very coarse sand and granules to small pebbles; poorly sorted; subrounded to angular; light yellowish brown (2.5Y 6/3).
700	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).
710	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).
720	Gravelly silty sand (gmS); very fine to very coarse sand, silt, and granules; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/3).
730	Sandy clay (sC); clay and coarse sand; poorly sorted; light olive brown (2.5Y 5/4).
740	Gravelly clayey sand (gmS); coarse to very coarse sand, clay, and granules; moderately sorted; subrounded to subangular; light olive brown (2.5Y 5/4).
750	Gravelly clayey sand (gmS); coarse to very coarse sand, clay, and granules; moderately sorted; subrounded to subangular; light olive brown (2.5Y 5/4).

**Table 11.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site RHSW (1S/5W-13B1-5), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
760	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to angular; light olive brown (2.5Y 5/4).
770	Gravelly silty sand (gmS); coarse to very coarse sand, silt, and granules; moderately sorted; subrounded to angular; light olive brown (2.5Y 5/4).
780	Silty sand (zS); very fine to very coarse sand and silt; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
790	Sandy clayey silt (sM); silt, clay, and very fine to coarse sand; very poorly sorted; light olive brown (2.5Y 5/3); calcium carbonate.
800	Sandy clayey silt (sM); silt, clay, and very fine to coarse sand; very poorly sorted; light olive brown (2.5Y 5/3); calcium carbonate.
810	Sandy clay (sC); clay and coarse sand; poorly sorted; light olive brown (2.5Y 5/4); calcium carbonate.
820	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
830	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
840	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
850	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
860	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
870	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; light yellowish brown (2.5Y 6/3); calcium carbonate.
880	Sandy clay (sC); clay and very coarse sand; poorly sorted; light olive brown (2.5Y 5/3).
890	Sandy clay (sC); clay and very coarse sand; poorly sorted; brown (7.5YR 5/4).
900	Sandy clay (sC); clay and coarse to very coarse sand; poorly sorted; brown (7.5YR 4/4).
910	Sandy clay (sC); clay and medium to very coarse sand; poorly sorted; brown (7.5YR 5/4).
920	Gravelly clay (gM); clay and granules; poorly sorted; yellowish brown (10YR 5/4).
930	Sandy clay (sC); clay and coarse sand; poorly sorted; yellowish brown (10YR 5/4).
940	Silty clay (M); clay and silt; well sorted; light olive brown (2.5Y 5/3).
950	Silty clay (M); clay and silt; well sorted; light olive brown (2.5Y 5/3).
960	Gravelly clay (gM); clay and granules; poorly sorted; light olive brown (2.5Y 5/3).
970	Gravelly silty clay (gM); clay, silt, and granules; poorly sorted; light olive brown (2.5Y 5/3).
980	Silty clayey sand (mS); very fine to very coarse sand, clay, and silt; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
990	Silty clayey sand (mS); very fine to very coarse sand, clay, and silt; very poorly sorted; subangular to angular; light olive brown (2.5Y 5/4).
1,000	Sandy clay (sC); clay and medium to very coarse sand; poorly sorted; yellowish brown (10YR 5/4).
1,018	No recovery.
C13 shoe	

**Table 12.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site FOG1 (1S/4W-29H4-8), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	140	No sample collected.
140	160	Gravelly sand (gS); fine sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
160	180	Gravelly sand (gS); very fine sand to granules; poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
180	200	Gravelly sand (gS); medium sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
200	220	Gravelly sand (gS); medium sand to granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
220	240	Gravelly sand (gS); very fine sand to granules; poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
240	260	Gravelly sand (gS); medium sand to granules with occasional pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.
260	280	Gravelly sand (gS); medium sand to pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
280	300	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/3).
300	320	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/3).
320	340	Sand (S); medium to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
340	360	Gravelly sand (gS); medium sand to granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
360	380	Silty sand (zS); silt to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
380	400	Silty sand (zS); silt to coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
400	420	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light brownish gray (2.5Y 6/2).
420	440	Sand (S); very fine to coarse sand; moderately sorted; angular to subangular; light brownish gray (2.5Y 6/2).
440	460	Sandy silt (sZ); silt with medium to very coarse sand; moderately sorted; light olive gray (5Y 6/2).
460	480	Sandy silty clay (sM); clay and silt with medium to very coarse sand; moderately sorted; dark greenish gray (10Y 4/1).
480	500	No sample collected.
500	520	Sandy silty clay (sM); clay and silt with coarse to very coarse sand; moderately sorted; dark greenish gray (10Y 4/1).
520	540	Silty clayey sand (mS); fine to medium sand with silt and clay; moderately sorted; subangular; dark greenish gray (10Y 4/1).
540	560	Sand (S); very fine to coarse sand; moderately sorted; angular to subangular; olive gray (5Y 5/2).
560	580	Silty sand (zS); silt to coarse sand; moderately sorted; subangular; light olive gray (5Y 6/2); shell fragments.
580	600	Sand (S); fine to very coarse sand; moderately sorted; angular to subangular; light olive gray (5Y 6/2).
600	620	Silty sand (zS); silt to coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
620	640	Silty clayey sand (mS); fine to medium sand with occasional silt and clay; moderately sorted; subangular; olive (5Y 4/3).
640	660	Sand (S); fine to coarse sand; moderately sorted; subangular; olive (5Y 4/3).
660	680	Silty clayey sand (mS); fine to coarse sand with some silt and clay; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3).
680	700	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/4).
700	720	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light yellowish brown (2.5Y 6/4).
720	740	Sand (S); very fine to coarse sand; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/4).
740	760	Sand (S); very fine to coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/4).
760	780	Silty sand (zS); silt to coarse sand; moderately sorted; subangular; olive gray (5Y 5/2).
780	800	Silty sand (zS); silt to very coarse sand; poorly sorted; angular to subangular; olive gray (5Y 5/2).
800	820	Silty sand (zS); silt to very coarse sand; poorly sorted; subangular; light olive gray (5Y 6/2).

**Table 13.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG1 (1S/4W-29H4-8), San Bernardino County, California.[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
0–150	Continuous core.
150	Gravelly sand (gS); coarse to very coarse sand with occasional granules and pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
160	Gravelly sand (gS); coarse to very coarse sand with granules; moderately sorted; subangular; olive brown (2.5Y 4/3).
170	Gravelly silty sand (gmS); coarse to very coarse sand with silt and granules; moderately sorted; subrounded; olive brown (2.5Y 4/3).
180	Sandy silty clay (sM); clay and silt with coarse sand; moderately sorted; olive brown (2.5Y 4/3).
190	Gravelly sand (gS); coarse to very coarse sand with granules; moderately sorted; subangular; olive brown (2.5Y 4/3).
200	Sand (S); coarse to very coarse sand; well sorted; subrounded; olive brown (2.5Y 4/3).
210	Sand (S); coarse to very coarse sand; well sorted; subrounded; olive brown (2.5Y 4/3).
220	Silty sand (zS); coarse to very coarse sand with silt; moderately sorted; subrounded; olive brown (2.5Y 4/3).
230	Silty sand (zS); coarse to very coarse sand with occasional silt; moderately sorted; subrounded; olive brown (2.5Y 4/3).
240	Silty sand (zS); coarse to very coarse sand and silt; moderately sorted; subangular; olive brown (2.5Y 4/3).
260	Gravelly sand (gS); coarse to very coarse sand with granules; moderately sorted; subangular; light olive brown (2.5Y 5/3).
270	Gravelly sand (gS); coarse to very coarse sand with granules; moderately sorted; subangular; light olive brown (2.5Y 5/3).
280	Sandy clayey silt (sM); silt and clay with coarse sand; moderately sorted; light olive brown (2.5Y 5/3).
290	Sandy clayey silt (sM); silt and clay with very coarse sand and granules; moderately sorted; light olive brown (2.5Y 5/3).
300	Sandy clayey silt (sM); silt and clay with occasional very coarse sand and granules; moderately sorted; light olive brown (2.5Y 5/3).
310	Sandy clayey silt (sM); silt and clay with occasional very coarse sand and granules; moderately sorted; light olive brown (2.5Y 5/3).
320	Sandy clayey silt (sM); silt and clay with occasional very coarse sand and granules; moderately sorted; light olive brown (2.5Y 5/3).
330	Gravelly sand (gS); coarse sand to granules with some very fine sand; moderately sorted; subrounded; light yellowish brown (2.5Y 6/3).
340	Gravelly sand (gS); very coarse sand and granules with occasional pebbles; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3).
350	Sandy gravel (sG); granules and very coarse sand with some pebbles; moderately sorted; angular to subrounded; olive brown (2.5Y 4/3).
360	Gravelly clayey silt (gM); silt and clay with very coarse sand and granules; moderately sorted; light olive brown (2.5Y 5/3).
370	Gravelly silty sand (gmS); very fine sand with occasional silt and granules; moderately sorted; subangular; light olive brown (2.5Y 5/4).
380	Gravelly sand (gS); very fine sand with very coarse sand and granules; moderately sorted; subrounded; light olive brown (2.5Y 5/3).
390	Gravelly silty sand (gmS); very fine sand and silt with granules and occasional pebbles; moderately sorted; subrounded; olive (5Y 4/3).
400	Gravelly sandy silt (gsM); silt with very fine sand and occasional granules and pebbles; moderately sorted; olive (5Y 4/3).
410	Gravelly sandy silt (gsM); silt with very fine sand and occasional granules and pebbles; moderately sorted; olive gray (5Y 4/2).
420	Gravelly clayey silt (gM); silt and clay with occasional very coarse sand to pebbles; moderately sorted; olive (5Y 4/3).
430	Gravelly clayey silt (gM); clay and silt with occasional granules; moderately sorted; light olive gray (5Y 6/2).
440	Gravelly silt (gM); silt with some granules and pebbles; moderately sorted; light olive gray (5Y 6/2).
450	Gravelly sandy clayey silt (gsM); silt and clay with some very fine sand and occasional granules and pebbles; moderately sorted; olive gray (5Y 4/2).
460	Silty clay (M); silt and clay; well sorted; dark greenish gray (10Y 4/1).
470	Silty clay (M); clay and silt with occasional very coarse sand; moderately sorted; dark greenish gray (10Y 4/1).
480	Silty clay (M); clay and silt with occasional very coarse sand; moderately sorted; dark greenish gray (5GY 4/1).
490	Silty clay (M); clay and silt with occasional very coarse sand; moderately sorted; greenish gray (10Y 5/1).
500	Silty clay (M); clay with some silt; well sorted; dark greenish gray (10Y 4/1).
510	Silty clay (M); clay and silt; well sorted; dark greenish gray (10Y 4/1).
520	Silty clay (M); clay and silt; well sorted; very dark greenish gray (10Y 3/1).
530	Sandy clayey silt (sM); silt with clay and coarse to very coarse sand; moderately sorted; very dark greenish gray (5GY 3/1).

**Table 13.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG1 (1S/4W-29H4-8), San Bernardino County, California.—Continued[Abbreviations: ft, feet;  $\mu$ m, micrometer]

Depth (ft)	Description
540	Sandy clayey silt (sM); silt and clay with some coarse to very coarse sand; moderately sorted; dark greenish gray (5GY 4/1).
550	Sandy silt (sZ); silt with very fine and coarse sand; moderately sorted; very dark greenish gray (10Y 3/1).
560	Sandy clayey silt (sM); silt and clay with some coarse sand; moderately sorted; dark grayish brown (2.5Y 4/2).
570	Sandy clayey silt (sM); silt and clay with some coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
580	Sandy clayey silt (sM); silt and clay with some coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
590	Sandy clayey silt (sM); silt with some clay and very coarse sand and granules; moderately sorted; olive gray (5Y 4/2).
600	Sandy clayey silt (sM); silt with clay and coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
610	Sandy clayey silt (sM); silt with clay and coarse to very coarse sand; moderately sorted; olive (5Y 4/3).
620	Silty sand (zS); coarse to very coarse sand with very fine sand and silt; moderately sorted; subrounded; olive brown (2.5Y 4/3).
630	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
640	Silty sand (zS); coarse to very coarse sand with silt to very fine sand; moderately sorted; subangular to subrounded; olive (5Y 4/3).
650	Sandy silt (sZ); silt with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
660	Sandy silt (sZ); silt with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
670	Silty sand (zS); coarse to very coarse sand with silt and very fine sand; moderately sorted; subrounded; olive brown (2.5Y 4/3).
680	Sand (S); coarse to very coarse sand with very fine sand; moderately sorted; subrounded; olive brown (2.5Y 4/4).
690	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive (5Y 4/3).
700	Silty sand (zS); coarse to very coarse sand with silt and very fine sand; moderately sorted; subrounded; olive gray (5Y 4/2).
710	Sandy silt (sZ); silt with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
720	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; dark grayish brown (2.5Y 4/2).
730	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive brown (2.5Y 4/3).
740	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive brown (2.5Y 4/3).
750	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; dark grayish brown (2.5Y 4/2).
760	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive brown (2.5Y 4/3).
770	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; greenish gray (10Y 5/1).
780	Sandy silt (sZ); silt and very fine sand with occasional coarse to very coarse sand; moderately sorted; dark greenish gray (10Y 4/1).
790	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; dark greenish gray (5GY 4/1).
800	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive (5Y 4/3).
810	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).
820	Sandy silt (sZ); silt and very fine sand with coarse to very coarse sand; moderately sorted; olive gray (5Y 4/2).

**Table 14.** Lithologic log from sieved drill cuttings (125- $\mu$ m screen opening) from multiple-well monitoring site FOG2 (1S/4W-29K1-5), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; <, less than;  $\mu$ m, micrometer]

Depth (ft)		Description
From	To	
0	20	Gravelly sand (gS); medium to very coarse sand with occasional granules; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
20	40	Sand (S); fine to medium sand with some coarse to very coarse sand; moderately sorted; subangular; light yellowish brown (2.5Y 6/3).
40	60	Slightly gravelly sand ((g)S); fine to medium sand with some coarse to very coarse sand with occasional granules and pebbles; poorly sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
60	80	Gravelly sand (gS); fine to very coarse sand with some granules and pebbles; poorly sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
80	100	Gravelly sand (gS); medium to coarse sand with some very coarse sand, granules, and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
100	120	Gravelly sand (gS); medium to coarse sand with some very coarse sand, granules and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
120	140	Gravelly sand (gS); medium to coarse sand with some very coarse sand, granules, and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
140	160	Gravelly sand (gS); fine to coarse sand with some very coarse sand, granules, and pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
160	180	Gravelly sand (gS); fine to coarse sand with some very coarse sand, granules, and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
180	200	Gravelly sand (gS); fine to coarse sand with some very coarse sand, granules, and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.
200	220	Slightly gravelly sand ((g)S); fine to coarse sand with occasional very coarse sand and granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
220	240	Gravelly sand (gS); fine to coarse sand with some very coarse sand, granules, and pebbles; poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
240	260	Gravelly sand (gS); fine to very coarse sand with some granules and pebbles; poorly sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <12 mm in diameter.
260	280	Gravelly silty sand (gmS); medium to very coarse sand and silt with granules and pebbles; poorly sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.
280	300	Slightly gravelly sand ((g)S); very fine to coarse sand with occasional very coarse sand and granules; poorly sorted; subangular; light yellowish brown (2.5Y 6/3).
300	320	Gravelly sand (gS); medium to very coarse sand with granules and pebbles; moderately sorted; subangular; light yellowish brown (2.5Y 6/3); pebbles are <10 mm in diameter.
320	340	Slightly gravelly sand ((g)S); medium to very coarse sand with occasional granules; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
340	360	Slightly gravelly sand ((g)S); medium to very coarse sand with occasional granules and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3).
360	380	Gravelly sand (gS); medium to very coarse sand with some granules and pebbles; moderately sorted; angular to subangular; light yellowish brown (2.5Y 6/3); pebbles are <8 mm in diameter.
380	400	Slightly gravelly sand ((g)S); fine to coarse sand with occasional very coarse sand, granules, and pebbles; poorly sorted; subangular; light brownish gray (2.5Y 6/2).
400	420	Silty sand (zS); very fine sand and silt; well sorted; subangular; greenish gray (5GY 6/1).
420	440	Silty sand (zS); very fine sand and silt; well sorted; subangular; greenish gray (5GY 6/1).
440	460	Silty sand (zS); very fine sand and silt with occasional coarse sand; moderately sorted; subangular to angular; very dark greenish gray (10Y 3/1).
460	480	Clayey sand (cS); fine to medium sand with some clay; moderately sorted; subrounded; very dark greenish gray (10Y 3/1).
480	500	Sand (S); fine to medium sand; well sorted; subangular; dark greenish gray (10Y 4/1).
500	520	Sand (S); fine to medium sand; well sorted; subangular; olive gray (5Y 4/2).
520	540	Sand (S); fine to medium sand; well sorted; angular to subangular; very dark greenish gray (10Y 3/1).
540	560	Sand (S); fine to medium sand; well sorted; angular to subangular; very dark greenish gray (10Y 3/1); mica.

**Table 15.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG2 (1S/4W-29K1-5), San Bernardino County, California.[Abbreviations: ft, feet; mm, millimeter; >, greater than;  $\mu$ m, micrometer]

Depth (ft)	Description
10	Sand (S); coarse to very coarse sand; well sorted; subangular; light brownish gray (10YR 6/2).
20	Sandy gravel (sG); granules and pebbles with some very coarse sand; moderately sorted; subangular; mostly light olive gray (5Y 6/2).
30	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subangular to subrounded; mostly light olive gray (5Y 6/2); pebbles are >10 mm in diameter.
40	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subangular to subrounded; mostly light olive gray (5Y 6/2); pebbles are >10 mm in diameter.
50	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; angular to subangular; light brownish gray (10YR 6/2); pebbles are >15 mm in diameter.
60	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subangular; light brownish gray (10YR 6/2); pebbles are >15 mm in diameter.
65	Gravelly silty sand (gmS); very fine sand and silt with very coarse sand to pebbles; moderately sorted; subangular; dark olive brown (2.5Y 3/3); pebbles are >10 mm in diameter.
70	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subrounded to rounded; mostly olive brown (2.5Y 4/3); pebbles are >10 mm in diameter.
80	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subrounded to subangular; mostly olive brown (2.5Y 4/3); pebbles are >12 mm in diameter.
90	Silty sandy gravel (msG); very coarse sand to pebbles with silt; moderately sorted; subangular to subrounded; olive brown (2.5Y 4/3); pebbles are >15 mm in diameter.
100	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subrounded to rounded; mostly olive brown (2.5Y 4/4); pebbles are >12 mm in diameter.
110	Sandy gravel (sG); granules and pebbles with some very coarse sand; moderately sorted; subrounded to subangular; mostly olive brown (2.5Y 4/3); pebbles are >15 mm in diameter.
120	Sandy gravel (sG); granules and pebbles with some very coarse sand; moderately sorted; subangular; mostly olive brown (2.5Y 4/3); pebbles are >20 mm in diameter.
130	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subangular to subrounded; mostly olive brown (2.5Y 4/3); pebbles are >20 mm in diameter.
140	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; subangular to subrounded; mostly olive brown (2.5Y 4/3); pebbles are >20 mm in diameter.
150	Sandy gravel (sG); granules and pebbles with occasional very coarse sand; moderately sorted; subangular; mostly dark olive brown (2.5Y 3/3).
160	Silty sandy gravel (msG); granules and pebbles with very coarse sand and occasional silt; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
170	Gravelly sand (gS); very coarse sand with granules and pebbles; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
180	Gravelly sand (gS); very coarse sand with some granules and pebbles; moderately sorted; subrounded; mostly light olive brown (2.5Y 5/3); pebbles are >10 mm in diameter.
190	Gravelly sand (gS); very coarse sand with granules and pebbles; moderately sorted; subrounded; mostly light olive brown (2.5Y 5/3); pebbles are >20 mm in diameter.
200	Gravelly sandy silt ((g)sM); silt with some very coarse sand to pebbles; moderately sorted; olive brown (2.5Y 4/3).
210	Gravelly silty sand (gmS); very coarse sand and granules with occasional silt and pebbles; moderately sorted; subrounded; olive brown (2.5Y 4/3).
220	Gravelly silty sand (gmS); very coarse sand and granules with occasional silt and pebbles; moderately sorted; subrounded; olive brown (2.5Y 4/3).
230	Gravelly silty sand (gmS); very coarse sand and granules with occasional silt; moderately sorted; subrounded; olive brown (2.5Y 4/3).
240	Sandy gravel (sG); granules and pebbles with very coarse sand; moderately sorted; angular; mostly light olive brown (2.5Y 5/3); pebbles are >15 mm in diameter.
250	Gravelly sand (gS); very coarse sand with granules and pebbles; moderately sorted; angular to subangular; light olive brown (2.5Y 5/3); pebbles are >12 mm in diameter.
260	Gravelly silty sand (gmS); very coarse sand with granules and pebbles and occasional silt; moderately sorted; subangular; light olive brown (2.5Y 5/3).
270	Gravelly clayey silt (gM); silt and clay with some granules and pebbles; moderately sorted; olive brown (2.5Y 4/4).

**Table 15.** Lithologic log from shaker drill cuttings (250- $\mu$ m screen opening) from multiple-well monitoring site FOG2 (1S/4W-29K1-5), San Bernardino County, California.—Continued[Abbreviations: ft, feet; mm, millimeter; >, greater than;  $\mu$ m, micrometer]

Depth (ft)	Description
280	Sand (S); very fine sand with occasional granules and pebbles; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
290	Sand (S); very fine sand with occasional granules; well sorted; subrounded; light olive brown (2.5Y 5/4).
300	Slightly gravelly silty sand ((g)mS); very coarse sand with occasional pebbles and silt; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
310	Slightly gravelly silty sand ((g)mS); very coarse sand with occasional silt and pebbles and granules; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
320	Gravelly silty sand (gmS); very coarse sand with some granules and pebbles and silt; moderately sorted; subrounded; light olive brown (2.5Y 5/4).
330	Gravelly silty sand (gmS); very coarse sand to pebbles with occasional silt; moderately sorted; subangular to subrounded; light olive brown (2.5Y 5/4); pebbles are >10 mm in diameter.
340	Sandy gravel (sG); granules to pebbles with very coarse to coarse sand; moderately sorted; subangular; light olive brown (2.5Y 5/4); pebbles are >17 mm in diameter.
350	Slightly gravelly sand ((g)S); very coarse sand with occasional granules; well sorted; subangular to subrounded; light olive brown (2.5Y 5/4).
360	Sandy silty clay (sM); clay and silt with some very coarse sand; moderately sorted; olive (5Y 5/3).
370	Slightly gravelly silty sand ((g)mS); very coarse sand with silt and very fine sand with occasional granules; moderately sorted; subrounded; olive (5Y 5/3).
380	Slightly gravelly sand ((g)S); very coarse sand with occasional granules and very little silt; moderately sorted; subangular; olive (5Y 5/3).
390	Sandy clayey silt (sM); silt with some clay and occasional very coarse sand; moderately sorted; dark greenish gray (10Y 4/1).
400	Clayey silt (M); silt with some clay; well sorted; dark greenish gray (10Y 4/1).
410	Clayey silt (M); silt with some clay; well sorted; dark greenish gray (10Y 4/1).
420	Clayey silt (M); silt and clay; well sorted; dark greenish gray (10Y 4/1).
430	Silty clay (M); clay and silt; well sorted; dark greenish gray (10Y 4/1).
440	Clayey silt (M); silt and clay; well sorted; dark greenish gray (10Y 4/1).
450	Slightly gravelly clayey silt ((g)M); silt and clay with occasional very coarse sand to pebbles; moderately sorted; very dark greenish gray (10Y 3/1); pebbles are >10 mm in diameter.
460	Slightly gravelly sandy silt ((g)sM); silt with some coarse sand to granules; moderately sorted; very dark greenish gray (10Y 3/1); dark organic pieces.
470	Sandy silt (sZ); silt and very fine sand with occasional very coarse sand; moderately sorted; very dark greenish gray (10Y 3/1).
480	Sand (S); very fine sand with coarse to very coarse sand; moderately sorted; subangular; olive gray (5Y 5/2).
490	Sand (S); coarse to very coarse sand with some medium sand; moderately sorted; subangular; dark gray (5Y 4/1).
500	Silty sand (zS); coarse to very coarse sand with occasional silt; moderately sorted; subangular; dark gray (5Y 4/1).
510	Silty sand (zS); coarse to very coarse sand with occasional silt; moderately sorted; subangular; light olive gray (5Y 6/2).
520	Sandy silt (sZ); silt with coarse to very coarse sand; moderately sorted; light olive gray (5Y 6/2).
530	Silty sand (zS); coarse to very coarse sand with silt and very fine sand; moderately sorted; angular to subangular; light olive gray (5Y 6/2).
540	Sand (S); coarse to very coarse sand with very fine sand; moderately sorted; angular to subangular; light olive gray (5Y 6/2).
550	Sand (S); coarse to very coarse sand; well sorted; angular to subangular; olive gray (5Y 4/2); biotite rich.
560	Sand (S); coarse to very coarse sand; well sorted; angular to subangular; olive gray (5Y 5/2); biotite rich.

**Table 16.** Date range of available water-level data, count of water-level measurements, and maximum and minimum water-level elevations for select wells, San Bernardino County, California.

[State well number: See well-numbering diagram in text. Location of sites shown in figure 2. **Abbreviations:** ft, feet; mm/dd/yyyy, month/day/year; NAVD 88, North American Vertical Datum of 1988; USGS, U.S. Geological Survey]

<b>USGS site identification number</b>	<b>State well number</b>	<b>Common name</b>	<b>Start date (mm/dd/yyyy)</b>	<b>End date (mm/dd/yyyy)</b>	<b>Number of measurements</b>	<b>Maximum water level (ft above NAVD 88)</b>	<b>Minimum water level (ft above NAVD 88)</b>
341013117253901	1N/5W-17L1	RCZ6-1	06/27/2011	05/22/2013	19	1,094.25	1,083.92
341013117253902	1N/5W-17L2	RCZ6-2	06/27/2011	05/22/2013	19	1,093.77	1,083.00
341013117253903	1N/5W-17L3	RCZ6-3	06/27/2011	05/22/2013	21	1,659.87	1,608.23
341013117253904	1N/5W-17L4	RCZ6-4	06/27/2011	05/22/2013	21	1,681.82	1,608.57
341013117253905	1N/5W-17L5	RCZ6-5	06/27/2011	05/22/2013	22	1,777.82	1,762.07
341013117253906	1N/5W-17L6	RCZ6-6	06/27/2011	05/22/2013	22	1,777.82	1,762.07
340851117281901	1N/6W-26A1	RCNE-1	08/26/2002	05/30/2013	102	1,035.36	774.38
340851117281902	1N/6W-26A2	RCNE-2	06/20/2002	05/30/2013	104	1,084.98	1,051.24
340851117281903	1N/6W-26A3	RCNE-3	06/20/2002	05/30/2013	103	1,085.98	1,051.72
340829117284301	1N/6W-26K2	RCSW-1	07/16/2002	05/30/2013	83	1,066.14	873.10
340829117284302	1N/6W-26K3	RCSW-2	06/20/2002	05/30/2013	83	1,100.31	1,065.88
340716117230601	1S/5W-03A3	CRCR-1	07/03/2008	05/21/2013	44	992.17	966.64
340716117230602	1S/5W-03A4	CRCR-2	07/03/2008	05/21/2013	44	992.25	967.25
340716117230603	1S/5W-03A5	CRCR-3	07/03/2008	05/21/2013	44	992.67	968.81
340716117230604	1S/5W-03A6	CRCR-4	07/03/2008	05/21/2013	44	992.77	969.35
340716117230605	1S/5W-03A7	CRCR-5	07/03/2008	05/21/2013	44	992.77	969.61
340716117230606	1S/5W-03A8	CRCR-6	01/22/2006	05/21/2013	38	1,290.72	1,246.70
340521117212001	1S/5W-13B1	RHSW-1	09/04/2008	05/21/2013	45	917.94	904.20
340521117212002	1S/5W-13B2	RHSW-2	09/04/2008	05/21/2013	47	915.98	894.51
340521117212003	1S/5W-13B3	RHSW-3	09/04/2008	05/21/2013	46	901.26	881.15
340521117212004	1S/5W-13B4	RHSW-4	09/04/2008	05/21/2013	46	902.02	788.76
340521117212005	1S/5W-13B5	RHSW-5	09/04/2008	05/21/2013	46	910.78	892.20
340326117185301	1S/4W-29H4	FOG1-1	06/28/2002	06/03/2013	116	868.94	848.16
340326117185302	1S/4W-29H5	FOG1-2	09/25/2002	06/03/2013	115	868.39	849.47
340326117185303	1S/4W-29H6	FOG1-3	06/28/2002	06/03/2013	116	895.42	838.29
340326117185304	1S/4W-29H7	FOG1-4	06/29/2002	06/03/2013	116	910.87	826.07
340326117185305	1S/4W-29H8	FOG1-5	09/25/2002	06/03/2013	112	923.34	868.87
340317117190401	1S/4W-29K1	FOG2-1	06/26/2002	06/03/2013	117	863.74	834.14
340317117190402	1S/4W-29K2	FOG2-2	06/26/2002	06/03/2013	117	894.68	824.20
340317117190403	1S/4W-29K3	FOG2-3	06/26/2002	06/03/2013	117	905.11	819.60
340317117190404	1S/4W-29K4	FOG2-4	06/25/2002	06/03/2013	117	911.55	820.50
340317117190405	1S/4W-29K5	FOG2-5	06/25/2002	06/03/2013	115	914.03	856.10

**Table 17.** Field measurement, major-ion, nutrient, and selected trace-element data in groundwater samples from selected monitoring sites, San Bernardino County, California.

[State well number: See well-numbering diagram in text. Location of sites shown in figure 2. All samples were analyzed at U.S. Geological Survey (USGS) laboratories. The 5-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Analysis for each sample is shown on one line on consecutive pages. **Abbreviations:** As, arsenic; B, boron; Ba, barium; E, estimated or having a higher degree of uncertainty; Fe, iron; I, iodide; Li, lithium; mg/L, milligrams per liter; mm/dd/yyyy, month/day/year; Mn, manganese; N, nitrate; P, phosphorus; Sr, strontium; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; <, actual value is less than value shown; —, no data; +, plus]

State well number	USGS site identification number	Common name	Sample date (mm/dd/yyyy)	Dissolved oxygen (mg/L, as O <sub>2</sub> ) (00300)	pH (standard units) (00400)	Specific conductance (µS/cm) (0095)	Water temperature (°C) (00010)	Dissolved solids (mg/L) (70300)	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bicarbonate (mg/L) (39086)
1N/5W-17L5	341013117253905	RCZ6-5	04/28/2011	8.2	7.4	298	18	202	50.2	7.96	2.57	9.25	125
1N/5W-17L6	341013117253906	RCZ6-6	04/28/2011	8.1	7.5	314	19	190	49.2	7.69	2.58	9.09	123
1S/5W-03A3	340716117230601	CRCR-1	11/21/2007	9.0	7.6	352	20	232	42.1	8.61	1.45	21.1	153
1S/5W-03A4	340716117230602	CRCR-2	11/20/2007	9.6	7.8	279	20	173	30.8	10.0	1.15	13.1	136
1S/5W-03A5	340716117230603	CRCR-3	11/14/2007	11.3	7.7	270	21	166	28.7	10.2	1.26	11.4	121
1S/5W-03A6	340716117230604	CRCR-4	11/19/2007	14.8	7.9	335	20	210	51.4	5.87	2.01	10.2	152
1S/5W-03A7	340716117230605	CRCR-5	11/14/2007	7.4	7.8	266	20	164	35.1	4.71	2.16	11.5	111
1S/5W-13B2	340521117212002	RHSW-2	10/23/2007	6.5	7.8	325	23	197	42.0	4.85	2.00	20.4	114
1S/5W-13B3	340521117212003	RHSW-3	10/22/2007	7.8	7.7	340	22	214	45.9	5.04	1.91	15.7	114
1S/5W-13B4	340521117212004	RHSW-4	10/22/2007	8.2	7.7	368	22	230	51.6	5.62	2.12	12.0	108
1S/5W-13B5	340521117212005	RHSW-5	08/12/2010	7.0	7.7	595	—	408	101	10.1	2.90	14.9	192
1S/4W-29H4	340326117185301	FOG1-1	11/05/2007	1.6	9.6	444	21	228	3.06	0.207	0.52	90.0	67
1S/4W-29H5	340326117185302	FOG1-2	11/05/2007	1.2	9.4	399	22	237	2.03	0.055	0.28	84.2	112
1S/4W-29H6	340326117185303	FOG1-3	11/06/2007	2.9	8.6	256	22	152	8.06	0.925	1.13	44.0	84
1S/4W-29H7	340326117185304	FOG1-4	11/06/2007	1.4	7.4	531	21	296	48.1	7.79	3.12	43.2	167
1S/4W-29H8	340326117185305	FOG1-5	11/06/2007	2.6	7.3	482	21	280	37.1	7.37	5.79	45.1	123
1S/4W-29K1	340317117190401	FOG2-1	11/07/2007	1.8	8.8	485	22	285	5.18	0.549	1.21	98.2	168
1S/4W-29K2	340317117190402	FOG2-2	11/07/2007	7.6	7.9	327	21	206	37.7	4.07	2.03	24.9	136
1S/4W-29K3	340317117190403	FOG2-3	11/07/2007	1.4	7.7	596	21	372	71.4	8.88	3.59	34.0	166
1S/4W-29K4	340317117190404	FOG2-4	11/08/2007	1.8	7.3	435	18	269	38.4	7.36	3.33	36.4	123
1S/4W-29K5	340317117190405	FOG2-5	11/08/2007	2.4	7.3	472	17	281	44.1	8.93	5.39	35.8	146

**Table 17.** Field measurement, major-ion, nutrient, and selected trace-element data in groundwater samples from selected monitoring sites, San Bernardino County, California.  
—Continued

[State well number: See well-numbering diagram in text. Location of sites shown in figure 2. All samples were analyzed at U.S. Geological Survey (USGS) laboratories. The 5-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Analysis for each sample is shown on one line on consecutive pages. **Abbreviations:** As, arsenic; B, boron; Ba, barium; E, estimated or having a higher degree of uncertainty; Fe, iron; I, iodide; Li, lithium; mg/L, milligrams per liter; mm/dd/yyyy, month/day/year; Mn, manganese; N, nitrate; P, phosphorus; Sr, strontium; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; <, actual value is less than value shown; —, no data; +, plus]

State well number	USGS site identification number	Common name	Sample date (mm/dd/yyyy)	Carbonate (mg/L) (00452)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)	Silica (mg/L, as SiO <sub>2</sub> ) (00955)	Sulfate (mg/L) (00945)	Nitrogen, NO <sub>2</sub> +NO <sub>3</sub> (mg/L, as N) (00631)	Nitrogen, nitrite (mg/L, as N) (00613)	Phosphorus (mg/L, as P) (00666)	Orthophosphate (mg/L, as P) (00671)	Arsenic (µg/L, as As) (01000)
IN/5W-17L5	341013117253905	RCZ6-5	04/28/2011	—	2.91	0.38	18.3	18.8	1.69	<0.001	—	0.025	1.7
IN/5W-17L6	341013117253906	RCZ6-6	04/28/2011	—	2.85	0.36	18.3	18.7	1.66	<0.001	—	0.020	1.7
IS/5W-03A3	340716117230601	CRCR-1	11/21/2007	—	5.45	0.28	32.2	18.4	1.28	<0.002	—	0.027	1.0
IS/5W-03A4	340716117230602	CRCR-2	11/20/2007	—	4.67	0.28	27.4	11.5	1.09	<0.002	—	0.054	1.4
IS/5W-03A5	340716117230603	CRCR-3	11/14/2007	—	3.44	0.27	27.4	13.1	0.62	<0.002	—	0.060	1.9
IS/5W-03A6	340716117230604	CRCR-4	11/19/2007	—	5.02	0.31	22.4	11.7	1.77	<0.002	—	0.059	0.84
IS/5W-03A7	340716117230605	CRCR-5	11/14/2007	—	4.77	0.34	21.6	6.97	2.91	<0.002	—	0.077	1.2
IS/5W-13B2	340521117212002	RHSW-2	10/23/2007	0	6.59	0.24	25.1	10.4	1.11	<0.002	—	0.066	1.3
IS/5W-13B3	340521117212003	RHSW-3	10/22/2007	0	5.40	0.25	24.9	13.9	2.01	<0.002	—	0.034	0.90
IS/5W-13B4	340521117212004	RHSW-4	10/22/2007	0	5.45	0.32	23.9	18.2	5.19	<0.002	—	0.023	0.80
IS/5W-13B5	340521117212005	RHSW-5	08/12/2010	—	19.4	0.27	23.4	59.4	11.4	<0.002	<0.04	0.034	0.75
IS/4W-29H4	340326117185301	FOG1-1	11/05/2007	9	45.4	7.45	18.4	27.1	E0.03	0.002	—	0.026	60.6
IS/4W-29H5	340326117185302	FOG1-2	11/05/2007	12	26.1	3.54	17.0	16.4	<0.04	<0.002	—	0.045	7.1
IS/4W-29H6	340326117185303	FOG1-3	11/06/2007	1	8.82	1.11	13.7	24.2	0.25	<0.002	—	0.016	7.1
IS/4W-29H7	340326117185304	FOG1-4	11/06/2007	—	30.2	0.58	27.8	45.6	0.69	0.006	—	0.052	1.7
IS/4W-29H8	340326117185305	FOG1-5	11/06/2007	—	32.3	0.80	20.3	20.3	1.37	<0.002	—	1.02	7.0
IS/4W-29K1	340317117190401	FOG2-1	11/07/2007	5	37.8	3.00	15.2	9.91	<0.04	E0.001	—	0.105	3.9
IS/4W-29K2	340317117190402	FOG2-2	11/07/2007	—	7.19	0.24	23.1	23.1	0.58	<0.002	—	0.017	2.3
IS/4W-29K3	340317117190403	FOG2-3	11/07/2007	—	33.0	0.41	24.1	70.8	0.70	E0.001	—	0.017	2.3
IS/4W-29K4	340317117190404	FOG2-4	11/08/2007	0	31.1	0.68	25.5	40.6	0.95	0.002	—	0.558	12.9
IS/4W-29K5	340317117190405	FOG2-5	11/08/2007	0	27.7	0.63	17.0	40.9	2.31	<0.002	—	0.578	3.1

**Table 17.** Field measurement, major-ion, nutrient, and selected trace-element data in groundwater samples from selected monitoring sites, San Bernardino County, California.  
—Continued

[State well number: See well-numbering diagram in text. Location of sites shown in figure 2. All samples were analyzed at U.S. Geological Survey (USGS) laboratories. The 5-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. Analysis for each sample is shown on one line on consecutive pages. **Abbreviations:** As, arsenic; B, boron; Ba, barium; E, estimated or having a higher degree of uncertainty; Fe, iron; I, iodide; Li, lithium; mg/L, milligrams per liter; mm/dd/yyyy, month/day/year; Mn, manganese; N, nitrate; P, phosphorus; Sr, strontium; µg/L, micrograms per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; <, actual value is less than value shown; —, no data; +, plus]

State well number	USGS site identification number	Common name	Sample date (mm/dd/yyyy)	Barium (µg/L, as Ba) (01005)	Organic carbon (mg/L) (00681)	Boron (µg/L, as B) (01020)	Iodide (mg/L, as I) (71865)	Iron (µg/L, as Fe) (01046)	Lithium (µg/L, as Li) (01130)	Manganese (µg/L, as Mn) (01056)	Strontium (µg/L, as Sr) (01080)	Link to complete dataset
1N/5W-17L5	341013117253905	RCZ6-5	04/28/2011	20.0	0.28	17	<0.001	3.5	5.77	0.85	244	RCZ6-5 (1N/5W-17L5)
1N/5W-17L6	341013117253906	RCZ6-6	04/28/2011	16.2	0.28	17	<0.001	<3.2	5.72	0.19	235	RCZ6-6 (1N/5W-17L6)
1S/5W-03A3	340716117230601	CRCR-1	11/21/2007	24.9	<0.40	10	<0.002	<8.0	4.42	<0.40	221	CRCR-1 (1S/5W-03A3)
1S/5W-03A4	340716117230602	CRCR-2	11/20/2007	15.5	<0.40	8.6	<0.002	<8.0	2.35	<0.40	163	CRCR-2 (1S/5W-03A4)
1S/5W-03A5	340716117230603	CRCR-3	11/14/2007	12.8	<0.40	14	<0.002	<8.0	2.54	<0.40	164	CRCR-3 (1S/5W-03A5)
1S/5W-03A6	340716117230604	CRCR-4	11/19/2007	23.2	<0.40	12	<0.002	<8.0	0.79	<0.40	253	CRCR-4 (1S/5W-03A6)
1S/5W-03A7	340716117230605	CRCR-5	11/14/2007	13.6	<0.40	15	<0.002	<8.0	0.79	<0.40	211	CRCR-5 (1S/5W-03A7)
1S/5W-13B2	340521117212002	RHSW-2	10/23/2007	32.4	E0.21	33	<0.002	<8.0	3.12	0.53	312	RHSW-2 (1S/5W-13B2)
1S/5W-13B3	340521117212003	RHSW-3	10/22/2007	35.0	<0.40	15	<0.002	<8.0	2.99	<0.40	300	RHSW-3 (1S/5W-13B3)
1S/5W-13B4	340521117212004	RHSW-4	10/22/2007	27.2	<0.40	12	<0.002	<8.0	1.46	<0.40	301	RHSW-4 (1S/5W-13B4)
1S/5W-13B5	340521117212005	RHSW-5	08/12/2010	42.0	—	35	<0.002	<8.0	2.40	<0.20	549	RHSW-5 (1S/5W-13B5)
1S/4W-29H4	340326117185301	FOG1-1	11/05/2007	5.5	0.65	1,260	0.166	<8.0	4.30	0.56	31.9	FOG1-1 (1S/4W-29H4)
1S/4W-29H5	340326117185302	FOG1-2	11/05/2007	11.5	0.43	345	0.077	<8.0	1.47	0.71	19.9	FOG1-2 (1S/4W-29H5)
1S/4W-29H6	340326117185303	FOG1-3	11/06/2007	13.0	<0.40	42	E0.001	<8.0	1.78	<0.40	115	FOG1-3 (1S/4W-29H6)
1S/4W-29H7	340326117185304	FOG1-4	11/06/2007	41.0	0.77	247	0.008	<8.0	7.75	16.1	322	FOG1-4 (1S/4W-29H7)
1S/4W-29H8	340326117185305	FOG1-5	11/06/2007	30.7	0.57	390	0.005	<8.0	9.12	4.34	137	FOG1-5 (1S/4W-29H8)
1S/4W-29K1	340317117190401	FOG2-1	11/07/2007	9.4	1.8	338	0.053	<8.0	7.16	14.9	45.7	FOG2-1 (1S/4W-29K1)
1S/4W-29K2	340317117190402	FOG2-2	11/07/2007	28.2	E0.37	63	<0.002	<8.0	2.76	<0.40	291	FOG2-2 (1S/4W-29K2)
1S/4W-29K3	340317117190403	FOG2-3	11/07/2007	34.6	0.60	152	0.012	<8.0	4.68	9.25	504	FOG2-3 (1S/4W-29K3)
1S/4W-29K4	340317117190404	FOG2-4	11/08/2007	30.3	0.74	207	0.004	<8.0	8.75	9.61	251	FOG2-4 (1S/4W-29K4)
1S/4W-29K5	340317117190405	FOG2-5	11/08/2007	33.1	1.21	188	0.004	<8.0	6.99	<0.40	256	FOG2-5 (1S/4W-29K5)

**Table 18.** Deuterium, oxygen-18, and tritium data in groundwater samples from selected monitoring sites, San Bernardino County, California.

[State well-number: See well numbering diagram in text. Location of sites shown in figure 2. All data were analyzed at U.S. Geological Survey (USGS) laboratories. The 5-digit USGS parameter code below the constituent name is used to uniquely identify a specific constituent or property. **Abbreviations:** mm/dd/yyyy, month/day/year; per mil, isotopic ratio in parts per thousand; pmc, percent modern carbon; —, no data]

State well number	USGS site identification number	Common name	Sample date (mm/dd/yyyy)	$\delta^{18}\text{O}$ , delta oxygen-18 (per mil) (82085)	$\delta\text{D}$ , deuterium/protium ratio (per mil) (82082)	Tritium (picocuries per liter) (07000)	Delta carbon-13 (per mil) (82081)	Carbon-14 (pmc) (49933)
1N/5W-17L5	341013117253905	RCZ6-5	04/28/2011	-9.26	-61.90	11	-13.24	91.82
1N/5W-17L6	341013117253906	RCZ6-6	04/28/2011	-9.31	-61.70	11	-13.30	92.05
1S/5W-03A3	340716117230601	CRCR-1	11/29/2005	-7.48	-47.80	—	-12.70	80.31
1S/5W-03A4	340716117230602	CRCR-2	12/01/2005	-7.61	-47.50	—	-13.20	77.58
1S/5W-03A5	340716117230603	CRCR-3	11/30/2005	-8.27	-51.20	—	-13.50	77.85
1S/5W-03A6	340716117230604	CRCR-4	11/30/2005	-8.88	-57.70	2.0	-12.40	81.31
1S/5W-03A7	340716117230605	CRCR-5	11/29/2005	-8.16	-51.90	11	-13.70	73.94
1S/5W-13B2	340521117212002	RHSW-2	02/28/2006	-8.49	-56.60	0.2	-11.70	64.63
1S/5W-13B3	340521117212003	RHSW-3	02/27/2006	-8.62	-57.50	0.3	-12.70	76.36
1S/5W-13B4	340521117212004	RHSW-4	02/27/2006	-8.34	-57.20	1.4	-12.90	80.62
1S/4W-13B5	340521117212005	RHSW-5	10/23/2007	—	—	5.9	-13.79	85.73
1S/4W-29H4	340326117185301	FOG1-1	06/28/2002	-9.57	-66.00	0.6	-12.18	6.480
1S/4W-29H5	340326117185302	FOG1-2	05/10/2003	-9.63	-66.20	0.2	-11.07	3.360
1S/4W-29H6	340326117185303	FOG1-3	06/28/2002	-8.90	-58.70	—	-12.36	21.37
1S/4W-29H7	340326117185304	FOG1-4	06/29/2002	-8.21	-56.20	11	-12.63	98.51
1S/4W-29H8	340326117185305	FOG1-5	02/09/2006	-8.53	-60.80	13	-11.60	95.70
1S/4W-29K1	340317117190401	FOG2-1	06/26/2002	-9.31	-63.90	—	-9.29	4.030
1S/4W-29K2	340317117190402	FOG2-2	06/26/2002	-8.92	-59.50	3.4	-12.75	91.68
1S/4W-29K3	340317117190403	FOG2-3	06/27/2002	-8.54	-58.50	8.5	-13.35	104.4
1S/4W-29K4	340317117190404	FOG2-4	06/25/2002	-7.91	-56.30	11	-13.09	87.87
1S/4W-29K5	340317117190405	FOG2-5	06/25/2002	-7.37	-53.00	17	-14.41	91.36

Prepared by the Sacramento Publishing Service Center.

For more information concerning this report, contact:

Director  
U.S. Geological Survey  
California Water Science Center  
6000 J Street, Placer Hall  
Sacramento, CA 95819  
dc\_ca@usgs.gov

or visit our Web site at:  
<http://ca.water.usgs.gov>

