Prepared in cooperation with the Joshua Basin Water District

Data from a Thick Unsaturated Zone in Joshua Tree, San Bernardino County, California, 2007–09

Data Series 717

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

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By Matthew Burgess, John Izbicki, Nicholas Teague, David O'Leary, Dennis Clark, and Michael Land

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KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2012

Suggested citation:
Burgess, M., Izbicki, J., Teague, N., O'Leary, D., Clark, D., and Land, M., 2012, Data from a thick unsaturated zone in Joshua Tree, San Bernardino County, California, 2007–09: U.S. Geological Survey Data Series 717, 103 p.

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
quart (qt)	0.9464	liter (L)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	Pressure	
bar	100	kilopascal (kPa)

SI to Inch/Pound

Multiply	By	To obtain
	Volume	
milliliter (mL)	33,820	ounce, fluid (fl. oz)
milliliter (mL)	264.2	gallon (gal)
	Flow rate	
liter per minute (L/min)	0.2642	gallon per minute (gal/min)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
	Pressure	
kilopascal (KPa)	0.010	Bar
kilopascal (KPa)	0.1019977664	Meter of Head
kilopascal (KPa)	0.33455256555	Foot of Head

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32

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

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

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 (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Well-Numbering System

Wells are identified and numbered according to their location in the rectangular grid 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 meridian. In California, there are three base lines and meridians; Humboldt (H), Mount Diablo (M), and San Bernardino (S). All wells in the study area are referenced to the San Bernardino base line and meridian (S). Well numbers consist of 15 characters and follow the format 001N006E35A001S. In this report wells are abbreviated and written 1N/6E-35A1.

Acknowledgments

This study was funded by the Joshua Basin Water District and the USGS Cooperative Water Program. The authors thank Ms. Marina West and Mr. Joseph Guzzetta from Joshua Basin Water District for their assistance.

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Abstract

Data were collected on the physical properties of unsaturated alluvial deposits, the chemical composition of leachate extracted from unsaturated alluvial deposits, the chemical and isotopic composition of groundwater and unsaturated-zone water, and the chemical composition of unsaturated-zone gas at four monitoring sites in the southwestern part of the Mojave Desert in the town of Joshua Tree, San Bernardino County, California. The presence of denitrifying and nitrate-reducing bacteria from unsaturated alluvial deposits was evaluated for two of these monitoring sites that underlie unsewered residential development.

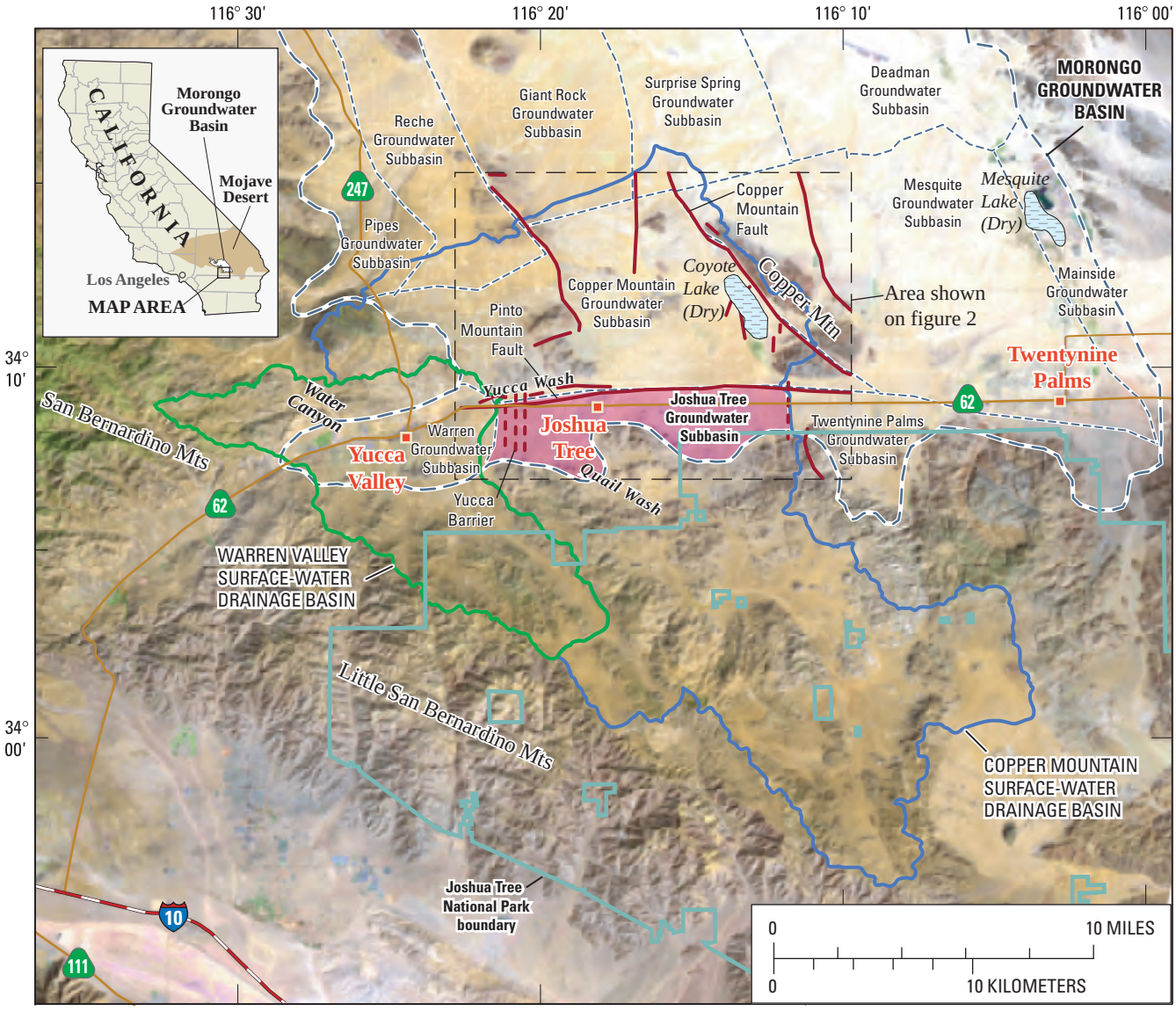
Four unsaturated-zone monitoring sites were installed in the Joshua Tree area—two in an unsewered residential development and two adjacent to a proposed artificial-recharge site in an undeveloped area. The two boreholes in residential development areas were installed by using the ODEX air-hammer method. One borehole was drilled through the unsaturated zone to a depth of 541 ft (feet) below land surface; a well screened across the water table was installed. Groundwater was sampled from this well. The second borehole was drilled to a depth of 81 ft below land surface. Drilling procedures, lithologic and geophysical data, construction details, and instrumentation placed in these boreholes are described. Core material was analyzed for water content, bulk density, matric potential, particle size, and water retention. The leachate from over 500 subsamples of cores and cuttings was analyzed for soluble anions, including fluoride, sulfate, bromide, chloride, nitrate, nitrite, and orthophosphate. Groundwater was analyzed for major ions, inorganic compounds, select trace elements, and isotopic composition. Unsaturated-zone water from suction-cup lysimeters was analyzed for major ions, inorganic compounds, select trace elements, and isotopic composition. Unsaturated-zone gas samples were analyzed for argon, oxygen, nitrogen, methane, carbon dioxide, ethane, nitrous oxide, and carbon monoxide. Drill cuttings were analyzed for denitrifying and nitrate-reducing bacteria.

One of the boreholes installed adjacent to the Joshua Basin Water District proposed groundwater-recharge facility was installed by using the ODEX air-hammer method and the other was installed by using a 7.875-inch hollow-stem auger. Drilling procedures, lithologic and geophysical data, construction details, and instrumentation placed in these boreholes are described; however, geochemical data were not available at the time of publication.

Introduction

Historically, groundwater from the Joshua Tree subbasin of the Morongo groundwater basin (*fig. 1*) has been the sole source of water supply for the community of Joshua Tree. Because of an imbalance between groundwater recharge and pumpage, groundwater levels in the subbasin have declined by as much as 30 ft since 1958 (Nishikawa and others, 2004). Joshua Basin Water District (JBWD) is planning to construct an artificial-recharge facility designed to reverse the decline of groundwater levels and to store water in the Joshua Tree groundwater subbasin. The California State Water Project (SWP) will supply the artificial-recharge water.

In the Warren groundwater subbasin, immediately west of the Joshua Tree subbasin, an artificial-recharge program that began in 1995 has reversed water-level declines and raised the water levels by as much as 250 ft by 2001 (Nishikawa and others, 2003). An increase in nitrate (NO_3) concentrations in the groundwater from low background levels to those that exceed the U.S. Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) as nitrogen (Nishikawa and others, 2003) was associated with the water-level recovery. Nishikawa and others (2003) concluded that the most likely source of the increased NO_3 concentrations in the Warren groundwater subbasin was septic-tank effluent stored in the unsaturated zone that was entrained by rising water levels resulting from the artificially recharged water.



Base from U.S. Geological Survey digital data, 1:100,000, 1981–89; Universal Transverse Mercator Projection, Zone 11. Background image from satellite data compiled by U.S. Geological Survey, Geologic Division, 2000.

Faults modified from Bortugno and Spittler, 1986.

EXPLANATION

Joshua Tree groundwater subbasin

Selected faults—Dashed where approximately located

Cities

Figure 1. Location of study area in Joshua Tree, San Bernardino County, California

The community of Joshua Tree relies on septic systems to dispose of wastewater. JBWD would like to avoid NO_3 contamination similar to what took place in the Warren subbasin. The data in this report serve to establish a baseline for monitoring the transport of solutes through the unsaturated zone in an area of unsewered residential development in proximity to a location being considered for an artificial-recharge facility in Joshua Tree, San Bernardino County, California.

Study Area Description and Hydrogeologic Setting

The following summary of the local hydrogeology is included to provide background information; this report makes no interpretation of data collected previously or during this study. The study area is in the southwestern Mojave Desert, about 100 miles (mi) east of Los Angeles, in the 18-square-mile (mi^2) Joshua Tree subbasin of the Morongo groundwater

basin (*fig. 1*). The principal population center in the subbasin is the community of Joshua Tree. The climate in the study area is arid, characterized by low precipitation, low humidity, and high summer temperatures. The Joshua Tree groundwater subbasin is bounded by the Little San Bernardino Mountains to the south, the Yucca Barrier and the Warren groundwater subbasin to the west, the Pinto Mountain Fault to the north, and the Twentynine Palms groundwater subbasin to the east. The Pinto Mountain Fault separates the Joshua Tree groundwater subbasin from the Copper Mountain groundwater subbasin to the north (Nishikawa and others, 2004).

Nishikawa and others (2004) divided the geologic units of the Joshua Tree groundwater subbasin, as described by Bedford and Miller (1997), into three generalized stratigraphic units. These units are designated as a basement complex of pre-Tertiary granitic and metamorphic rocks, Tertiary sedimentary and volcanic deposits (T_{sy} and T_{vy}), and Quaternary alluvial deposits (Qsu). The depth to the basement complex has been estimated by using gravity surveys that indicate an east-west elongate basin parallel to the Pinto Mountain Fault (Roberts and others 2002). The maximum thickness of the Tsy, Tvy, and Qsu deposits of the Joshua Tree groundwater subbasin could be greater than 4,500 ft in two locations east of the community of Joshua Tree; the average thickness of the sediments within the subbasin is about 2,000 ft (Nishikawa and others, 2004).

The basin-fill Tertiary sedimentary and volcanic deposits and Quaternary alluvial deposits are the water-bearing units in the Joshua Tree groundwater subbasin (Nishikawa and others, 2004). Nishikawa and others (2004) used lithologic and downhole geophysical logs to identify the differences in sedimentary deposits and differentiate between the lower, middle, and upper aquifer zones. The Tertiary sedimentary and volcanic deposits were assigned to a single aquifer (the "lower" aquifer zone) and the Quaternary alluvial deposits were divided into two aquifer zones—"middle" and "upper" (Nishikawa and others, 2004). Most of the production wells are perforated in the upper aquifer only.

The principal sources of recharge to the Joshua Tree groundwater subbasin are runoff of precipitation from the Copper Mountain surface-water drainage basin in the Little San Bernardino Mountains to the south, and groundwater underflow from the neighboring Warren groundwater subbasin to the west (Nishikawa and others, 2004). The principal pathway for recharge is the infiltration of precipitation runoff in stream channels and through fractures in the bedrock (Lewis, 1972). Nishikawa and others (2004) used borehole instrumentation in Quail Wash (*fig. 1*) to estimate that the annual recharge from stream inflow to the Joshua Tree groundwater subbasin was 71 acre-feet per year (acre-ft/yr). Results of model simulations suggest that an additional 85 acre-ft/yr enters the Joshua Tree groundwater subbasin from the Warren groundwater subbasin as underflow (Nishikawa and others, 2004).

In 2004, groundwater pumped by JBWD for domestic and commercial use was the main discharge from the Joshua Tree groundwater subbasin (Nishikawa and others, 2004). Total groundwater production by JBWD during the 44-year period from 1958 to 2001 was about 42,000 acre-ft. According to JBWD records, annual pumpage increased from about 135 acre-ft in 1958 to a maximum of about 1,600 acre-ft in 2001.

Septic tanks are the primary form of wastewater treatment in the Joshua Tree groundwater subbasin; therefore, septic-tank effluent is a potential source of groundwater recharge (Nishikawa and others, 2004). To study the effects of the movement of septic-tank effluent through the unsaturated zone in Joshua Tree, two boreholes (JTUZ-1 and JTUZ-2) were drilled and instrumented in June 2007 in an unsewered residential development (*fig. 2*). Two additional boreholes (JTUZ-3 and JTUZ-4) near a proposed artificial-recharge site were drilled and instrumented in December 2009 and April 2010, respectively (*fig. 2*).

Purpose and Scope

This report presents data collected from May 2007 through April 2010 in instrumented boreholes drilled as part of a cooperative study between the U.S. Geological Survey (USGS) and JBWD to track the flow of water and the transport of solutes through the unsaturated zone at an unsewered residential development and at a proposed artificial-recharge site in Joshua Tree.

This report contains data for lithologic observations and geophysical measurements collected in boreholes during drilling; physical and hydraulic analyses of core and cutting materials; the chemical composition of leachate from over 500 subsamples of cores and cuttings; chemical and isotopic analyses of groundwater collected from the water table and of water and gases collected from the unsaturated zone; and, analyses of nitrate-reducing and denitrifying organisms in the unsaturated zone. Physical and hydraulic properties data from JTUZ-3 and JTUZ-4 were not available at the time of publication and are not presented in this report.

Site Names and Instrument-Numbering System

Several names were assigned to each unsaturated-zone monitoring site, including a descriptive name, station name, and the USGS site identification number. The descriptive name begins with the acronym JTUZ; JT stands for Joshua Tree, the town in which it is located, and UZ indicates the borehole was established to study the unsaturated zone. Following JTUZ is a site number (1 or 2) and a code identifying the type of instrumentation and its depth: AT, DEPS, GAS, HDP, LYS, or WELL, for advanced tensiometer, dielectric permittivity sensor, gas sampler, heat dissipation probe, suction-cup lysimeter, and screened well sections, respectively. For example, JTUZ-1 GAS @ 90 is a gas sampler 90 ft below land surface (bls) in borehole number 1 in the community of Joshua Tree.

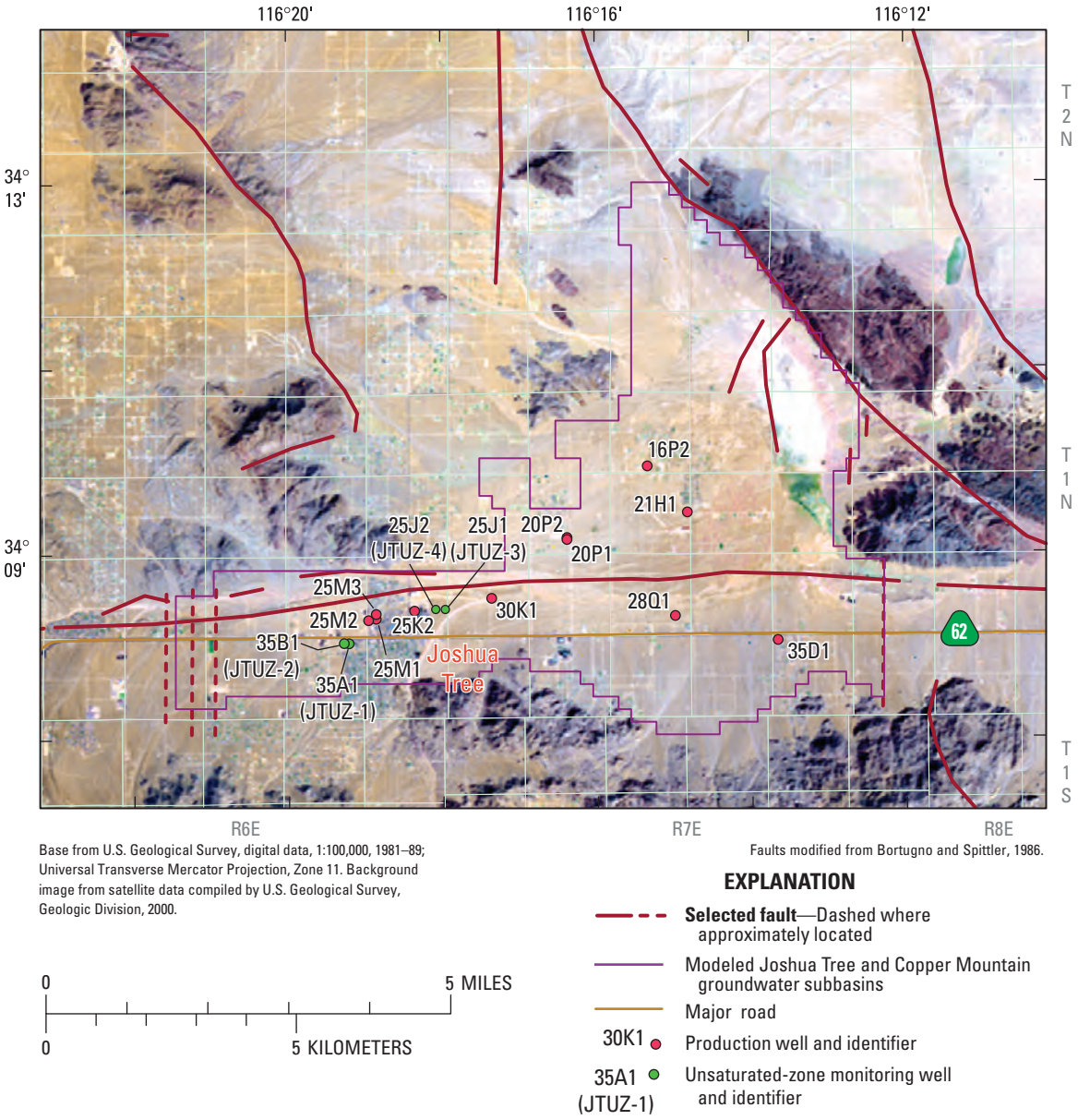


Figure 2. Location of unsaturated-zone monitoring sites and production wells in Joshua Tree, San Bernardino County, California

The first component of the station name is described in the front matter of this report under the heading 'Well-Numbering System'; the second component is a suffix identifying the type of instrumentation in a similar manner as described above (for example, 001N006E35A002SAT).

Finally, each instrument at an unsaturated-zone monitoring site was assigned a 15-digit USGS site identification number, assigned sequentially from bottom to top of the borehole. This number is the primary identifier of a site within USGS databases. Details of site names and instrumentation are provided in *tables 1* and *2*.

Drilling Procedures and Data Collection

Four unsaturated-zone monitoring sites were installed by the USGS as part of this study (*fig. 2*). Three (JTUZ-1, JTUZ-2, and JTUZ-4) were installed by using the ODEX air-hammer method, also known as the under-reamer method (Driscoll, 1986; Hammermeister and others, 1986). The fourth, JTUZ-3, was drilled by using a CME-550 hollow-stem-auger drill rig equipped with 7.875-inch (in.) hollow-stem augers.

The ODEX drilling method minimizes disturbance of the unsaturated material near the borehole by using air rather than water as a drilling fluid. This method reduces the potential for contamination from drilling fluids. This allows for the collection of cuttings, cores, and water samples that can be analyzed for chemical properties. These samples better represent the undisturbed unsaturated zone than those collected from boreholes drilled by using the mud-rotary method.

Drill depths were 541 ft bls at JTUZ-1, 81 ft bls at JTUZ-2, and 437 ft bls at JTUZ-4. JTUZ-1 and JTUZ-4 were completed in saturated aquifer material near the water table. JTUZ-2 was completed in the unsaturated zone. The diameters of all ODEX holes drilled as part of this study were 8.875 in. At night and other times when drilling stopped, the ODEX pipe was sealed to prevent the movement of air into and out of the drill hole.

Table 1. Site names, instrumentation names and numbers, and description of instrumentation for unsaturated-zone monitoring sites near unsewered residential development near Joshua Tree, San Bernardino County, California, 2007.

[Site location shown in figure 2. **Abbreviations**: AT, advanced tensiometer; ft, feet; GAS, gas sampler; HDP, heat dissipation probe; LYS, suction-cup lysimeter; @, at; USGS, U.S. Geological Survey]

Common site name	Instrumentation names and numbers			Description of instrumentation
	Descriptive name	Station name and instrument suffix	USGS site identification number	
JTUZ-1	JTUZ-1 2-inch well	001N006E35A001S	340756116190601	Well, perforated from 522 to 532 ft.
	JTUZ-1 AT @ 517	001N006E35A002SAT	340756116190602	Advanced tensiometer at 517 ft.
	JTUZ-1 LYS @ 516.5	001N006E35A003SLYS	340756116190603	Suction-cup lysimeter at 516.5 ft.
	JTUZ-1 GAS @ 515	001N006E35A004SGS	340756116190604	Gas sampler at 515 ft.
	JTUZ-1 HDP @ 482	001N006E35A005SHDP	340756116190605	Heat dissipation probe at 482 ft.
	JTUZ-1 LYS @ 464	001N006E35A006SLYS	340756116190606	Suction-cup lysimeter at 464 ft.
	JTUZ-1 GAS @ 462	001N006E35A007SGS	340756116190607	Gas sampler at 462 ft.
	JTUZ-1 HDP @ 461	001N006E35A008SHDP	340756116190608	Heat dissipation probe at 461 ft.
	JTUZ-1 LYS @ 346	001N006E35A009SLYS	340756116190609	Suction-cup lysimeter at 346 ft.
	JTUZ-1 GAS @ 344	001N006E35A010SGS	340756116190610	Gas sampler at 344 ft.
	JTUZ-1 HDP @ 343	001N006E35A011SHDP	340756116190611	Heat dissipation probe at 343 ft.
	JTUZ-1 AT @ 292	001N006E35A012SAT	340756116190612	Advanced tensiometer at 292 ft.
	JTUZ-1 LYS @ 291	001N006E35A013SLYS	340756116190613	Suction-cup lysimeter at 291 ft.
	JTUZ-1 GAS @ 290	001N006E35A014SGS	340756116190614	Gas sampler at 290 ft.
	JTUZ-1 HDP @ 289	001N006E35A015SHDP	340756116190615	Heat dissipation probe at 289 ft.
	JTUZ-1 HDP @ 245	001N006E35A016SHDP	340756116190616	Heat dissipation probe at 245 ft.
	JTUZ-1 GAS @ 176	001N006E35A017SGS	340756116190617	Gas sampler at 176 ft.
	JTUZ-1 HDP @ 175	001N006E35A018SHDP	340756116190618	Heat dissipation probe at 175 ft.
	JTUZ-1 AT @ 92	001N006E35A019SAT	340756116190619	Advanced tensiometer at 92 ft.
	JTUZ-1 LYS @ 91	001N006E35A020SLYS	340756116190620	Suction-cup lysimeter at 91 ft.
	JTUZ-1 GAS @ 90	001N006E35A021SGS	340756116190621	Gas sampler at 90 ft.
	JTUZ-1 HDP @ 75	001N006E35A022SHDP	340756116190622	Heat dissipation probe at 75 ft.
	JTUZ-1 HDP @ 39	001N006E35A023SHDP	340756116190623	Heat dissipation probe at 39 ft.
JTUZ-2	JTUZ-2 HDP @ 78	001N006E35B001SHDP	340756116191701	Heat dissipation probe at 78 ft.
	JTUZ-2 AT @ 71	001N006E35B002SAT	340756116191702	Advanced tensiometer at 71 ft.
	JTUZ-2 LYS @ 70	001N006E35B003SLYS	340756116191703	Suction-cup lysimeter at 70 ft.
	JTUZ-2 HDP @ 69	001N006E35B004SHDP	340756116191704	Heat dissipation probe at 69 ft.
	JTUZ-2 GAS @ 68	001N006E35B005SGS	340756116191705	Gas sampler at 68 ft.
	JTUZ-2 AT @ 62	001N006E35B006SAT	340756116191706	Advanced tensiometer at 62 ft.
	JTUZ-2 LYS @ 61	001N006E35B007SLYS	340756116191707	Suction-cup lysimeter at 61 ft.
	JTUZ-2 HDP @ 60	001N006E35B008SHDP	340756116191708	Heat dissipation probe at 60 ft.
	JTUZ-2 GAS @ 59	001N006E35B009SGS	340756116191709	Gas sampler at 59 ft.
	JTUZ-2 HDP @ 45	001N006E35B010SHDP	340756116191710	Heat dissipation probe at 45 ft.
	JTUZ-2 AT @ 39	001N006E35B011SAT	340756116191711	Advanced tensiometer at 39 ft.
	JTUZ-2 HDP @ 38	001N006E35B012SHDP	340756116191712	Heat dissipation probe at 38 ft.
	JTUZ-2 GAS @ 37	001N006E35B013SGS	340756116191713	Gas sampler at 37 ft.
	JTUZ-2 HDP @ 15	001N006E35B014SHDP	340756116191714	Heat dissipation probe at 15 ft.
	JTUZ-2 GAS @ 14	001N006E35B015SGS	340756116191715	Gas sampler at 14 ft.

Table 2. Site names, instrumentation names and numbers, and description of instrumentation for unsaturated-zone monitoring sites near proposed recharge facility near Joshua Tree, San Bernardino County, California, 2009–10.

[Site location shown in figure 2. **Abbreviations**: AT, advanced tensiometer; DEPS, dielectric permittivity sensor; ft, feet; GAS, gas sampler; HDP, heat dissipation probe; LYS, suction-cup lysimeter; @, at; USGS, U.S. Geological Survey]

Common site name	Instrumentation names and numbers			Description of instrumentation
	Descriptive name	Station name and instrument suffix	USGS site identification number	
JTUZ-3	JTUZ-3 LYS @ 102.5	001N006E25J001SLYS	340824116180001	Suction-cup lysimeter at 102.5 ft.
	JTUZ-3 TEST HOLE	001N006E25J002STH	340824116180002	Test hole at 102 ft.
	JTUZ-3 DEPS @ 80	001N006E25J003SDEPS	340824116180003	Dielectric permittivity sensor at 80 ft.
	JTUZ-3 DEPS @ 36	001N006E25J004SDEPS	340824116180004	Dielectric permittivity sensor at 36 ft.
JTUZ-4	JTUZ-4 2-inch WELL	001N006E25J005S	340824116180701	Well, perforated from 417 to 427 ft.
	JTUZ-4 LYS @ 415	001N006E25J006SLYS	340824116180702	Suction-cup lysimeter at 415 ft.
	JTUZ-4 DEPS @ 400	001N006E25J007SDEPS	340824116180703	Dielectric permittivity sensor at 400 ft.
	JTUZ-4 HDP @ 400	001N006E25J008SHDP	340824116180704	Heat dissipation probe at 400 ft.
	JTUZ-4 AT @ 375	001N006E25J009SAT	340824116180705	Advanced tensiometer at 375 ft.
	JTUZ-4 LYS @ 373	001N006E25J010SLYS	340824116180706	Suction-cup lysimeter at 373 ft.
	JTUZ-4 DEPS @ 372	001N006E25J011SDEPS	340824116180707	Dielectric permittivity sensor at 372 ft.
	JTUZ-4 DEPS @ 326	001N006E25J012SDEPS	340824116180708	Dielectric permittivity sensor at 326 ft.
	JTUZ-4 HDP @ 300	001N006E25J013SHDP	340824116180709	Heat dissipation probe at 300 ft.
	JTUZ-4 HDP @ 245	001N006E25J014SHDP	340824116180710	Heat dissipation probe at 245 ft.
	JTUZ-4 HDP @ 208	001N006E25J015SHDP	340824116180711	Heat dissipation probe at 208 ft.
	JTUZ-4 AT @ 195	001N006E25J016SAT	340824116180712	Advanced tensiometer at 195 ft.
	JTUZ-4 LYS @ 194	001N006E25J017SLYS	340824116180713	Suction-cup lysimeter at 194 ft.
	JTUZ-4 DEPS @ 192	001N006E25J018SDEPS	340824116180714	Dielectric permittivity sensor at 192 ft.
	JTUZ-4 HDP @ 162	001N006E25J019SHDP	340824116180715	Heat dissipation probe at 162 ft.
	JTUZ-4 DEPS @ 119	001N006E25J020SDEPS	340824116180716	Dielectric permittivity sensor at 119 ft.
	JTUZ-4 HDP @ 119	001N006E25J021SHDP	340824116180717	Heat dissipation probe at 119 ft.
	JTUZ-4 AT @ 76	001N006E25J022SAT	340824116180718	Advanced tensiometer at 76 ft.
	JTUZ-4 LYS @ 75	001N006E25J023SLYS	340824116180719	Suction-cup lysimeter at 75 ft.
	JTUZ-4 DEPS @ 73	001N006E25J024SDEPS	340824116180720	Dielectric permittivity sensor at 73 ft.
	JTUZ-4 HDP @ 44	001N006E25J025SHDP	340824116180721	Heat dissipation probe at 44 ft.
	JTUZ-4 LYS @ 22	001N006E25J026SLYS	340824116180722	Suction-cup lysimeter at 22 ft.
	JTUZ-4 HDP @ 20	001N006E25J027SHDP	340824116180723	Heat dissipation probe at 20 ft.
	JTUZ-4 DEPS @ 20	001N006E25J028SDEPS	340824116180724	Dielectric permittivity sensor at 20 ft.

Cuttings were collected at 1-ft intervals in buckets from the "cyclone" discharge, a means of cuttings disposal that focuses the discharge of cuttings in one location below a cylinder that dissipates the force of the compressed air used in drilling (*fig. 3*). Sample collection was coordinated with drilling rates to allow cuttings to be collected at discrete intervals. Subsamples of cuttings from each 1-ft interval were saved in 1-quart, re-sealable plastic bags for water extractions and in smaller-volume plastic fishing tackle boxes for further lithologic description in the laboratory and for archiving. At select locations, material was subsampled and saved in a heat-sealable aluminum pouch to retain moisture. The site, date, time, and depth of the cuttings were recorded on the pouch.

Five cores were collected from the JTUZ-1 borehole, six cores were collected from the JTUZ-4 borehole, and no cores were collected from JTUZ-2 (analyses of JTUZ-4 core material were not complete at time of press, 2012). Cores were collected on the basis of lithologic changes observed in the cuttings. Before collection, the 2-ft-long core barrel was lined with four 4-in.-diameter, 6-in.-long aluminum or brass core liners. Immediately after each core was collected, (1) the core barrel was retrieved and disassembled, (2) material in the nose cone of the core barrel was collected and saved in a heat-sealable aluminum pouch, (3) core liners were extruded from the end of the core barrel, (4) the core liners were capped with plastic end-caps containing a filter paper (for later analysis of matric potential) and sealed with electrical tape, (5) the depth and orientation of the core was recorded on the end-caps, (6) each core liner was wrapped in plastic and placed into a heat-sealable aluminum pouch (that was immediately sealed by using a conventional clothes iron), and (7) the site, date, time, and depth of the core were recorded on the pouch. Four pouches, one for each 6-in.-long core liner, were required for each core. Plastic and heat-sealable aluminum pouches, used to store cuttings and cores, are commercially available and are designed and tested to retain moisture in core material (*fig. 4*;

Figure 3. Collection of ODEX drilling cuttings from "cyclone" discharge, in Joshua Tree, San Bernardino County, California, May 2007

Izbicki and others, 2000). A core was collected from 100 to 105 ft bls by using a split-spoon-type sampler at the bottom of the JTUZ-3 borehole.

Lithologic Data

Detailed lithologic logs were compiled for each ODEX monitoring site from descriptions of drill cuttings and core material collected at each borehole at 1-ft intervals (*tables 3* and *4*). These logs were initially compiled in the field to define lithologic changes that would affect infiltration to determine which depths were best suited for instruments to be placed in the borehole. The lithologic logs that were initially compiled from descriptions in the field were later refined on the basis of descriptions from binocular microscope analysis of samples at the USGS San Diego Water Quality Laboratory.

In the field, cuttings were laid out on the ground in rows of 10-ft intervals, such that major lithologic changes could be identified as drilling proceeded (*fig. 5*). Cuttings and core material were described in the field by texture, sorting,

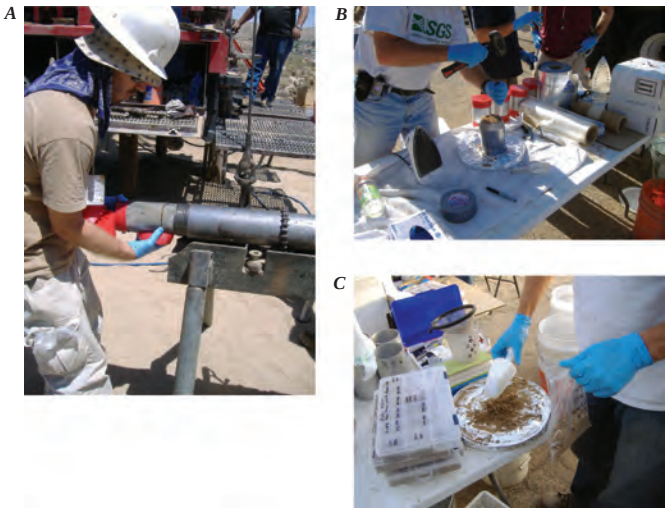


Figure 4. Core sampling techniques, in Joshua Tree, San Bernardino County, California, May 2007. *A*, Plastic core end-caps being placed on the core liner as it is extruded from the core barrel; *B*, Removal of material from the nose of the core barrel; *C*, Archiving material from the nose of the core barrel for chemical extractions.

rounding, color, and other major features when applicable (for example, major changes in mineralogy). The texture of cuttings was determined by using a method developed by Folk (1954; *fig. 6*), and particle-size descriptions follow the National Research Council (Lane, 1947) classification. This classification allows general grain-size terms (such as "sand") to be correlated with size limits in metric or English units. In the laboratory, grain sizes of samples were described under an optical microscope detailing every size of grain seen in order of most to least prominent. Modifiers were used to quantify percentages of grain sizes. For example, a sample composed of 60-percent sand and 40-percent silt would be called 'sand and silt'; a sample composed of 80-percent sand and 20-percent silt would be called 'sand with some silt'; a sample composed of 89-percent sand and 11-percent silt would be called 'sand with occasional silt.' Occasionally, modifiers were combined to thoroughly describe the samples. The colors of dry cuttings were determined by using the numerical designation in the Munsell Soil Color Charts (Munsell, 1994).

In addition to lithologic data, the specific conductance of a mixture of 50 mL of distilled water and 50 +/- 1 grams (g) of cuttings or core material that had passed through a 1-millimeter (mm) mesh-size sieve was measured and recorded in the field at 1-ft intervals (*figs. 7*, *8*, *9*, and *10*). These reconnaissance data were collected to locate where in the unsaturated zone the salts had naturally accumulated independent of lithology, prior to installation of the instrumentation, so that additional instruments could be placed in locations of high specific conductance.

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
0	5.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; angular to sub-angular; very pale brown (10 YR 7/4) dry
5.5	6.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; angular to sub-angular; very pale brown (10 YR 7/4) dry
6.5	7.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; angular to sub-angular; very pale brown (10 YR 7/4) dry
7.5	8.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular; very pale brown (10 YR 7/3) dry
8.5	9.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular; very pale brown (10 YR 7/3) dry
9.5	10.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; light brownish gray (10 YR 6/2) dry
10.5	11.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; pale brown (10 YR 6/3) dry
11.5	12.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; pale brown (10 YR 6/3) dry
12.5	13.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; pale brown (10 YR 6/3) dry; some clumping of material
13.5	14.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <15 mm, with occasional silt; very poorly sorted; angular to sub-angular; pale brown (10 YR 6/3) dry
14.5	15.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; pale brown (10 YR 6/3) dry
15.5	16.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; angular to sub-angular; very pale brown (10 YR 7/3) dry; some clumping of material
16.5	17.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some and pebbles <20 mm; very poorly sorted; angular to sub-angular; very pale brown (10 YR 7/3) dry
17.5	18.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <12 mm; very poorly sorted; angular to sub-angular; light yellowish brown (10 YR 6/4) dry
18.5	19.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, pebbles <15 mm and silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
19.5	20.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, pebbles <15 mm and silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
20.5	21.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, pebbles <15 mm and silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
21.5	22.5	Gravelly sand; very coarse sand and very fine sand to granules with some pebbles <20 mm; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist
22.5	23.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist
23.5	24.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <10 mm, with occasional silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
24.5	25.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules and pebbles <6 mm, with occasional silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
25.5	26.5	Gravelly sand; very coarse sand and very fine sand to granules with some silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
26.5	27.5	Gravelly sand; very coarse sand and very fine sand to granules with some pebbles <12 mm; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist
27.5	28.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <25 mm; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
28.5	29.5	Gravelly sand; very coarse sand to granules and very fine to coarse sand; moderately sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
29.5	30.5	Gravelly sand; very coarse sand to granules and very fine to coarse sand with some pebbles <15 mm and silts; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
30.5	31.5	Gravelly sand; coarse sand to very coarse sand and very fine sand to granules with some silts with occasional pebbles <40 mm; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
31.5	32.5	Gravelly sand; coarse sand to very coarse sand and very fine sand to granules; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
32.5	33.5	Gravelly sand; coarse sand to very coarse sand and very fine sand to granules; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
33.5	34.5	Gravelly sand; very coarse sand to granules and very fine to coarse sand with some pebbles <15 mm; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
34.5	35.5	Gravelly sand; coarse sand to very coarse sand and very fine sand to granules with some silts; very poorly sorted; angular to sub-angular; dark yellowish brown (10 YR 4/4) moist; some clumping of material
35.5	36.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist; some clumping of material
36.5	37.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some silt; very poorly sorted; angular to sub-angular; yellowish brown (10 YR 5/4) moist
37.5	38.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; some clumping of material
38.5	39.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 4/3) moist; some clumping of material
39.5	40.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some silt, with occasional pebbles <15 mm; poorly sorted; sub-angular; brown (10 YR 4/3) moist; some clumping of material
40.5	41.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some silt, with occasional pebbles <15 mm; poorly sorted; sub-angular; brown (10 YR 4/3) moist; some clumping of material
41.5	42.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some silt, with occasional pebbles <15 mm; very poorly sorted; grains finer than very coarse sand = sub-angular, granules = sub-rounded; brown (10 YR 4/3) moist; some clumping of material
42.5	43.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some silt, with occasional pebbles <15 mm; very poorly sorted; grains finer than very coarse sand = sub-angular, granules = sub-rounded; brown (10 YR 4/3) moist; some clumping of material
43.5	44.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some silt, with occasional pebbles <15 mm; very poorly sorted; grains finer than very coarse sand = sub-angular, granules = sub-rounded; brown (10 YR 4/3) moist; some clumping of material
44.5	45.5	Gravelly sand; medium sand and very fine to very coarse sand with some silts and granules, with occasional clays; very poorly sorted; angular to sub-angular; brown (7.5 YR 4/4) moist; some clumping of material; mica rich
45.5	46.5	Gravelly sand; medium sand and very fine to very coarse sand with some silts and granules, with occasional clays; very poorly sorted; angular to sub-angular; brown (7.5 YR 4/4) moist; some clumping of material
46.5	47.5	Gravelly sand; medium sand and very fine to very coarse sand with some silts and granules, with occasional clays; very poorly sorted; angular to sub-angular; brown (7.5 YR 4/4) moist; some clumping of material
47.5	48.5	Gravelly sand; medium sand and very fine to very coarse sand with some granules, with occasional silt; very poorly sorted; angular to sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
48.5	49.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
49.5	50.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
50.5	51.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; minor clumping of material
51.5	52.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
52.5	53.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules, with occasional pebbles <25 mm; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
53.5	54.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules, with occasional pebbles <15 mm; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist
54.5	55.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules, with occasional pebbles <15 mm; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
55.5	56.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules, with occasional pebbles <10 mm; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
56.5	57.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
57.5	58.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, with occasional pebbles <10 mm; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping of material
58.5	59.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand; moderately sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; not a lithology change, no compression from 2nd drill rig, not enough air to blow coarser particle
59.5	60.5	No sample collected
60.5	61.5	No sample collected
63.5	—	Nose cone; gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, with occasional pebbles <10 mm; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; some clumping
63.5	64.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules, with occasional pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/6) moist; some clumping
64.5	65.5	Slightly gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist; some clumping of material
65.5	66.5	Sand; coarse to very coarse sand and very fine to medium sand with occasional silt; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist
66.5	67.5	Gravelly sand; coarse to very coarse sand and very fine to medium sand with some granules, with occasional pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/6) moist
67.5	68.5	Sand; fine to medium sand and coarse to very coarse sand with some silts to very fine sands; moderately sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
68.5	69.5	Slightly gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist; some clumping of material
69.5	70.5	Slightly gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; not a lithology change, no compression from 2nd drill rig, not enough air
70.5	71.5	Slightly gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; not a lithology change, no compression from 2nd drill rig, not enough air
71.5	72.5	Slightly gravelly sand; medium to coarse sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; not a lithology change, no compression from 2nd drill rig, not enough air
72.5	73.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
73.5	74.5	Gravelly sand; medium to coarse sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
74.5	75.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/6) moist
75.5	76.5	Gravelly sand; medium sand and very fine sand to granules with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) moist
76.5	77.5	Gravelly sand; medium sand and very fine sand to granules with occasional silt and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) moist

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
77.5	78.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
78.5	79.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
79.5	80.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
80.5	81.5	Gravelly sand; medium sand and very coarse sand with some very fine to coarse sands with occasional silt, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) moist
81.5	82.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular – angular; yellowish brown (10 YR 5/4) moist
82.5	83.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) moist
83.5	84.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist
84.5	85.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular; yellowish brown (10 YR 5/6) moist
85.5	86.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular; yellowish brown (10 YR 5/6) moist
86.5	87.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <30 mm, with occasional silt; very poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist
87.5	88.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <30 mm, with occasional silt; very poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist
88.5	89.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <25 mm, with occasional silt; very poorly sorted; sub-angular – angular; yellowish brown (10 YR 5/4) moist
89.5	90.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular – angular; yellowish brown (10 YR 5/4) moist
90.5	91.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular – angular, pebbles sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
91.5	92.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular – angular; brown (7.5 YR 4/4) moist; clumping, caliche
92.5	93.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
93.5	94.5	Slightly gravelly silty sand; fine sand and silt to coarse sand with some very coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
94.5	95.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; moderately sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
95.5	96.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
96.5	97.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
97.5	98.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
98.5	99.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
99.5	100.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sand to granules with occasional pebbles; poorly sorted; sub-angular; dark yellowish brown (10 YR 4/6) moist; clumping, caliche
100.5	101.5	Gravelly sand very coarse sand and medium sand to granules with some very fine to medium sand and with occasional pebbles <8 mm; moderately sorted; sub-angular; light yellowish brown (10 YR 6/4) moist; clumping
101.5	102.5	Gravelly sand medium sand and very fine sand to granules with occasional silt and pebbles <8 mm; poorly sorted; sub-angular; very pale brown (10 YR 7/3) dry; clumping

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
102.5	103.5	Gravelly sand coarse sand and very fine sand to granules with occasional silt and pebbles <8 mm; very poorly sorted; sub-angular; light yellowish brown (10 YR 6/4) moist; clumping
103.5	104.5	Gravelly sand very coarse sand and medium sand to granules with some very fine to medium sand and with occasional pebbles <15 mm; moderately sorted; sub-angular; brownish yellow (10 YR 6/6) moist; clumping
104.5	105.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <30 mm, with occasional silt; very poorly sorted; sub-angular – angular; light yellowish brown (10 YR 6/4) moist; clumping
105.5	106.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular sands – sub-rounded granules; light yellowish brown (10 YR 6/4) moist; clumping
106.5	107.5	Gravelly sand very coarse sand and very fine sand to granules with occasional silt and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
107.5	108.5	Gravelly sand; very coarse sand and very fine sand to granules with occasional silt and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist
108.5	109.5	Gravelly sand; very coarse sand and very fine sand to granules with some silts and with occasional pebbles <15 mm; very poorly sorted; sub-angular; pale brown (10 YR 6/3) moist
109.5	110.5	Slightly gravelly sand; very coarse sand and very fine sand to granules with some silts and with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist
110.5	111.5	Slightly gravelly sand; very coarse sand and very fine sand to granules with some silts and with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist
111.5	112.5	Slightly gravelly sand; very coarse sand and very fine sand to granules with some silts and with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist
112.5	113.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular sands – sub-rounded granules; yellowish brown (10 YR 5/4) moist
113.5	114.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular sands – sub-rounded granules; very pale brown (10 YR 7/4) moist
114.5	115.5	Gravelly sand very coarse sand and medium sand to granules with some very fine to medium sand and with occasional pebbles <15 mm; poorly sorted; sub-angular – angular; light yellowish brown (10 YR 6/4) moist
115.5	116.5	Gravelly sand very coarse sand and medium sand to granules with some very fine to medium sand and with occasional pebbles <15 mm; poorly sorted; sub-angular – angular; light yellowish brown (10 YR 6/4) moist
116.5	117.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist
117.5	118.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist; clumping
118.5	119.5	Slightly gravelly sand; medium sand and silts to very coarse sand with some granules and with occasional pebbles <8 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
109.5	120.5	Slightly gravelly sand; medium sand and silts to very coarse sand with some granules and with occasional pebbles <8 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
120.5	121.5	Slightly gravelly sand; medium sand and silts to very coarse sand with some granules and with occasional pebbles <8 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
121.5	122.5	Slightly gravelly sand; medium sand and silts to very coarse sand with some granules and with occasional pebbles <8 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
122.5	123.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
123.5	124.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
124.5	125.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist
125.5	126.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist
126.5	127.5	Gravelly sand; coarse sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) moist;

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
127.5	128.5	Sand; fine sand and silts to medium sand with some coarse to very coarse sand and with occasional granules and pebbles <8 mm; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
128.5	129.5	Sand; fine sand and silts to medium sand with some coarse sand to granules and with occasional pebbles <8 mm; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
129.5	130.5	Sand; fine sand and silts to medium sand with some coarse sand to granules and with occasional pebbles <8 mm; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
130.5	131.5	Slightly gravelly sand medium sand and very fine sand to granules with occasional pebbles <15 mm and silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
131.5	132.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
132.5	133.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
133.5	134.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
134.5	135.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist; clumping
135.5	136.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist
136.5	137.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
137.5	138.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
138.5	139.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
139.5	140.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
140.5	141.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
141.5	142.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist
142.5	143.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; clumping
143.5	144.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist; clumping
144.5	145.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) moist
145.5	146.5	Gravelly sand; medium to very coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist
146.5	147.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/6) moist;
147.5	148.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm and occasional silts; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
148.5	149.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
149.5	150.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
150.5	151.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist
151.5	152.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
152.5	153.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
153.5	154.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
154.5	155.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
155.5	156.5	Gravelly sand; fine sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
156.5	157.5	Slightly gravelly sand; fine sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
157.5	158.5	Slightly gravelly sand; fine sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumping
158.5	159.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) moist
159.5	160.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) moist
160.5	161.5	Gravelly sand; fine sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) moist; minor clumping
161.5	162.5	Sand; fine sand and fine to very coarse sand with some silts; moderately sorted; sub-angular; light reddish brown (2.5 YR 6/4) moist
162.5	163.5	Gravelly sand; fine sand and fine to very coarse sand with some granules and silts with occasional pebbles <10 mm; moderately sorted; sub-angular; light reddish brown (2.5 YR 6/4) moist
163.5	164.5	Gravelly sand; fine to very fine sand and coarse to very coarse sand with some granules and silts with occasional pebbles <30 mm; moderately sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
164.5	165.5	Sand; fine to very fine sand and medium to very coarse sand with some granules and silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
165.5	166.5	Sand; fine to very fine sand and medium to very coarse sand with some granules and silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
166.5	167.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
167.5	168.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
168.5	169.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
169.5	170.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
170.5	171.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
171.5	172.5	Slightly gravelly sand; fine to very fine sand and medium to granules with some silts with occasional pebbles <8 mm; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) moist; clumping
172.5	173.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
173.5	174.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
174.5	175.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
175.5	176.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
176.5	177.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
177.5	178.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; clumps effervesce with acid
178.5	179.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
179.5	180.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
180.5	181.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
182.5	183.5	Slightly gravelly sand; coarse sand and medium sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
183.5	184.5	Gravelly sand; coarse sand and medium sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
184.5	185.5	Sand; fine sand and very fine to very coarse sand with some granules and occasional pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumps effervesce with acid
185.5	186.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
186.5	187.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid
187.5	188.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumps effervesce with acid, first occurence of basalt pebbles
188.5	189.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silts with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist; clumps effervesce with acid
189.5	190.5	Gravelly sand; medium sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) moist; clumps effervesce with acid
190.5	191.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumps effervesce with acid
191.5	192.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; clumps effervesce with acid
192.5	193.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; clumps effervesce with acid
193.5	194.5	Gravelly sand; coarse to very coarse sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; clumps effervesce with acid
194.5	195.5	Gravelly sand; very coarse sand and medium sand to granules with some pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid, basalt pebble ~5 mm
195.5	196.5	Gravelly sand; very coarse sand and medium sand to granules with some pebbles <25 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumps effervesce with acid, basalt pebbles ~15 mm
196.5	197.5	Gravelly sand; very coarse sand and fine sand to granules with some pebbles <25 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
197.5	198.5	Gravelly sand; coarse sand and medium sand to granules with some pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
198.5	199.5	Gravelly sand; very coarse sand and fine sand to granules with some pebbles <30 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry
199.5	200.5	Gravelly sand; fine sand and very fine sand to granules with some pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; clumps effervesce with acid
200.5	201.5	Gravelly sand; fine sand and very fine sand to granules with some pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumping
201.5	202.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumps effervesce with acid

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
202.5	—	Nose cone; gravelly sand; very coarse sand and granules to pebbles <15 mm with some fine to medium sands; moderately sorted; sub-angular – angular; pale brown (10 YR 6/3) dry
202.5	203.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry;
203.5	204.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumping
204.5	205.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; minor basalt very coarse grain
205.5	206.5	Gravelly sand; medium sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; minor basalt very coarse grain
206.5	207.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumps effervesce with acid
207.5	208.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; minor basalt very coarse grain
208.5	209.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; basalt very coarse grain to pebbles
209.5	210.5	Gravelly sand; medium sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; minor basalt very coarse grain
210.5	211.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; basalt very coarse grain to pebbles
211.5	212.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; basalt very coarse grain to pebbles
212.5	213.5	Gravelly sand; coarse sand and very fine sand to granules with some silts and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; basalt very coarse grain to pebbles ~15 mm
213.5	214.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; minor basalt very coarse grain
214.5	215.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; minor basalt very coarse grain
215.5	216.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; minor basalt very coarse grain
216.5	217.5	Gravelly sand; medium sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry; minor basalt very coarse grain
217.5	218.5	Gravelly sand; medium sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; minor basalt very coarse grain
218.5	219.5	Sand; medium sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
219.5	220.5	Sand; medium sand and very fine to very coarse sand with occasional silt and granules; moderately sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
220.5	221.5	Sand; medium sand and very fine to very coarse sand with occasional silt and granules; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
221.5	222.5	Sand; medium sand and very fine to very coarse sand with occasional silt and granules; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
222.5	223.5	Sand; medium sand and very fine to very coarse sand with occasional silt and granules; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
223.5	224.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silt with occasional pebbles <7 mm; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
224.5	225.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silt with occasional pebbles <7 mm; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
225.5	226.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
226.5	227.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
227.5	228.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
228.5	229.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
229.5	230.5	Gravelly sand; coarse sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
230.5	231.5	Slightly gravelly sand; fine to medium sand and very fine sand to granules with some silt with occasional pebbles <7 mm; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
231.5	232.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
232.5	233.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
233.5	234.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
234.5	235.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
235.5	236.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
236.5	237.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
237.5	238.5	Gravelly sand; medium sand and very fine sand to granules with some silt and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
238.5	239.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; basalt granules
239.5	240.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; clumps effervesce with acid
240.5	241.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <30 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
241.5	242.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
242.5	243.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
243.5	244.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
244.5	245.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
245.5	246.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
246.5	247.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
247.5	248.5	Slightly gravelly sand; fine to medium sand and very fine sand to granules with some silt; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 8/3) dry
248.5	249.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
249.5	250.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; basalt granules
250.5	251.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
251.5	252.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; basalt granules
252.5	253.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; basalt granules
253.5	254.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
254.5	255.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
255.5	256.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
256.5	257.5	Gravelly sand; medium sand and very fine sand to pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
257.5	258.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) moist; came out of hole very moist; ~15mm basalt pebble
258.5	259.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
259.5	260.5	Slightly gravelly sand; fine to medium sand and very fine sand to granules with some silt, with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
260.5	261.5	Gravelly sand; medium sand and very fine sand to pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
261.5	262.5	Sand; fine sand and very fine to coarse sand with some very coarse sand, granules and silts, with occasional pebbles <8 mm; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) moist
262.5	263.5	Slightly gravelly sand; medium sand and very fine sand to granules with some silt with occasional pebbles <7 mm; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry
263.5	264.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) dry
264.5	265.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
265.5	266.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
266.5	267.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
267.5	268.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <15 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
268.5	269.5	Slightly gravelly sand; medium sand and very fine sand to granules with occasional pebbles <10 mm and silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
269.5	270.5	Slightly gravelly sand; medium sand and very fine sand to granules with occasional pebbles <10 mm and silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
270.5	271.5	Gravelly sand; medium sand and fine sand to granules with some pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
271.5	272.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
272.5	273.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
273.5	274.5	Gravelly sand; medium sand and very fine sand to granules with some pebbles <20 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
274.5	275.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
275.5	276.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
276.5	277.5	Gravelly sand; fine sand and very fine sand to granules with some silts and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
277.5	278.5	Gravelly sand; medium sand and fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
278.5	279.5	Gravelly sand; medium sand and fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
279.5	280.5	Sand; medium sand and very fine to coarse sand with some very coarse sand, granules and silts; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; very small sample
280.5	281.5	Sand; medium sand and very fine to coarse sand with some very coarse sand, granules and silts; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; very small sample
281.5	282.5	Sand; medium sand and very fine to coarse sand with some very coarse sand, granules and silts; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; very small sample
282.5	283.5	Sand; medium sand and very fine to coarse sand with some very coarse sand, granules and silts; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry; very small sample
283.5	284.5	Gravelly sand; medium sand and fine sand to pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
284.5	285.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping, no effervescence
285.5	286.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping, no effervescence
286.5	287.5	Slightly gravelly sand; very fine sand and fine to coarse sand with some silts, very coarse sands and granules; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
287.5	288.5	Slightly gravelly sand; very fine sand and fine to coarse sand with some silts, very coarse sands and granules; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
288.5	289.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry; clumping, no effervescence
289.5	290.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry; clumping, no effervescence
290.5	291.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry; clumping, no effervescence
291.5	292.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry; clumping, no effervescence
292.5	293.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some silts and granules with occasional pebbles <8 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry; clumping, no effervescence
293.5	294.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
294.5	295.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
295.5	296.5	Gravelly sand; fine to medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
296.5	297.5	Gravelly sand; fine to medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3)dry
297.5	298.5	Gravelly sand; fine to medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
298.5	299.5	Gravelly sand; fine to medium sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
299.5	300.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silt, with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumps, effervesce with acid
300.5	301.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silt, with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry; clumping, no effervescence

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
301.5	302.5	No sample collected
303	—	Nose cone; gravelly sand; medium sand and fine sand to pebbles <25 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
302.5	303.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
303.5	304.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
304.5	305.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
305.5	306.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
306.5	307.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
307.5	308.5	Slightly gravelly sand; medium sand and very fine sand to granules with occasional pebbles <10 mm and silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
308.5	309.5	Slightly gravelly sand; medium sand and very fine sand to granules with occasional pebbles <10 mm and silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
309.5	310.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silt, with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
310.5	311.5	Slightly gravelly sand; fine sand and very fine sand to granules with some silt, with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
311.5	312.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
312.5	313.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
313.5	314.5	Silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
314.5	315.5	Slightly gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
315.5	316.5	Slightly gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
316.5	317.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
317.5	318.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
318.5	319.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
319.5	320.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
320.5	321.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
321.5	322.5	Slightly gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
322.5	323.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
323.5	324.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
324.5	325.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
325.5	326.5	Gravelly sand; medium to coarse sand and very fine sand to granules with some pebbles <10 mm, with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
326.5	327.5	Slightly gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
327.5	328.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
328.5	329.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
329.5	330.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <20 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
330.5	331.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
331.5	332.5	Gravelly sand; medium sand and fine to very coarse sand with some silts granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
332.5	333.5	Slightly gravelly sand; medium sand and fine to very coarse sand with some silts granules; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
333.5	334.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
334.5	335.5	Gravelly silty sand; fine sand and very fine to very coarse sand with some silts and with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
335.5	336.5	Slightly gravelly sand; medium sand and very fine to very coarse sand with some granules and with occasional silt; moderately sorted; sub-angular; light gray (10 YR 7/2) dry
336.5	337.5	Slightly gravelly sand; medium sand and very fine to very coarse sand with some granules and with occasional silt; moderately sorted; sub-angular; pale brown (10 YR 6/3) dry
337.5	338.5	Gravelly sand; medium sand and very fine to very coarse sand with some granules and and pebbles <10 mm and with occasional silt; poorly ssorted; sub-angular; pale brown (10 YR 6/3) dry
338.5	339.5	Slightly gravelly sand; medium sand and very fine to very coarse sand with some granules and with occasional silt; moderately sorted; sub-angular; pale brown (10 YR 6/3) dry
339.5	340.5	Gravelly sand; fine sand and very fine to coarse sand with some very coarse sand to granules and pebbles <10 mm; very poorly sorted; angular to sub-angular; brown (10 YR 5/3) dry
340.5	341.5	Gravelly sand; medium sand and very fine to very coarse sand with some granules and and pebbles <10 mm and with occasional silt; poorly sorted; sub-angular; yellowish brown (10 YR 5/4) dry
343	—	Nose cone: Slightly gravelly sand; medium sand and fine to very coarse sand with some granules and with occasional pebbles <7 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumping
341.5	342.5	Gravelly sand; coarse sand and medium to very coarse sand with some granules and occasional fine sands and pebbles <7 mm; moderately sorted; sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping
342.5	343.5	Gravelly sand; coarse sand and fine to very coarse sand with some granules and occasional pebbles <7 mm; moderately sorted; sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping
343.5	344.5	Gravelly sand; coarse sand and fine to very coarse sand with some granules and occasional pebbles <7 mm; moderately sorted; sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping
344.5	345.5	Sand; medium sand with fine to very coarse sand with occasional granules; well sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry; clumping, no effervescence
345.5	346.5	Sand; medium sand with fine to very coarse sand with some granules; moderately sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry; clumping, no effervescence
346.5	347.5	Slightly gravelly sand; medium sand with fine to very coarse sand with some granules and with occasional pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry; clumping, no effervescence
347.5	348.5	Slightly gravelly sand; medium sand with fine to very coarse sand with some granules and with occasional pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry; clumping, no effervescence
348.5	349.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
349.5	350.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping, no effervescence
350.5	351.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry; clumping, no effervescence
351.5	352.5	Sand; fine and very fine to coarse sand with some very coarse sands and with occasional granules and silts; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
352.5	353.5	Slightly gravelly sand; fine and very fine to coarse sand with some very coarse sands and granules and with occasional silt; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
353.5	354.5	Slightly gravelly sand; fine and very fine to coarse sand with some very coarse sands and granules and with occasional silt; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumping, no effervescence
354.5	355.5	Slightly gravelly sand; fine and very fine to coarse sand with some very coarse sands and granules and with occasional silt; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry; clumping, no effervescence
355.5	356.5	Slightly gravelly sand; fine and very fine to coarse sand with some very coarse sands and granules and with occasional silt; poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
356.5	357.5	Gravelly sand; fine and very fine to very coarse sands with some pebbles <10 mm and granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
357.5	358.5	Gravelly sand; fine and very fine to very coarse sands with some pebbles <10 mm and granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
358.5	359.5	Slightly gravelly sand; fine and very fine to coarse sand with some silts, very coarse sands and granules; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
359.5	360.5	Slightly gravelly sand; fine and very fine to coarse sand with some very coarse sands and granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; clumping, no effervescence
360.5	361.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale red (2.5 YR 7/2) dry
361.5	362.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale red (2.5 YR 7/2) dry
362.5	363.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
363.5	364.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
364.5	365.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
365.5	366.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; reddish brown (2.5 YR 5/3) dry
366.5	367.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
367.5	368.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
368.5	369.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
369.5	370.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
370.5	371.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
371.5	372.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
372.5	373.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
373.5	374.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
374.5	375.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; minor clumping, no effervescence
375.5	376.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; minor clumping, no effervescence
376.5	377.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry; minor clumping, no effervescence
377.5	378.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light reddish brown (2.5 YR 7/3) dry
378.5	379.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light reddish brown (2.5 YR 7/3) dry
379.5	380.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light reddish brown (2.5 YR 7/3) dry
380.5	381.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
381.5	382.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
382.5	383.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
383.5	384.5	Sand; fine sand and very fine to very coarse sand with some silts; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
384.5	385.5	Sand; fine sand and very fine to very coarse sand with some silts; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
385.5	386.5	Sand; fine sand and very fine to very coarse sand with some silts; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
386.5	387.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
387.5	388.5	Gravelly sand; fine sand and very fine to very coarse sand with some silt, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
388.5	389.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sands to granules and with occasional pebble <10 mm; very poorly sorted; angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
389.5	390.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sands to granules and with occasional pebble <10 mm; very poorly sorted; angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
390.5	391.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sands to granules and with occasional pebble <10 mm; very poorly sorted; angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
391.5	392.5	Slightly gravelly silty sand; fine sand and silt to medium sand with some coarse sands to granules and with occasional pebble <10 mm; very poorly sorted; angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
392.5	393.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
393.5	394.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
394.5	395.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
395.5	396.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
396.5	397.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
397.5	398.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
398.5	399.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some granules and with occasional silt; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
399.5	400.5	Gravelly sand; medium sand and very fine to very coarse sands with some granules and pebbles <20 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
400.5	401.5	Gravelly sand; medium sand and very fine to very coarse sands with some granules and with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
401.5	402.5	Gravelly sand; medium sand and very fine to very coarse sands with some granules and pebbles <20 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
402.5	403.5	Gravelly sand; fine to very fine sand and medium to very coarse sands with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 8/3) dry
403.5	404.5	Gravelly sand; fine to very fine sand and medium to very coarse sands with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 8/3) dry
404.5	405.5	Gravelly sand; medium sand and fine to very coarse sands with some granules and with occasional silt and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
405.5	406.5	Gravelly sand; medium sand and fine to very coarse sands with some granules and with occasional silt and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
406.5	407.5	Gravelly sand; coarse sand and medium to very coarse sands with some granules and pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
407.5	408.5	Gravelly sand; coarse sand and medium to very coarse sands with some granules and pebbles <20 mm; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
408.5	409.5	Gravelly sand; medium sand and very fine to very coarse sands with some silts, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
409.5	410.5	Gravelly sand; medium sand and very fine to very coarse sands with some silts, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
410.5	411.5	Slightly gravelly sand; medium sand and very fine to very coarse sands with some silts, granules and pebbles <30 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
411.5	412.5	Slightly gravelly sand; fine sand and very fine to very coarse sands with some silts, granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
412.5	413.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
413.5	414.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
414.5	415.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
415.5	416.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
416.5	417.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
417.5	418.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
418.5	419.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
419.5	420.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
420.5	421.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
423	—	Nose cone; gravelly sand; coarse sand to granules and very fine to very coarse sands with some and pebbles <10 mm; moderatley sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
421.5	422.5	Gravelly sand; medium to coarse sand and very fine sands to granules with occasional silt and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
422.5	423.5	Slightly gravelly sand; fine to medium sand and very fine sands to granules with occasional silt and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
423.5	424.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
424.5	425.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
425.5	426.5	Gravelly silty sand; medium to coarse sand and silts to granules with some pebbles <20 mm; very poorly sorted; angular to sub-rounded; pale brown (10 YR 6/3) dry
426.5	427.5	Gravelly silty sand; medium to coarse sand and silts to granules with some pebbles <25 mm; very poorly sorted; angular to sub-rounded; pale brown (10 YR 6/3) dry
427.5	428.5	Slightly gravelly sand; fine sand and very fine to coarse sand with some silts, very coarse sand and granules and with occasional pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
428.5	429.5	Slightly gravelly sand; fine sand and very fine to coarse sand with some silts, very coarse sand and granules and with occasional silt and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
429.5	430.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
430.5	431.5	Silty sand; fine to medium sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
431.5	432.5	Silty sand; fine to medium sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
432.5	433.5	Silty sand; fine to medium sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
433.5	434.5	Silty sand; very fine to fine sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
434.5	435.5	Silty sand; very fine to fine sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
435.5	436.5	Silty sand; very fine to fine sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
436.5	437.5	Silty sand; very fine to fine sands and silts with occasional coarse sand to pebble <20 mm; well sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
437.5	438.5	Slightly gravelly sand; fine sand and very fine to coarse sand with some silts, very coarse sand and granules and with occasional silt and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) moist
438.5	439.5	Slightly gravelly sand; fine sand and very fine to coarse sand with some silts, very coarse sand and granules and with occasional silt and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/4) moist
439.5	440.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
440.5	441.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
441.5	442.5	Silty sand; medium to coarse sand and silts with some very fine to very coarse sands and with occasional granules; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
442.5	443.5	Gravelly sand; medium to very coarse sand with some very fine sands and granules with occasional pebbles <10 mm; poorly sorted; angular to rounded; very pale brown (10 YR 7/3) dry
443.5	444.5	Slightly gravelly silty sand; medium to very coarse sand and silts to granules with occasioal pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
444.5	445.5	Slightly gravelly silty sand; medium to very coarse sand and silts to granules with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
445.5	446.5	Gravelly silty sand; fine to medium sand and silts to very coarse sand with some granules and pebbles <15 mm; very poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
446.5	447.5	Slightly gravelly sand; medium sand and very fine to very coarse sand with some silts, granules with occasional and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; light yellowish brown (10 YR 6/4) dry
447.5	448.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
448.5	449.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
449.5	450.5	Slightly gravelly silty sand; medium to very coarse sand and silts to granules with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
450.5	451.5	Slightly gravelly silty sand; medium to very coarse sand and silts to granules with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
451.5	452.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) dry
452.5	453.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
453.5	454.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
454.5	455.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
455.5	456.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
456.5	457.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; light gray (10 YR 7/1) dry
457.5	458.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; light gray (10 YR 7/1) dry
458.5	459.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; light gray (10 YR 7/1) dry
459.5	460.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
460.5	461.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
461.5	462.5	Sand; fine to medium sand with some very fine to very coarse sand and granules; well sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
462.5	463.5	Slightly gravelly sand; fine to medium sand and very fine to very coarse sand with some granules and pebbles <10 mm; well sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
463.5	464.5	Slightly gravelly sand; fine to medium sand and very fine to very coarse sand with some granules and pebbles <10 mm; well sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) dry
464.5	465.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
465.5	466.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
466.5	467.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
467.5	468.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
468.5	469.5	Slightly gravelly silty sand; very fine to fine sand and silts to coarse sand with some very coarse sand and granules and with occasional pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
469.5	470.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
470.5	471.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
471.5	472.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
472.5	473.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
473.5	474.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
474.5	475.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
475.5	476.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
476.5	477.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
477.5	478.5	Silty sand; very fine to fine sands and silts with some medium to very coarse sands; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
478.5	479.5	Silty sand; very fine to fine sands and silts to very coarse sands with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
479.5	480.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
480.5	481.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
481.5	482.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
482.5	483.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
483.5	484.5	Slightly gravelly sand; fine sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
484.5	485.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
485.5	486.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
486.5	487.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
487.5	488.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
488.5	489.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
489.5	490.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
490.5	491.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
491.5	492.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
492.5	493.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <10 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry; clumping, effervesces with acid
493.5	494.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
494.5	495.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
495.5	496.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
496.5	497.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
497.5	498.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry

Table 3. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than; ~, approximately; =, equal; —, not applicable]

Depth		Description
From	To	
498.5	499.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
499.5	500.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
500.5	501.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
501.5	502.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
502.5	503.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
503.5	504.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
504.5	505.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
505.5	506.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
506.5	507.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
507.5	508.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
508.5	509.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
509.5	510.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
510.5	511.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
511.5	512.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
512.5	513.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
513.5	514.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
514.5	515.5	Silty sand; fine sand and silt with some very fine sand and occasional medium to coarse sands; well sorted; sub-angular to sub-rounded; white (10 YR 8/1) dry; may not represent lithologic change, may be a function of ODEX drill blowing only fine-grained fraction through
515.5	516.5	Silty sand; fine sand and silt with some very fine sand and occasional medium to coarse sands; well sorted; sub-angular to sub-rounded; white (10 YR 8/1) dry; may not represent lithologic change, may be a function of ODEX drill blowing only fine-grained fraction through
516.5	526.5	No sample collected
526.5	527.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
527.5	528.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
528.5	529.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
529.5	530.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
530.5	531.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry
531.5	532.5	Gravelly sand; fine sand and very fine to very coarse sand with some granules and pebbles <15 mm and with occasional silt; very poorly sorted; sub-angular to sub-rounded; light gray (10 YR 7/2) dry

Table 4. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35B1S (JTUZ-2) in Joshua Tree, San Bernardino County, California.

[Site location shown in figure 2. Altitude of land surface, approximately 2,790 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), June 1–6, 2007. Total depth drilled: 81 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than]

Depth (ft)		Description
From	To	
2	3	Gravelly sand; medium sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
3	4	Gravelly sand; medium sand and very fine to very coarse sand with some granules; with occasional pebbles <12 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
4	5	Gravelly sand; medium sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
5	6	Gravelly sand; medium sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
6	7	No sample collected
7	8	Gravelly silty sand; medium sand and silt to very coarse sand with some granules; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
8	9	Gravelly sand; medium sand and fine to very coarse sand with some very fine sand and granules, with occasional silts; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
9	10	Gravelly silty sand; medium sand and silt to very coarse sand with some granules with occasional pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
10	11	Gravelly silty sand; medium sand and silt to very coarse sand with some granules with occasional pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
11	12	Gravelly sand; medium sand and very fine to very coarse sand with some granules with occasional pebbles <7 mm; very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
12	13	Gravelly sand; medium sand and fine to very coarse sand with some granules, silts and very fine sands; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
13	14	Gravelly sand; medium sand and fine to very coarse sand with some granules, silts and very fine sands; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
14	15	Gravelly sand; medium sand and fine to very coarse sand with some granules, silts and very fine sands; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
15	16	Gravelly sand; medium sand and fine to very coarse sand with some granules, silts and very fine sand, with occasional pebbles <10 mm, very poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
16	17	Gravelly sand; medium sand and fine to very coarse sand with some granules with occasional silts and very fine sand; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
17	18	Gravelly sand; coarse sand and very fine to very coarse sand with some granules and silt; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
18	19	Gravelly sand; coarse sand and very fine to very coarse sand with some granules; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
19	20	Slightly gravelly sand; fine sand and very fine to very coarse sand with occasional granules; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
20	21	Slightly gravelly sand; fine sand and very fine to coarse sand with some very coarse sand and granules; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
21	22	No sample collected
22	23	Gravelly sand; medium sand and fine to very coarse sand with some granules and very fine sand with some occasional silt; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
23	24	Gravelly sand; fine sand and very fine to very coarse sand with some granules with occasional silt; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
24	25	Gravelly sand; fine sand and very fine to very coarse sand with some granules with occasional pebbles <7 mm and silt; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
25	26	Gravelly sand; fine sand and medium to very coarse sand with some granules and pebbles <7 mm with occasional silts; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
26	27	Gravelly sand; fine sand and medium to very coarse sand with some granules and pebbles <7 mm with occasional silts; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
27	28	Gravelly sand; fine sand and medium to very coarse sand with some granules and pebbles <7 mm with occasional silts; moderately sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry

Table 4. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35B1S (JTUZ-2) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,790 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), June 1–6, 2007. Total depth drilled: 81 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than]

Depth (ft)		Description
From	To	
28	29	Gravelly sand; fine sand and silts to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) dry
29	30	Gravelly sand; fine sand and silts to very coarse sand with some granules and pebbles <10 mm; very poorly sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/6) dry
32	32	Slightly gravelly sand; very fine sand and silts to medium sand with occasional coarse to very coarse sand and granules; well sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
32	33	Gravelly sand; medium sand and very fine to very coarse sand with some granules with occasional silt; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
33	34	Gravelly sand; fine sand and silt to coarse sand with some very coarse sand to granules; moderately sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry, clumping-no fizz
34	35	Sand; fine sand and very fine to very coarse sand; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry, clumping effervesces with acid; retains moisture 1 week after collection
35	36	Gravelly sand; medium sand and very fine to coarse sand with some very coarse sand to granules with occasional silt; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
36	37	Gravelly sand; medium sand and very fine to coarse sand with some very coarse sand to granules with occasional silt; moderately sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
37	38	Gravelly sand; medium sand and silt to coarse sand with some very coarse sand to granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
38	39	Gravelly sand; medium sand and silt to coarse sand with some very coarse sand to granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
39	40	Gravelly sand; medium sand and silt to coarse sand with some very coarse sand to granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
40	41	Gravelly sand; medium sand and silt to coarse sand with some very coarse sand to granules; poorly sorted; sub-angular to sub-rounded; very pale brown (10 YR 7/3) dry
41	42	Gravelly sand; medium sand and silts to granules; very poorly sorted; sub-angular to rounded; pale brown (10 YR 6/3) dry
42	43	Gravelly sand; medium sand and silts to granules with some pebbles <6 mm; very poorly sorted; sub-angular-rounded; pale brown (10 YR 6/3) dry
43	44	Gravelly sand; medium sand and silts to granules with some pebbles <6 mm; very poorly sorted; sub-angular-rounded; pale brown (10 YR 6/3) dry
44	45	Gravelly sand; medium sand and silts to granules with some pebbles <20 mm; very poorly sorted; sub-angular to rounded; pale brown (10 YR 6/3) dry
45	46	Gravelly sand; medium sand and fine to very coarse sand with some granules with occasional pebbles <20 mm; moderately sorted; sub-angular-sub-rounded; yellowish brown (10 YR 5/4) dry
46	47	Gravelly sand; medium sand and fine to very coarse sand with some granules with occasional pebbles <20 mm; moderately sorted; sub-angular-sub-rounded; yellowish brown (10 YR 5/4) dry
47	48	Gravelly sand; medium sand and fine to very coarse sand with some granules with occasional pebbles <20 mm; moderately sorted; sub-angular-sub-rounded; yellowish brown (10 YR 5/4) dry
48	49	Gravelly sand; medium sand and fine to very coarse sand with some granules and pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) dry
49	50	Gravelly sand; medium sand and fine to very coarse sand with some granules and pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) dry
50	51	Gravelly sand; medium sand and fine to very coarse sand with some granules and pebbles <10 mm; moderately sorted; sub-angular to sub-rounded; brownish yellow (10 YR 6/6) dry
51	52	Gravelly sand; medium sand and very fine to very coarse sand with some granules with occasional pebbles <10 mm; poorly sorted; sub-angular to rounded; (10 YR 6/4) dry
52	53	Slightly gravelly sand; fine to coarse sand with very fine sand with some very coarse sand with occasional granules; well sorted; angular to sub-angular pale brown (10 YR 6/3) dry
53	54	Sand; medium sand and fine to coarse sand with some very coarse sand; well sorted; angular to sub-angular pale brown (10 YR 6/3) dry

Table 4. Lithologic logs for unsaturated-zone monitoring site 1N/6E-35B1S (JTUZ-2) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,790 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), June 1–6, 2007. Total depth drilled: 81 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than]

Depth (ft)		Description
From	To	
54	55	Slightly gravelly sand; fine sand and very fine to coarse sand with some very coarse sand and silts with occasional granules; moderately sorted; angular – sub-rounded; very pale brown (10 YR 7/3) dry
55	56	Gravelly silty sand; fine to medium sand and silt with some coarse to very coarse sand and granules; poorly sorted; sub-angular to sub-rounded; (10 YR 8/4) dry
56	57	Gravelly sand; very fine to fine sand with some medium to very coarse sand and granules; well sorted; sub-angular to rounded; (10 YR 8/4) dry
57	58	Sand; very fine to medium sand with occasional coarse sand; very well sorted; angular – sub-angular (10 YR 4/6) dry
58	59	Gravelly sand; very fine to medium sand with some coarse to very coarse sand and granules; moderately sorted; angular to rounded; (10 YR 4/6) dry
59	60	Gravelly sand; very fine to medium sand with some coarse to very coarse sand and granules; moderately sorted; angular to rounded; (10 YR 4/6) dry
60	61	Gravelly sand; medium sand and very fine to very coarse sand with some granules with occasional pebble <10 mm; very poorly sorted; sub-angular to sub-rounded; pale brown (10 YR 6/3) dry
61	62	Gravelly sand; fine to medium sand and silt to very coarse sand with some granules with occasional pebbles <6 mm; very poorly sorted; very coarse and finer sub-angular to sub-rounded; granules; sub-rounded to rounded; pale brown (10 YR 6/3) dry
62	63	Gravelly sand; medium sand and very fine to very coarse sand with some granules and pebbles <10 mm; poorly sorted; angular – sub-rounded; yellowish brown (10 YR 5/4) dry
63	64	Gravelly sand; fine to medium sand and very fine to very coarse sand with some granules with occasional silts; poorly sorted; angular – sub-rounded; yellowish brown (10 YR 5/4) dry
64	65	Sand; very fine to medium sand with some coarse to very coarse sand and silt; moderately sorted; sub-angular to sub-rounded; yellowish brown (10 YR 5/4) dry
65	66	Gravelly sand; very fine to medium sand with some coarse to very coarse sand and silt with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
66	67	Gravelly sand; very fine to medium sand with some coarse to very coarse sand and silt with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry
67	68	Gravelly sand; very fine to medium sand with some coarse to very coarse sand and silt with occasional granules and pebbles <10 mm; poorly sorted; sub-angular to sub-rounded; dark yellowish brown (10 YR 4/4) dry retains moisture 1 week after collected, clump
68	69	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
69	70	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
70	71	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
71	72	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
72	73	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
73	74	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
74	75	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
75	76	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry
76	77	Gravelly sand; very fine to coarse sand and very coarse sand with some granules and pebbles <15 mm; poorly sorted; sub-angular to sub-rounded; brown (10 YR 5/3) dry

Table 5. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J1S (JTUZ-3) in Joshua Tree, San Bernardino County, California.

[Site location shown in figure 2. Altitude of land surface, approximately 2,777 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), May 21– June 1, 2007. Total depth drilled: 545 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994); cutting colors specified as identified dry or moist. **Abbreviations**: ft, feet; mm, millimeter; >, greater than; <, less than]

Depth (ft)		Description
From	To	
0	5	Slightly gravelly sand; medium to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; olive brown (2.5Y 4/3)
5	10	Slightly gravelly sand; medium to very coarse sand and granules to small pebbles; poorly sorted; sub-angular to angular; olive brown (2.5Y 4/3)
10	15	Slightly gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to angular; olive brown (2.5Y 4/3)
15	20	Slightly gravelly sand; medium to very coarse sand and granules; small pebbles; poorly sorted; sub-angular to angular; olive brown (2.5Y 4/3)
20	25	Slightly gravelly sand; medium to very coarse sand and granules; poorly sorted; sub-angular to angular olive brown (2.5Y 4/3)
25	30	Slightly gravelly sand; medium to very coarse sand and granules; poorly sorted; sub-angular to angular olive brown (2.5Y 4/3)
30	35	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; sub-rounded to sub-angular; light olive brown (2.5Y 5/3)
35	40	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angulart to sub-angular; light olive brown (2.5Y 5/3)
40	45	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angulart to sub-angular; light olive brown (2.5Y 5/3)
45	50	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; sub-rounded to sub-angular; light olive brown (2.5Y 5/3)
50	55	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angular to sub-angular; light olive brown (2.5Y 5/3)
55	60	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
60	65	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
65	70	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
70	75	Gravelly sand; medium to very coarse sand and granules; poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
75	80	Gravelly sand; medium to very coarse sand and granules to small pebbles; poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
80	85	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
85	90	Gravelly sand; medium to very coarse sand and granules; poorly sorted; angular to sub-angular; light to olive brown (2.5Y 5/3)
90	95	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angular to sub-angular; olive brown (2.5Y 4/4)
95	100	Gravelly sand; medium to very coarse sand and granules to small pebbles; very poorly sorted; angular to sub-angular; olive brown (2.5Y 4/4)
100	105	Core-Shoe; gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angular to sub-angular; olive brown (2.5Y 4/4)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
0	6	No samples collected
6	7	Sand; very fine to very coarse sand; poorly sorted; sub-angular to very angular; light olive brown (2.5Y 5/3)
7	8	Sand; very fine to medium sand; well sorted; angular to very angular; light olive brown (2.5Y 5/3)
8	9	Sand; very fine to medium sand; well sorted; angular to very angular; light olive brown (2.5Y 5/3)
9	10	Sand; very fine to medium sand; well sorted; angular to very angular; light olive brown (2.5Y 5/3)
10	11	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to very angular; light olive brown (2.5Y 5/4)
11	12	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to very angular; light olive brown (2.5Y 5/4)
12	13	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; light olive brown (2.5Y 5/4)
13	14	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; light olive brown (2.5Y 5/4)
14	15	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; light olive brown (2.5Y 5/4)
15	16	Sandy gravel; granules to medium pebbles and medium to very coarse sand; poorly sorted; sub-angular to very angular; light yellowish brown (2.5Y 6/3)
16	17	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; light olive brown (2.5Y 5/4)
17	18	Gravelly sand; fine to very coarse sand and granules to small pebbles; very poorly sorted; very angular; light olive brown (2.5Y 5/4)
18	38	No sample collected
38	39	Gravelly silty sand; very fine to very coarse sand and silt and granules; very poorly sorted; sub-rounded to angular; light yellowish brown (10YR 6/4)
39	40	Gravelly silty sand; very fine to very coarse sand and silt and granules; very poorly sorted; sub-rounded to angular; light yellowish brown (10YR 6/4)
40	41	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
41	42	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
42	43	Sand; very fine to medium sand; well sorted; angular to very angular; brown (10YR 5/3)
43	44	Sand; very fine to coarse sand; moderately sorted; angular; brown (10YR 5/3)
44	45	Sand; very fine to coarse sand; moderately sorted; angular; brown (10YR 5/3)
45	46	Gravelly sand; medium to very coarse sand and granules to medium pebbles; poorly sorted; angular to very angular; brown (10YR 5/3)
46	47	Gravelly sand; medium to very coarse sand and granules to medium pebbles; poorly sorted; angular to very angular; brown (10YR 5/3)
47	48	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
48	49	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
49	50	Gravelly sand; fine to very coarse sand and granules; poorly sorted; angular to very angular; brown (10YR 5/3)
50	51	Gravelly sand; fine to very coarse sand and granules; poorly sorted; angular to very angular; brown (10YR 5/3)
51	52	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
52	53	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
53	54	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
54	55	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
55	56	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
56	57	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
57	58	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
58	59	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
59	60	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; pale brown (10YR 6/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
60	61	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
61	62	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
62	63	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
63	64	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
64	65	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; pale brown (10YR 6/3)
65	66	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; pale brown (10YR 6/3)
66	67	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; pale brown (10YR 6/3)
67	68	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
68	69	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
69	70	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
70	71	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
71	72	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
72	73	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
73	74	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
74	75	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
75	76	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
76	77	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
77	78	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
78	79	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; poorly sorted; angular; brown (10YR 5/3)
79	80	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
80	81	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; angular to very angular; brown (10YR 5/3)
81	82	Gravelly sand; very fine to very coarse sand and granules to medium sand; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
82	83	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
83	84	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
84	85	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
85	86	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
86	87	Sand; very fine to very coarse sand and granules; very poorly sorted; angular; brown (10YR 5/3)
87	88	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
88	89	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
89	90	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
90	91	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
91	92	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
92	93	Slightly gravelly sand; very fine to very coarse sand and small pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
93	94	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
94	95	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
95	96	Slightly gravelly sand; very fine to very coarse sand and small pebbles; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
96	97	Slightly gravelly sand; very fine to very coarse sand and small pebbles; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
97	98	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
98	99	No sample collected
99	100	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
100	101	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
101	102	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
102	103	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
103	104	Sandy gravel; granules to small pebbles and coarse to very coarse sand; moderately sorted; sub-rounded to sub-angular; brown (10YR 5/3)
104	105	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
105	106	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
106	107	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
107	108	Slightly gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
108	109	Slightly gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
109	110	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
110	111	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
111	112	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
112	113	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
113	114	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
114	115	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
115	116	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
116	117	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
117	118	Gravelly sand; very fine to very coarse sand and granules with trace large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
118	119	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
119	120	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
120	121	Sand; very fine to coarse sand; poorly sorted; angular; brown (10YR 5/3)
121	122	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
122	123	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
123	124	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
124	125	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
125	126	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
126	127	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
127	128	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
128	129	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
129	130	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
130	131	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
131	132	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
132	133	Sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
133	134	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
134	135	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
135	136	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
136	137	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
137	138	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
138	139	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
139	140	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
140	141	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
141	142	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
142	143	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
143	144	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
144	145	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
145	146	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
146	147	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
147	148	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
148	149	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
149	150	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
150	151	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
151	152	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
152	153	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
153	154	No sample collected
154	155	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
155	156	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
156	157	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
157	158	Gravelly sand; coarse to very coarse sand and granules; moderately sorted; sub-angular to angular; yellowish brown (10YR 5/4)
158	159	Gravelly sand; coarse to very coarse sand and granules; moderately sorted; sub-angular to angular; yellowish brown (10YR 5/4)
159	160	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
160	161	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
161	162	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
162	163	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
163	164	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
164	165	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
165	166	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
166	167	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
167	168	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
168	169	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
169	170	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
170	171	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
171	172	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
172	173	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
173	174	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
174	175	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
175	176	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
176	177	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
177	178	Slightly gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
178	179	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
179	180	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
180	181	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
181	182	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
182	183	Sand; very fine to coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
183	184	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
184	185	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
185	186	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
186	187	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
187	188	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
188	189	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
189	190	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
190	191	Sand; medium to very coarse sand; moderately sorted; sub-rounded to angular; brown (10YR 5/3)
191	192	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
192	193	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
193	194	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
194	195	Slightly gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
195	196	Slightly gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
196	197	Slightly gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
197	198	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
198	199	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
199	200	Gravelly sand; coarse to very coarse sand and granules to medium sand; poorly sorted; angular to very angular; brown (10YR 5/3)
200	201	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
201	202	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
202	203	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
203	204	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
204	205	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
205	206	Sand; medium to very coarse sand; well sorted; angular to very angular; brown (10YR 5/3)
206	207	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
207	208	Sand; very fine to very coarse sand; poorly sorted; sub-angular to very angular; brown (10YR 5/3)
208	209	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
209	210	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
210	211	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
211	212	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
212	213	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
213	214	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
214	215	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
215	216	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
216	217	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
217	218	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
218	219	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
219	220	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
220	221	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
221	222	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
222	223	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
223	224	Slightly gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
224	225	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
225	226	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
226	227	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
227	228	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
228	229	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
229	230	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
230	231	Gravelly sand; very fine to very coarse sand and granules to large pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
231	232	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
232	233	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
233	234	Gravelly sand; medium to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
234	235	Sandy gravel; granules to small pebbles and medium to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
235	236	Gravelly sand; fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
236	237	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
237	238	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
238	239	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
239	240	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
240	241	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
241	242	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
242	243	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
243	244	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
244	245	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
245	246	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
246	247	Gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
247	248	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
248	249	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
249	250	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
250	251	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
251	252	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
252	253	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
253	254	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
254	255	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
255	256	Sandy gravel; granules to small pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; brown (10YR 5/3)
256	257	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
257	258	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
258	259	Gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
259	260	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
260	261	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
261	262	Gravelly sand; medium to very coarse sand and granules; moderately sorted; angular to very angular; brown (10YR 5/3)
262	263	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
263	264	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
264	265	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
265	266	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
266	267	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
267	268	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
268	269	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
269	270	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
270	271	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
271	272	Sandy gravel; granules to medium pebbles and medium to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
272	273	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
273	274	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
274	275	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
275	276	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
276	277	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
277	278	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
278	279	Sand; very fine to very coarse sand and trace medium pebbles; poorly sorted; sub-angular to angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
279	280	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
280	280.5 shoe	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
280	281	Gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
281	282	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; pale brown (10YR 6/3)
282	283	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; pale brown (10YR 6/3)
283	284	Sand; very fine to very coarse sand and trace small to medium pebbles; poorly sorted; angular to very angular; brown (10YR 5/3)
284	285	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
285	286	Sand; very fine to very coarse sand and trace granules; poorly sorted; angular to very angular; brown (10YR 5/3)
286	287	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
287	288	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
288	289	Gravelly sand; very fine to very coarse sand and granules with trace large pebbles; very poorly sorted; sub-rounded to angular; brown (10YR 5/3)
289	290	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
290	291	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
291	292	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
292	293	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
293	294	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
294	295	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
295	296	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; brown (10YR 5/3)
296	297	Sandy gravel; granules to small pebbles and very fine to very coarse sand; very poorly sorted; angular to very angular; brown (10YR 5/3)
297	298	Gravelly sand; very fine to very coarse sand and granules with trace medium pebbles; very poorly sorted; angular to very angular; brown (10YR 5/3)
298	299	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; brown (10YR 5/3)
299	300	Sandy gravel; granules to small pebbles and fine to very coarse sand; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
300	301	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
301	302	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
302	303	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to very angular; brown (10YR 5/3)
303	304	Gravelly sand; very fine to very coarse sand and granules to small pebbles; poorly sorted; sub-angular to angular; brown (10YR 5/3)
304	305	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
305	306	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
306	307	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; brown (10YR 5/3)
307	308	Sandy gravel; granules to small pebbles and very coarse sand; moderately sorted; sub-rounded to angular; light yellowish brown (10YR 6/4); trace medium wood chips
308	309	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
309	310	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
310	311	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
311	312	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
312	313	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; angular to very angular; brown (10YR 5/3)
313	314	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; angular to very angular; brown (10YR 5/3)
314	315	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; brown (10YR 5/3)
315	316	Sand; medium to very coarse sand; well sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
316	317	Sand; medium to very coarse sand; well sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
317	318	Sand; medium to very coarse sand; well sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
318	319	Sand; medium to very coarse sand; well sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
319	320	Sand; medium to very coarse sand; well sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
320	320.5	Shoe; gravelly sand; medium to very coarse sand and granules to small pebbles; poorly sorted; angular to very angular; light yellowish brown (10YR 6/4)
320	321	Gravelly sand; medium to very coarse sand and granules to small pebbles; poorly sorted; angular to very angular; light yellowish brown (10YR 6/4)
321	322	Sandy gravel; granules to small pebbles and medium to very coarse sand; poorly sorted; sub-rounded to angular; light yellowish brown (10YR 6/4)
322	323	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
323	324	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
324	325	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
325	326	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-rounded to sub-angular; yellowish brown (10YR 5/4)
326	327	No sample collected
327	328	Sand; medium to coarse sand; well sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
328	329	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; brown (10YR 5/3)
329	330	Gravelly sand; medium to very coarse sand and granules with trace medium pebbles; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
330	331	Gravelly sand; medium to very coarse sand and granules with trace medium pebbles; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
331	332	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
332	333	Sand; medium to very coarse sand; well sorted; sub-rounded to sub-angular; yellowish brown (10YR 5/4)
333	334	Sand; medium to very coarse sand; well sorted; sub-rounded to sub-angular; yellowish brown (10YR 5/4)
334	335	Sand; fine to coarse sand; well sorted; sub-angular to angular; yellowish brown (10YR 5/4)
335	336	Sand; fine to coarse sand; well sorted; sub-angular to angular; yellowish brown (10YR 5/4)
336	337	Sand; very fine to very coarse sand; poorly sorted; rounded to angular; yellowish brown (10YR 5/4)
337	338	Sand; very fine to very coarse sand; poorly sorted; rounded to angular; yellowish brown (10YR 5/4)
338	339	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
339	340	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
340	341	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
341	342	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
342	343	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
343	344	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
344	345	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
345	346	Gravelly sand; very fine to very coarse sand and granules to small pebbles and trace large pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
346	347	Gravelly sand; very fine to very coarse sand and granules to small pebbles and trace large pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
347	348	Gravelly sand; very fine to very coarse sand and granules to small pebbles and trace large pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
348	349	Sand; very fine to coarse sand; poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
349	350	Gravelly sand; very fine to very coarse sand and granules with trace large pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
350	351	Sand; very fine to coarse sand; poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
351	352	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
352	353	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
353	354	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
354	355	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
355	356	Gravelly sand; very fine to very coarse sand and small to medium pebbles; very poorly sorted; rounded to angular; yellowish brown (10YR 5/4)
356	357	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
357	358	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
358	359	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
359	360	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
360	361	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
361	362	Gravelly sand; coarse to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
362	363	Gravelly sand; very fine to very coarse sand and granules to small pebbles and trace medium pebbles; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
363	364	Sand; very fine to very coarse sand; poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
364	365	Sand; very fine to coarse sand and trace medium pebbles; poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
365	366	Gravelly sand; very fine to very coarse sand and granules to small pebbles; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
366	367	Gravelly sand; very fine to very coarse sand and granules to small pebbles; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
367	368	Sand; very fine to very coarse sand and trace small pebbles; poorly sorted; sub-rounded to angular; light yellowish brown (10YR 6/4)
368	369	Sand; very fine to very coarse sand and trace small pebbles; poorly sorted; sub-rounded to angular; light yellowish brown (10YR 6/4)
369	370	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; angular to very angular; light yellowish brown (10YR 6/4)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
370	371	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; light yellowish brown (10YR 6/4)
371	372	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; light yellowish brown (10YR 6/4)
372	373	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; light yellowish brown (10YR 6/4)
373	374	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-angular to very angular; yellowish brown (10YR 5/4)
374	375	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
375	376	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
376	377	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
377	378	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
378	379	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
379	380	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
380	381	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
381	382	Gravelly sand; fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
382	383	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
383	384	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
384	385	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
385	386	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
386	387	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
387	388	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
388	389	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
389	390	Sand; very fine to coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
390	391	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
391	392	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
392	393	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
393	394	Sand; very fine to very coarse sand and trace granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
394	395	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
395	396	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
396	397	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; pale brown (10YR 6/3)
397	398	Sand; very fine to very coarse sand; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
398	399	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
399	400	Slightly gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
400	401	Slightly gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
401	402	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
402	403	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
403	404	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
404	405	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
405	406	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
406	407	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
407	408	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; angular to very angular; yellowish brown (10YR 5/4)
408	409	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; sub-rounded to sub-angular; yellowish brown (10YR 5/4)
409	410	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
410	411	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
411	412	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
412	413	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
413	414	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
413 shoe	415	Gravelly sand; very fine to very coarse sand and granules to medium pebbles; very poorly sorted; sub-angular to very angular; yellowish brown (10YR 5/4)
414	415	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; light yellowish brown (10YR 6/4)
415	416	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; angular to very angular; light yellowish brown (10YR 6/4)
416	417	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; sub-angular to angular; light yellowish brown (10YR 6/4)
417	418	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
418	419	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
419	420	Sand; very fine to very coarse sand; poorly sorted; sub-angular to angular; yellowish brown (10YR 5/4)
420	421	Gravelly sand; medium to very coarse sand and granules; moderately sorted; sub-rounded to sub-angular; brown (10YR 5/3)
421	422	Sandy gravel; granules to medium pebbles and coarse to very coarse sand; poorly sorted; rounded to very angular; brown (10YR 5/3)
422	423	Slightly gravelly sand; medium to very coarse sand and granules to large pebbles; poorly sorted; sub-rounded to angular; brown (10YR 5/3)
423	424	Gravelly sand; very fine to very coarse sand and granules to small pebbles; very poorly sorted; rounded to angular; brown (10YR 5/3)
424	425	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
425	426	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; sub-rounded to angular; yellowish brown (10YR 5/4)
426	427	Gravelly sand; very coarse sand and granules to medium pebbles; moderately sorted; rounded to sub-angular; yellowish brown (10YR 5/4)
427	428	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; rounded to angular; yellowish brown (10YR 5/4)
428	429	Slightly gravelly sand; very fine to very coarse sand and granules; poorly sorted; rounded to angular; yellowish brown (10YR 5/4)
429	430	No sample collected
430	431	Silty sand; very fine to very coarse sand and silt; poorly sorted; rounded to sub-angular; brown (10YR 5/3)
431	432	Gravelly silty sand; very fine to very coarse sand, silt and granules to small pebbles; very poorly sorted; rounded to sub-angular; brown (10YR 5/3)
432	433	Gravelly sand; medium to very coarse sand and granules; poorly sorted; sub-rounded to angular; brown (10YR 5/3)

Table 6. Lithologic logs for unsaturated-zone monitoring site 1N/6E-25J5S (JTUZ-4) in Joshua Tree, San Bernardino County, California.—Continued

[Site location shown in figure 2. Altitude of land surface, approximately 2,680 ft above North American Vertical Datum of 1988 (NAVD 88). Depth is reported in feet below land surface. Drilled by U.S. Geological Survey using Overburden Drilling with Eccentric Drilling (ODEX), April 2–12, 2010. Total depth drilled: 438 ft. Construction data and instrumentation given in table 1 and figure 8. Munsell notation of color given in parentheses following color name (Munsell, 1994). **Abbreviations**: ft, feet]

Depth (ft)		Description
From	To	
433	434	Sand; very fine to coarse sand; poorly sorted; rounded to angular; brown (10YR 5/3)
434	435	Sand; very fine to coarse sand; poorly sorted; rounded to angular; brown (10YR 5/3)
435	436	Gravelly sand; coarse to very coarse sand and granules; well sorted; sub-rounded to angular; brown (10YR 5/3)
436	437	Sandy gravel; granules to small pebbles and very coarse sand; well sorted; sub-rounded to angular; brown (10YR 5/3)
437	438	Gravelly sand; very fine to very coarse sand and granules; very poorly sorted; rounded to angular; brown (10YR 5/3)

Figure 5. ODEX cuttings arranged so that major lithologic changes could be identified, 1N/6E-35A1 (JTUZ-1), Joshua Tree, San Bernardino County, California, May 2007

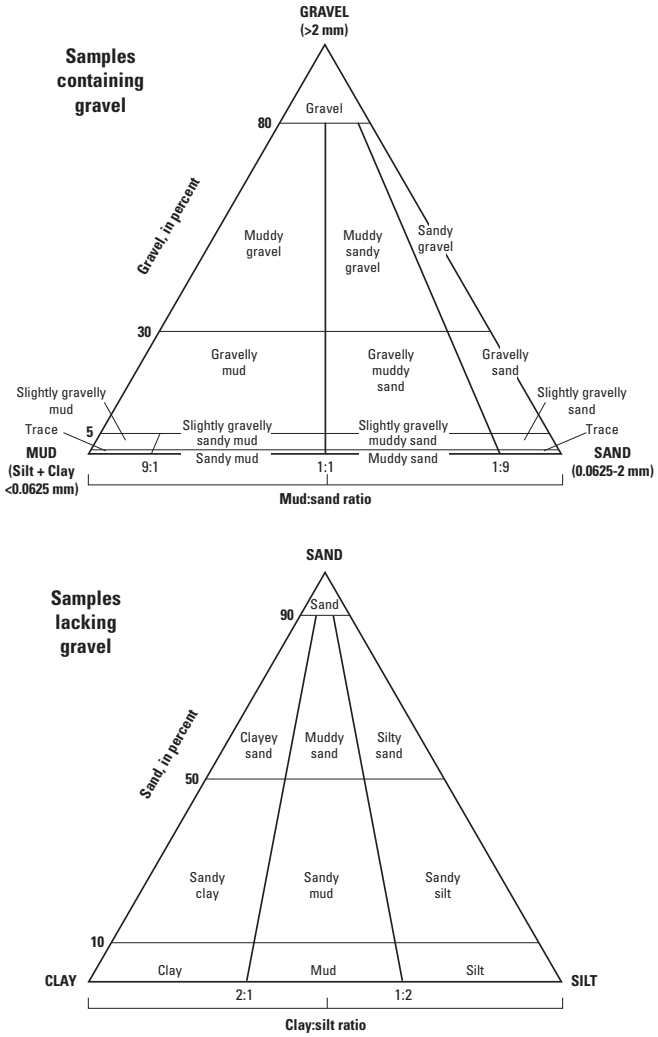


Figure 6. Nomenclature used to describe texture in lithologic logs (Modified from Folk, 1954). mm, millimeter; <, less than.

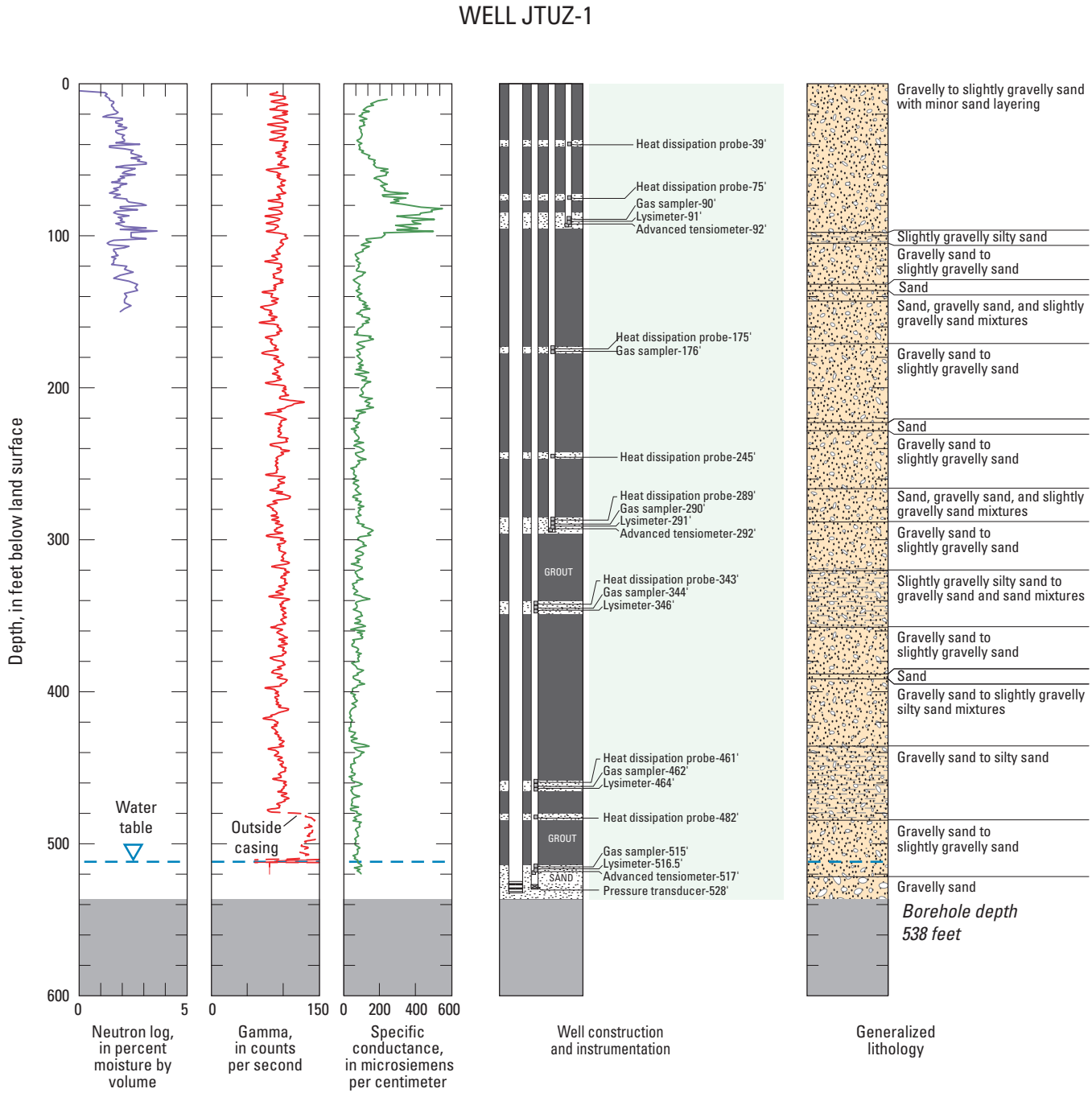


Figure 7. Neutron log, gamma log, lithology, and instrumentation for unsaturated-zone monitoring site 1N/6E-35A1 (JTUZ-1) in Joshua Tree, San Bernardino County, California

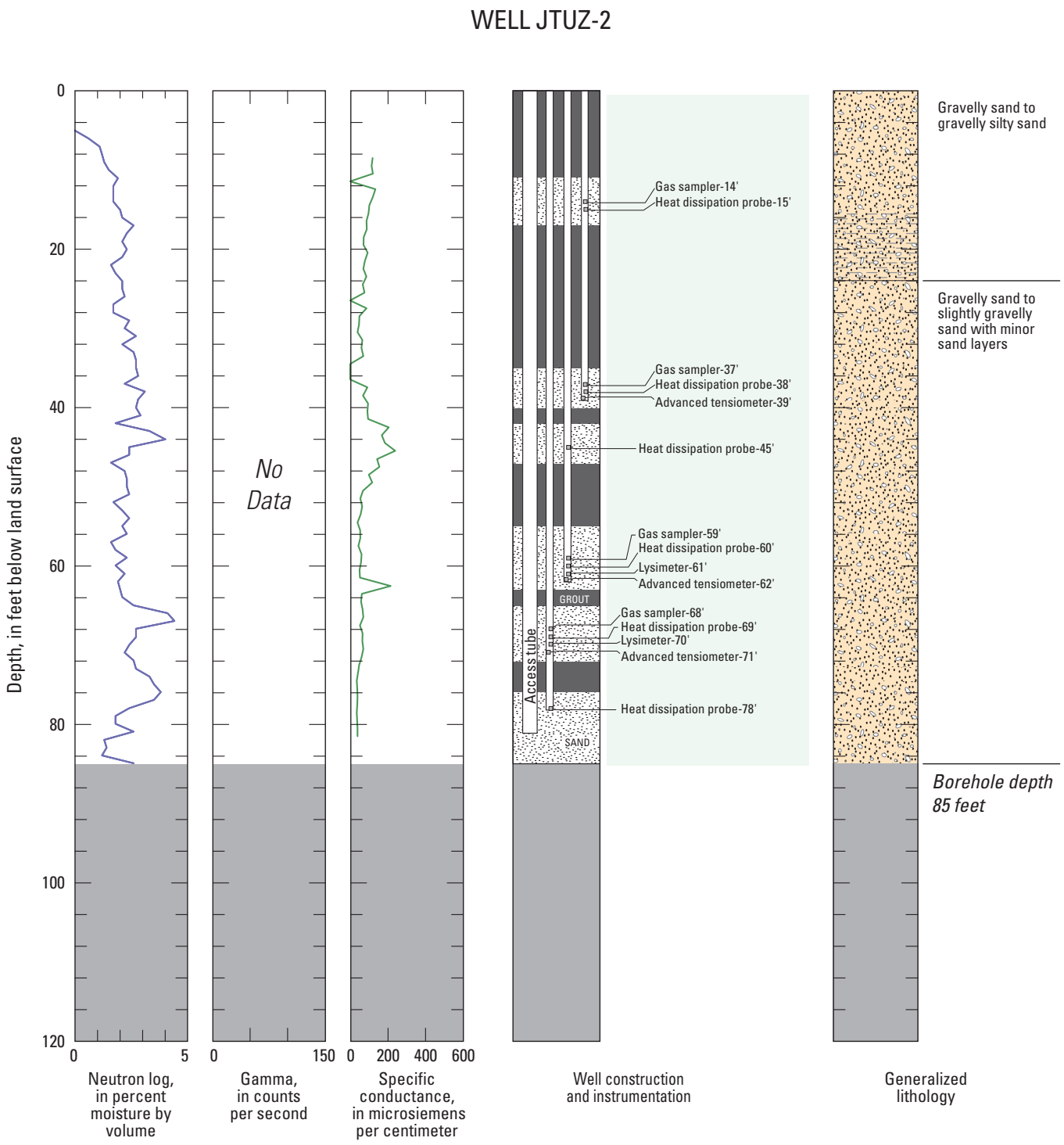


Figure 8. Neutron log, gamma log, lithology, and instrumentation for unsaturated-zone monitoring site 1N/6E-35B1 (JTUZ-2) in Joshua Tree, San Bernardino County, California

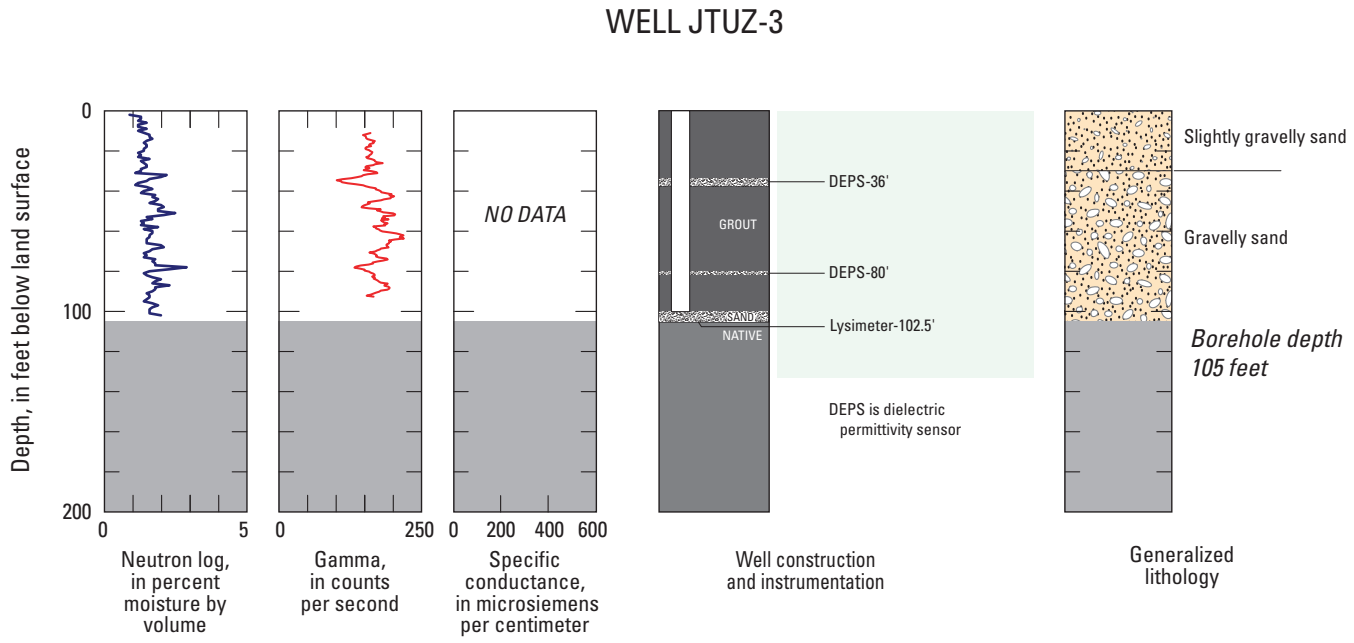


Figure 9. Neutron log, gamma log, lithology, and instrumentation for unsaturated-zone monitoring site 1N/6E-25J1 (JTUZ-3) in Joshua Tree, San Bernardino County, California

A detailed lithologic log was compiled for the monitoring site drilled with the auger rig, by using descriptions of drill cuttings that were collected at 5-ft intervals (*table 5*). These logs were initially compiled in the field and were reexamined in greater detail at a later date at the USGS San Diego Water Quality Laboratory. The same classification scheme used to describe the cuttings collected by the ODEX method was used to describe the auger cuttings. Because of the nature of auger drilling, where cuttings are mechanically brought to the surface from the subsurface along the helical auger flights rather than forced to the surface by air or mud, the depth of origin of cuttings collected with the auger rig is less certain than it is with other drilling methods. Because of this uncertainty, the specific conductance of cuttings obtained with the auger rig was not measured.

Geophysical Logs

Holes drilled by using the ODEX method are continuously cased with steel pipe during drilling; therefore, it is not possible to collect an extensive suite of geophysical logs (for example, electromagnetic logs) prior to installation of the borehole. However, natural-gamma logs and neutron logs were collected in the cased holes before the instrumentation was installed and were used with other information for planning site construction and instrument placement (*figs. 7*, *8*, *9*, and *10*). Natural-gamma logs measure the intensity of gamma-ray emissions resulting from natural decay of potassium-40 and the daughter products of uranium and thorium. These logs are used primarily as lithologic indicators and for geologic correlation. Clay, as well as potassium-feldspar-rich gravel, generally has more intense gamma-ray emissions than gravels containing less potassium feldspar (Schlumberger, 1972; Hearst and Nelson, 1985; Driscoll, 1986). Neutron logs measure the backscattering of neutrons generated from a nuclear source in the logging tool. A direct relation exists between the water content of the formation and the neutron log measurement (Schlumberger, 1972; Hearst and Nelson, 1985; Troxler, 1994). At each measurement depth, the logs were affected by differences in the position of the neutron source within the pipe and by differences in the thickness of the ODEX pipe.

Site Construction and Instrumentation

Details of site construction and placement of instruments are provided in *figures 7–10* and *tables 1* and *2*. The design of each unsaturated-zone monitoring site was determined on the basis of (l) data needs at the site; (2) data collected from cuttings and core material (*tables 3*–6) including lithology, specific conductance of leachate, gamma logs, and neutron logs (*figs. 7–10*); and (3) limitations on the amount of instrumentation that can be placed in a single 8.875-in.-diameter drill hole. A 2-in.-diameter polyvinyl chloride (PVC) pipe was installed in the boreholes drilled with ODEX to serve as an access tube for geophysical measurements. In JTUZ-1 and JTUZ-4, the access tube also serves as a well, screened below the water table. Instruments installed in the boreholes included matric-potential sensors—advanced tensiometers (Hubble and Sisson, 1998) and heat-dissipation probes (Reece,

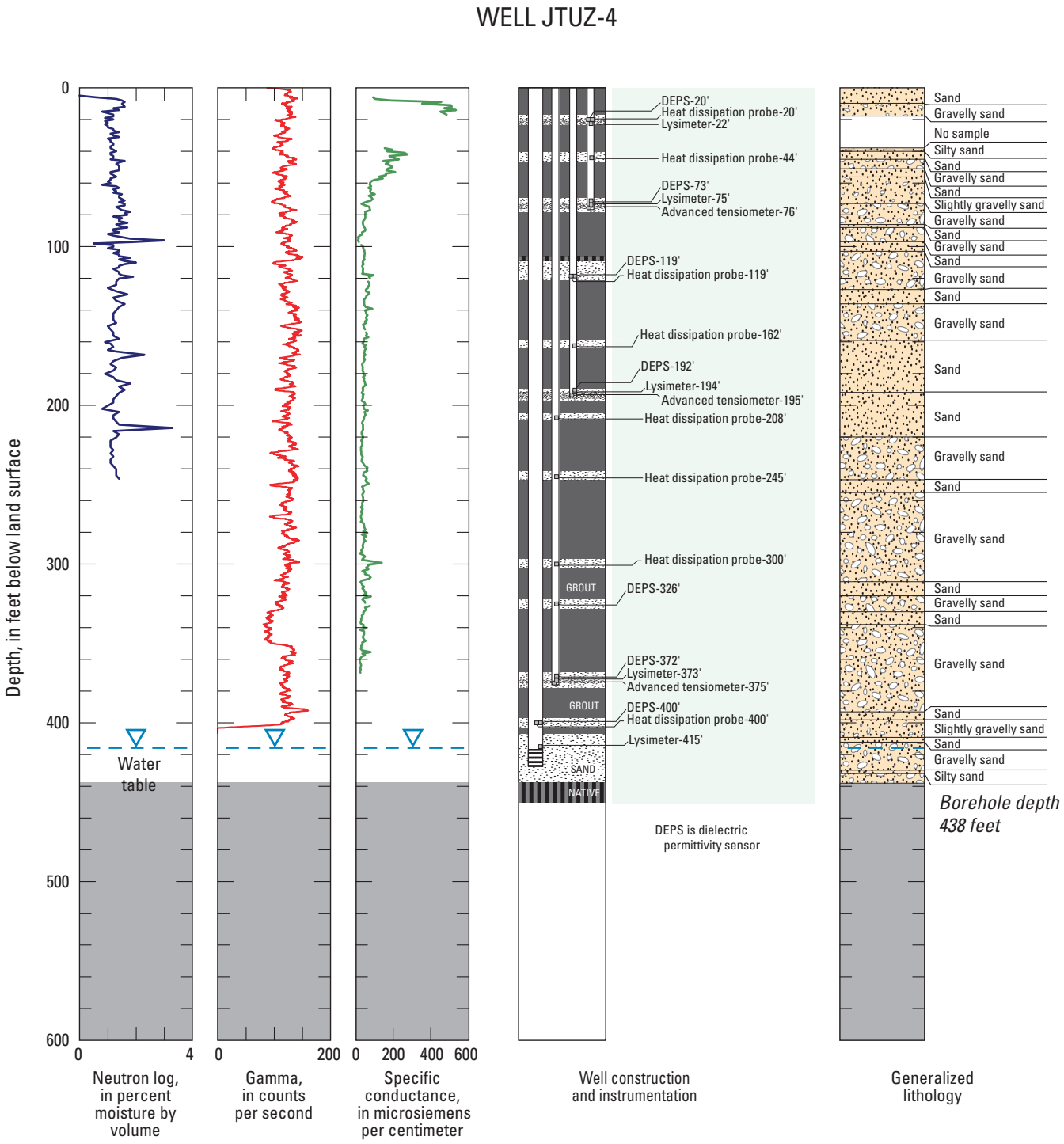


Figure 10. Neutron log, gamma log, lithology, and instrumentation for unsaturated-zone monitoring site 1N/6E-25J5 (JTUZ-4) in Joshua Tree, San Bernardino County, California

1996), suction-cup lysimeters, and gas samplers (*fig. 11*). Dielectric permittivity sensors (DEPS) were installed in JTUZ-3 and JTUZ-4. Matric potentials can be recorded in length units of m or ft or in pressure units of Megapascals (MPa) or bars; different instruments employ different units. Data are displayed in the native units of each instrument. Conversions between metric and SI units and length and pressure units are in the Conversion Factors. All instruments installed in these sites were commercially available.

Advanced tensiometers consist of a porous ceramic cup connected to land surface through a 1-in.-diameter PVC pipe. A pressure transducer is attached to the advanced tensiometer to measure matric potential (negative pressure) within the tensiometer range to about −8-meter (m) head (Cassle and

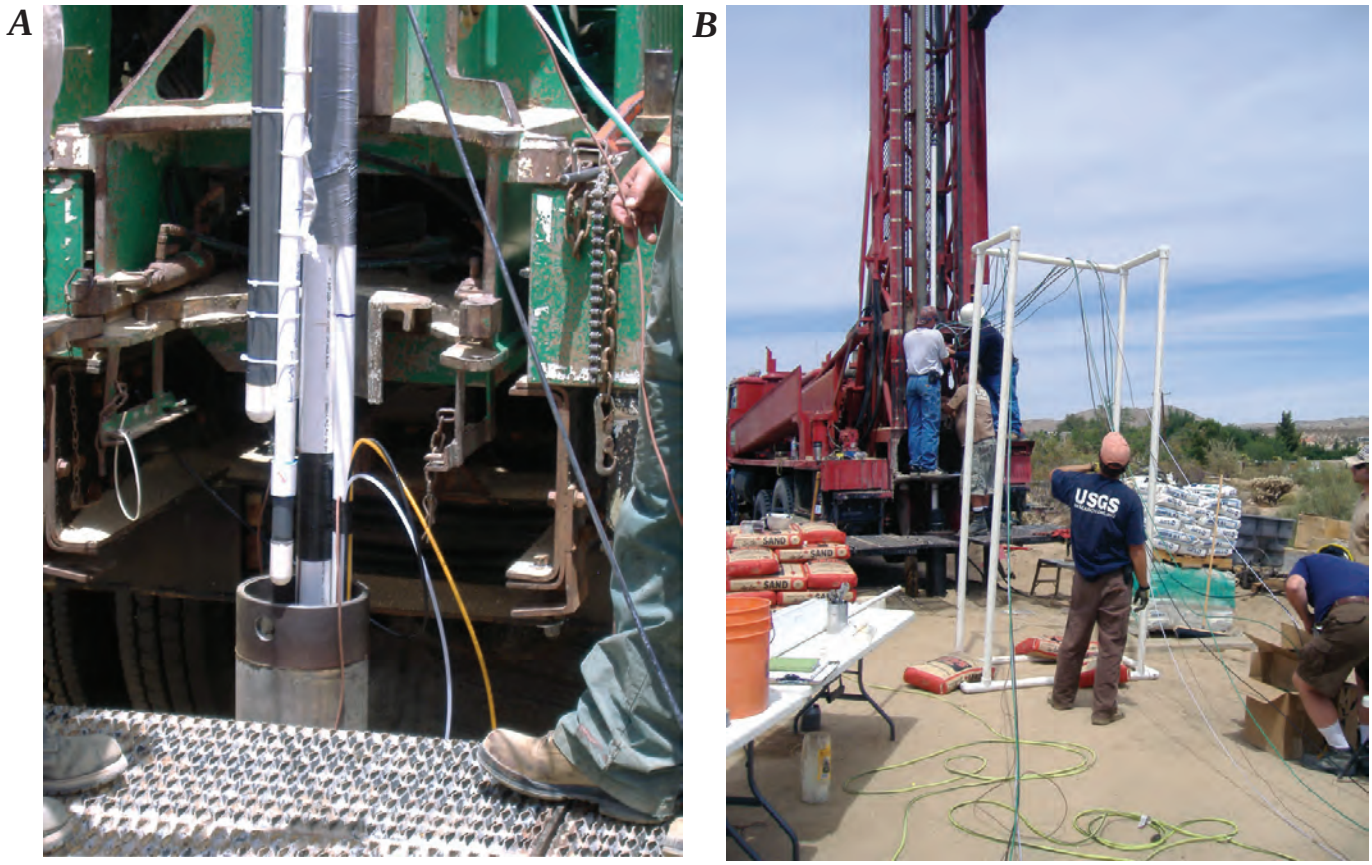


Figure 11. Borehole instrumentation (left) and installation 1N/6E-35A1 (JTUZ-1), in Joshua Tree, San Bernardino County, California, May 2007. Shown in photo on left, *A*, are an advanced tensiometer (lower cup, just above the drill pipe) and a suction-cup lysimeter (left) attached to the 2-inch PVC access tube. Lysimeter and gas sampler tubes from lower instruments are visible to the right of the instrument bundle. Photo on right, *B*, shows multiple lysimeter and gas-sampler tubes being fed into the borehole.

Klute, 1986) and, when saturated, positive pressure to a depth of about 8 m (the total range of pressure measureable with the advanced tensiometer is from 8 m to -8 m). Advanced tensiometers can also measure temperature though a thermistor that is part of the instrument. Because of space limitations, only a limited number of advanced tensiometers (usually not more than three) can be installed in a single borehole. Advanced tensiometers were installed above clay layers, as indicated by the lithologic and natural-gamma logs, where the downward movement of water can be impeded and wet conditions (or even saturated conditions) could be present (Izbicki and others, 2008).

Heat-dissipation probes measure the rate of movement of heat in a calibrated ceramic cylinder, which varies with water content (Phene and others, 1971). The probes were individually calibrated, as described by Flint and others (2002), at the USGS California Water Science Center Hydrologic Research Laboratory in Sacramento, California to allow the raw data to be converted to matric potential. The minimum value of matric potential detectable by the heat-dissipation probes is about −0.07 bars (−0.7 m of water). The heat-dissipation probes are connected to land surface by wires, and although a large number of heat-dissipation probes can be installed in a single borehole, the actual number installed is usually limited by the number of available input channels in the data-logger at land surface. The heat-dissipation probes were installed below clay layers and in more massive lithologic units where saturated conditions were not expected to develop during artificial recharge (Izbicki and others, 2008).

Suction-cup lysimeters were installed within each borehole to collect unsaturated-zone water-quality samples. Suction-cup lysimeters were paired with advanced tensiometers or heat-dissipation probes to relate changes in water quality to changes in matric potential (or pressure). Suction-cup lysimeters were connected to land surface by using two 1/8-in.-diameter nylon tubes. One tube was for the application of vacuum to draw water into the body of the lysimeter prior to sample collection. This tube also was used for the application of pressure to force water from the body of the lysimeter to the surface through the other tube during sample collection. The tubes used for application of pressure and vacuum and for sample collection were color coded in a spectral order with red identifying the deepest lysimeter and blue identifying the shallowest.

Gas samplers consisted of a 0.004-in.-slot stainless-steel well screen 10 in. long and 0.5 in. in diameter capped on one

end while the other end had a threaded opening. The samplers were connected to the surface by using 1/8-in.-diameter nylon tubing. Purging of 1 to 2 liters per minute (L/min) for 4 to 6 hours three times over the course of a year prior to sample collection was required to ensure that air introduced into the unsaturated zone during drilling was removed before samples representative of formational gases could be collected from the gas samplers (Weeks and McMahon, 2007).

DEPS were installed at JTUZ-4 to measure the matric potential of the surrounding material. DEPS measure matric potential in the range of −10 kilopascals (kPa) to −500 kPa. The dielectric permittivity of the porous ceramic plate is highly dependent on the amount of moisture present in the pores of the ceramic. When an excitation voltage is applied, the electrical resistance across the ceramic varies with changing moisture content, which can be correlated to a matric potential. Calibration of the DEPS was performed by the manufacturer prior to installation. The DEPS were packed in silica flour, wrapped in cheesecloth, and saturated to optimize the hydraulic conductivity between the instrument and the surrounding material; the DEPS was connected to a data logger at the surface.

Instruments within the borehole were packed in material designed to facilitate contact with the surrounding unsaturated zone and enhance instrument performance (#60 sand or silica flour, depending on the instrument). Instruments were separated from each other vertically by a low-permeability seal consisting of a three-part mixture of bentonite chips, granulated bentonite, and #3-graded sand for structural support. The bentonite was installed dry; Izbicki and others (2000) have shown, through repeated neutron logging, that bentonite hydrates after installation within the borehole.

Vaults were installed on the surface, roughly flush with the land surface by using concrete surface seals (*fig. 12A*). Tubes for the gas samplers were color coded and arranged from deepest to shallowest. The gas sampler tubes were sealed with compression fittings. Pressure/vacuum tubes for the suction-cup lysimeters were color coded and arranged from deepest to shallowest. Sample tubes for the suction-cup lysimeters were color coded and arranged from deepest to shallowest to the right of the pressure/vacuum tubes. The suction-cup lysimeter tubes were sealed by folding over a radiator hose and crimping it closed with washers. The data logger and related electronics were placed inside a water tight, re-sealable plastic box (*fig. 12B*).

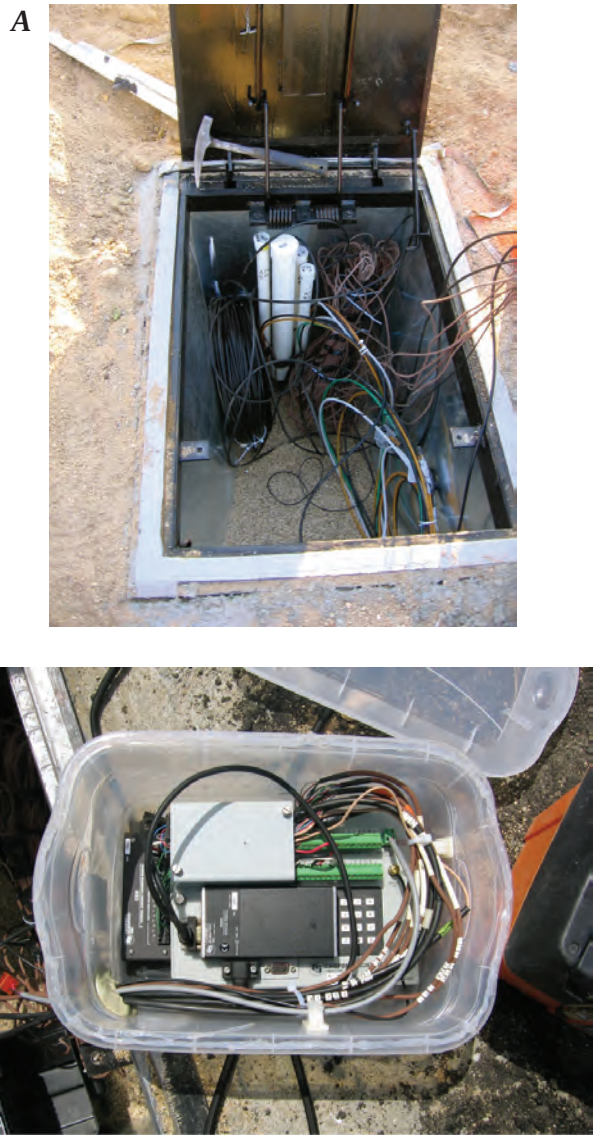


Figure 12. Site vault and electronic data logger, in Joshua Tree, San Bernardino County, California, May 2007. *A*, Site vault and *B*, electronic data logger.

Physical and Hydraulic Properties of Unsaturated Materials

Physical-property data including particle-size distribution, bulk density, porosity, volumetric water content, saturation, matric potential, and residual water content are used to evaluate the materials composing the unsaturated zone and their hydraulic characteristics. Particle-size data describe the physical components that make up the unsaturated zone and were determined for select cuttings samples. Bulk-density data describe the mass of the material per volume. Volumetric-water-content data describe the amount of water in each core sample. Porosity data describe the ratio of the volume or interstices in the material to total volume; saturation data describe the percentage of total pore space that contained water. Porosity and saturation data are calculated from a dry weight of total oven dryness at 105 degrees Celsius (°C). Residual-water-content data are calculated from oven drying core material at 60-percent relative humidity, which approximates a water potential of −70 megapascals (MPa), similar to wilting point (Flint and Flint, 2002). This dryness is used to calculate the effective porosity, providing the pore space available for drainage or plant water use. The effective saturation is also calculated from this dryness and indicates the amount of free water in the sample. The effective values more accurately represent the water that will be available (Flint and Flint, 2002). Matric-potential data describe how tightly that water is held in the unsaturated zone and can be used to calculate if that water is draining freely as a result of gravitational forces.

Physical properties of unsaturated materials, such as volumetric water content, bulk density, and matric potential were determined for selected cuttings and cores collected from JTUZ-1 and JTUZ-2 as part of this study. Laboratory measurements were made at the USGS California Water Science Center Hydrologic Research Laboratory, Sacramento. Field measurements for matric potential and unsaturated-zone temperature from JTUZ-1 and JTUZ-2 are also presented in this section. Physical and hydraulic properties data from JTUZ-3 and JTUZ-4 were not available at the time of publication and are not presented in this report.

Laboratory Data

Particle-size distribution (dry-sieve method), bulk density, porosity, volumetric water content, saturation, residual water content, effective porosity, effective saturation, and saturated hydraulic conductivity were measured by using American Society for Testing and Materials (1987) methods. Volumetric water content can be converted to gravimetric water content by dividing by the bulk density (Hillel, 1982). Matric potential of cores was measured in the laboratory by using the filter-paper method (Campbell and Gee, 1986). Results of particle-size analysis for selected drill cuttings samples from JTUZ-1 are given in *table 7*. Particle-size analysis was not performed on cutting materials from JTUZ-2. Results of laboratory analysis for bulk density, porosity, water content, saturation, and matric potential for JTUZ-1 and JTUZ-2 are given in *table 8*. Saturated-hydraulic-conductivity data and the gradient at which hydraulic conductivity were measured for JTUZ-1 and JTUZ-2 are given in *table 9*.

Field Data

Matric potential in the unsaturated zone under field conditions was measured at advanced tensiometers and heat-dissipation probes. These instruments were connected to data loggers in vaults at land surface that collected and recorded data at 4-hour intervals. The data loggers were powered by using deep-cycle batteries that were replaced with fresh batteries at approximately 6-week intervals. Water levels in JTUZ-1 were measured hourly by using an advanced tensiometer placed below the water table. These data were checked monthly against manual measurements in the monitoring well made with a calibrated electric tape. Water-level data are shown in *figure 13*. Matric-potential data collected by using heat-dissipation probes are shown in *figures 14–16* for JTUZ-1 and *figures 17–19* for JTUZ-2. Matric-potential data collected by using advanced tensiometers are shown in *figure 20* for JTUZ-1 and *figure 21* for JTUZ-2. Temperature data from advanced tensiometers are shown in *figures 22* and *23*. These data are available from the USGS computerized National Water Information System (NWIS) at *http://waterdata.usgs.gov/nwis*.

Table 7. Results of particle-size analysis for selected drill cuttings from unsaturated-zone monitoring site 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California.

[Data were analyzed at the U.S. Geological Survey Hydrologic Research Laboratory, Sacramento, California. Site location is shown in figure 2]

Depth (feet)	Percent finer than size indicated, in millimeters									
	Rock 19.0	Gravel		Very coarse sand 2.0	Coarse sand 0.85	Medium sand 0.417	Fine sand 0.25	Very fine sand 0.125	Silt 0.053	Clay 0.002
		9.52	4.76							
24.0	100	100	100	95	83	63	41	23	14	6
47.0	100	100	98	73	55	42	30	19	12	5
62.0	100	100	96	76	57	40	27	17	10	4
68.0	100	100	100	88	66	44	27	15	10	4
81.0	100	100	90	70	55	44	33	22	12	4
82.0	100	100	100	84	68	56	48	36	23	8
99.0	100	100	100	96	94	90	82	56	30	10
111.0	100	100	99	88	73	45	23	10	5	3
144.0	100	100	100	93	80	63	46	30	19	7
164.0	100	100	100	92	76	55	38	23	14	5
184.0	100	100	99	92	80	65	50	32	19	7
204.0	100	100	99	85	63	39	22	14	11	8
206.0	100	99	97	76	49	30	17	10	7	6
218.0	100	100	99	85	60	39	25	16	10	4
246.0	100	100	98	73	43	21	11	7	5	3
265.0	100	100	99	88	58	33	15	8	5	3
271.0	100	100	97	65	52	35	19	9	5	3
285.0	100	100	100	99	95	76	42	17	8	3
293.0	100	100	100	93	85	75	66	53	32	12
305.0	100	100	100	96	91	75	49	27	14	3
307.0	100	95	77	59	46	32	21	13	8	2
308.0	100	100	99	86	70	50	30	18	10	2
322.0	100	100	99	94	78	53	30	16	10	2
330.0	100	100	100	95	79	52	30	18	10	1
345.0	100	100	99	90	78	64	49	30	15	2
347.0	100	100	97	82	62	43	26	14	7	1
352.0	100	100	99	94	85	69	47	25	14	3
365.0	100	100	99	91	76	58	39	22	12	2
371.0	100	100	100	96	87	75	58	37	19	3
384.0	100	100	98	90	71	50	34	21	12	3
389.0	100	100	100	97	83	59	39	23	13	3
404.0	100	100	100	78	53	32	18	10	7	2
411.0	100	100	100	82	60	42	25	13	8	3
424.0	100	100	100	95	80	54	30	16	8	3
427.0	100	100	96	79	52	33	19	11	7	3
427.5	100	100	100	85	70	50	32	18	9	4
441.0	100	100	100	95	84	69	53	36	21	8
449.0	100	100	99	91	80	60	38	22	11	5
459.0	100	100	100	97	91	79	64	47	30	13
466.0	100	100	99	93	83	71	53	32	17	4
478.0	100	100	100	97	88	73	55	38	22	6
489.0	100	100	99	85	59	38	24	14	8	3
498.0	100	100	98	76	48	25	14	8	6	3
503.0	100	100	99	89	73	54	38	24	15	7
515.0	100	100	100	98	79	47	27	17	11	5
530.0	100	100	100	91	76	51	31	19	13	5

Table 8. Bulk-density, water-content, and matric-potential data for selected core material from unsaturated-zone monitoring sites 1N/6E-35A1-23S (JTUZ-1) and 1N/6E-35B1-15S (JTUZ-2) in Joshua Tree, San Bernardino County, California, May and June 2007.

[Analyses were done at the U.S. Geological Survey Hydrologic Research Laboratory, Sacramento, California. Site locations are shown in figure 2. **Abbreviations**: cm^3, cubic centimeter; ft, foot; g, gram; m^3, cubic meter; MPa, mega pascal; %, percent]

Site	Depth of core (ft)	Bulk density (g/cm^3)	Volumetric water content (m^3/m^3)	Porosity (m^3/m^3)	Saturation (%)	Residual water content (m^3/m^3)	Effective porosity (m^3/m^3)	Effective saturation (%)	Matric potential, filter paper (MPa)
JTUZ-1	63.5	1.88	0.105	0.315	0.332	0.015	0.300	0.299	–0.02
	202.5	1.83	0.091	0.325	0.281	0.019	0.306	0.237	–0.02
	303.0	1.80	0.064	0.323	0.200	0.009	0.314	0.177	–0.03
	343.0	1.84	0.089	0.342	0.260	0.011	0.330	0.235	–0.02
	423.5	1.71	0.081	0.383	0.210	0.049	0.334	0.094	–0.05
JTUZ-2	32.0	1.78	0.195	0.371	0.527	0.062	0.309	0.432	–0.01
	77.0	2.00	0.168	0.259	0.650	0.096	0.163	0.444	0.00

Table 9. Saturated hydraulic conductivity for selected core material from unsaturated-zone monitoring sites 1N/6E-35A1-23S (JTUZ-1) and 1N/6E-35B1-15S (JTUZ-2) in Joshua Tree, San Bernardino County, California, May and June 2007.

[Data were analyzed at the U.S. Geological Survey Hydrologic Research Laboratory, Sacramento, California. Site locations are shown in figure 2. Gradient is the hydraulic gradient across the 15.25 cm core length. **Abbreviations**: cm/s, centimeters per second; ft, foot; kPa, kilopascal]

Site	Depth (ft)	Saturated hydraulic conductivity (cm/s)	Gradient (kPa)
JTUZ-1	67.5	3.0E-04	6
	67.5	2.6E-04	18
	206.0	1.4E-03	5
	206.0	1.0E-03	23
	306.5	2.8E-03	5
	306.5	2.6E-03	14
	346.0	3.1E-04	15
	346.0	2.8E-04	30
	426.5	9.2E-05	30
	426.5	8.9E-05	44
JTUZ-2	32.0	9.6E-05	30
	32.0	9.0E-05	60
	77.0	2.7E-06	120
	77.0	3.2E-06	165

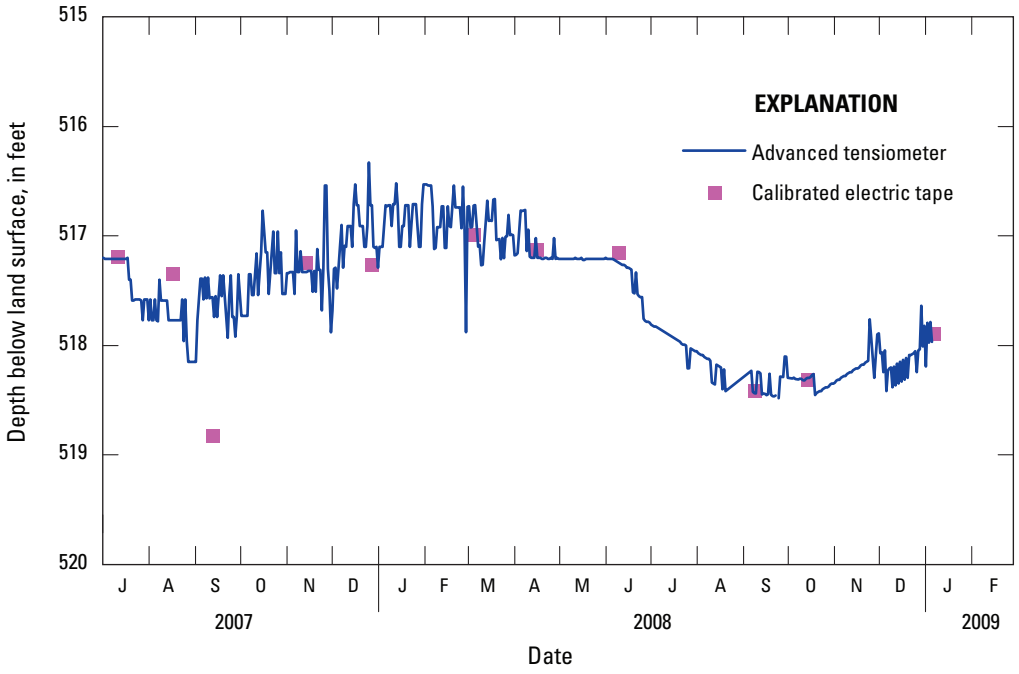


Figure 13. Water level at JTUZ-1 (1N/6E-35A1) in Joshua Tree, San Bernardino County, California, July 2007 to September 2009

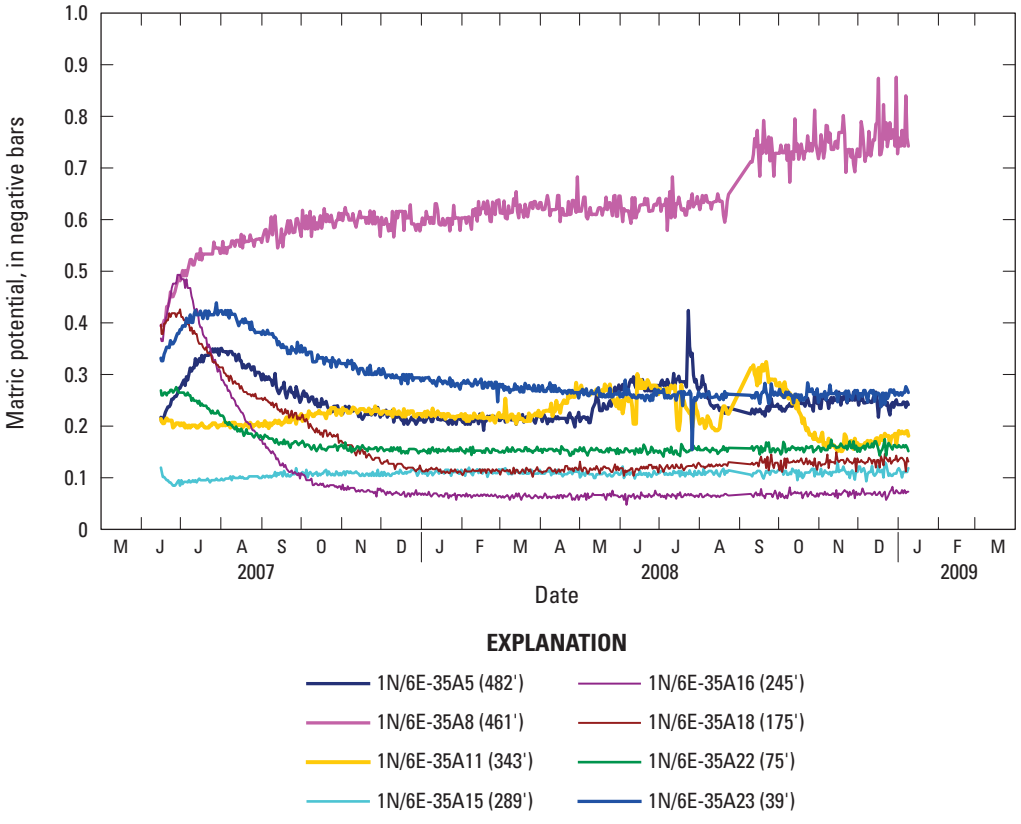


Figure 14. Heat-dissipation probe (HDP) soil moisture for site JTUZ-1 (1N/6E-35A5, 1N/6E-35A8, 1N/6E-35A11, 1N/6E-35A15, 1N/6E-35A16, 1N/6E-35A18, 1N/6E-35A22, and 1N/6E-35A23) in Joshua Tree, San Bernardino County, California, July 2007 to September 2009. Data for individual HDPs are presented in figures 15–16. Note: the spike in matric potential immediately following installation is a function of the instruments equilibrating with the conditions in the unsaturated zone. The highly negative matric potential values at 1N/6E-35A8 represent extremely dry conditions. Data available online at *http://waterdata.usgs.gov/nwis*.

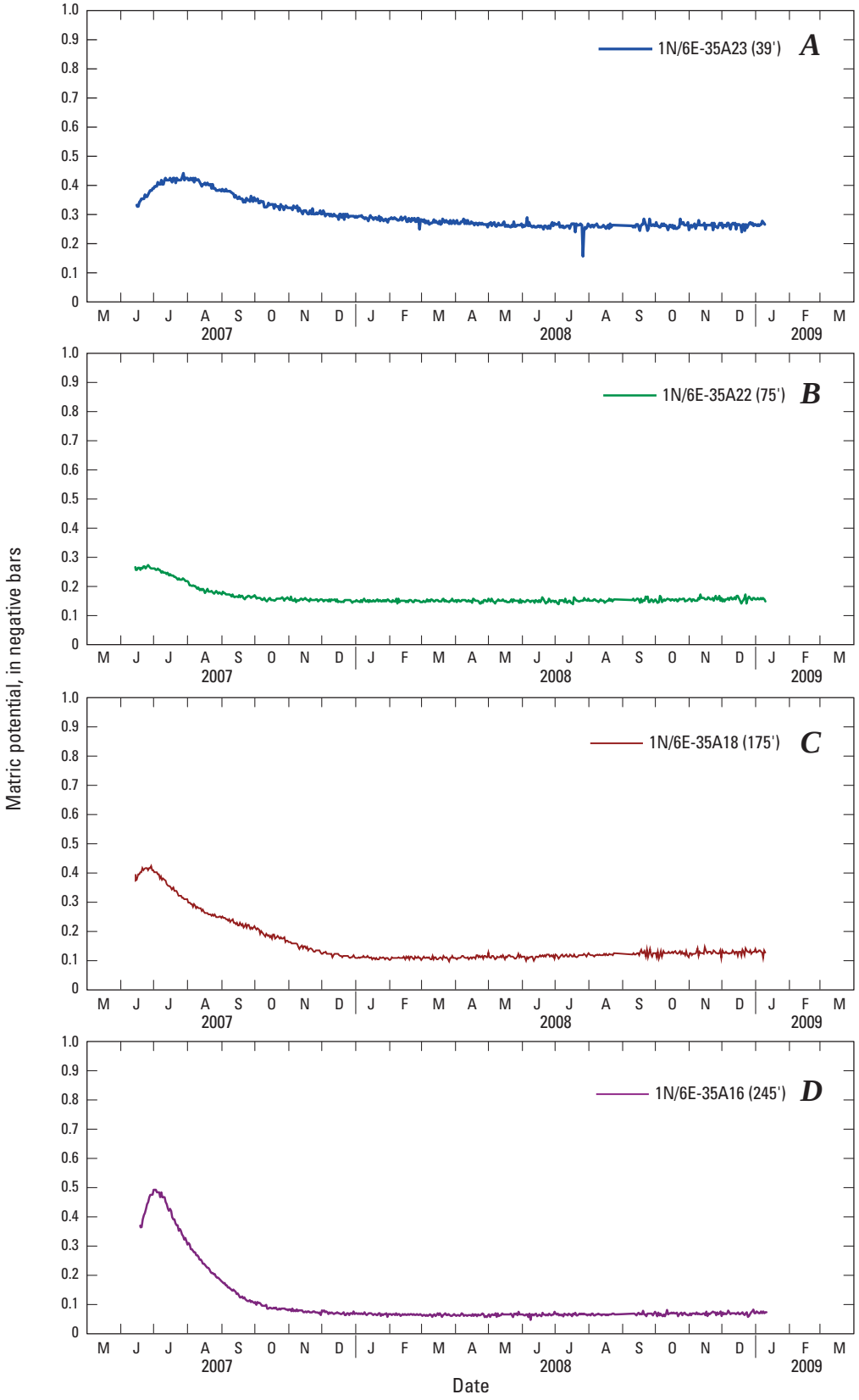


Figure 15. Matric-potential data collected between 39 and 245 ft below land surface at site JTUZ-1 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 from heat-dissipation probes (HDP): *A*, 1N/6E-35A23; *B*, 1N/6E-35A22; *C*, 1N/6E-35A18; and *D*, 1N/6E-35A16. Data available online at *http://waterdata.usgs.gov/nwis*.

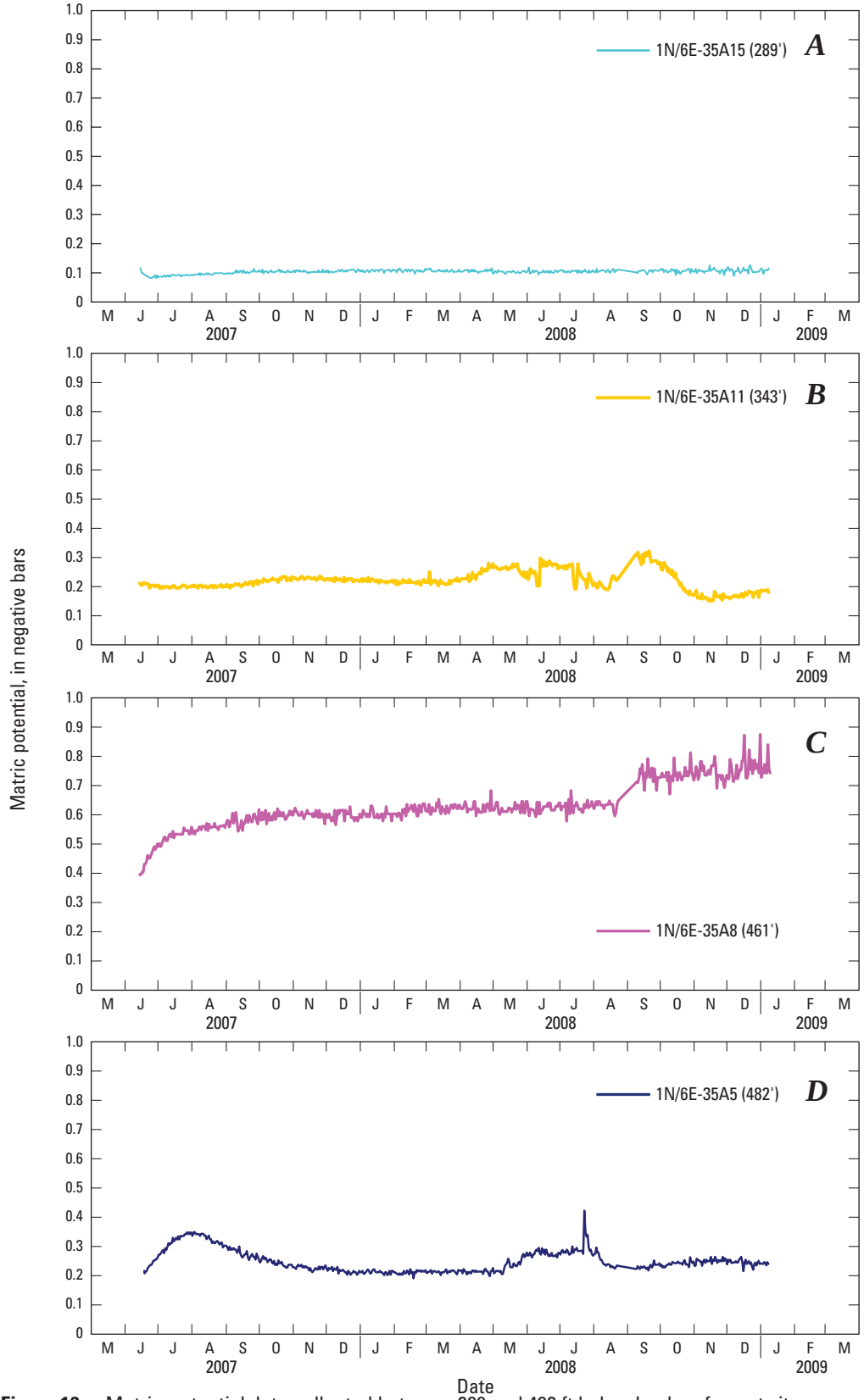


Figure 16. Matric-potential data collected between 289 and 482 ft below land surface at site JTUZ-1 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 from heat-dissipation probes (HDP): *A*, 1N/6E-35A15; *B*,1N/6E-35A11; *C*, 1N/6E-35A8; and *D*, 1N/6E-35A5. Data available online at *http://waterdata.usgs.gov/nwis*.

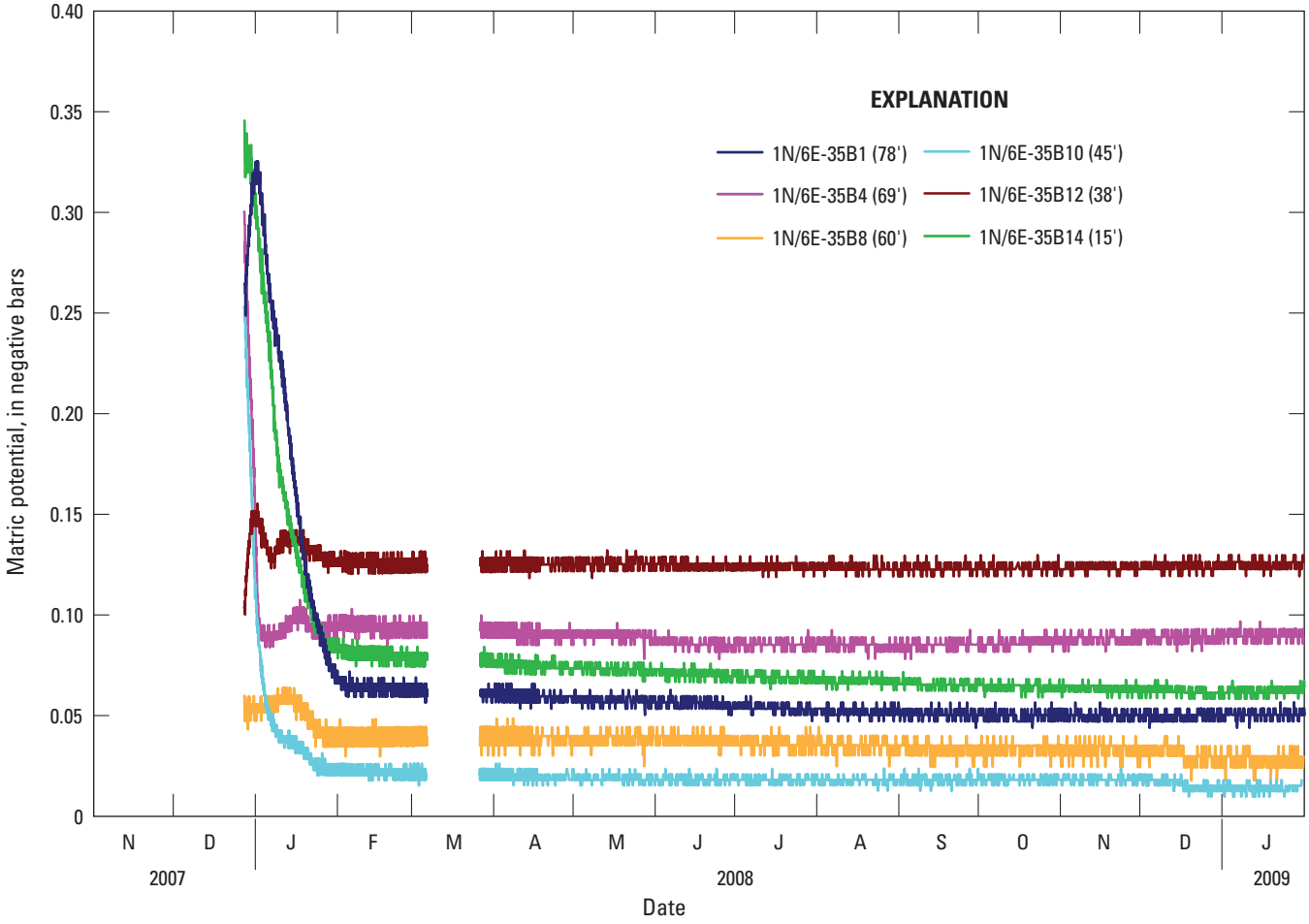


Figure 17. Heat-dissipation probe (HDP) soil moisture for site JTUZ-2 (1N/6E-35B1, 1N/6E-35B4, 1N/6E-35B8, 1N/6E-35B10, 1N/6E-35B12, and 1N/6E-35B14) in Joshua Tree, San Bernardino County, California, July 2007 to September 2009. Data for individual HDPs presented in figures 18 and 19. Note: the spike in matric potential immediately following installation is a function of the instruments equilibrating with the conditions in the unsaturated zone. Data available online at *http://waterdata.usgs.gov/nwis*.

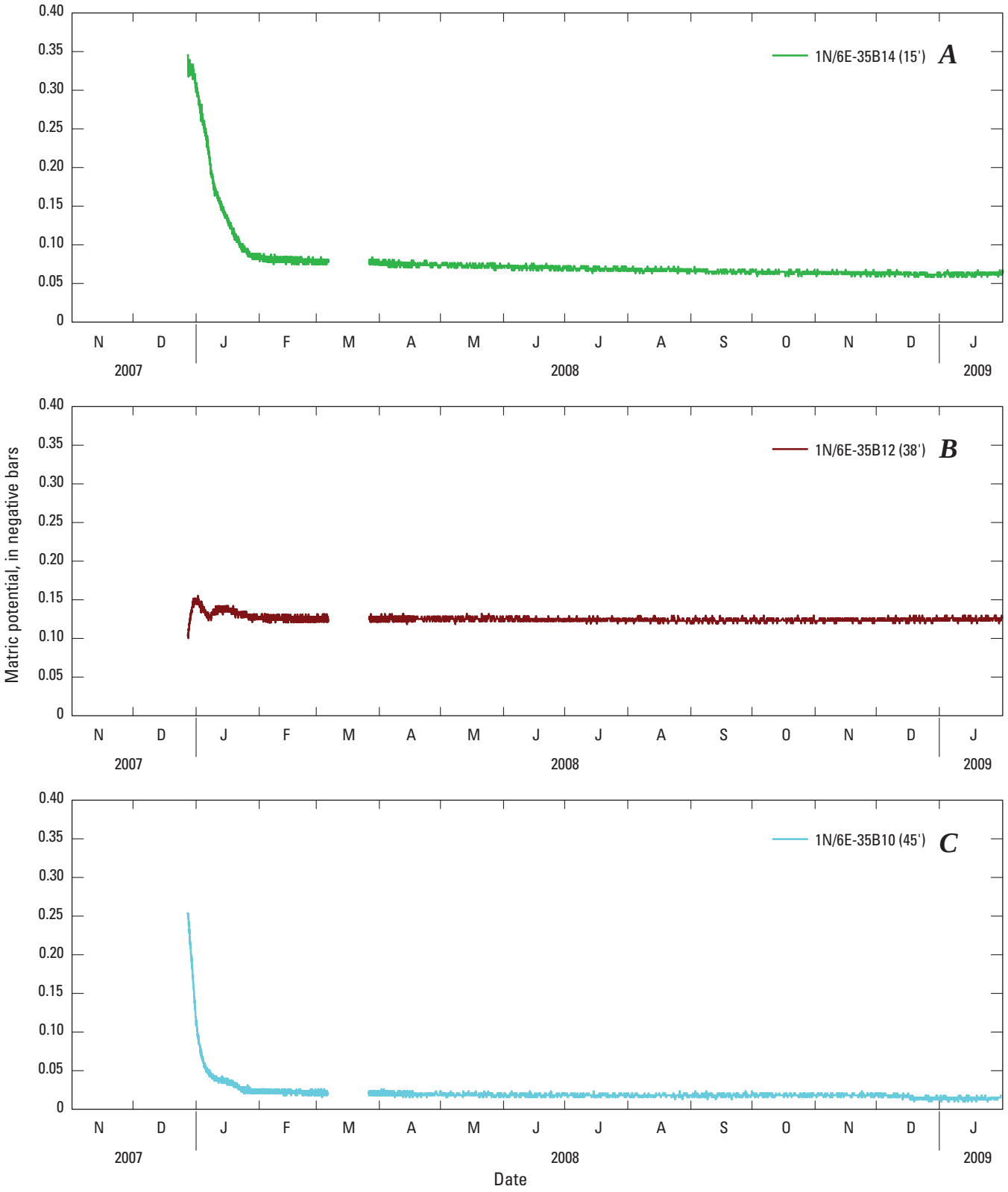


Figure 18. Matric-potential data collected between 15 and 45 ft at site JTUZ-2 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 from heat-dissipation probes (HDP): *A*, 1N/6E-35B14; *B*, 1N/6E-35B12; and *C*, 1N/6E-35B10. Data available online at *http://waterdata.usgs.gov/nwis*.

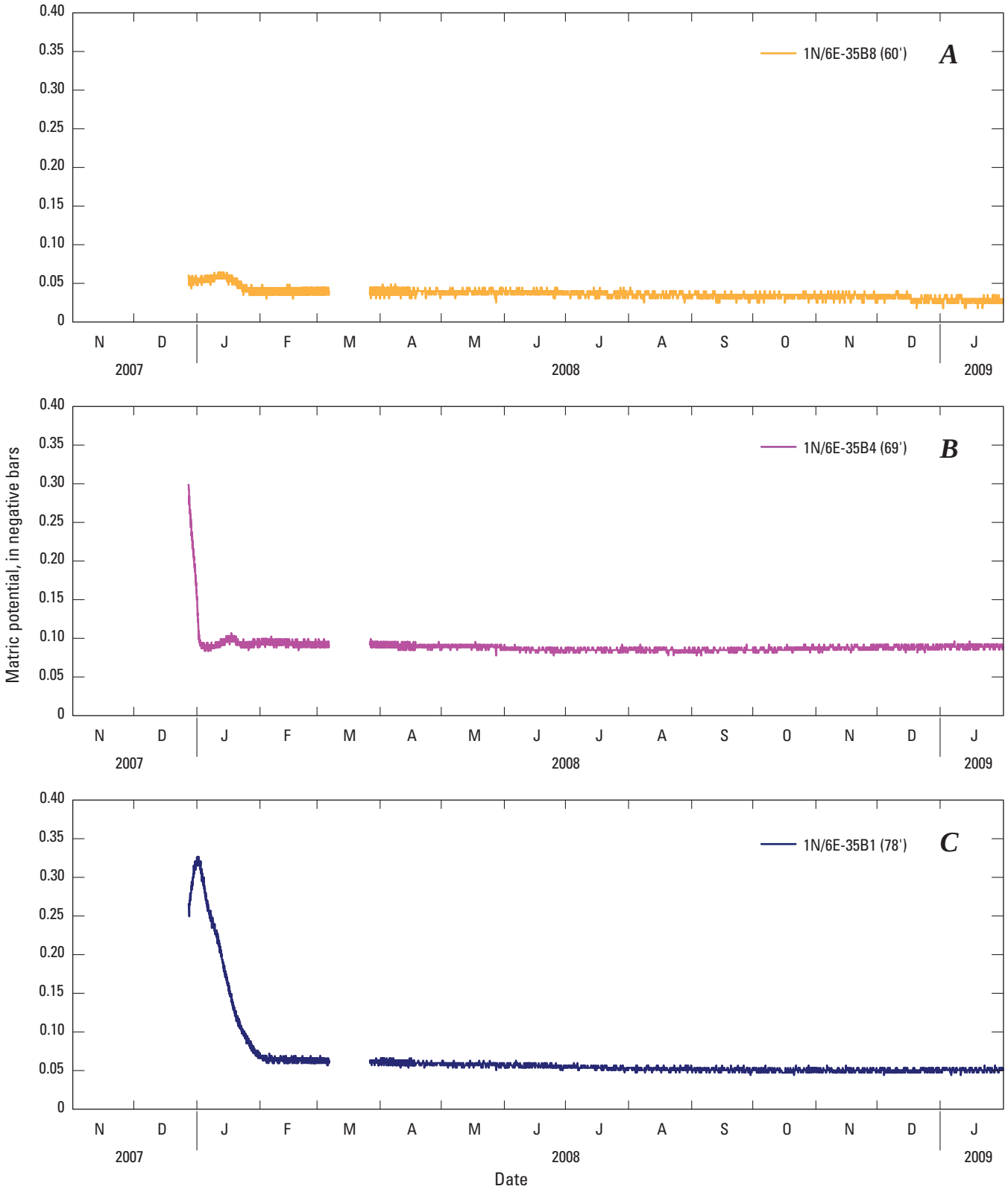


Figure 19. Matric-potential data collected between 60 and 78 ft at site JTUZ-2 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 from heat-dissipation probes (HDP): *A*, 1N/6E-35B8; *B*, 1N/6E-35B4; and *C*, 1N/6E-35B1. Data available online at *http://waterdata.usgs.gov/nwis*.

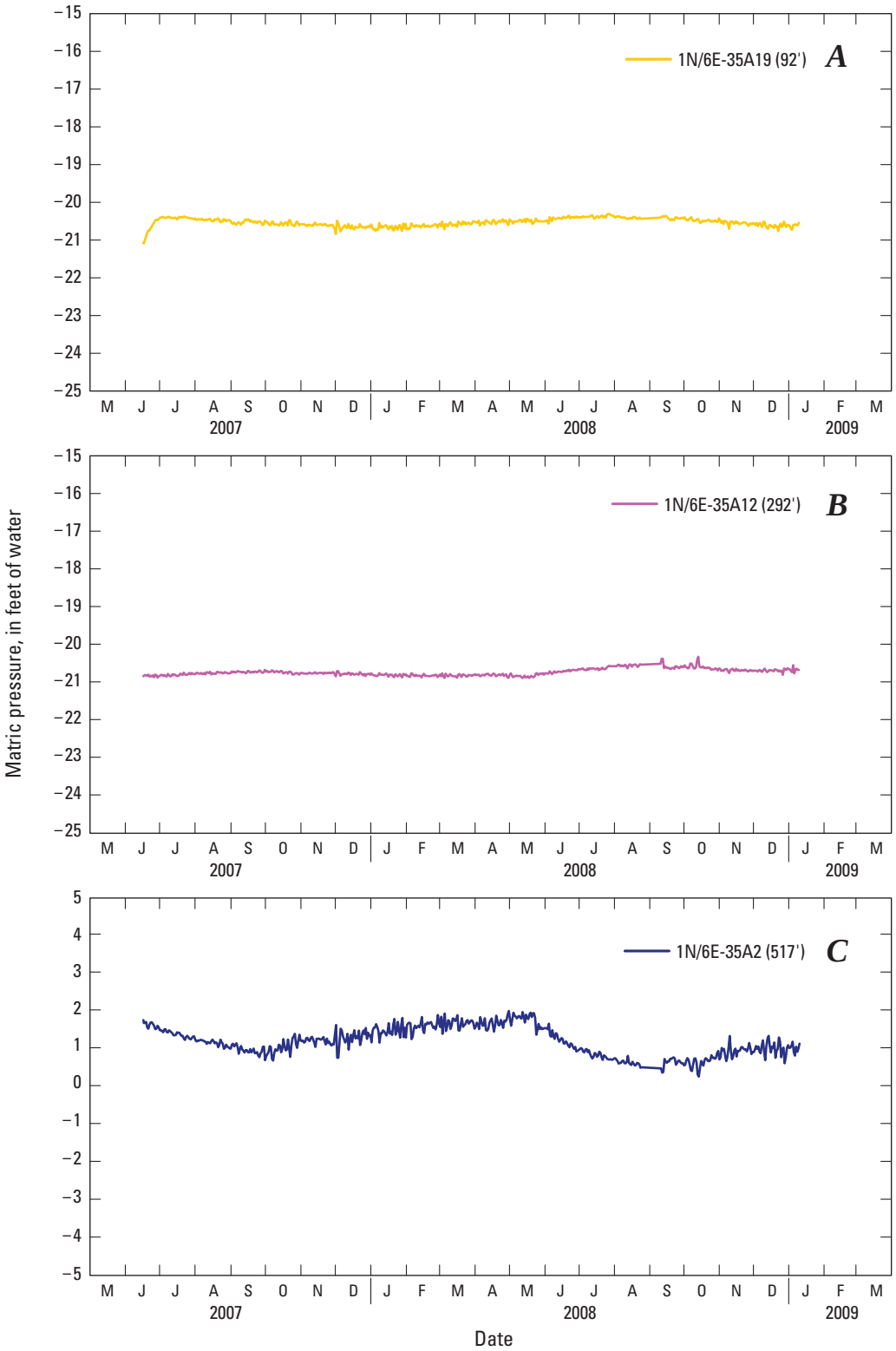


Figure 20. Matric-potential data collected at site JTUZ-1 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 by advanced tensiometers: *A*, 1N/6E-35A2; *B*, 1N/6E-35A12; and *C*, 1N/6E-35A19. Data available online at *http://waterdata.usgs.gov/nwis*.

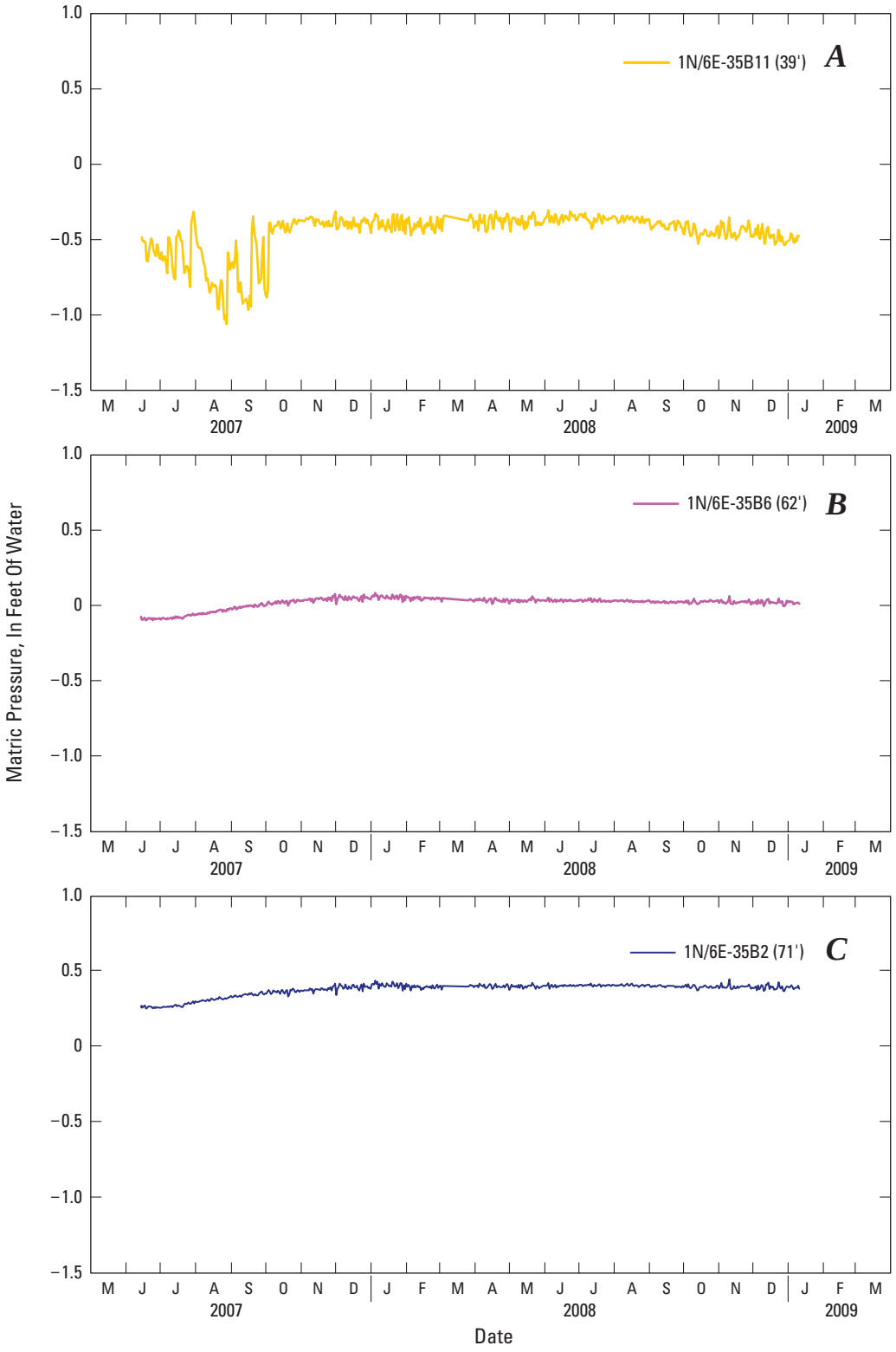


Figure 21. Temperatures measured at site JTUZ-1 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 by advanced tensiometers: A, 1N/6E-35A2; B, 1N/6E-35A12; and C, 1N/6E-35A19. Data available online at *http://waterdata.usgs.gov/nwis*.

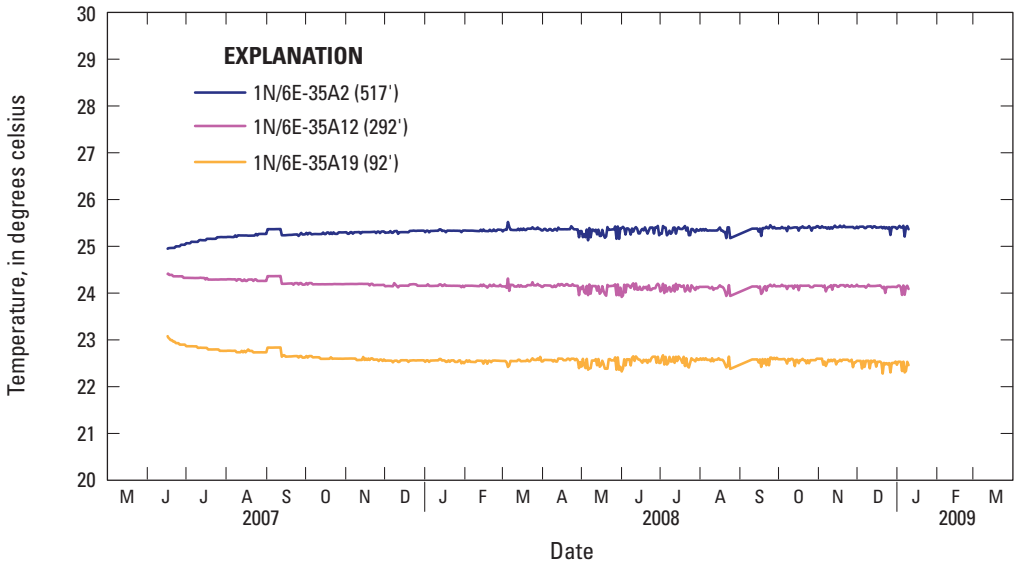


Figure 22. Temperatures measured at site JTUZ-1 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 by advanced tensiometers. Data available online at *http://waterdata.usgs.gov/nwis*.

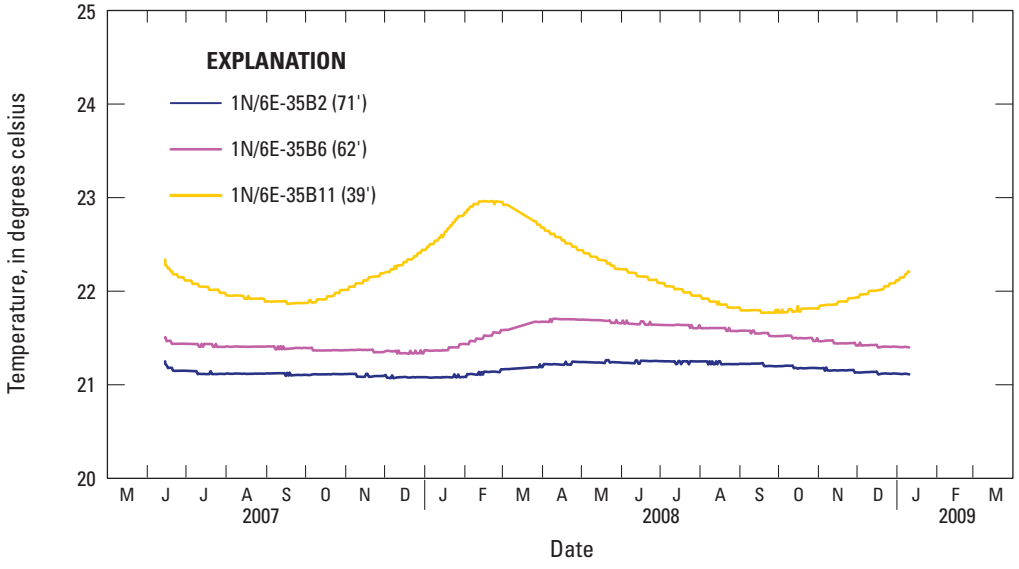


Figure 23. Temperatures measured at site JTUZ-2 in Joshua Tree, San Bernardino County, California, July 2007 to September 2009 by advanced tensiometers; Data available online at http://waterdata.usgs.gov/nwis.

Geochemical Data

The chemical composition of unsaturated-zone cores and cuttings were analyzed. The chemical and isotopic composition of groundwater, collected from the well installed just below the water table in JTUZ-1, and unsaturated-zone water, collected by suction-cup lysimeters, was analyzed. Unsaturated-zone gases were analyzed for chemical composition. Geochemical data from JTUZ-3 and JTUZ-4 were not available at the time of publication and are not presented in this report.

Chemistry of Leachate from Cores and Cuttings

Water extracted from core and drill-cutting materials was analyzed for soluble anions including fluoride, sulfate, bromide, chloride, nitrate, nitrite, and orthophosphate. For each core selected for analysis, the material analyzed came from the nose cone of the core. Water-extractable chloride can be used to calculate the length of time since recharge at the site has taken place, by using an estimated chloride concentration for the incoming rainfall (Izbicki and others, 2002). Nitrate concentrations can be used to calculate the mass of nitrate in the subsurface that can be mobilized as a result of artificial or natural recharge.

Concentrations of soluble anions in the soil and dissolved in soil water were determined by analyzing leachate extracted from sediment samples with distilled water. Before extraction, core material and cuttings were dried in an oven at 70°C for 12 hours then sieved to obtain 50 (±0.005) g of material having a particle size less than 1.4 millimeters (mm). The sieved sample was mixed with 50 milliliters (mL) of de-ionized water, shaken vigorously on a wrist shaker for 24 hours, and centrifuged at 5,000 revolutions per minute (rpm) for 1 hour to allow the remaining solids to settle. The supernatant was pressure filtered, by using a syringe, through a 0.45-mm pore-sized disk-filter. The first 10 mL of sample was used to rinse the filter and was discarded. The remaining sample was filtered and analyzed for soluble anions (fluoride, sulfate, bromide, chloride, nitrate, nitrite, and orthophosphate) at the USGS San Diego Water Quality Laboratory by using the ion chromatography method (U.S. Environmental Protection Agency, 1993). Sample handling and extraction procedures were similar to those used by Prudic (1994), except in this study the ratio of core material to distilled water was greater and the samples were centrifuged before filtration and analysis. The samples were centrifuged prior to filtration to remove fine-grained/colloidal material that would have impeded filtration. The ratio of cutting/core material to distilled water used for laboratory extractions was based on a weight per volume ratio, whereas the ratio used in the field for specific-conductance measurements was based on a volume per volume ratio. However, the results are believed to be comparable (Izbicki and others, 2000). The ratio of solid to water in the method used for this analysis allows for easy conversion from milligrams per liter in the extractant to milligrams per kilogram in the alluvium. Concentrations of soluble anions in leachate water extracted from cuttings and cores are given in *table 10* for JTUZ-1 and *table 11* for JTUZ-2.

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May 2007.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
5.5	6.5	239	–	4.9	<0.5	<0.5	<0.06	<0.030	<0.500
6.5	7.5	189	–	87.0	<0.5	3.6	<0.06	E0.020	<0.500
7.5	8.5	169	–	50.0	1.4	<2.0	0.31	0.170	<0.500
9.5	10.5	165	–	34.0	1.7	<0.5	0.28	0.050	<0.500
10.5	11.5	131	–	50.0	1.6	<2.0	0.59	E0.020	<0.500
11.5	12.5	118	–	30.0	0.3	<1.0	1.26	E0.010	<0.500
12.5	13.5	108	–	16.0	<0.5	<2.0	1.23	E0.020	<0.500
13.5	14.5	141	–	18.0	<0.5	<0.5	1.68	E0.020	<0.500
14.5	15.5	102	–	13.0	<0.5	<2.0	2.12	0.040	<0.500
15.5	16.5	104	–	15.0	<0.5	<2.0	2.39	0.030	<0.500
16.5	17.5	86	–	9.0	<0.5	<2.0	1.68	E0.010	<0.500
17.5	18.5	106	–	9.2	<0.5	<0.5	1.34	0.040	E0.300
18.5	19.5	128	–	11.0	<0.5	<0.5	1.09	E0.020	<0.500
19.5	20.5	90	–	11.0	<0.5	<0.5	0.31	<0.030	<0.500
20.5	21.5	114	–	8.2	<0.5	E0.4	0.09	E0.010	<0.500
21.5	22.5	109	–	10.0	<0.5	<0.5	<0.06	<0.030	E0.300
22.5	23.5	117	–	14.0	<0.5	<0.5	<0.06	<0.030	<0.500
23.5	24.5	88	–	11.0	<0.5	<0.5	<0.06	<0.030	<0.500
24.5	25.5	87	–	11.0	<0.5	<0.5	<0.06	<0.030	E0.300
25.5	26.5	97	–	18.0	<0.5	<0.5	0.89	<0.030	<0.500
26.5	27.5	94	–	10.0	<0.5	<0.5	1.13	<0.030	<0.500
27.5	28.5	98	–	11.0	<0.5	<0.5	1.24	<0.030	<0.500
28.5	29.5	102	–	9.8	<0.5	<0.5	0.98	<0.030	<0.500
29.5	30.5	101	–	11.0	<0.5	<0.5	1.04	<0.030	<0.500
30.5	31.5	97	–	10.0	<0.5	<0.5	<0.06	E0.010	<0.500
31.5	32.5	90	–	9.8	<0.5	<0.5	2.38	<0.030	<0.500
32.5	33.5	73	–	7.8	<0.5	<0.5	0.09	<0.030	<0.500
33.5	34.5	82	–	8.8	<0.5	<0.5	2.32	<0.030	<0.500
34.5	35.5	100	–	13.0	<0.5	<0.5	2.58	<0.030	E0.300
35.5	36.5	83	–	20.0	<0.5	<0.5	2.12	<0.030	<0.500
36.5	37.5	87	–	16.0	<0.5	<0.5	<0.06	<0.030	<0.500
37.5	38.5	91	–	19.0	<0.5	<0.5	2.66	<0.030	E0.400
38.5	39.5	86	–	29.0	<0.5	<0.5	1.81	<0.030	<0.500
39.5	40.5	110	–	41.0	<0.5	<1.0	2.81	<0.030	<0.500
40.5	41.5	99	–	43.0	<0.5	1.2	3.30	<0.030	<0.500
41.5	42.5	119	–	42.0	<0.5	<0.5	0.38	E0.010	<0.500
42.5	43.5	145	–	53.0	<0.5	E0.3	0.39	E0.010	<0.500
43.5	44.5	137	–	57.0	<0.5	<0.5	0.38	E0.010	<0.500
44.5	45.5	139	–	55.0	<0.5	<0.5	0.32	<0.030	<0.500
45.5	46.5	174	–	73.0	<0.5	<0.5	0.27	<0.030	E0.400
46.5	47.5	166	–	85.0	<0.5	<1.0	0.34	0.050	<0.500
47.5	48.5	173	–	110	<0.5	<1.0	0.25	<0.030	<0.500
48.5	49.5	164	–	110	<0.5	1.1	0.47	<0.030	<0.500
49.5	50.5	172	–	94.0	<0.5	2.6	0.58	<0.030	<0.500
50.5	51.5	181	–	79.0	<0.5	4.9	0.53	E0.010	<0.500
51.5	52.5	244	–	90.0	<0.5	7.7	1.28	E0.010	<0.500
52.5	53.5	204	–	81.0	E0.1	20.0	4.95	E0.010	<0.500

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
53.5	54.5	245	–	88.0	E0.1	33.0	8.97	E0.010	<0.500
54.5	55.5	233	–	82.0	E0.1	32.0	9.35	<0.030	<0.500
55.5	56.5	234	–	66.0	E0.2	41.0	14.6	E0.010	<0.500
56.5	57.5	184	–	72.0	E0.1	33.0	10.9	<0.030	<0.500
57.5	58.5	168	–	65.0	E0.1	19.0	6.13	E0.010	<0.500
58.5	59.5	196	–	66.0	E0.1	19.0	6.28	E0.010	<0.500
59.5	60.5	–	–	67.0	E0.1	19.0	6.41	<0.030	<0.500
62.5	63.5	204	–	47.0	E0.1	21.0	7.06	E0.010	<0.500
63.5	64.5	220	–	62.0	E0.1	25.0	7.04	<0.030	<0.500
64.0	65.0	–	–	57.0	E0.1	22.0	0.93	0.400	<0.500
64.5	65.5	228	–	56.0	E0.1	20.0	5.51	E0.020	<0.500
65.5	66.5	224	–	53.0	E0.1	22.0	5.87	<0.030	<0.500
66.5	67.5	258	–	67.0	E0.1	29.0	7.72	<0.030	<0.500
67.5	68.5	355	–	51.0	<0.5	28.0	6.91	<0.030	<0.500
68.5	69.5	213	–	66.0	<0.5	38.0	9.89	<0.030	<0.500
69.5	70.5	219	–	56.0	<0.5	41.0	11.4	<0.030	<0.500
70.5	71.5	343	–	56.0	<0.5	42.0	11.6	<0.030	<0.500
71.5	72.5	277	–	67.0	<0.5	55.0	14.8	<0.030	<0.500
72.5	73.5	305	–	55.0	<0.5	47.0	12.8	<0.030	<0.500
73.5	74.5	259	–	45.0	<0.5	42.0	11.4	<0.030	<0.500
74.5	75.5	324	–	56.0	<0.5	50.0	13.4	<0.030	<0.500
75.5	76.5	375	–	47.0	<0.5	57.0	16.6	<0.030	<0.500
76.5	77.5	426	–	67.0	E0.2	73.0	26.1	<0.030	<1.00
77.5	78.5	544	–	97.0	0.3	110	39.2	<0.030	<1.00
78.5	79.5	482	–	120	0.3	130	46.0	<0.030	<1.00
79.5	80.5	487	–	93.0	0.4	12.0	5.39	E0.010	<0.500
80.5	81.5	423	–	74.0	0.4	95.0	34.6	E0.010	<0.500
81.5	82.5	420	–	68.0	0.4	98.0	36.3	E0.020	<1.00
82.5	83.5	292	–	52.0	0.3	88.0	42.9	E0.010	<1.00
83.5	84.5	353	–	46.0	0.3	73.0	35.7	<0.030	<1.00
84.5	85.5	499	–	58.0	0.3	90.0	44.2	E0.010	<1.00
85.5	86.5	376	–	52.0	0.4	84.0	45.0	E0.010	<1.00
86.5	87.5	384	–	43.0	0.3	63.0	34.3	E0.010	<1.00
87.5	88.5	425	–	56.0	0.3	71.0	39.3	E0.010	<1.00
88.5	89.5	286	–	43.0	0.3	67.0	37.7	E0.010	<1.00
89.5	90.5	342	–	32.0	0.3	58.0	33.9	E0.010	<0.500
90.5	91.5	408	–	34.0	E0.2	52.0	31.0	E0.010	<0.500
91.5	92.5	292	–	36.0	0.3	73.0	42.0	E0.010	<0.500
92.5	93.5	494	–	5.3	0.3	18.0	12.4	E0.010	<0.500
93.5	94.5	221	–	48.0	0.3	104	60.8	E0.010	<0.500
94.5	95.5	229	–	26.0	E0.1	37.0	32.2	<0.030	<0.500
95.5	96.5	–	–	51.0	E0.2	47.0	29.8	E0.010	<0.500
96.5	97.5	208	–	39.0	E0.1	33.0	20.8	<0.030	1.80
97.5	98.5	123	–	23.0	E0.1	22.0	11.8	<0.030	<0.500
98.5	99.5	127	–	22.0	<0.5	21.0	11.0	E0.010	<0.500
99.5	100.5	150	–	35.0	E0.1	20.0	11.2	E0.010	<0.500
100.5	101.5	112	–	12.0	<0.5	6.1	3.91	<0.030	E0.300

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
101.5	102.5	98	–	9.4	<0.5	6.6	3.99	<0.030	<0.500
102.5	103.5	141	–	7.6	<1	4.3	2.71	<0.030	<0.500
103.5	104.5	122	–	6.7	<1	3.4	2.46	E0.010	<0.500
104.5	105.5	103	–	8.9	<1	3.6	2.69	<0.030	<0.500
105.5	106.5	108	–	11.0	<0.5	4.5	2.17	<0.030	<0.500
106.5	107.5	84	–	7.7	<0.5	3.7	2.12	E0.010	<0.500
107.5	108.5	64	–	6.5	<0.5	3.2	1.50	E0.020	<0.500
108.5	109.5	67	–	6.6	<0.5	3.7	1.74	E0.010	<0.500
109.5	110.5	75	–	7.1	<0.5	4.4	1.46	0.080	<0.500
110.5	111.5	83	–	13.0	<0.5	3.7	1.72	0.030	<0.500
111.5	112.5	68	–	8.2	<0.5	2.5	1.16	0.060	<0.500
112.5	113.5	78	–	10.0	<0.5	3.0	1.52	E0.020	<0.500
113.5	114.5	93	–	11.0	<0.5	4.1	1.70	0.120	<0.500
114.5	115.5	80	–	8.9	<0.5	2.6	1.16	0.050	<0.500
115.5	116.5	86	–	11.0	<0.5	5.2	1.47	0.080	E0.300
116.5	117.5	80	–	13.0	<0.5	5.6	2.14	E0.020	E0.400
117.5	118.5	72	–	11.0	<0.5	5.1	1.46	0.100	E0.300
118.5	119.5	72	–	11.0	<0.5	4.7	0.12	0.040	E0.300
119.5	120.5	121	–	16.0	<0.5	5.0	1.08	0.340	E0.300
120.5	121.5	106	–	22.0	<0.5	6.8	–	0.030	E0.300
121.5	122.5	103	–	19.0	<0.5	6.8	3.91	E0.010	E0.300
122.5	123.5	80	–	18.0	E0.1	8.8	–	0.310	E0.300
123.5	124.5	70	–	12.0	<0.5	5.2	1.79	0.040	E0.400
124.5	125.5	54	–	11.0	E0.1	5.1	–	0.040	E0.300
125.5	126.5	64	–	3.6	<0.5	5.9	0.40	E0.010	<0.500
126.5	127.5	78	–	10.0	<0.5	4.6	1.06	0.030	E0.300
127.5	128.5	91	0.27	27.2	E0.03	7.4	3.86	0.046	E0.038
128.5	129.5	84	0.38	23.9	0.07	6.4	3.76	E0.016	0.072
129.5	130.5	81	0.31	16.8	0.09	5.3	2.54	E0.029	0.099
130.5	131.5	88	0.31	16.3	E0.02	5.1	2.93	E0.022	0.055
132.5	133.5	81	–	10.0	<0.5	3.6	–	E0.010	<0.500
133.5	134.5	100	–	12.0	<0.5	5.2	3.84	E0.020	<0.500
134.5	135.5	83	–	14.0	<0.5	6.5	–	0.390	<0.500
135.5	136.5	74	–	6.3	<0.5	3.9	–	0.130	<0.500
136.5	137.5	92	–	6.4	<0.5	4.5	–	0.060	<0.500
137.5	138.5	85	–	8.9	E0.1	5.3	1.73	E0.020	<0.500
138.5	139.5	110	–	7.4	<0.5	5.5	–	0.040	<0.500
139.5	140.5	124	–	12.0	<0.5	3.7	–	0.300	<0.500
140.5	141.5	105	–	11.0	<0.5	2.4	–	0.090	<0.500
141.5	142.5	132	–	13.0	<0.5	4.1	–	<0.030	<0.500
142.5	143.5	111	–	11.0	E0.1	6.5	0.85	0.030	E0.300
143.5	144.5	144	–	14.0	E0.1	7.2	–	0.390	E0.300
144.5	145.5	95	–	22.0	E0.1	11.0	5.17	0.170	0.600
145.5	146.5	91	–	9.3	–	5.9	–	0.060	<0.500
146.5	147.5	72	–	8.6	E0.1	8.0	3.28	0.070	E0.300
147.5	148.5	102	–	5.3	E0.1	6.1	–	0.200	<0.500
148.5	149.5	100	–	8.0	E0.1	7.3	2.25	0.170	E0.300

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
149.5	150.5	140	–	10.0	E0.1	8.1	3.49	0.280	E0.300
150.5	151.5	143	–	8.3	E0.1	8.9	5.68	<0.010	E0.300
151.5	152.5	120	–	8.2	E0.1	9.6	6.23	0.110	E0.300
152.5	153.5	139	–	11.0	E0.1	12.0	8.38	<0.010	<0.500
153.5	154.5	104	–	9.6	E0.1	9.8	6.45	E0.010	E0.300
154.5	155.5	106	–	11.0	E0.1	8.1	4.84	E0.010	E0.300
155.5	156.5	97	–	14.0	E0.1	7.6	–	E0.010	E0.300
156.5	157.5	80	–	14.0	E0.1	7.4	–	E0.010	E0.300
157.5	158.5	78	–	22.0	E0.1	8.9	–	E0.010	0.600
158.5	159.5	71	–	17.0	E0.1	8.9	–	E0.010	E0.300
159.5	160.5	79	–	14.0	E0.1	9.3	–	E0.010	E0.300
160.5	161.5	60	–	12.0	<0.5	7.6	4.99	E0.010	E0.300
161.5	162.5	150	–	8.0	<0.5	5.6	–	0.030	E0.300
162.5	163.5	140	–	9.4	<0.5	6.3	–	0.040	<0.500
163.5	164.5	164	–	11.0	<0.5	5.0	–	E0.010	E0.300
164.5	165.5	133	–	17.0	E0.1	8.8	–	E0.010	E0.300
165.5	166.5	85	–	15.0	E0.1	7.8	–	E0.010	E0.300
166.5	167.5	73	–	10.0	<0.5	5.4	3.42	<0.030	E0.300
167.5	168.5	95	–	13.0	E0.1	7.8	–	E0.010	<0.500
168.5	169.5	116	–	19.0	E0.1	10.0	–	E0.010	<0.500
169.5	170.5	100	–	16.0	E0.1	8.8	–	E0.010	<0.500
170.5	171.5	72	–	14.0	<0.5	7.1	–	E0.010	<0.500
171.5	172.5	81	–	11.0	<0.5	5.0	–	E0.010	E0.300
172.5	173.5	90	–	12.0	<0.5	5.2	3.33	<0.030	E0.300
173.5	174.5	91	–	17.0	<0.5	8.7	–	E0.010	<0.500
174.5	175.5	73	–	25.0	E0.1	11.0	–	E0.010	E0.300
175.5	176.5	82	–	10.0	–	6.7	–	<0.030	<0.500
176.5	177.5	92	–	14.0	–	6.8	–	E0.010	<0.500
177.5	178.5	104	0.21	17.1	0.06	7.3	4.87	E0.052	E0.032
178.5	179.5	96	0.37	19.3	0.06	7.9	5.66	E0.040	0.051
179.5	180.5	81	0.19	20.8	0.07	8.5	6.00	E0.048	E0.049
180.5	181.5	108	0.26	21.9	0.07	8.1	5.41	E0.047	E0.027
181.5	182.5	86	0.83	14.9	0.05	5.4	2.75	E0.014	E0.015
182.5	183.5	99	0.87	37.1	0.08	7.8	0.97	E0.017	E0.037
183.5	184.5	70	0.62	10.3	E0.04	4.9	2.93	E0.022	<0.050
184.5	185.5	111	0.58	12.8	E0.05	6.0	4.00	E0.022	E0.021
185.5	186.5	139	0.52	15.4	0.07	6.8	4.20	0.101	E0.027
186.5	187.5	62	0.35	12.6	E0.05	6.3	4.26	E0.043	E0.028
187.5	188.5	95	0.27	17.7	0.08	10.5	7.60	E0.032	E0.036
188.5	189.5	127	0.31	17.8	0.10	11.5	7.95	E0.016	<0.050
189.5	190.5	125	0.49	17.0	0.07	8.8	6.16	E0.036	0.051
190.5	191.5	100	0.60	11.0	E0.05	6.4	4.05	E0.027	E0.021
191.5	192.5	149	0.49	16.0	0.07	6.0	3.96	E0.029	E0.025
192.5	193.5	125	1.20	12.4	0.06	4.3	2.94	E0.020	E0.031
193.5	194.5	115	0.87	11.7	E0.05	3.8	2.25	0.106	E0.024
194.5	195.5	114	1.31	9.9	E0.05	5.2	3.72	E0.034	E0.028
195.5	196.5	102	0.55	10.4	E0.05	4.8	3.33	E0.039	E0.028

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
196.5	197.5	96	0.57	15.5	0.05	6.3	4.22	E0.034	E0.022
197.5	198.5	100	0.45	12.2	E0.05	5.4	3.50	E0.054	E0.020
198.5	199.5	108	0.30	11.2	E0.05	5.6	3.78	E0.049	<0.050
199.5	200.5	107	0.29	13.7	E0.05	6.0	4.28	E0.023	E0.019
200.5	201.5	88	0.28	12.7	0.07	5.8	3.93	E0.016	E0.023
202.0	203.0	–	0.29	10.8	E0.05	5.8	0.06	E0.014	<0.050
202.5	203.5	158	0.42	14.3	0.07	7.8	3.63	E0.036	E0.023
203.5	204.5	128	0.44	10.2	E0.04	5.4	2.72	E0.014	0.060
204.5	205.5	117	0.43	10.0	E0.04	5.3	2.95	E0.015	E0.042
205.5	206.5	144	0.42	11.4	0.06	5.9	3.83	E0.023	E0.039
206.5	207.5	138	0.41	11.5	E0.05	6.1	3.69	E0.014	E0.036
207.5	208.5	126	0.50	7.7	E0.05	4.8	3.24	0.055	E0.040
208.5	209.5	164	0.52	9.2	E0.05	5.5	3.82	E0.039	E0.019
209.5	210.5	122	0.35	8.0	E0.05	6.0	4.01	0.058	E0.044
210.5	211.5	68	0.32	6.5	E0.05	5.4	3.86	E0.016	0.085
211.5	212.5	120	0.35	5.7	E0.04	4.9	3.32	0.087	0.056
212.5	213.5	88	0.30	6.9	E0.05	5.9	3.35	0.065	0.059
213.5	214.5	79	0.48	5.4	E0.04	4.3	2.76	E0.015	0.140
214.5	215.5	79	0.52	4.4	E0.03	3.2	2.05	E0.014	0.136
215.5	216.5	76	0.50	6.0	E0.03	3.9	2.44	E0.042	0.136
216.5	217.5	54	0.52	6.2	E0.04	4.3	2.98	E0.033	0.166
217.5	218.5	57	0.45	5.9	E0.04	4.0	2.66	0.081	0.208
218.5	219.5	88	0.28	4.0	E0.04	3.6	2.30	E0.026	0.153
219.5	220.5	77	0.37	3.3	E0.04	3.9	2.03	E0.022	0.149
220.5	221.5	65	0.48	3.4	E0.04	4.3	2.37	E0.020	0.180
222.5	223.5	43	–	4.0	<1	4.6	2.77	<0.030	0.500
223.5	224.5	68	–	E2.7	<1	3.2	1.55	<0.030	0.500
224.5	225.5	58	–	3.0	<0.5	4.0	1.98	<0.030	E0.400
225.5	226.5	65	0.97	2.4	E0.04	3.6	1.58	E0.015	0.484
226.5	227.5	72	0.88	2.4	E0.04	3.7	1.25	E0.013	0.644
227.5	228.5	81	0.80	2.5	E0.04	3.9	1.10	E0.014	0.349
228.5	229.5	86	0.50	2.0	E0.03	2.5	0.31	E0.025	0.340
229.5	230.5	80	1.03	8.6	E0.04	3.7	0.59	E0.015	0.293
230.5	231.5	61	1.18	3.1	E0.04	3.2	0.48	E0.023	0.537
231.5	232.5	109	0.44	3.5	E0.03	4.1	0.16	E0.024	0.121
232.5	233.5	72	0.58	3.3	E0.04	3.9	0.39	E0.021	0.142
233.5	234.5	56	0.41	3.2	E0.03	4.0	0.54	E0.028	0.227
234.5	235.5	85	0.71	3.3	E0.05	4.8	0.06	<0.050	0.242
236.5	237.5	112	0.34	2.6	E0.04	4.3	E0.05	<0.050	0.117
238.5	239.5	65	1.12	3.5	0.05	5.5	0.45	E0.024	0.351
239.5	240.5	67	1.28	3.3	E0.04	4.4	0.06	E0.013	0.470
241.5	242.5	95	0.71	2.9	E0.04	4.1	E0.05	<0.050	0.227
243.5	244.5	77	–	3.6	<0.5	4.4	0.97	<0.030	E0.300
244.5	245.5	88	–	5.0	<0.5	4.3	–	<0.030	E0.300
245.5	246.5	85	–	3.6	–	4.2	–	E0.010	E0.400
246.5	247.5	72	–	3.3	–	4.1	–	E0.010	E0.300
247.5	248.5	71	–	3.0	<0.5	3.7	–	<0.030	E0.300

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
248.5	249.5	40	–	3.3	<0.5	4.4	0.60	E0.010	<0.500
249.5	250.5	57	0.57	2.7	E0.05	4.2	E0.05	<0.050	0.061
250.5	251.5	59	0.65	2.3	E0.04	3.6	0.06	<0.050	0.156
251.5	252.5	55	0.56	2.5	E0.04	4.0	0.07	<0.050	E0.029
253.5	254.5	70	–	3.0	–	4.0	–	<0.030	<0.500
254.5	255.5	65	–	3.0	<0.5	3.4	0.89	<0.030	E0.300
255.5	256.5	50	–	E2.8	<0.5	3.7	–	E0.010	<0.500
256.5	257.5	82	–	E1.8	<0.5	5.3	0.87	E0.010	E0.300
257.5	258.5	58	0.70	2.1	E0.04	3.4	E0.05	<0.050	0.095
258.5	259.5	54	0.28	2.1	E0.04	3.5	0.06	<0.050	0.082
259.5	260.5	74	0.49	2.8	0.05	5.3	E0.05	<0.050	E0.019
261.5	262.5	–	0.51	2.6	E0.03	2.7	E0.05	<0.050	0.073
263.5	264.5	73	–	3.6	<0.5	3.7	–	E0.010	<0.500
264.5	265.5	82	–	3.4	<0.5	4.0	–	E0.020	<0.500
265.5	266.5	96	–	3.3	<0.5	3.8	–	E0.010	<0.500
266.5	267.5	57	–	3.3	<0.5	4.0	–	0.040	<0.500
267.5	268.5	51	–	3.5	<0.5	4.2	0.88	E0.010	<0.500
268.5	269.5	78	–	3.2	<0.5	3.9	–	E0.010	<0.500
269.5	270.5	66	0.61	2.6	E0.05	5.1	1.10	0.064	E0.021
271.5	272.5	88	0.54	E1.9	0.06	4.4	2.07	E0.051	0.152
272.5	273.5	81	0.60	E1.9	0.06	5.2	2.11	0.074	0.154
273.5	274.5	111	0.53	1.9	E0.05	5.2	2.56	E0.041	0.111
274.5	275.5	80	0.56	2.4	0.08	7.8	4.04	0.112	0.065
276.5	277.5	95	0.78	3.8	0.08	8.6	3.59	0.068	E0.017
277.5	278.5	83	0.64	4.1	0.07	8.6	3.73	0.084	E0.043
278.5	279.5	80	0.87	3.6	0.07	9.0	3.66	0.110	0.083
279.5	280.5	84	0.49	3.6	0.07	8.9	3.73	E0.040	<0.050
280.5	281.5	96	0.65	4.0	E0.05	6.3	2.05	0.152	E0.019
281.5	282.5	67	0.58	5.9	E0.04	5.5	2.24	E0.040	E0.070
282.5	283.5	81	0.66	6.1	E0.04	5.3	2.00	0.050	0.145
283.5	284.5	84	0.64	4.9	E0.03	4.0	1.16	0.089	0.178
285.5	286.5	113	0.95	10.1	E0.04	6.9	2.64	0.060	E0.045
287.5	288.5	120	–	12.0	<0.5	8.7	3.97	<0.030	E0.300
288.5	289.5	148	–	11.0	<0.5	7.7	–	<0.030	E0.300
289.5	290.5	163	–	16.0	E0.1	13.0	5.74	<0.030	0.600
290.5	291.5	147	–	11.0	<0.5	9.1	3.85	<0.030	E0.300
291.5	292.5	132	–	11.0	<0.5	9.9	3.80	<0.030	E0.300
292.5	293.5	149	0.80	12.4	E0.05	8.9	4.69	E0.014	E0.034
293.5	294.5	91	0.84	7.3	E0.04	6.3	3.49	E0.015	0.087
294.5	295.5	79	1.03	5.9	E0.02	3.2	1.22	E0.032	0.098
295.5	296.5	77	1.06	7.4	E0.04	5.4	2.80	E0.027	0.096
296.5	297.5	98	1.01	6.9	E0.04	4.6	1.67	E0.027	E0.042
297.5	298.5	111	1.15	8.5	E0.03	5.2	2.24	E0.016	E0.032
298.5	299.5	107	1.18	9.4	E0.04	5.6	2.29	E0.018	E0.030
299.5	300.5	125	1.10	12.2	E0.03	6.1	2.79	E0.013	E0.023
300.5	301.5	94	1.08	10.7	E0.05	7.4	2.63	E0.015	E0.020
302.5	303.5	66	0.99	12.3	E0.033	8.6	3.05	E0.016	E0.046

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
303.0	304.0	–	1.09	11.4	E0.05	8.5	0.07	<0.050	<0.050
303.5	304.5	97	1.56	11.9	E0.04	6.5	1.61	0.296	0.082
304.5	305.5	110	1.43	12.9	E0.03	7.5	3.13	E0.015	E0.018
305.5	306.5	104	1.34	10.9	E0.03	6.2	2.67	E0.016	<0.050
306.5	307.5	75	1.39	7.3	E0.02	4.5	1.87	E0.027	0.093
307.5	308.5	66	1.23	8.0	E0.03	4.9	2.08	E0.023	0.056
308.5	309.5	92	1.45	9.5	E0.03	5.2	2.12	0.094	E0.041
309.5	310.5	75	1.32	10.7	E0.03	6.0	2.07	0.065	0.061
310.5	311.5	83	0.68	10.1	E0.03	5.9	1.86	E0.048	0.053
311.5	312.5	43	1.35	10.5	E0.03	4.6	0.91	E0.040	E0.080
312.5	313.5	71	1.65	15.4	E0.03	5.9	3.55	E0.014	<0.050
313.5	314.5	102	1.32	16.6	E0.04	6.0	3.67	E0.016	E0.021
314.5	315.5	101	0.93	14.2	E0.02	5.4	3.28	E0.024	E0.036
316.5	317.5	64	0.92	15.2	E0.02	5.8	3.69	E0.017	E0.030
317.5	318.5	65	0.94	11.5	E0.02	4.1	2.51	E0.014	E0.035
318.5	319.5	75	1.48	10.9	E0.02	3.7	1.65	E0.031	E0.032
319.5	320.5	74	1.32	13.3	E0.02	4.0	2.50	<0.050	E0.027
320.5	321.5	83	0.91	15.0	E0.02	4.8	2.66	E0.015	E0.030
321.5	322.5	106	0.97	19.3	E0.02	5.3	3.20	E0.020	E0.030
322.5	323.5	72	1.02	13.2	E0.04	4.4	0.07	<0.050	0.073
323.5	324.5	74	0.92	13.7	E0.02	4.3	0.06	<1.01	0.065
324.5	325.5	48	0.58	10.4	E0.02	3.4	0.06	<2.01	0.052
325.5	326.5	52	0.71	8.3	E0.02	3.1	0.06	<3.01	<0.050
326.5	327.5	60	0.75	14.0	E0.03	5.0	0.06	<4.01	E0.023
327.5	328.5	52	1.03	9.4	<0.05	3.0	0.08	E0.015	E0.029
328.5	329.5	69	1.07	11.1	E0.03	4.5	0.06	<0.050	0.074
329.5	330.5	78	0.75	10.0	E0.03	3.7	0.06	<0.050	0.061
330.5	331.5	62	0.89	6.4	E0.02	2.7	E0.05	E0.013	<0.050
331.5	332.5	57	0.75	6.8	E0.02	2.9	E0.05	E0.013	E0.015
332.5	333.5	93	0.74	8.0	E0.03	3.5	E0.05	<0.050	E0.028
333.5	334.5	107	0.67	7.3	E0.03	3.7	0.22	E0.051	E0.038
334.5	335.5	145	1.02	9.5	E0.02	3.6	0.06	<0.050	<0.050
335.5	336.5	100	1.12	6.0	E0.02	2.9	0.25	E0.030	<0.050
336.5	337.5	70	0.92	5.0	E0.02	2.2	E0.05	<0.050	E0.024
337.5	338.5	65	0.71	4.0	E0.02	2.1	0.37	E0.039	0.053
338.5	339.5	73	1.71	5.3	E0.01	2.2	0.17	E0.015	E0.019
339.5	340.5	75	0.94	4.7	E0.01	2.2	0.96	E0.041	E0.043
340.5	341.5	72	1.09	6.4	E0.02	3.3	2.09	E0.019	0.051
341.5	342.5	53	1.25	4.1	E0.02	1.9	0.06	<0.050	0.058
342.5	343.5	76	1.10	6.2	E0.04	2.8	0.06	E0.020	0.065
343	344	–	1.08	4.3	<0.05	2.8	0.07	E0.039	<0.050
343.5	344.5	96	1.12	6.4	E0.02	2.6	E0.05	E0.036	0.064
344.5	345.5	96	1.14	8.8	E0.05	4.3	E0.05	<0.050	0.051
345.5	346.5	103	1.11	7.8	E0.04	4.5	0.06	<0.050	0.066
346.5	347.5	77	0.93	7.8	E0.03	3.9	0.06	<0.050	0.119
347.5	348.5	66	1.07	9.6	E0.02	3.7	0.06	E0.015	<0.050
348.5	349.5	91	1.04	5.3	E0.02	3.1	0.08	E0.019	<0.050

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
349.5	350.5	93	1.94	4.8	E0.02	3.0	2.40	E0.023	E0.029
350.5	351.5	61	1.85	5.2	E0.01	3.1	2.13	E0.019	E0.023
351.5	352.5	102	1.47	6.8	E0.05	3.9	3.09	E0.014	E0.016
352.5	353.5	121	1.70	6.8	E0.03	4.2	3.76	E0.016	E0.027
353.5	354.5	79	1.78	5.9	E0.03	3.7	2.70	0.148	E0.016
354.5	355.5	39	1.80	4.4	E0.02	2.6	1.64	E0.027	0.055
355.5	356.5	115	1.48	4.5	E0.02	3.0	2.05	E0.042	E0.031
356.5	357.5	76	1.59	4.8	E0.01	3.5	2.88	E0.018	E0.036
357.5	358.5	103	1.46	4.6	0.20	2.8	1.68	0.286	E0.034
358.5	359.5	93	1.46	5.3	E0.02	3.4	2.58	0.080	E0.027
359.5	360.5	105	1.56	6.4	E0.02	4.6	3.69	0.078	E0.022
360.5	361.5	102	1.80	4.9	<0.05	3.1	1.62	0.102	0.053
361.5	362.5	50	1.34	5.2	E0.02	2.6	0.78	0.058	E0.027
362.5	363.5	59	1.69	4.1	E0.02	2.6	1.58	E0.015	0.078
363.5	364.5	56	1.30	3.7	E0.02	2.3	0.99	E0.042	0.084
364.5	365.5	46	1.34	3.9	E0.02	2.4	0.97	0.152	E0.048
365.5	366.5	47	1.43	5.1	E0.02	3.7	2.39	0.060	0.054
366.5	367.5	72	1.44	3.1	E0.02	2.1	1.09	0.064	0.073
367.5	368.5	82	1.32	5.4	E0.02	4.1	2.44	0.140	E0.039
368.5	369.5	79	1.55	4.9	E0.02	3.7	2.06	0.108	E0.024
369.5	370.5	68	1.40	4.5	E0.02	3.3	1.40	0.228	<0.050
370.5	371.5	98	1.68	4.7	E0.04	3.7	2.29	E0.021	0.057
371.5	372.5	78	1.29	4.3	E0.02	3.6	1.45	E0.018	E0.045
372.5	373.5	87	1.21	4.5	E0.05	3.3	0.81	0.088	<0.050
373.5	374.5	78	1.23	4.5	E0.02	3.5	0.70	0.542	E0.021
374.5	375.5	81	1.13	5.0	E0.02	3.7	0.92	0.122	<0.050
375.5	376.5	85	1.11	5.5	E0.05	4.1	0.91	0.127	<0.050
376.5	377.5	44	1.37	4.3	E0.04	2.9	0.50	0.115	<0.050
377.5	378.5	54	2.93	4.7	0.07	3.3	E0.04	E0.013	0.070
378.5	379.5	66	3.80	4.5	E0.04	3.2	0.87	E0.016	0.203
379.5	380.5	72	5.00	5.2	E0.05	3.8	1.04	E0.015	0.262
380.5	381.5	76	4.20	4.9	E0.03	3.5	0.98	0.072	0.150
381.5	382.5	110	2.94	11.2	E0.02	4.6	0.06	E0.014	0.057
382.5	383.5	96	3.36	7.0	E0.02	3.8	0.92	E0.017	0.125
383.5	384.5	75	1.30	4.9	E0.03	3.5	0.71	E0.015	<0.050
384.5	385.5	80	1.35	5.4	E0.03	3.9	0.47	0.153	0.090
385.5	386.5	54	0.81	4.3	E0.02	3.2	0.42	E0.042	E0.032
386.5	387.5	54	1.60	4.1	E0.02	3.1	0.36	0.127	0.111
387.5	388.5	65	1.26	3.8	E0.02	2.9	0.30	0.035	<0.050
388.5	389.5	92	1.20	5.3	E0.03	4.4	0.40	0.156	0.056
389.5	390.5	87	1.03	5.0	E0.03	5.5	E0.05	0.930	0.074
390.5	391.5	116	1.27	4.0	0.06	5.1	0.59	0.512	E0.043
391.5	392.5	76	1.22	2.4	E0.04	4.1	0.07	0.596	E0.017
392.5	393.5	73	1.28	2.1	E0.03	3.7	E0.05	0.325	0.059
393.5	394.5	50	1.40	2.0	E0.03	3.5	0.66	E0.042	0.156
394.5	395.5	48	1.20	2.0	E0.03	3.7	E0.05	E0.013	0.067
395.5	396.5	51	1.04	2.3	E0.03	3.6	E0.04	<0.050	E0.029

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
396.5	397.5	40	1.15	2.0	E0.03	3.4	0.52	0.075	0.074
397.5	398.5	65	1.06	2.1	E0.03	3.7	0.24	0.076	E0.029
398.5	399.5	54	1.28	2.0	E0.03	3.3	0.09	E0.029	0.069
399.5	400.5	62	1.32	2.1	E0.04	3.7	0.24	<0.050	0.098
400.5	401.5	63	1.43	2.3	E0.04	4.0	0.12	<0.050	0.065
401.5	402.5	76	0.79	3.8	E0.04	3.9	E0.04	<0.050	E0.015
402.5	403.5	65	0.85	E1.9	E0.03	2.7	0.07	<0.050	E0.044
403.5	404.5	45	0.76	E1.9	E0.03	3.0	E0.05	<0.050	E0.040
404.5	405.5	62	1.02	E1.7	E0.03	2.7	E0.05	<0.050	0.084
405.5	406.5	68	1.06	E1.7	E0.03	2.4	0.06	<0.050	0.098
406.5	407.5	49	1.36	2.2	E0.06	2.9	E0.05	<0.050	0.103
407.5	408.5	41	1.21	2.8	E0.03	2.3	E0.05	<0.050	0.070
408.5	409.5	37	0.98	E1.7	E0.02	1.7	E0.05	0.013	0.082
409.5	410.5	33	1.00	E1.7	E0.03	1.7	E0.05	<0.050	0.095
410.5	411.5	36	1.02	E1.7	E0.02	1.6	E0.05	<0.050	0.111
411.5	412.5	43	1.12	E1.9	E0.03	1.6	E0.04	<0.050	0.086
412.5	413.5	33	1.30	E1.8	E0.02	1.4	0.07	<0.050	0.236
413.5	414.5	40	1.57	2.1	E0.02	1.8	E0.05	<0.050	0.140
414.5	415.5	49	0.99	E1.9	E0.02	1.5	E0.05	<0.050	0.207
415.5	416.5	42	1.22	E1.9	E0.02	1.5	E0.05	E0.014	0.145
416.5	417.5	40	1.38	2.0	E0.02	1.8	0.21	E0.014	0.202
417.5	418.5	39	1.32	E1.7	E0.02	1.3	E0.05	E0.015	0.333
418.5	419.5	41	1.60	2.0	E0.02	1.6	0.12	E0.019	0.227
419.5	420.5	31	1.45	E1.7	E0.02	1.6	0.13	E0.019	0.269
420.5	421.5	33	1.28	E1.7	E0.02	1.5	0.14	E0.017	0.185
421.5	422.5	30	1.42	3.3	E0.02	1.9	0.06	E0.014	0.094
422.5	423.5	65	1.37	2.8	E0.02	1.9	E0.05	<0.050	0.079
423	424	–	0.75	E1.7	E0.02	1.8	E0.05	<0.050	E0.045
423.5	424.5	61	1.36	2.2	0.12	1.7	0.08	E0.014	0.118
424.5	425.5	52	1.19	E1.7	E0.02	1.6	0.09	E0.031	0.091
425.5	426.5	39	1.70	2.0	E0.02	1.8	0.08	E0.026	0.075
426.5	427.5	74	1.71	2.2	E0.02	1.8	0.07	E0.013	0.104
427.5	428.5	43	1.67	E1.8	E0.04	1.7	E0.05	E0.020	0.085
428.5	429.5	45	1.70	2.2	E0.04	2.2	0.08	E0.015	0.061
429.5	430.5	74	1.67	2.4	E0.04	3.0	0.25	E0.041	E0.027
430.5	431.5	118	1.63	2.6	E0.02	2.1	E0.05	E0.013	E0.034
431.5	432.5	140	1.80	2.5	E0.03	1.9	E0.05	E0.014	0.080
432.5	433.5	58	1.43	2.5	E0.04	1.9	E0.04	<0.050	E0.049
433.5	434.5	65	1.44	2.7	E0.03	2.1	E0.05	<0.050	0.058
434.5	435.5	80	1.69	2.5	E0.04	2.5	E0.05	E0.014	0.107
435.5	436.5	113	1.75	2.7	E0.03	2.0	E0.05	E0.013	0.065
436.5	437.5	95	2.09	2.8	E0.03	2.2	0.09	<0.050	0.077
437.5	438.5	94	1.61	2.1	E0.02	1.3	0.06	<0.050	0.142
438.5	439.5	81	2.17	E1.9	E0.02	1.3	E0.05	E0.013	0.186
439.5	440.5	58	2.21	2.3	E0.04	1.4	E0.05	<0.050	0.105
440.5	441.5	58	2.39	2.2	E0.02	1.6	0.07	E0.014	0.097
441.5	442.5	57	2.13	2.7	E0.02	1.5	<0.05	<0.050	0.056

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
442.5	443.5	66	2.19	2.3	E0.02	1.3	0.06	E0.013	0.123
443.5	444.5	40	2.20	2.5	E0.03	1.4	E0.04	<0.050	0.095
444.5	445.5	41	1.99	2.1	E0.02	1.4	0.06	<0.050	E0.100
445.5	446.5	38	2.35	E1.9	E0.03	1.2	0.09	<0.050	0.090
446.5	447.5	47	1.99	2.3	E0.02	1.5	<0.05	<0.050	E0.040
447.5	448.5	49	1.91	2.4	E0.03	1.4	<0.05	<0.050	E0.027
448.5	449.5	43	1.62	2.0	E0.04	E1.0	E0.05	<0.050	0.061
449.5	450.5	64	1.94	2.0	E0.02	1.1	<0.05	<0.050	0.067
450.5	451.5	59	1.67	2.5	E0.02	1.2	E0.05	E0.013	E0.043
451.5	452.5	30	1.48	2.6	E0.02	1.3	E0.04	<0.050	E0.033
452.5	453.5	48	1.59	2.4	E0.01	1.1	E0.05	E0.013	0.054
453.5	454.5	43	1.60	2.7	E0.03	1.2	0.07	E0.016	E0.019
454.5	455.5	52	1.63	3.2	E0.02	1.4	<0.05	<0.050	<0.050
455.5	456.5	84	1.70	2.9	E0.01	1.3	E0.04	<0.050	<0.050
456.5	457.5	102	2.08	2.5	E0.01	1.1	<0.05	<0.050	0.068
457.5	458.5	83	2.04	2.5	E0.02	1.1	<0.05	<0.050	0.066
458.5	459.5	43	1.78	2.3	E0.01	1.1	E0.04	<0.050	E0.035
459.5	460.5	50	1.78	2.4	E0.01	1.1	E0.05	<0.050	E0.039
461.5	462.5	46	1.97	6.9	E0.01	1.3	E0.05	<0.050	E0.037
462.5	463.5	48	2.05	4.2	E0.01	1.1	E0.05	E0.014	E0.044
463.5	464.5	60	1.68	2.7	E0.02	E1.0	E0.05	<0.050	E0.029
464.5	465.5	89	1.56	3.5	E0.01	1.2	<0.05	<0.050	E0.019
465.5	466.5	57	1.42	3.4	E0.02	1.2	<0.05	<0.050	E0.032
466.5	467.5	46	1.61	2.7	E0.01	1.1	<0.05	<0.050	E0.047
467.5	468.5	46	1.38	2.8	E0.03	1.1	<0.05	<0.050	E0.020
468.5	469.5	49	1.51	2.4	E0.02	1.1	<0.05	E0.013	E0.041
469.5	470.5	44	1.52	2.4	E0.02	E1.0	<0.05	<0.050	E0.029
470.5	471.5	42	1.59	2.8	E0.02	1.1	E0.04	<0.050	E0.028
471.5	472.5	82	1.40	2.6	E0.02	1.1	<0.05	<0.050	E0.019
472.5	473.5	38	1.27	3.1	E0.02	1.1	<0.05	<0.050	E0.015
473.5	474.5	39	1.28	3.2	E0.02	1.1	<0.05	<0.050	E0.018
474.5	475.5	75	1.27	3.1	E0.02	1.1	<0.05	<0.050	E0.017
475.5	476.5	71	1.27	3.3	E0.02	1.1	0.06	E0.013	E0.026
476.5	477.5	98	1.04	3.3	E0.02	1.1	0.06	<0.050	E0.038
477.5	478.5	74	1.33	4.4	E0.02	1.7	E0.05	<0.050	E0.033
478.5	479.5	58	1.77	2.6	E0.01	1.1	E0.05	<0.050	0.070
479.5	480.5	71	1.50	2.3	E0.02	E1.0	E0.05	<0.050	E0.028
480.5	481.5	52	1.43	2.3	<0.05	E1.0	0.06	E0.013	E0.029
481.5	482.5	97	1.08	3.3	E0.03	E1.0	E0.05	<0.050	E0.018
482.5	483.5	87	1.09	4.2	E0.02	1.2	E0.05	<0.050	E0.018
483.5	484.5	87	1.08	2.2	E0.01	E0.9	<0.05	<0.050	E0.030
484.5	485.5	90	1.10	2.9	E0.02	E0.9	E0.04	<0.050	E0.036
485.5	486.5	72	1.17	2.0	E0.02	E0.9	<0.05	<0.050	E0.038
486.5	487.5	66	1.98	2.0	<0.05	E0.9	E0.05	E0.013	0.145
487.5	488.5	72	1.72	E1.8	E0.02	E0.8	<0.05	<0.050	0.114
488.5	489.5	78	1.59	2.0	E0.01	E0.9	<0.05	<0.050	0.083
489.5	490.5	76	1.87	2.5	E0.02	E1.0	<0.05	E0.013	0.058

Table 10. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance (µS/cm) (00095)	Fluoride (mg/kg) (00950)	Sulfate (mg/kg) (00945)	Bromide (mg/kg) (71870)	Chloride (mg/kg) (00940)	Nitrate-N (mg/kg) (00618)	Nitrite-N (mg/kg) (00613)	Ortho-phosphate (mg/kg) (00671)
490.5	491.5	82	1.42	2.6	<0.05	E0.9	E0.05	<0.050	E0.039
491.5	492.5	70	1.44	E1.7	<0.05	E0.8	<0.05	E0.013	0.187
492.5	493.5	61	1.51	E1.6	<0.05	E0.8	E0.04	<0.050	0.319
493.5	494.5	68	1.52	E1.6	<0.05	E0.8	<0.05	<0.050	0.194
494.5	495.5	67	1.05	E1.6	E0.02	E0.8	E0.04	<0.050	0.104
495.5	496.5	63	1.04	E1.6	E0.02	E0.8	E0.05	E0.013	0.087
496.5	497.5	64	1.00	E1.8	E0.01	1.1	E0.04	<0.050	0.054
497.5	498.5	78	1.01	2.1	E0.02	E1.0	E0.04	<0.050	E0.044
498.5	499.5	90	0.94	2.6	<0.05	E1.0	E0.04	<0.050	E0.027
499.5	500.5	74	1.13	2.1	E0.01	E0.9	E0.04	E0.013	E0.042
500.5	501.5	79	1.02	2.1	E0.02	E0.9	E0.04	<0.050	E0.045
501.5	502.5	78	1.07	E1.9	E0.02	E0.9	E0.04	E0.014	0.063
502.5	503.5	76	1.03	E1.8	E0.02	E0.8	E0.04	E0.013	0.073
503.5	504.5	52	1.07	E1.8	E0.02	E1.0	E0.04	E0.015	0.084
504.5	505.5	66	1.11	E1.7	<0.05	E0.8	E0.04	E0.013	0.113
505.5	506.5	59	1.03	<2.0	E0.02	E0.8	0.05	<0.050	0.130
506.5	507.5	77	1.03	E1.6	E0.01	E0.8	E0.05	E0.014	0.106
508.5	509.5	81	1.06	E1.6	E0.02	E0.9	E0.04	E0.013	0.068
509.5	510.5	96	1.20	2.2	E0.02	1.2	E0.04	E0.014	0.080
510.5	511.5	100	1.05	E1.8	E0.01	E0.9	E0.05	E0.014	0.104
511.5	512.5	59	1.04	E1.9	E0.01	E0.9	0.12	0.059	0.092
512.5	513.5	90	1.02	E1.5	E0.01	E0.8	0.11	E0.045	0.157
513.5	514.5	75	0.95	E1.4	<0.05	E0.8	0.06	E0.013	0.186
514.5	515.5	90	0.83	2.2	E0.02	1.5	E0.05	E0.013	E0.047
515.5	516.5	96	0.86	2.1	E0.01	1.6	E0.05	E0.017	E0.022
525.5	526.5	–	0.97	2.2	E0.03	1.1	E0.04	<0.050	E0.033
526.5	527.5	–	1.10	2.3	E0.02	1.2	E0.04	<0.050	0.053
527.5	528.5	–	1.05	2.2	E0.02	1.2	E0.04	<0.050	E0.048
528.5	529.5	–	1.11	2.2	E0.02	1.2	E0.05	<0.050	E0.049
529.5	530.5	–	1.11	2.4	E0.01	1.3	E0.04	<0.050	E0.046
530.5	531.5	–	1.10	2.3	E0.02	1.3	E0.04	<0.050	E0.041
531.5	532.5	–	0.95	2.0	E0.01	1.2	0.06	E0.016	E0.042

Table 11. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35B1S (JTUZ-2) in Joshua Tree, San Bernardino County, California, June, 2007.

[Five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance, (µS/cm) (00095)	Bromide, (mg/kg) (71870)	Chloride, (mg/kg) (00940)	Fluoride, (mg/kg) (00950)	Sulfate, (mg/kg) (00945)	Nitrate-N, (mg/kg) (00618)	Nitrite-N, (mg/kg) (00613)	Ortho-phosphate, (mg/kg) (00671)
2.5	3.5	–	E0.032	1.9	1.1	8.4	0.9	E0.01	0.1
3.5	4.5	–	E0.034	2.1	1.03	9.1	0.48	E0.01	0.1
4.5	5.5	–	E0.028	2.4	1.17	8.1	0.61	E0.01	0.1
5.5	6.5	–	E0.026	2	0.99	7.9	0.43	E0.01	0.07
6.5	7.5	–	E0.038	2.5	1.18	10	0.63	E0.01	0.07
8.5	9.5	–	E0.033	2.4	1.37	11.6	1.04	E0.03	0.09
9.5	10.5	–	E0.023	1.6	1.52	8.1	0.27	E0.01	0.17
10.5	11.5	–	E0.02	2.6	1	6.5	0.89	E0.01	0.13
11.5	12.5	–	E0.019	2.5	1.61	9.3	1.15	E0.01	0.16
12.5	13.5	–	E0.021	3.8	0.77	8.6	2.74	E0.01	0.13
13.5	14.5	–	E0.017	2.5	0.63	8.3	1.16	E0.01	0.17
14.5	15.5	–	E0.015	1.9	1.45	7.8	0.81	E0.01	0.29
15.5	16.5	–	E0.014	2.2	0.19	9.2	0.93	E0.02	0.21
16.5	17.5	–	E0.049	2.8	0.83	9.4	1.45	E0.01	0.29
17.5	18.5	–	E0.026	2.5	1.02	12.4	0.93	E0.01	0.26
18.5	19.5	–	0.06	3	0.71	15.5	1.17	E0.02	0.15
19.5	20.5	–	E0.025	3.4	0.71	17.3	1.46	E0.04	0.21
20.5	21.5	–	E0.029	3.5	0.61	23.2	1.7	E0.04	0.2
22.5	23.5	–	E0.03	3.1	0.62	18.1	1.6	E0.03	0.38
23.5	24.5	–	E0.038	2.3	0.5	12.5	0.38	E0.04	0.76
24.5	25.5	–	E0.045	2.1	0.85	12.3	0.46	E0.04	0.81
25.5	26.5	–	E0.03	2.3	1.04	13.7	0.25	E0.03	1.15
26.5	27.5	–	E0.037	2.5	0.32	17.8	2.21	E0.04	0.39
27.5	28.5	–	E0.037	2.3	1.02	16.5	0.08	E0.03	0.28
28.5	29.5	–	E0.022	1.5	1.09	14.7	0.35	E0.01	0.2
29.5	30.5	–	E0.031	1.8	1	14.5	0.31	E0.02	0.26
32.5	33.5	–	E0.025	2	3.37	11.8	E0.04	<0.01	0.82
33.5	34.5	–	E0.039	2.6	1.8	18.4	0.08	E0.03	0.16
34.5	35.5	–	0.08	4.8	0.61	31.8	1.39	0.06	0.05
35.5	36.5	–	0.30	3.9	2.38	20.3	1.19	E0.02	0.11
36.5	37.5	–	E0.049	4.4	1.9	20.9	0.7	E0.02	0.07
37.5	38.5	–	E0.024	9	0.81	78.2	<0.04	<0.01	0.08
38.5	39.5	–	0.06	6.4	0.59	53.5	0.61	E0.02	0.06
39.5	40.5	–	E0.045	5.8	0.69	42	0.69	E0.01	0.06
40.5	41.5	–	E0.039	5.8	0.56	45.8	0.54	E0.01	0.06
41.5	42.5	–	E0.026	5.1	0.75	32.6	0.37	E0.01	0.08
42.5	43.5	–	E0.029	4	0.87	22	0.75	E0.02	0.12
43.5	44.5	–	E0.021	3.8	0.92	14.4	2.6	E0.01	0.19
44.5	45.5	–	E0.023	3.2	0.86	11.8	0.84	E0.02	0.3
45.5	46.5	–	E0.018	3.1	0.56	7	0.58	E0.02	0.3
46.5	47.5	–	E0.018	2.2	0.3	4.4	0.5	E0.01	0.27
47.5	48.5	–	E0.013	2.2	0.78	4.1	0.62	E0.01	0.53
48.5	49.5	–	E0.027	3.8	0.76	5.1	0.88	E0.03	0.51
49.5	50.5	–	E0.018	3.2	0.5	5.4	1.06	E0.01	0.37
50.5	51.5	–	E0.017	4.1	0.71	8.2	1.01	E0.02	0.58
51.5	52.5	–	E0.015	2.6	0.77	3.8	1.16	E0.01	0.76
52.5	53.5	–	E0.016	3.1	0.77	3.5	0.9	E0.02	0.87

Table 11. Chemical compositions of leachate from selected core material and cuttings from 1N/6E-35B1S (JTUZ-2) in Joshua Tree, San Bernardino County, California, June, 2007.—Continued

[Five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: E, Estimated; ft, feet; mg/kg, milligram per kilogram; µS/cm, microsiemen per centimeter at 25 degrees Celsius; –, no data; <, less than value shown]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Specific conductance, (µS/cm) (00095)	Bromide, (mg/kg) (71870)	Chloride, (mg/kg) (00940)	Fluoride, (mg/kg) (00950)	Sulfate, (mg/kg) (00945)	Nitrate-N, (mg/kg) (00618)	Nitrite-N, (mg/kg) (00613)	Ortho-phosphate, (mg/kg) (00671)
53.5	54.5	–	E0.023	3.7	0.53	5.1	0.91	E0.01	0.39
54.5	55.5	–	E0.02	3.1	0.53	3.5	0.79	E0.02	0.49
55.5	56.5	–	E0.015	2.4	0.5	4.1	0.32	E0.01	0.36
56.5	57.5	–	E0.019	3	0.59	4.6	0.32	E0.02	0.3
57.5	58.5	–	0.20	4.8	0.33	20.9	0.83	E0.01	0.17
58.5	59.5	–	0.17	5.8	0.52	18.3	1.68	E0.02	0.18
59.5	60.5	–	E0.019	2.8	0.65	14.4	0.05	E0.01	0.13
60.5	61.5	–	E0.017	2.8	0.52	9.3	0.09	<0.01	0.13
61.5	62.5	–	E0.037	10.7	0.49	27.5	0.09	E0.03	0.09
62.5	63.5	–	E0.027	2.5	0.3	9.3	0.17	E0.02	0.24
63.5	64.5	–	E0.04	2.5	0.33	11.7	0.23	E0.01	0.23
64.5	65.5	–	E0.025	3.4	0.23	10.8	0.69	<0.01	0.12
65.5	66.5	–	E0.031	5.7	0.37	18.4	1.78	E0.01	0.14
66.5	67.5	–	E0.03	4.8	0.45	16.6	1.38	E0.01	0.17
67.5	68.5	–	E0.028	4.2	0.87	12.7	0.69	E0.01	0.21
68.5	69.5	–	E0.022	2.1	0.22	6.9	0.1	<0.01	0.16
69.5	70.5	–	E0.024	5	0.31	13.9	0.34	E0.02	0.23
70.5	71.5	–	E0.016	1.6	0.33	5.7	E0.05	E0.01	0.38
71.5	72.5	–	E0.019	2.2	0.81	5.3	0.47	E0.01	0.39
72.5	73.5	–	E0.018	3.1	1.29	9.2	0.46	E0.01	0.39
73.5	74.5	–	E0.018	2.4	1.37	7	0.44	E0.01	0.85
74.5	75.5	–	E0.018	2	1.31	4	0.46	E0.01	0.63
75.5	76.5	–	E0.023	3	1.23	4.9	0.58	E0.02	0.7
76.5	77.5	–	E0.018	2.1	1.24	3.7	0.49	E0.01	0.73
Blank			<0.01	E0.288	E0.023	E0.561	E0.04	E0.01	E0.023

Precision of results from leachate samples was evaluated with quality-control analyses (replicate samples). Duplicate samples of cutting material were collected at four depth intervals. Each of these replicate samples was prepared as described above (mixed with 50 mL of de-ionized water and shaken vigorously on a wrist shaker for 12 hours). The filtered extractant from each replicate sample was then split into triplicate (splits) and each aliquot was analyzed for soluble anions as described above for the environmental samples. The average precision of the replicate sampling of alluvial material for all replicate pairs was 8.3 percent for chloride and 47.2 percent for nitrate. The average precision of the analyses from the ion chromatograph, based upon triplicate analyses of split samples, was 1.8 percent for chloride and 16.3 percent for nitrate. A limitation of the quality-control analyses was that all replicate samples were made at depth intervals where concentrations of ions are relatively low. Replicate samples where concentrations of ions were higher were not available. Because of the low concentrations of ions in the leachate sampled (parts per billion for some constituents; nitrate, nitrite, bromide), a high percent difference between splits does not correspond to a large difference in the magnitude between concentrations.

The quality-control data for each split are presented individually for each constituent evaluated along with the average and standard deviation for the three splits of each subsample in *table 12*. Precision of the ion chromatograph analyses for splits within each subsample and precision of the subsampling of alluvial material between subsamples at the same depth interval is also presented in *table 12*.

Blank samples were collected to evaluate bias and contamination from distilled water. Laboratory analytical blanks collected on three samples are presented in *table 12*. All analyses for blank sample water are less than the reporting limit for each constituent.

Table 12. Quality control summary of leacate from cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.

[Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: DI, de-ionized water; ft, feet; mg/L, milligram per liter; mm/dd/yyyy, month/day/year; Rep, replicate; <, less than value shown; –, no data; ’, feet]

Site	Sample	Analysis date (mm/dd/yyyy)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Flouride (mg/L) (00950)	Sulfate (mg/L) (00945)	Nitrate-N (mg/L) (00618)	Nitrite-N (mg/L) 00613)	Ortho-phosphate (mg/L) (00671)
JTUZ-1	510-511’ 08_0345 (a)	06/04/2008	0.02	0.80	1.03	1.51	0.05	0.01	0.13
	510-511’ 08_0345 (b)	06/04/2008	<0.01	0.80	1.03	1.50	0.05	0.01	0.13
	510-511’ 08_0345 (c)	06/04/2008	<0.01	0.80	1.04	1.51	0.05	0.01	0.13
	Average:		0.01	0.80	1.03	1.51	0.05	0.01	0.13
	Standard deviation:		0.00	0.00	0.00	0.71	0.00	0.00	0.21
	Precision ion chromatograph analyses, percent:		50.00	0.63	0.48	0.20	0.00	0.00	0.79
	510-511’ 08_0346 (a)	06/04/2008	0.01	0.77	1.09	1.62	0.05	0.01	0.12
	510-511’ 08_0346 (b)	06/04/2008	0.01	0.76	1.06	1.60	0.05	0.01	0.12
	510-511’ 08_0346 (c)	06/04/2008	0.01	0.78	1.08	1.61	0.05	0.01	0.12
	Average:		0.01	0.77	1.08	1.61	0.05	0.01	0.12
	Standard deviation:		0.00	0.01	0.01	0.73	0.00	0.00	0.20
	Precision ion chromatograph analyses, percent:		9.37	2.35	2.13	1.24	2.19	0.00	2.51
	Precision of subsampling, percent:		66.67	4.13	4.26	6.91	3.58	7.41	6.21
JTUZ-1	449-450’ Rep	06/04/2008	0.02	1.39	2.06	2.15	0.07	0.01	0.13
	449-450’ 08_0116	05/27/2008	0.02	1.39	1.99	2.11	0.06	0.01	0.10
	Average:		0.02	1.39	2.03	2.13	0.06	0.01	0.11
	Standard deviation:		0.01	0.98	1.43	1.51	0.05	0.01	0.08
	Precision ion chromatograph analyses, percent:		6.06	0.00	3.60	2.11	14.17	0.00	28.83
JTUZ-1	449-450’ 08_0373 (a)	06/05/2008	0.02	1.40	2.48	2.21	0.05	0.01	0.11
	449-450’ 08_0373 (b)	06/05/2008	0.02	1.39	2.45	2.21	0.05	0.01	0.11
	449-450’ 08_0373 (c)	06/05/2008	0.02	1.33	2.44	2.18	0.01	0.01	0.11
	Average:		0.02	1.37	2.46	2.20	0.03	0.01	0.11
	Standard deviation:		0.00	0.03	0.02	0.01	0.02	0.00	0.00
	Precision ion chromatograph analyses, percent:		5.66	4.45	1.79	1.00	104.85	0.00	0.94
	Precision of subsampling, percent:		6.83	1.40	19.23	3.27	68.78	0.00	4.61
JTUZ-1	286-287’ 08_0188	05/30/2008	0.04	5.46	0.58	5.87	2.24	0.04	0.07
	286-287’ (b)	06/04/2008	0.04	5.35	0.58	5.83	2.22	0.04	0.09
	286-287’ (c)	06/04/2008	0.04	5.35	0.60	5.79	2.20	0.04	0.09
	Average:		0.04	5.39	0.59	5.83	2.22	0.04	0.08
	Standard deviation:		0.00	0.05	0.01	0.03	0.02	0.00	0.01
	Precision ion chromatograph analyses, percent:		0.00	2.06	2.04	1.34	1.80	0.00	25.51
JTUZ-1	286-287’ 08_0211	05/30/2008	0.04	5.92	0.59	4.74	0.99	0.24	0.08
	286-287’ 1550 (b)	06/04/2008	0.04	5.95	0.61	4.58	0.95	0.24	0.09
	286-287’ 1550 (c)	06/04/2008	0.04	5.89	0.57	4.56	0.94	0.24	0.08
	Average:		0.04	5.92	0.59	4.63	0.96	0.24	0.08
	Standard deviation:		0.00	0.02	0.01	0.08	0.02	0.00	0.00
	Precision ion chromatograph analyses, percent:		2.36	0.96	6.09	3.85	4.69	2.52	3.59
	Precision of subsampling, percent:		8.20	9.43	0.57	23.04	79.19	142.38	1.61
JTUZ-1	326-327’ 08_0230	05/30/2008	0.02	5.28	0.97	19.32	3.20	0.02	0.03
	326-327’ 848 (b)	06/04/2008	0.04	5.28	1.19	20.02	3.14	0.02	0.03
	326-327’ 848 (c)	06/04/2008	0.02	5.29	1.00	18.91	3.16	0.02	0.03
	Average:		0.03	5.28	1.05	19.42	3.17	0.02	0.03
	Standard deviation:		0.01	0.00	0.10	0.46	0.03	0.00	0.00
	Precision ion chromatograph analyses, percent:		54.88	0.17	21.18	5.69	1.89	0.00	13.79

Table 12. Quality control summary of leacate from cuttings from 1N/6E-35A1-23S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.—Continued

Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: DI, de-ionized water; ft, feet; mg/L, milligram per liter; mm/dd/yyyy, month/day/year; Rep, replicate; <, less than value shown; –, no data; ', feet]

Site	Sample	Analysis date (mm/dd/yyyy)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Flouride (mg/L) (00950)	Sulfate (mg/L) (00945)	Nitrate-N (mg/L) (00618)	Nitrite-N (mg/L) (00613)	Ortho-phosphate (mg/L) (00671)
JTUZ-1	326-327' 08_0231	05/30/2008	0.03	6.40	1.22	20.79	4.65	0.06	<0.02
	326-327' 1026 (b)	06/04/2008	0.02	6.16	1.02	20.37	4.61	0.06	<0.02
	326-327' 1026 (c)	06/04/2008	0.02	6.42	1.13	20.43	4.61	0.05	0.03
	Average:		0.02	6.33	1.12	20.53	4.62	0.06	0.02
	Standard deviation:		0.00	0.12	0.08	0.18	0.02	0.01	0.01
	Precision ion chromatograph analyses, percent:		12.33	3.98	18.07	2.05	0.89	30.36	50.00
	Precision of subsampling, percent:		11.61	18.04	6.50	5.56	37.29	115.49	92.44
JTUZ-1	DI Blank #2637		<0.5	<0.5	–	<3	<0.06	<0.03	<0.5
	DI Blank 08_0210		<0.01	0.4	0.04	0.9	0.05	0.01	0.04
	DI Blank 08_0148		<0.01	0.4	0.05	0.9	<0.01	<0.01	0.05

Groundwater Chemistry

The chemical and isotopic composition of groundwater at JTUZ-1 was analyzed for samples collected from the water-table well. Samples were collected by using a positive-displacement piston-pump after at least three casing volumes had been pumped from the well and field measurements of pH, specific conductance, and temperature had stabilized to within 5 percent of the previously recorded value. Samples were collected in accordance with the protocols established by the USGS National Field Manual (U.S. Geological Survey, variously dated). These sampling protocols ensure that a representative sample of groundwater is collected at each site and that potential contamination of samples during collection and handling is minimized. Results for chemical and isotopic analysis of water from the water-table well at JTUZ-1 are presented in *table 13*.

All samples collected from the groundwater well were analyzed for soluble anions (fluoride, sulfate, bromide, chloride, nitrate, nitrite, and orthophosphate) at the USGS San Diego Water Quality Laboratory by using ion chromatography (U.S. Environmental Protection Agency, 1993). Samples from the water-table well were sent to the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, for analysis of major ions, nutrients, and selected trace elements, by using methods by Fishman and Friedman (1989), Fishman (1993), and Garbarino and others (2002; 2006). Selected samples were sent to the USGS Stable Isotope Laboratory (SIL) in Reston, Virginia, for analysis of the stable isotopes of oxygen ($\delta^{18}O$), and hydrogen (dD) in water and nitrogen ($\delta^{15}N$), and $\delta^{18}O$ of nitrate by using mass spectrometry (Epstein and Mayeda, 1953; Coplen and others, 1991).

Unsaturated-Zone Water Chemistry

The chemical and isotopic composition of unsaturated-zone water was analyzed for samples collected from suction-cup lysimeters. All samples collected from the lysimeters were analyzed for soluble anions (fluoride, sulfate, bromide, chloride, nitrate, nitrite, and orthophosphate) at the USGS San Diego Water Quality Laboratory by using ion chromatography (U.S. Environmental Protection Agency, 1993). Selected samples from the suction-cup lysimeters and all samples from the water-table well were sent to the USGS NWQL for analysis of major ions, nutrients, and selected trace elements by using methods by Fishman and Friedman (1989), Fishman (1993), and Garbarino and others (2002; 2006). Selected samples were sent to the USGS SIL for analysis of the stable isotopes of oxygen ($\delta^{18}O$), nitrogen ($\delta^{15}N$), and hydrogen (dD) by using mass spectrometry (Epstein and Mayeda, 1953; Coplen and others, 1991). Results of chemical and isotopic analysis for water from suction-cup lysimeters are presented in *tables 14* and *15*.

Table 13. Chemical composition of water from well 1N/6E35A1S in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations:** $CaCO_3$, calcium carbonate; cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; M, presence of compound verified but not quantified; mg/L, milligram per liter; mm/dd/yyyy, month/day/year; nm, nanometer; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown; ", inch; µg/L, microgram per liter]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Absorbance, UV, 254-nm, 1-cm pathlength (units per centimeter) (50624)	Dissolved oxygen, water, unfiltered (mg/L) (00300)	pH, water, unfiltered, field (standard units) (00400)	Specific conductance (µS/cm) (00095)	Temperature, water (°C) (00010)
JTUZ-1	2" well	08/16/2007	13:35	0.011	7.4	8.1	–95	27.6
	1N/6E-35A1	03/05/2008	18:00	0.01	5.9	8.2	417	20.0
		09/12/2008	12:05	0.009	6.4	8.1	413	25.6
		03/11/2009	10:30	–	6.5	8.1	413	22.2
		07/01/2009	13:20	–	7.1	8.0	419	28.2
		09/17/2009	14:20	–	7.5	8.1	399	29.5

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Dissolved solids dried at 180°C (mg/L) (70300)	Calcium, water, filtered (mg/L) (00915)	Magnesium, water, filtered (mg/L) (00925)	Potassium, water, filtered (mg/L) (00935)	Sodium, water, filtered (mg/L) (00930)
JTUZ-1	2" well	08/16/2007	13:35	278	24.3	4.13	3.67	52.5
	1N/6E-35A1	03/05/2008	18:00	274	26.2	4.10	3.80	49.7
		09/12/2008	12:05	270	24.4	4.00	3.81	53.9
		03/11/2009	10:30	275	25.3	4.05	3.59	50.8
		07/01/2009	13:20	268	26.6	4.14	3.58	51.9
		09/17/2009	14:20	–	–	–	–	–

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Alkalinity (mg/L as $CaCO_3$) (39036)	Bicarbonate (mg/L) (29804)	Bicarbonate (mg/L) (00453)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)
JTUZ-1	2" well	08/16/2007	13:35	–	–	–	0.12	25.4
	1N/6E-35A1	03/05/2008	18:00	92	110	107	0.14	23.9
		09/12/2008	12:05	87	104	104	0.13	23.3
		03/11/2009	10:30	86	104	104	0.14	24.4
		07/01/2009	13:20	87	105	102	0.07	23.2
		09/17/2009	14:20	89	107	106	0.13	–

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Fluoride (mg/L) (00950)	Silica (mg/L as SiO_2) (00955)	Sulfate (mg/L) (00945)	Ammonia plus organic nitrogen (mg/L as nitrogen) (00623)	Ammonia (mg/L as nitrogen) (00608)
JTUZ-1	2" well	08/16/2007	13:35	0.7	23.6	25.3	0.13	E0.019
	1N/6E-35A1	03/05/2008	18:00	0.63	24.8	25.2	<0.14	<0.020
		09/12/2008	12:05	0.69	24.3	24.7	<0.14	<0.020
		03/11/2009	10:30	E0.67	24.0	25.9	<0.10	<0.020
		07/01/2009	13:20	0.65	23.6	25.2	<0.10	<0.020
		09/17/2009	14:20	–	–	–	E0.08	<0.020

Table 13. Chemical composition of water from well 1N/6E35A1S in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: $CaCO_3$, calcium carbonate; cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; M, presence of compound verified but not quantified; mg/L, milligram per liter; mm/dd/yyyy, month/day/year; nm, nanometer; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown; ”, inch; µg/L, microgram per liter]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Nitrate plus nitrite (mg/L as nitrogen) (00631)	Nitrate (mg/L as nitrogen) (00618)	Nitrite (mg/L as nitrogen) (00613)	Orthophosphate (mg/L as phosphorus) (00671)	Phosphorus (mg/L as phosphorus) (00666)
JTUZ-1	2” well	08/16/2007	13:35	12.7	12.7	0.027	0.015	<0.04
	1N/6E-35A1	03/05/2008	18:00	12.4	E12.4	E0.002	0.013	<0.04
		09/12/2008	12:05	12.5	–	<0.002	0.011	<0.04
		03/11/2009	10:30	12.6	–	<0.002	0.013	E0.03
		07/01/2009	13:20	12.2	–	<0.002	0.018	<0.04
		09/17/2009	14:20	12.0	–	<0.002	0.015	<0.04

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Aluminum (µg/L) (01106)	Barium (µg/L) (01005)	Chromium (µg/L) (01030)	Iron (µg/L) (01046)	Lithium (µg/L) (01130)
JTUZ-1	2” well	08/16/2007	13:35	4.2	29.6	12.9	<6	6
	1N/6E-35A1	03/05/2008	18:00	6.4	31.9	–	<8	6
		09/12/2008	12:05	3.5	29.6	15.4	<8	6
		03/11/2009	10:30	E3.0	32.5	–	<4	7
		07/01/2009	13:20	E3.1	30.6	–	<4	6
		09/17/2009	14:20	–	–	–	–	–

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Manganese (µg/L) (01056)	Strontium (µg/L) (01080)	Arsenic (µg/L) (01000)	Boron (µg/L) (01020)	Iodide (mg/L) (71865)
JTUZ-1	2” well	08/16/2007	13:35	6.4	270	1.6	51	0.003
	1N/6E-35A1	03/05/2008	18:00	0.7	284	1.5	53	0.003
		09/12/2008	12:05	0.8	269	1.7	50	0.002
		03/11/2009	10:30	0.2	282	1.5	56	E0.002
		07/01/2009	13:20	E0.1	282	1.8	57	E0.002
		09/17/2009	14:20	–	–	–	–	E0.002

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Organic carbon (mg/L) (00681)	Deuterium/ protium ratio (per mil) (82082)	Nitrogen-15/ nitrogen-14 ratio in nitrate fraction (per mil) (82690)	Oxygen-18/ oxygen-16 ratio in nitrate fraction (per mil) (63041)	Oxygen-18/ oxygen-16 ratio (per mil) (82085)
JTUZ-1	2” well	08/16/2007	13:35	0.5	–78.30	9.24	–3.73	–10.87
	1N/6E-35A1	03/05/2008	18:00	0.5	–78.00	–	–	–10.89
		09/12/2008	12:05	0.3	–78.40	–	–	–10.91
		03/11/2009	10:30	0.4	–78.00	9.06	–3.72	–10.9
		07/01/2009	13:20	–	–77.50	–	–	–10.94
		09/17/2009	14:20	–	–77.20	–	–	–10.91

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µg/L, microgram per liter; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Absorbance, UV, 254 nm, 1-cm pathlength (units per cm) (50624)	Dissolved oxygen, water, unfiltered (mg/L) (00300)	pH, water, unfiltered, field (standard units) (00400)	Specific conductance (µS/cm) (00095)	Temperature, water (°C) (00010)	Dissolved solids dried at 180°C (mg/L) (70300)	Calcium, water, filtered (mg/L) (00915)	Magnesium, water, filtered (mg/L) (00925)
JTUZ-1	LYS @ 516.5	07/18/2007	09:40	–	–	–	–	–	–	–	–
	1N/6E-35A3 LYS	07/19/2007	09:40	–	–	8.4	396	–	–	–	–
		08/16/2007	12:50	–	–	8.5	384	–	–	–	–
		08/16/2007	12:51	–	–	–	–	–	–	–	–
		11/29/2007	07:40	–	–	8.8	355	–	–	15.3	3.26
		01/14/2008	12:30	–	–	8.6	359	–	258	16.4	3.13
		01/15/2008	08:45	1.3	–	8.6	356	–	–	–	–
		03/05/2008	17:20	–	–	8.3	356	–	–	17.9	2.97
		05/07/2008	08:30	–	–	–	–	–	262	18	3.11
		05/07/2008	08:31	–	–	–	–	–	–	–	–
		05/08/2008	06:55	1.18		8.4	345	–	–	–	–
		05/08/2008	06:56	–	–	–	–	–	–	–	–
		07/28/2008	09:20	–	–	–	–	–	–	18.4	3.22
		07/28/2008	09:21	–	–	–	–	–	–	–	–
		09/12/2008	11:40	1.27	–	8.2	366	–	–	–	–
		01/07/2009	17:10	–	–	8.1	398	–	–	20.2	3.36
		03/11/2009	11:05	–	–	8.3	360	–	–	18.8	3.3
		06/05/2009	15:03	–	–	8.7	387	–	–	–	–
		07/01/2009	16:10	–	–	–	–	–	–	–	–
		09/17/2009	14:08	–	–	–	–	–	233	18.2	3.43
JTUZ-1	LYS @ 346	08/16/2007	12:25	–	–	8.2	26,600	–	–	–	–
	1N/6E-35A9 LYS	11/29/2007	07:20	–	–	8.5	23,100	–	–	1,230	554
		01/14/2008	12:55	–	–	8.4	14,600	–	–	–	–
		01/15/2008	09:00	–	–	8.5	15,800	–	–	–	–
		03/05/2008	17:45	–	–	7.7	9,370	–	–	491	192
		05/07/2008	08:45	–	–	–	–	–	4,590	390	132
		05/07/2008	08:46	–	–	–	–	–	–	–	–
		05/08/2008	07:05	–	–	8.4	5,760	–	–	–	–
		07/28/2008	09:40	–	–	–	–	–	–	304	103
		07/28/2008	09:41	–	–	–	–	–	–	–	–
		09/12/2008	11:30	1.47	–	7.9	4,700	–	–	–	–
		01/07/2009	17:30	–	–	7.8	3,720	–	–	–	–
		06/05/2009	15:08	–	–	8.3	2,910	–	–	–	–

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

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Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Potassium, water, filtered (mg/L) (00935)	Sodium, water, filtered (mg/L) (00930)	Alkalinity (mg/L as calcium carbonate) (39036)	Bicarbonate (mg/L) (29804)	Bicarbonate (mg/L) (00453)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)
JTUZ-1	LYS @ 516.5	07/18/2007	09:40	–	–	–	–	–	0.1	28.3	1.09
	1N/6E-35A3 LYS	07/19/2007	09:40	–	–	–	–	–	–	–	–
		08/16/2007	12:50	–	–	–	–	–	–	–	–
		08/16/2007	12:51	–	–	–	–	–	0.2	24.2	1.05
		11/29/2007	07:40	4.14	53	–	–	–	0.24	19.3	–
		01/14/2008	12:30	3.89	50.6	–	–	–	0.18	17.8	0.91
		01/15/2008	08:45	–	–	–	–	–	–	–	–
		03/05/2008	17:20	3.34	43.2	120	145	143	0.15	15.9	–
		05/07/2008	08:30	3.57	49.5	–	–	–	0.17	16.1	–
		05/07/2008	08:31	–	–	–	–	–	0.2	17	0.95
		05/08/2008	06:55	–	–	–	–	–	–	–	–
		05/08/2008	06:56	–	–	–	–	–	0.1	16.9	1.01
		07/28/2008	09:20	3.53	46.5	–	–	–	0.15	16.7	–
		07/28/2008	09:21	–	–	–	–	–	0.1	17.1	1.04
		09/12/2008	11:40	–	–	–	–	–	–	–	–
		01/07/2009	17:10	3.83	48.5	–	–	–	0.11	16.2	–
		03/11/2009	11:05	3.48	44.4	–	–	–	0.14	16.1	–
		06/05/2009	15:03	–	–	–	–	–	–	–	–
		07/01/2009	16:10	–	–	–	–	–	–	–	–
		09/17/2009	14:08	3.37	44.1	–	–	–	0.15	–	E1.03
JTUZ-1	LYS @ 346	08/16/2007	12:25					–	–	–	–
	1N/6E-35A9 LYS	11/29/2007	07:20	116	3,630	–	–	–	30.3	<0.12	–
		01/14/2008	12:55	–	–	–	–	–	–	–	–
		01/15/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	17:45	44.2	1,100	–	–	–	10.1	2,550	–
		05/07/2008	08:45	36.5	866	–	–	–	6.3	1,580	–
		05/07/2008	08:46	–	–	–	–	–	5.7	1,580	0.57
		05/08/2008	07:05	–	–	–	–	–	5.4	1,310	0.61
		07/28/2008	09:40	29.5	633	–	–	–	4.56	1,160	–
		07/28/2008	09:41	–	–	–	–	–	4.2	1,140	0.65
		09/12/2008	11:30	–	–	–	–	–	–	–	–
		01/07/2009	17:30	–	–	–	–	–	–	–	–
		06/05/2009	15:08	–	–	–	–	–	–	–	–

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

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Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Silica (mg/L as SiO_2) (00955)	Sulfate (mg/L) (00945)	Ammonia plus organic nitrogen (mg/L as nitrogen) (00623)	Ammonia (mg/L as nitrogen) (00608)	Nitrate plus nitrite (mg/L as nitrogen) (00631)	Nitrate (mg/L as nitrogen) (00618)	Nitrite (mg/L as nitrogen) (00613)	Ortho-phophate (mg/L as phosphorus) (00671)
JTUZ-1	LYS @ 516.5	07/18/2007	09:40	–	27.6	–	–	1.63	–	2.93	0.04
	1N/6E-35A3 LYS	07/19/2007	09:40	–	–	–	–	–	–	–	–
		08/16/2007	12:50	–	–	13	0.124	3.27	1.46	1.81	0.018
		08/16/2007	12:51	–	24.7	–	–	1.5	–	1.93	0.05
		11/29/2007	07:40	18.4	22.1	–	–	–	–	–	–
		01/14/2008	12:30	18.3	21.2	–	–	–	–	–	–
		01/15/2008	08:45	–	–	5.7	<.020	5.11	4.99	0.123	0.014
		03/05/2008	17:20	18.2	19.6	–	–	–	–	–	–
		05/07/2008	08:30	18.4	20	8.6	0.163	5.19	5.11	0.081	–
		05/07/2008	08:31	–	19.5	–	–	5.33	5.25	0.08	<0.020
		05/08/2008	06:55	–	–	–	–	–	–	–	–
		05/08/2008	06:56	–	21.2	–	–	5.75	5.69	0.06	<0.020
		07/28/2008	09:20	17.5	19.6	–	–	–	–	–	–
		07/28/2008	09:21	–	18.7	–	–	–	–	0.07	E.020
		09/12/2008	11:40	–	–	–	–	–	–	–	–
		01/07/2009	17:10	17.8	19.3	14	0.352	5.11	4.98	0.133	E.005
		03/11/2009	11:05	17.2	19.2	–	–	–	–	–	–
		06/05/2009	15:03	–	–	–	–	–	–	–	–
		07/01/2009	16:10	–	–	9.4	0.496	4.97	4.85	0.126	0.01
		09/17/2009	14:08	E19.0	–	7.6	0.21	5.23	5.01	0.217	0.01
JTUZ-1	LYS @ 346	08/16/2007	12:25	–	–	–	–	–	–	–	–
	1N/6E-35A9 LYS	11/29/2007	07:20	43.1	<0.18	–	–	–	–	–	–
		01/14/2008	12:55	–	–	22	2.53	87.3	85.9	1.39	.036
		01/15/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	17:45	47.8	969	–	–	–	–	–	–
		05/07/2008	08:45	50.8	766	8.7	0.308	102	101	1.16	–
		05/07/2008	08:46	–	805	–	–	102	101	1.28	0.260
		05/08/2008	07:05	–	709	–	–	101	101	0.070	0.130
		07/28/2008	09:40	38	628	–	–	–	–	–	–
		07/28/2008	09:41	–	643	–	–	103	–	<0.010	0.160
		09/12/2008	11:30	–	–	–	–	–	–	–	–
		01/07/2009	17:30	–	–	15	0.694	101	101	0.028	0.046
		06/05/2009	15:08	–	–	–	–	–	–	–	–

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

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Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Phosphorus (mg/L as phosphorus) (00666)	Aluminum (µg/L) (01106)	Barium (µg/L) (01005)	Chromium (µg/L) (01030)	Iron (µg/L) (01046)	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	Strontium, (µg/L) (01080)
JTUZ-1	LYS @ 516.5	07/18/2007	09:40	–	–	–	–	–	–	–	–
	1N/6E-35A3 LYS	07/19/2007	09:40	–	–	–	–	–	–	–	–
		08/16/2007	12:50	0.05	–	–	–	–	–	–	–
		08/16/2007	12:51	–	–	–	–	–	–	–	–
		11/29/2007	07:40	–		8.1	0.39	8	–	24.9	–
		01/14/2008	12:30	–	16.3	10.3	–	<8	11	34.4	186
		01/15/2008	08:45	E0.03	–	–	–	–	–	–	–
		03/05/2008	17:20	–	–	17.6	2.8	<8	–	35.4	–
		05/07/2008	08:30	–	27.2	17.7	–	<8	8	21.6	197
		05/07/2008	08:31	–	–	–	–	–	–	–	–
		05/08/2008	06:55	–	–	–	–	–	–	–	–
		05/08/2008	06:56	–	–	–	–	–	–	–	–
		07/28/2008	09:20	–	–	20.4	4.5	13	–	15.5	–
		07/28/2008	09:21	–	–	–	–	–	–	–	–
		09/12/2008	11:40	–	–	–	–	–	–	–	–
		01/07/2009	17:10	<0.04	–	21.6	3.1	<4	–	7.3	–
		03/11/2009	11:05	–	–	21.0	2.1	E3	–	9.4	–
		06/05/2009	15:03	–	–	–	–	–	–	–	–
		07/01/2009	16:10	<0.04	–	–	–	–	–	–	–
		09/17/2009	14:08	<0.04	23.1	22.4	–	<4	8	17.3	219
JTUZ-1	LYS @ 346	08/16/2007	12:25	–	–	–	–	–	–	–	–
	1N/6E-35A9 LYS	11/29/2007	07:20	–	–	120	21.1	9	–	138	–
		01/14/2008	12:55	0.32	–	–	–	–	–	–	–
		01/15/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	17:45	–	–	68.0	6.3	<40	–	53.6	–
		05/07/2008	08:45	–	5.5	52.0	–	<32	92	26.8	3,130
		05/07/2008	08:46	–	–	–	–	–	–	–	–
		05/08/2008	07:05	–	–	–	–	–	–	–	–
		07/28/2008	09:40	–	–	47.2	5.6	E13	–	16.5	–
		07/28/2008	09:41	–	–	–	–	–	–	–	–
		09/12/2008	11:30	–	–	–	–	–	–	–	–
		01/07/2009	17:30	0.24	–	–	–	–	–	–	–
		06/05/2009	15:08	–	–	–	–	–	–	–	–

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

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Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Arsenic (µg/L) (01000)	Boron (µg/L) (01020)	Iodide (mg/L) (71865)	Organic carbon (mg/L) (00681)	Deuterium/ protium ratio (per mil) (82082)	Nitrogen-15/ nitrogen-14 ratio in nitrate fraction (per mil) (82690)	Oxygen-18/ oxygen-16 ratio in nitrate fraction (per mil) (63041)	Oxygen-18/ oxygen-16 ratio (per mil) (82085)
JTUZ-1	LYS @ 516.5	07/18/2007	09:40	–	–	–	–	–	–	–	–
	1N/6E-35A3 LYS	07/19/2007	09:40	–	–	–	–	–	–	–	–
		08/16/2007	12:50	–	–	–	–	–75.70	20.30	–7.64	–10.70
		08/16/2007	12:51	–	–	–	–	–	–	–	–
		11/29/2007	07:40	1.9	146	0.006	–	–76.00	–	–	–10.74
		01/14/2008	12:30	2.0	112	0.008	–	–	–	–	–
		01/15/2008	08:45	–	–	–	435	–77.60	–	–	–11.04
		03/05/2008	17:20	1.8	100	0.006	–	–76.90	–	–	–10.94
		05/07/2008	08:30	1.8	96	0.007	–	–76.30	–	–	–11.01
		05/07/2008	08:31	–	–	–	–	–	–	–	–
		05/08/2008	06:55	–	–	–	382	–77.60	–	–	–11.01
		05/08/2008	06:56	–	–	–	–	–	–	–	–
		07/28/2008	09:20	1.7	87	0.009	–	–76.50	–	–	–10.92
		07/28/2008	09:21	–	–	–	–	–	–	–	–
		09/12/2008	11:40	–	–	–	386	–	–	–	–
		01/07/2009	17:10	1.6	70	0.009	–	–	–	–	–
		03/11/2009	11:05	1.4	83	0.009	–	–78.00	11.60	0.19	–10.90
		06/05/2009	15:03	–	–	–	–	–	–	–	–
		07/01/2009	16:10	–	–	–	–	–	–	–	–
		09/17/2009	14:08	1.5	81	0.011	295	–77.70	–	–	–10.97
JTUZ-1	LYS @ 346	08/16/2007	12:25	–	–	–	–	–73.60	–	–	–10.18
	1N/6E-35A9 LYS	11/29/2007	07:20	30.4	1,580	1.99	–	–74.50	–	–	–10.13
		01/14/2008	12:55	–	–	–	–	–72.60	–	–	–10.40
		01/15/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	17:45	25.8	1,350	1.01	–	–74.60	–	–	–10.48
		05/07/2008	08:45	24.4	1,180	0.700	–	–75.10	–	–	–10.47
		05/07/2008	08:46	–	–	–	–	–	–	–	–
		05/08/2008	07:05	–	–	–	–	–	–	–	–
		07/28/2008	09:40	21.1	1,000	0.592	–	–74.90	–	–	–10.46
		07/28/2008	09:41	–	–	–	–	–	–	–	–
		09/12/2008	11:30	–	–	–	428	–	–	–	–
		01/07/2009	17:30	–	–	–	–	–	–	–	–
		06/05/2009	15:08	–	–	–	–	–	–	–	–

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

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Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Absorbance, UV, 254 nm, 1-cm pathlength, (units per cm) (50624)	Dissolved oxygen, water, unfiltered, (mg/L) (00300)	pH, water, unfiltered, field, (standard units) (00400)	Specific conductance, (µS/cm) (00095)	Temperature, water, (°C) (00010)	Dissolved solids dried at 180°C, (mg/L) (70300)	Calcium, water, filtered, (mg/L) (00915)	Magnesium, water, filtered, (mg/L) (00925)
JTUZ-1	LYS @ 91	07/18/2007	10:30	–	–	–	–	–	–	–	–
	1N/6E-35A20 LYS	07/19/2007	10:30	–	–	7.4	9,170	–	–	–	–
		08/16/2007	12:05	–	–	7.6	8,980	–	–	–	–
		08/16/2007	12:06	–	–	–	–	–	–	–	–
		11/29/2007	07:00	–	–	8	8,510	–	–	1,140	185
		01/14/2008	13:20	0.386	–	7.8	9,030	–	–	–	–
		01/15/2008	09:10	–	–	8.1	9,440	–	–	–	–
		01/16/2008	09:00	–	–	8.4	10,100	–	–	–	–
		03/05/2008	18:00	–	–	7.3	10,100	–	–	1,320	201
		05/07/2008	08:52	–	–	–	–	–	9,150	1,550	226
		05/07/2008	08:53	–	–	–	–	–	–	–	–
		05/08/2008	07:10	–	–	7.8	11,200	–	–	–	–
		05/08/2008	07:11	–	–	–	–	–	–	–	–
		07/28/2008	09:25	–	–	–	–	–	–	1,600	249
		07/28/2008	09:26	–	–	–	–	–	–	–	–
		09/12/2008	11:15	0.493	–	7.4	12,400	–	–	–	–
		03/11/2009	10:30	–	–	7.4	13,400	–	–	–	–
		06/05/2009	15:13	–	–	7.1	13,000	–	–	–	–
		07/01/2009	16:00	–	–	–	–	–	–	1,690	266
		09/17/2009	13:30	–	–	–	–	–	11,200	1,920	288

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µg/L, microgram per liter; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Potassium, water, filtered (mg/L) (00935)	Sodium, water, filtered (mg/L) (00930)	Alkalinity (mg/L as) calcium carbonate (39036)	Bicarbonate (mg/L) (29804)	Bicarbonate (mg/L) (00453)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)
JTUZ-1	LYS @ 91	07/18/2007	10:30	–	–	–	–	–	11.1	1,280	0.86
	1N/6E-35A20 LYS	07/19/2007	10:30	–	–	–	–	–	–	–	–
		08/16/2007	12:05	–	–	–	–	–	–	–	–
		08/16/2007	12:06	–	–	–	–	–	11.6	1,290	0.49
		11/29/2007	07:00	12.5	551	90	108	104	11.2	1,270	–
		01/14/2008	13:20	–	–	–	–	–	–	–	–
		01/15/2008	09:10	–	–	–	–	–	–	–	–
		01/16/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	18:00	7.86	487	72	87	87	12.7	1,370	–
		05/07/2008	08:52	8.59	607	–	–	–	14.1	1,500	0.16
		05/07/2008	08:53	–	–	–	–	–	14.1	1,580	0.17
		05/08/2008	07:10	–	–	–	–	–	–	–	–
		05/08/2008	07:11	–	–	–	–	–	16.3	1,830	0.16
		07/28/2008	09:25	8.26	627	–	–	–	14.9	1,630	–
		07/28/2008	09:26	–	–	–	–	–	14.7	1,690	1.16
		09/12/2008	11:15	–	–	–	–	–	–	–	–
		03/11/2009	10:30	–	–	–	–	–	–	–	–
		06/05/2009	15:13	–	–	–	–	–	–	–	–
		07/01/2009	16:00	8.01	1,220	–	–	–	17.2	1,910	–
		09/17/2009	13:30	8.78	1,450	–	–	–	19.2	1,850	0.11

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µg/L, microgram per liter; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Silica (mg/L as SiO_2) (00955)	Sulfate (mg/L) (00945)	Ammonia plus organic nitrogen (mg/L as nitrogen) (00623)	Ammonia (mg/L as nitrogen) (00608)	Nitrate plus nitrite (mg/L as nitrogen) (00631)	Nitrate (mg/L as nitrogen) (00618)	Nitrite (mg/L as nitrogen) (00613)	Ortho-phophate (mg/L as phosphorus) (00671)
JTUZ-1	LYS @ 91	07/18/2007	10:30	–	605	–	–	737	736	0.800	<0.020
	1N/6E-35A20 LYS	07/19/2007	10:30	–	–	–	–	–	–	–	–
		08/16/2007	12:05	–	–	2.9	<0.020	711	711	0.347	0.045
		08/16/2007	12:06	–	579	–	–	635	635	0.380	<0.020
		11/29/2007	07:00	34.9	529	–	–	–	–	–	–
		01/14/2008	13:20	–	–	–	–	–	–	–	–
		01/15/2008	09:10	–	–	2.6	0.152	761	760	0.596	0.040
		01/16/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	18:00	31.8	674	–	–	–	–	–	–
		05/07/2008	08:52	34.1	781	3.2	<0.100	864	863	0.277	–
		05/07/2008	08:53	–	836	–	–	924	924	0.390	<0.020
		05/08/2008	07:10	–	–	–	–	–	–	–	–
		05/08/2008	07:11	–	1,040	–	–	902	–	<0.010	<0.020
		07/28/2008	09:25	26.1	952	–	–	–	–	–	–
		07/28/2008	09:26	–	970	–	–	959	958	1.18	<0.020
		09/12/2008	11:15	–	–	–	–	–	–	–	–
		03/11/2009	10:30	–	–	–	–	–	–	–	–
		06/05/2009	15:13	–	–	–	–	–	–	–	–
		07/01/2009	16:00	32.8	1,360	0.33	0.181	991	990	0.174	0.040
		09/17/2009	13:30	32.4	1,370	0.96	0.307	1,010	1,010	0.434	0.035

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µg/L, microgram per liter; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Phosphorus (mg/L as phosphorus) (00666)	Aluminum (µg/L) (01106)	Barium (µg/L) (01005)	Chromium (µg/L) (01030)	Iron (µg/L) (01046)	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	Strontium (µg/L) (01080)
JTUZ-1	LYS @ 91	07/18/2007	10:30	–	–	–	–	–	–	–	–
	1N/6E-35A20 LYS	07/19/2007	10:30	–	–	–	–	–	–	–	–
		08/16/2007	12:05	0.12	–	–	–	–	–	–	–
		08/16/2007	12:06	–	–	–	–	–	–	–	–
		11/29/2007	07:00	–	–	181	0.78	<40	–	941	–
		01/14/2008	13:20	–	–	–	–	–	–	–	–
		01/15/2008	09:10	0.08	–	–	–	–	–	–	–
		01/16/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	18:00	–	–	142	1.8	<48	–	464	–
		05/07/2008	08:52	–	17.4	121	–	<48	71	288	9,900
		05/07/2008	08:53	–	–	–	–	–	–	–	–
		05/08/2008	07:10	–	–	–	–	–	–	–	–
		05/08/2008	07:11	–	–	–	–	–	–	–	–
		07/28/2008	09:25	–	–	99.9	2.0	<48	–	122	–
		07/28/2008	09:26	–	–	–	–	–	–	–	–
		09/12/2008	11:15	–	–	–	–	–	–	–	–
		03/11/2009	10:30	–	–	–	–	–	–	–	–
		06/05/2009	15:13	–	–	–	–	–	–	–	–
		07/01/2009	16:00	0.04	–	73.7	3.5	E30	–	5.4	–
		09/17/2009	13:30	E0.03	<40.0	71.3	–	E26	73	4.2	12,700

Table 14. Chemical composition of unsaturated-zone water from suction-cup lysimeters: 1N/6E-35A3 LYS, 1N/6E-35A9 LYS, 1N/6E-35A20 LYS, in unsaturated-zone monitoring site (JTUZ-1) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; °C, degrees Celsius; µg/L, microgram per liter; µS/cm, microsiemens per centimeter at 25°C; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Arsenic (µg/L) (01000)	Boron (µg/L) (01020)	Iodide (mg/L) (71865)	Organic carbon (mg/L) (00681)	Deuterium/ protium ratio (per mil) (82082)	Nitrogen-15/ mitrogen-14 ratio in nitrate fraction (per mil) (82690)	Oxygen-18/ oxygen-16 ratio in nitrate fraction (per mil) (63041)	Oxygen-18/ oxygen-16 ratio (per mil) (82085)
JTUZ-1	LYS @ 91	07/18/2007	10:30	–	–	–	–	–	–	–	–
	1N/6E-35A20 LYS	07/19/2007	10:30	–	–	–	–	–	–	–	–
		08/16/2007	12:05	–	–	–	–	–70.80	10.00	2.82	–9.01
		08/16/2007	12:06	–	–	–	–	–	–	–	–
		11/29/2007	07:00	3.7	212	0.046	–	–72.40	–	–	–9.04
		01/14/2008	13:20	–	–	–	62.8	–	–	–	–
		01/15/2008	09:10	–	–	–	–	–70.90	–	–	–8.98
		01/16/2008	09:00	–	–	–	–	–	–	–	–
		03/05/2008	18:00	2.2	232	0.039	–	–71.60	–	–	–8.99
		05/07/2008	08:52	2.4	228	0.037	–	–72.70	–	–	–8.91
		05/07/2008	08:53	–	–	–	–	–	–	–	–
		05/08/2008	07:10	–	–	–	–	–	–	–	–
		05/08/2008	07:11	–	–	–	–	–	–	–	–
		07/28/2008	09:25	2.3	196	0.039	–	–71.90	–	–	–8.74
		07/28/2008	09:26	–	–	–	–	–	–	–	–
		09/12/2008	11:15	–	–	–	66.2	–	–	–	–
		03/11/2009	10:30	–	–	–	62.7	–71.80	9.76	3.55	–8.70
		06/05/2009	15:13	–	–	–	–	–	–	–	–
		07/01/2009	16:00	2.9	269	0.028	–	–	–	–	–
		09/17/2009	13:30	3.8	264	0.025	21.2	–71.30	–	–	–8.68

Table 15. Chemical composition of water from suction-cup lysimeters: 1N/6E-35B3 LYS and 1N/6E-35B7 LYS in unsaturated-zone monitoring site (JTUZ-2) in Joshua Tree, San Bernardino County, California, 2007–09.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; µg/L; microgram per liter; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Absorbance, UV, 254 nm, 1-cm pathlength (units per cm) (50624)	Dissolved oxygen, water, unfiltered (mg/L) (00300)	pH, water, unfiltered, field (standard units) (00400)	Specific conductance (µS/cm) (00095)	Temperature, water (°C) (00010)	Dissolved solids dried at 180°C (mg/L) (70300)	Calcium, water, filtered (mg/L) (00915)	Magnesium, water, filtered (mg/L) (00925)
JTUZ-2	LYS @ 70	01/14/2008	13:55	–	–	–	27,400	–	–	–	–
	1N/6E-35B3 LYS	01/15/2008	09:30	–	–	–	19,000	–	–	–	–
		01/16/2008	09:20	–	–	–	16,600	–	–	–	–
		05/07/2008	07:35	–	–	–	–	–	–	–	–
		05/07/2008	07:36	–	–	–	–	–	–	–	–
		05/08/2008	08:05	–	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	8.9	3,760	–	–	–	–
JTUZ-2	LYS @ 61	07/18/2007	15:20	–	–	–	–	–	–	–	–
	1N/6E-35B7 LYS	07/19/2007	11:20	–	–	9.1	2,650	–	–	–	–
		08/16/2007	09:37	–	–	8.3	1,560	–	–	–	–
		11/29/2007	09:20	–	–	–	1,100	–	–	–	–
		01/14/2008	14:05	–	–	–	–	–	–	–	–
		01/15/2008	09:40	0.074	–	8.1	1,120	–	–	–	–
		01/16/2008	09:30	–	–	–	–	–	763	61.4	17.3
		03/05/2008	19:30	–	–	–	–	–	–	–	–
		05/07/2008	07:45	–	–	–	–	–	631	48.2	12.7
		05/07/2008	07:46	–	–	–	–	–	–	–	–
		05/08/2008	08:15	–	–	8.1	971	–	–	–	–
		05/08/2008	08:16	–	–	–	–	–	–	–	–
		07/28/2008	10:00	–	–	–	–	–	–	67.7	16.8
		07/28/2008	10:01	–	–	–	–	–	–	–	–
		01/07/2009	16:10	–	–	8	934	–	–	–	–
		03/11/2009	08:35	–	–	8.4	898	–	–	–	–
		06/05/2009	16:08	–	–	–	886	–	–	–	–
		07/01/2009	16:00	–	–	–	–	–	–	65.6	13.9
		09/17/2009	15:30	–	–	–	–	–	–	67.2	13.9

Table 15. Chemical composition of water from suction-cup lysimeters: 1N/6E-35B3 LYS and 1N/6E-35B7 LYS in unsaturated-zone monitoring site (JTUZ-2) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; µg/L; microgram per liter; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Potassium, water, filtered (mg/L) (00935)	Sodium, water, filtered (mg/L) (00930)	Alkalinity (mg/L as calcium carbonate) (39036)	Bicarbonate (mg/L) (29804)	Bicarbonate (mg/L) (00453)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)	Fluoride (mg/L) (00950)
JTUZ-2	LYS @ 70	01/14/2008	13:55	–	–	–	–	–	–	–	–
	1N/6E-35B3 LYS	01/15/2008	09:30	–	–	–	–	–	–	–	–
		01/16/2008	09:20	–	–	–	–	–	–	–	–
		05/07/2008	07:35	–	–	–	–	–	–	–	–
		05/07/2008	07:36	–	–	–	–	–	12.6	3,390	1.08
		05/08/2008	08:05	–	–	–	–	–	12.7	3,400	1
		03/11/2009	08:35	–	–	–	–	–	–	–	–
JTUZ-2	LYS @ 61	07/18/2007	15:20	–	–	–	–	–	2	584	0.69
	1N/6E-35B7 LYS	07/19/2007	11:20	–	–	–	–	–	–	–	–
		08/16/2007	09:37	–	–	–	–	–	–	–	–
		11/29/2007	09:20	–	–	–	–	–	–	–	–
		01/14/2008	14:05	–	–	–	–	–	–	–	–
		01/15/2008	09:40	–	–	–	–	–	–	–	–
		01/16/2008	09:30	6.12	156	–	–	–	0.15	53	0.14
		03/05/2008	19:30	–	–	–	–	–	–	–	–
		05/07/2008	07:45	4.65	128	–	–	–	0.13	41.8	–
		05/07/2008	07:46	–	–	–	–	–	0.1	45.3	0.11
		05/08/2008	08:15	–	–	–	–	–	–	–	–
		05/08/2008	08:16	–	–	–	–	–	0.1	45.2	0.16
		07/28/2008	10:00	4.18	119	–	–	–	0.11	43.3	–
		07/28/2008	10:01	–	–	–	–	–	0.1	44.7	0.09
		01/07/2009	16:10	–	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	–	–	–	–	–	–
		06/05/2009	16:08	–	–	–	–	–	–	–	–
		07/01/2009	16:00	2.25	76.8	–	–	–	0.11	43	–
		09/17/2009	15:30	2.36	77.5	–	–	–	0.1	38.7	–

Table 15. Chemical composition of water from suction-cup lysimeters: 1N/6E-35B3 LYS and 1N/6E-35B7 LYS in unsaturated-zone monitoring site (JTUZ-2) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; µg/L; microgram per liter; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Silica (mg/L as SiO_2) (00955)	Sulfate (mg/L) (00945)	Ammonia plus organic nitrogen (mg/L as nitrogen) (00623)	Ammonia (mg/L as nitrogen) (00608)	Nitrate plus nitrite (mg/L as nitrogen) (00631)	Nitrate (mg/L as nitrogen) (00618)	Nitrite (mg/L as nitrogen) (00613)	Ortho-phophate (mg/L as phosphorus) (00671)
JTUZ-2	LYS @ 70	01/14/2008	13:55	–	–	–	–	–	–	–	–
	1N/6E-35B3 LYS	01/15/2008	09:30	–	–	–	–	–	–	–	–
		01/16/2008	09:20	–	–	–	–	–	–	–	–
		05/07/2008	07:35	–	–	–	–	–	–	–	–
		05/07/2008	07:36	–	1,040	–	–	19.6	–	<0.010	0.3
		05/08/2008	08:05	–	1,040	–	–	18.9	–	<0.010	0.23
		03/11/2009	08:35	–	–	–	–	–	–	–	–
JTUZ-2	LYS @ 61	07/18/2007	15:20	–	182	–	–	34	31.2	2.79	0.26
	1N/6E-35B7 LYS	07/19/2007	11:20	–	–	–	–	–	–	–	–
		08/16/2007	09:37	–	–	–	–	–	–	–	–
		11/29/2007	09:20	–	–	–	–	–	–	–	–
		01/14/2008	14:05	–	–	–	–	–	–	–	–
		01/15/2008	09:40	–	–	0.36	0.05	37.8	37.6	0.108	0.208
		01/16/2008	09:30	45.5	143	–	–	–	–	–	–
		03/05/2008	19:30	–	–	–	–	–	–	–	–
		05/07/2008	07:45	48.8	100	2.6	<0.020	19.7	18.7	1.03	–
		05/07/2008	07:46		83	–	–	18.8	18.6	0.21	0.21
		05/08/2008	08:15	–	–	–	–	–	–	–	–
		05/08/2008	08:16	–	107	–	–	43	42	1.04	0.22
		07/28/2008	10:00	40.7	70.8	–	–	–	–	–	–
		07/28/2008	10:01	–	73	–	–	42.1	42.1	0.03	0.13
		01/07/2009	16:10	–	–	1.8	<0.020	30.7	26.7	3.96	0.122
		03/11/2009	08:35	–	–	–	–	–	–	–	–
		06/05/2009	16:08	–	–	–	–	–	–	–	–
		07/01/2009	16:00	46.6	58.6	0.6	0.075	25	24.4	0.619	0.157
		09/17/2009	15:30	46.3	57.6	0.81	0.377	28.7	27.4	1.29	0.128

Table 15. Chemical composition of water from suction-cup lysimeters: 1N/6E-35B3 LYS and 1N/6E-35B7 LYS in unsaturated-zone monitoring site (JTUZ-2) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; µg/L; microgram per liter; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Phosphorus, (mg/L as phosphorus) (00666)	Aluminum, (µg/L) (01106)	Barium, (µg/L) (01005)	Chromium, (µg/L) (01030)	Iron, (µg/L) (01046)	Lithium, (µg/L) (01130)	Manganese, (µg/L) (01056)	Strontium, (µg/L) (01080)
JTUZ-2	LYS @ 70	01/14/2008	13:55	–	–	–	–	–	–	–	–
	1N/6E-35B3 LYS	01/15/2008	09:30	–	–	–	–	–	–	–	–
		01/16/2008	09:20	–	–	–	–	–	–	–	–
		05/07/2008	07:35	–	–	–	–	–	–	–	–
		05/07/2008	07:36	–	–	–	–	–	–	–	–
		05/08/2008	08:05	–	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	–	–	–	–	–	–
JTUZ-2	LYS @ 61	07/18/2007	15:20	–	–	–	–	–	–	–	–
	1N/6E-35B7 LYS	07/19/2007	11:20	–	–	–	–	–	–	–	–
		08/16/2007	09:37	–	–	–	–	–	–	–	–
		11/29/2007	09:20	–	–	–	–	–	–	–	–
		01/14/2008	14:05	–	–	–	–	–	–	–	–
		01/15/2008	09:40	0.24	–	–	–	–	–	–	–
		01/16/2008	09:30	–	3.7	59.9	–	<8	17	2.1	499
		03/05/2008	19:30	–	–	–	–	–	–	–	
		05/07/2008	07:45	–	2.8	43.2	–	<8	24	5.6	389
		05/07/2008	07:46	–	–	–	–	–	–	–	–
		05/08/2008	08:15	–	–	–	–	–	–	–	–
		05/08/2008	08:16	–	–	–	–	–	–	–	–
		07/28/2008	10:00	–	–	59.2	1.2	<8	–	3.7	–
		07/28/2008	10:01	–	–	–	–	–	–	–	–
		01/07/2009	16:10	0.17	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	–	–	–	–	–	–
		06/05/2009	16:08	–	–	–	–	–	–	–	–
		07/01/2009	16:00	0.16	–	55.8	0.81	24	–	1.2	–
		09/17/2009	15:30	0.13	–	60.5	0.94	9	–	1.3	–

Table 15. Chemical composition of water from suction-cup lysimeters: 1N/6E-35B3 LYS and 1N/6E-35B7 LYS in unsaturated-zone monitoring site (JTUZ-2) in Joshua Tree, San Bernardino County, California, 2007–09.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Location of site is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: cm, centimeter; E, Estimated; ft, feet; hh:mm, hour:minute; mg/L, milligram per liter; nm, nanometer; mm/dd/yyyy, month/day/year; SiO_2, silicon dioxide; UV, ultraviolet; µg/L; microgram per liter; µS/cm, microsiemens per centimeter at 25°C; °C, degrees Celsius; –, no data; <, less than value shown]

Site	Instrumentation name	Date (mm/dd/yyyy)	Time (hh:mm)	Arsenic (µg/L) (01000)	Boron (µg/L) (01020)	Iodide (mg/L) (71865)	Organic carbon (mg/L) (00681)	Deuterium/ protium ratio (per mil) (82082)	Nitrogen–15/ nitrogen–14 ratio in nitrate fraction (per mil) (82690)	Oxygen–18/ oxygen–16 ratio in nitrate fraction (per mil) (63041)	Oxygen–18/ oxygen–16 ratio (per mil) (82085)
JTUZ–2	LYS @ 70	01/14/2008	13:55	–	–	–	–	–	–	–	–
	1N/6E–35B3 LYS	01/15/2008	09:30	–	–	–	–	–	–	–	–
		01/16/2008	09:20	–	–	–	–	–	–	–	–
		05/07/2008	07:35	–	–	–	–	–	–	–	–
		05/07/2008	07:36	–	–	–	–	–	–	–	–
		05/08/2008	08:05	–	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	–	22.9	–77.3	–	–	–10.91
JTUZ–2	LYS @ 61	07/18/2007	15:20	–	–	–	–	–	–	–	–
	1N/6E–35B7 LYS	07/19/2007	11:20	–	–	–	–	–	–	–	–
		08/16/2007	09:37	–	–	–	–	–	–	–	–
		11/29/2007	09:20	–	–	–	–	–	–	–	–
		01/14/2008	14:05	–	–	–	–	–	–	–	–
		01/15/2008	09:40	–	–	–	10.4	–74.4	–	–	–10.98
		01/16/2008	09:30	6.3	185	0.019	–	–76.1	–	–	–10.86
		03/05/2008	19:30	–	–	–	–	–75.7	–	–	–10.95
		05/07/2008	07:45	7.8	194	E.024	–	–75.7	–	–	–10.97
		05/07/2008	07:46	–	–	–	–	–	–	–	–
		05/08/2008	08:15	–	–	–	–	–76.7	–	–	–11.03
		05/08/2008	08:16	–	–	–	–	–	–	–	–
		07/28/2008	10:00	7	164	0.022	–	–76	–	–	–10.96
		07/28/2008	10:01	–	–	–	–	–	–	–	–
		01/07/2009	16:10	–	–	–	–	–	–	–	–
		03/11/2009	08:35	–	–	–	–	–	8.87	–5.87	–
		06/05/2009	16:08	–	–	–	–	–	–	–	–
		07/01/2009	16:00	5	165	0.012	–	–	–	–	–
		09/17/2009	15:30	5.1	180	0.014	3.2	–77	–	–	–11.02

Suction-cup lysimeters were used to collect samples by applying a vacuum (about 60 centibars) to the vacuum tube, which induces water to flow from the unsaturated zone into the lysimeters. Once in the lysimeters, the water was forced to the land surface by pressurizing the system by applying nitrogen gas to one tube of the two-tube system. If the matric potential of the unsaturated zone near the lysimeters is more negative than inside the lysimeter, water will not enter the lysimeters. For most lysimeters, it was necessary to apply a vacuum many times over a period of several months before the lysimeters yielded water and the first sample could be collected. Although water-yielding capabilities varied considerably from one lysimeter to another, about 2 to 4 weeks were required after a vacuum was applied to ensure a maximum accumulation of water within most lysimeters cups. Umari and others (1995) reported that shorter sampling periods resulted in partial loss of the sample through leakage back into the soil.

There is some uncertainty about whether the samples from the suction-cup lysimeters reliably represent the water in the unsaturated zone. Possible problems with data from suction-cup lysimeters include contamination of the sample by lysimeter materials, inability to collect sufficient sample volume for analysis, variability in sample collection because of variability in applied vacuum, and changes that take place in the sample, such as chemical precipitation during collection and storage within the body of the lysimeter (Umari and others, 1995).

Chemistry of Unsaturated-Zone Gases

Unsaturated-zone gas samples were collected once from the gas samplers over a period of 2 years and analyzed for argon, oxygen, nitrogen, methane, carbon dioxide, ethane, nitrous oxide, and carbon monoxide. Unsaturated-zone gas-sample data are given in *table 16* for JTUZ-1 and JTUZ-2.

Gas samplers were purged at a rate of 1 to 2 L/min for 4 to 6 hours three times over the course of a year prior to sample collection to purge the formation of any gases introduced during ODEX drilling (Weeks and McMahon, 2007). Samples of gases were collected in evacuated glass bulbs placed in-line between the low-density polyethylene (LDPE) tubing connecting the gas samplers to the surface and the porous tygon tubing of a peristaltic pump used to withdraw gas from the unsaturated zone. The bulbs ranged in volume from 0.5 to 2 L. Samples were collected by slowly opening the stopcock and allowing the bulb to fill with gas. After the bulb equilibrated for about 5 minutes, the stopcock was closed, the bulb was removed from the LDPE tube and peristaltic pump, and the sample bulb was shipped overnight to the USGS Laboratory in Menlo Park, California for analysis of unsaturated-zone gases.

Precision of analytics performed on samples of unsaturated-zone gases was evaluated with replicate samples in JTUZ-2. The replicate sample at 68 ft depth had concentrations of all gases that were within 1 percent of the environmental sample except for argon, which was within 5 percent; the replicate sample at 14 ft depth had concentrations that were within 2 percent of the environmental sample for all constituents analyzed. These replicate data are also presented in *table 16*.

Table 16. Unsaturated-zone gasses from gas samplers: 1N/6E-35A4 GS, 1N/6E-35A7 GS, 1N/6E-35A10 GS, 1N/6E-35A14 GS, 1N/6E-35A17 GS, 1N/6E-35A21 GS in unsaturated-zone monitoring site (JTUZ-1) and 1N/6E-35B5 GS, 1N/6E-35B9 GS, 1N/6E-35B13 GS, 1N/6E-35B15 GS in unsaturated-zone monitoring site (JTUZ 2) in Joshua Tree, San Bernardino County, California 2007–09.

[Analyses performed by William Evans at U.S. Geological Survey National Research Program Laboratory, Menlo Park, California. Location of sites is shown in figure 2. Sample depth in feet below land surface. **Abbreviations**: mm/dd/yyyy, month/day/year; REP, relicate data; vol-%, percent volume at standard pressure and temperature; <, less than; ', foot; @, at]

State well number	Common name	Date (mm/dd/yyyy)	Argon, Ar (vol-%)	Oxygen, O_2 (vol-%)	Nitrogen, N_2 (vol-%)	Methane, CH_4 (vol-%)	Carbon dioxide, CO_2 (vol-%)	Ethane, C_2H_6 (vol-%)	Nitrous oxide, N_2O (vol-%)	Carbon monoxide, CO (vol-%)
1N/6E-35A4 GS	JTUZ-1 @ 515'	07/14/2008	0.9263	20.6691	77.5603	0.0005	0.1150	<0.0002	<0.0005	<0.001
1N/6E-35A7 GS	JTUZ-1 @ 467'	07/14/2008	0.9120	20.4320	77.0390	<0.0002	0.1155	<0.0002	<0.0005	<0.001
1N/6E-35A10 GS	JTUZ-1 @ 344'	07/14/2008	0.9425	20.5104	77.8540	<0.0002	0.1470	<0.0002	<0.0005	<0.001
1N/6E-35A14 GS	JTUZ-1 @ 176'	07/14/2008	0.9426	20.3589	77.5519	<0.0002	0.2041	<0.0002	<0.0005	<0.001
1N/6E-35A17 GS	JTUZ-1 @ 136'	07/14/2008	0.9179	20.3041	77.0615	<0.0002	0.1682	<0.0002	<0.0005	<0.001
1N/6E-35A21 GS	JTUZ-1 @ 90'	07/14/2008	0.9359	20.3383	77.5328	<0.0002	0.3480	<0.0002	0.0003	<0.001
1N/6E-35B5 GS	JTUZ-2 @ 68'	07/14/2008	0.9460	20.3632	77.8437	<0.0002	0.5491	<0.0002	0.0002	<0.001
1N/6E-35B5 GS	JTUZ-2 @ 68'	07/14/2008, REP	0.9047	20.2909	77.4275	<0.0002	0.5474	<0.0002	<0.0005	<0.001
1N/6E-35B9 GS	JTUZ-2 @ 59'	07/14/2008	0.9307	20.3971	77.8539	0.0001	0.5681	<0.0002	0.0002	<0.001
1N/6E-35B13 GS	JTUZ-2 @ 37'	07/14/2008	0.9293	20.1009	76.9756	<0.0002	0.6048	<0.0002	<0.0005	<0.001
1N/6E-35B15 GS	JTUZ-2 @ 14'	07/14/2008	0.9149	20.5676	78.5203	<0.0002	0.6337	<0.0002	0.0002	<0.001
1N/6E-35B15 GS	JTUZ-2 @ 14'	07/14/2008, REP	0.9261	20.2425	77.4627	<0.0002	0.6465	<0.0002	<0.0005	<0.001

Microbiology of Cores and Cuttings

Concentrations of denitrifying and nitrate-reducing bacteria were estimated for samples from select drill cuttings and select cores to determine if denitrification or nitrate reduction is taking place in the unsaturated zone. Microbiological data are presented in *tables 17* and *18* for JTUZ-1 and JTUZ-2, respectively.

Implements used to collect samples for microbiological analysis, including core liners, implements used to handle the sample material, and the canula used to inject nitrogen gas into the aluminum pouch, were flame sterilized prior to use. Cutting and core materials collected for microbiological analysis were stored immediately after collection in heat-sealable aluminum pouches. Nitrogen gas was used to displace ambient atmosphere from the pouches before they were sealed. The sealed pouches were placed in a cool container, transported to the USGS San Diego Water Quality Laboratory at the end of the day's drilling, and analyzed within 24 hours.

Before being analyzed in the laboratory, samples were sieved to remove gravel to create a more uniform sample media and to facilitate comparison of data from different samples having a range of particle-size distributions. Denitrifying and nitrate-reducing bacteria abundances, in most probable number (MPN), were estimated by using 10 g of material incubated at 28°C in a nutrient broth containing 0.1-percent potassium nitrate by using methods described by Britton and Greeson (1987). According to the method, the production of nitrogen gas by denitrifying bacteria is identified after the 14-day incubation period by a visual assessment for the presence of a nitrogen gas bubble accumulated in an inverted tube (Durham Tube) within the culture tube. Nitrite produced by nitrate-reducing bacteria is identified by adding a zinc-copper-manganese-dioxide mixture to the culture tube. Nitrate remaining within the culture tube, indicative of incomplete or no nitrate reduction, reacts with this reagent and produces a deep red color. Enumeration of bacteria over a range from 30 to 21,000 MPN per sample was through five serial dilutions from the initial culture tubes by using procedures described in American Public Health Association (1985). In the laboratory, all sieves, bottles, test tubes, sample containers, and sample-handling implements were autoclaved before use. All equipment and sample media were cleaned and autoclaved after use and stored or discarded.

Precision of analytics performed on microbiological samples were evaluated with quality-control analyses (replicate samples). These replicate analyses are highly variable and only comparable on an order of magnitude scale. This is expected for this type of constituent. Replicate data are presented in *tables 17* and *18* for JTUZ-1 and JTUZ-2 respectively.

Table 17. Denitrifying and nitrate-reducing bacteria for drill cuttings from 1N/6E-35A1S (JTUZ-1) in Joshua Tree, San Bernardino County, California, May, 2007.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Bacterial data presented in National Water Information System as most probable number (MPN) per 100 milliliter of water extracted from drill cuttings. To convert this value to MPN per gram of alluvium, divide by 10. Sample depth in feet below land surface. **Abbreviations:** ft, feet; REP, replicate data; <, less than]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Bacteria, denitrifying, (MPN)	Bacteria, nitrate-reducing, (MPN)
20.5	21.5	93,000	90,000
20.5	21.5	150	9,300 REP
43.5	44.5	230	7,000
58.5	59.5	230	2,400,000
63.5	Core	<30	<30
77.5	78.5	230	30
78.5	79.5	40	23,000
95.5	96.5	230	400
107.5	108.5	<30	40
140.5	141.5	<30	<30
160.5	161.5	40	<30
180.5	181.5	90	4,300
200.5	201.5	<30	40
202	Core	<30	1,100
214.5	215.5	430	30
242.5	243.5	40	<30
242.5	243.5	70	<30 REP
261.5	262.5	430	<30
261.5	262.5	230	<30 REP
267.5	268.5	30	<30
281.5	282.5	<30	<30
289.5	290.5	40	40
300.5	301.5	<30	<30
302.5	Core	<30	<30
304.5	305.5	140	70
304.5	305.5	90	110 REP
318.5	319.5	<30	<30
326.5	327.5	40	<30
340.5	341.5	90	<30
342	Core	40	<30
348.5	349.5	70	<30
361.5	362.5	<30	40
367.5	368.5	<30	<30
380.5	381.5	40	40
385.5	386.5	<30	<30
400.5	401.5	<30	<30
407.5	408.5	<30	<30
420.5	421.5	<30	<30
422.5	Core	40	300
423.5	424.5	<30	<30
437.5	438.5	<30	<30
445.5	446.5	<30	<30
455.5	456.5	<30	<30
462.5	463.5	43,000	150,000
474.5	475.5	<30	<30
485.5	486.5	<30	3,000
494.5	495.5	<30	40
499.5	500.5	<30	<30
510.5	511.5	<30	<30
517.5	518.5	75,000	230,000
517.5	518.5	120,000	70,000 REP
526.5	527.5	1,100,000	30
541	Drill bit	150	3,000

Table 18. Denitrifying and nitrate-reducing bacteria for drill cuttings from 1N/6E-35B1S (JTUZ 2) in Joshua Tree, San Bernardino County, California, June, 2007.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code used to uniquely identify a specific constituent or property. Bacterial data presented in National Water Information System (NWIS) as most probable number (MPN) per 100 milliliters of water extracted from drill cuttings. To convert this value to MPN per gram of alluvium, divide by 10. Sample depth in feet below land surface. **Abbreviations:** ft, feet; REP, replicate data; <, less than]

Depth to top of sample interval (ft) (72015)	Depth to bottom of sample interval (ft) (72016)	Bacteria, denitrifying, (MPN)	Bacteria, nitrate-reducing, (MPN)
5	6	460,000	<30
5	6	7,500 REP	28,000 REP
8	9	93,000	300
17	18	4,300	430,000
29	29.5	930	240,000
40	41	230	12,000
46	47	4,300	<30
55	56	2,100	90,000
63	64	200	40
76.5	77	230	30

References Cited

American Public Health Association, 1985, Standard methods for the examination of water and wastewater (16th ed.): Washington D.C., American Public Health Association, 1268 p.

American Society for Testing and Materials, 1987, Annual book of ASTM standards: Philadelphia, Pa., American Society for Testing and Materials, v. 04.08, variously paged.

Bedford, D.R. and Miller, D.M., comps., 1997, Bedrock geology database for the Mojave Desert Ecoregion: *in* ARC/INFO data layers CD-ROM, Mojave Desert Ecosystem Program: Logan, Utah, Utah State University Press.

Bortugno, E.J., and Spittler, T.E., 1986, Geologic map of the San Bernardino quadrangle, California, 1:250,000: California Division of Mines and Geology Regional Geologic Map Series, Map No. 3A.

Britton, L.J., and Greeson, P.E. eds., 1988, Techniques of water-resources investigations of the United States Geological Survey, Chapter A4—Methods for collection and analysis of aquatic biological and microbiological samples: U.S. Geological Survey Open-File Report 88-190, 685 p. Also available at *http://pubs.er.usgs.gov/usgspubs/ofr/ofr88190.*

Campbell, G.S., and Gee, G.W., 1986, Water potential—Miscellaneous Methods, *in* Klute, A.L., ed., Methods of soil analysis, Part 1, Physical and mineralogical methods (2nd ed.): Madison, Wisc., American Society of Agronomy, chap. 25, p. 619–632.

Cassell, D.K., and Klute, A., 1986, Water potential—Tensiometry, *in* Klute, A.L., ed., Methods of soil analysis, Part 1, Physical and mineralogical methods (2nd ed.): Madison, Wisc., American Society of Agronomy, chap. 23, p. 563–594.

Coplen, T.B., Wildman, J.D., and Chen, J., 1991, Improvements in the gaseous hydrogen-water equilibration technique for hydrogen isotope ratio analysis: Analytical Chemistry, v. 63, p. 910-912.

Driscoll, F.G., 1986, Groundwater and wells: Saint Paul, Minn., Johnson Screens, 1089 p.

Epstein, S., and Mayeda, T.K., 1953, Variations of ^{18}O content of waters from natural sources: Geochimica et Cosmochimica Acta, v. 4, p. 213–224.

Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments (3rd ed.): U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p. Also available at *http://pubs.usgs.gov/twri/twri5-a1/pdf/TWRI_5-A1.pdf.*

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.

Flint, A.L., Campbell, G.S., Ellett, K.M., and Calissendorff, C., 2002, Calibration and temperature correction of heat dissipation matric potential sensors: Soil Science Society of America Journal v. 66, no. 5, p. 1439–1445.

Flint, L.E., and Flint, A.L., 2002, Porosity, *in* Dane, J.H., and Topp, G.C., eds., Methods of soil analysis, Part 4, Physical methods: Madison, Wisc., Soil Science Society of America Book Series Number 5, p. 241–254.

Folk, R.L., 1954, The distinction between grain size and mineral composition in sedimentary-rock nomenclature: Journal of Geology, v. 62, no. 4, p. 344–359.

Garbarino, J.R., Bednar, A.J., and Burkhardt, M.R., 2002, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Arsenic speciation in natural-water samples using laboratory and field methods: U.S. Geological Survey Water-Resources Investigations Report 02-4144, 40 p. Also available at *http://nwql.usgs.gov/pubs/WRIR/WRIR-02-4144.pdf.*

Garbarino, J.R., Kanagy, L.K., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment, and soil samples using collision/ reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, sec. B, chap.1, 88 p. Also available at *http://pubs.usgs.gov/tm/2006/tm5b1/PDF/TM5-B1.pdf.*

Hammermeister, D.P., Blout, D.O., and McDaniel, J.C., 1986, Drilling and coring methods that minimize the disturbance of cuttings, core, and rock formations in the unsaturated zone, Yucca Mountain, Nevada: Proceedings of the National Water Well Association Conference on Characterization and Monitoring of the Vadose (Unsaturated) Zone, National Water Well Association, Worthington, Ohio, p. 507–541.

Hearst, J.R., and Nelson, P.H., 1985, Well logging for physical properties: New York, McGraw-Hill Book Company, 571 p.

Hillel, Daniel, 1982, Introduction to soil physics: Academic Press, New York, 364 p.

Hubbell, J.M., and Sisson, J.B., 1998, Advanced tensiometer for shallow or deep soil water potential measurements: Soil Science, v. 163, no. 4, p. 271–277.

Izbicki, J.A., Flint, A.L., and Stamos, C.L., 2008, Artificial recharge through a thick, heterogeneous unsaturated zone: Groundwater, v. 46, no. 3, p. 475–488.

Izbicki, J.A., Clark, D.A., Pimentel, M.I., Land, Michael, Radyk, John, and Michel, R.L., 2000, Data from a thick unsaturated zone underlying Oro Grande and Sheep Creek washes in the western part of the Mojave Desert, near Victorville, San Bernardino County, California: U.S. Geological Survey Open-File Report 00-262, 133 p.

Izbicki, J.A., Radyk, John, and Michel, R.L., 2002, Movement of water through the thick unsaturated zone underlying Oro Grande and Sheep Creek Washes in the western Mojave Desert, USA: Hydrogeology, v. 10, no. 3, p. 409–427.

Lane, E. W., 1947, Report of the subcommittee on sediment terminology: American Geophysical Union Transactions, v. 28, no. 6, p. 936–938.

Lewis, R.E., 1972, Ground-water resources of the Yucca Valley–Joshua Tree area, San Bernardino County, California: U.S. Geological Survey Open-File Report 72-234, 51 p.

Munsell, 1994, Munsell soil color charts: Baltimore, Md., Munsell Color Company, Inc.

Nishikawa, Tracy, Densmore, J.N., Martin, Peter, and Matti, Jonathan, 2003, Evaluation of the source and transport of high nitrate concentrations in groundwater, Warren subbasin, California: U.S. Geological Survey Water-Resources Investigations Report 2003-4009, 133 p. Also available at *http://pubs.usgs.gov/wri/wrir034009/wrir034009.book.pdf*.

Nishikawa, Tracy, Izbicki, J.A., Hevesi, J.A., Stamos, C.L., and Martin, Peter, 2004, Evaluation of geohydrologic framework, recharge estimates, and groundwater flow of the Joshua Tree area, San Bernardino County, California: U.S. Geological Survey Scientific Investigations Report 2004-5267, 115 p. Also available at *http://pubs.usgs.gov/sir/2004/5267/sir2004-5267.pdf.*

Phene C.J., Hoffman, G.J., and Rawlins, S.I., 1971, Measuring soil matric potential in situ by sensing heat dissipation with in a porous body—Theory and sensor construction: Soil Science Society of America Proceedings, v. 35, no. 1, p. 27–33.

Prudic, D.E., 1994, Estimates of percolation rates and ages of water in unsaturated sediments at two Mojave Desert sites, California-Nevada: U. S. Geological Survey Open-File Report 94-4160, 19 p.

Reece, C.F., 1996, Evaluation of a line heat dissipation sensor for measuring soil matric potential: Soil Science Society of America Journal, v. 60, no. 4, p. 1022–1028, doi:*10.2136/sssaj*1996.03615995006000040009x.

Roberts, Carter, Jachens, Robert, Katzenstein, Allan, Smith, Gregory, and Johnson, Russell, 2002, Gravity map and data of the eastern half of the Big Bear Lake, 100,000 scale quadrangle, California and analysis of the depths of several basins: U.S. Geological Survey Open-File Report 02-353. Also available at *http://geopubs.wr.usgs.gov/open-file/of02-353/.*

Schlumberger, Inc., 1972, Log interpretation, Volume 1—Principles: New York, Schlumberger Limited, 112 p.

Troxler, Inc., 1994, Manual of operation and instruction, Model 4300, Depth moisture gage: Research Triangle Park, N.C., Troxler Electronic Laboratories, Inc., 150 p.

Umari, A.M.J., Martin, Peter, Schroeder, R.A., Duell, L.F.W., Jr., and Fay, R.G., 1995, Potential for ground-water contamination from movement of wastewater through the unsaturated zone, upper Mojave River Basin, California: U.S. Geological Survey Water-Resources Investigations Report 93-4137, 83 p.

U.S. Environmental Protection Agency, 1993, Method 300.0—Determination of inorganic anions by ion chromatography Part A: U.S. Environmental Protection Agency, Office of Research and Development, EPA 600/R-93/100, rev. 2.1, 29 p. Also available at http://www.epa.gov/waterscience/methods/method/files/300_0.pdf.

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at *http://pubs.water.usgs.gov/twri9A*.

Weeks, E.P., and McMahon, P.B., 2007, Nitrous oxide fluxes from cultivated areas and rangeland—U.S. High Plains: Vadose Zone Journal, v. 6, no. 3, p. 496–510.

Publishing support provided by the U.S. Geological Survey
Science Publishing Network, Sacramento and Raleigh Publishing Service Centers

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