U.S. Department of the Interior
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Quality Assurance and Analysis of Water Levels in Wells on Pahute Mesa and Vicinity, Nevada Test Site, Nye County, Nevada

Water-Resources Investigations Report 00-4014

Prepared in cooperation with the
U.S. DEPARTMENT OF ENERGY
under Interagency Agreement
DE-A108-96NV11967

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By Joseph M. Fenelon

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Carson City, Nevada
2000

U.S. DEPARTMENT OF THE INTERIOR
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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
	Volume	
acre-foot (acre-ft)	1,233	cubic meter
million gallons (Mgal)	3,785	cubic meter
billion gallons (Bgal)	3,785,000	cubic meter
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer
	Flow Rate	
inch per year (in/yr)	2.54	centimeter per year
	Volumetric Flow Rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year
	Density	
gram per cubic centimeter (gm/cc)	62.43	pound per cubic foot
	Pressure	
pound per square inch (lb/in^2)	6.895	kilopascal

Sea level: In this report, “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called “Sea-Level Datum of 1929”), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.

Temperature: Degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) by using the formula $^{o}C = 0.556(^{o}F{-}32)$.

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ABSTRACT

Periodic and continual water-level data from 1963 to 1998 were compiled and quality assured for 65 observation wells on Pahute Mesa and vicinity, Nye County, Nevada. As part of the quality assurance of all water levels, ancillary data pertinent to computing hydraulic heads in wells were compiled and analyzed. Quality-assured water levels that were not necessarily in error but which did not represent static heads in the regional aquifer system, or required some other qualification, were flagged. Water levels flagged include those recovering from recent pumping or well construction, water levels affected by nuclear tests, and measurements affected by borehole deviations.

A cursory examination of about 30 wells with available water-level and down-hole temperature data indicate that water levels in most wells on Pahute Mesa would not be significantly affected by temperature if corrected to 95 degrees Fahrenheit. Wells with large corrections (greater than 10 feet) are those with long water columns (greater than 1,500 feet of water above the assumed point of inflow) in combination with mean water-column temperatures exceeding 105 degrees Fahrenheit.

Water-level fluctuations in wells on Pahute Mesa are caused by several factors including infiltration of precipitation, barometric pressure, Earth tides, ground-water pumpage, and seismic events caused by tectonic activity and underground nuclear testing. No observed water-level fluctuations were attributed to a naturally occurring earthquake. The magnitude and duration of changes in water levels caused by nuclear tests are affected by the test size and the distance from a well to the test. Identifying water levels that might be affected by past nuclear tests is difficult because pre-testing water-level data are sparse.

Hydrologically significant trends were found in 13 of 25 wells with multiple years of water-level record. The largest change in water levels (1,029 feet in 25 years) occurred in well U-19v PS 1D as a result of the Almendro nuclear test. Likely explanations for trends in most of the wells are either changes in precipitation patterns that affect recharge rates to the ground-water system, pumping effects from water-supply well U-20 WW, or a combination of these two factors.

INTRODUCTION

Pahute Mesa is located in Nye County, southern Nevada (fig. 1). Areas 19 and 20 in the northern part of the Nevada Test Site (NTS) cover the eastern half of Pahute Mesa (fig. 2). In these two areas, 77 of 85 nuclear tests were detonated near[1] or below the water table (Laczniak and others, 1996, p. 51). Accurate ground-water levels beneath Pahute Mesa are necessary to determine the flow paths of ground water containing or potentially containing radioactive contaminants from these tests. Quality-assured water-level data can be used to construct flow maps, calibrate steady-state and transient ground-water flow models, and locate sites for future remedial monitoring. In addition, ground-water levels that vary with time due to different factors can be analyzed for trends. Determining the causes of existing trends can aid in understanding factors influencing the flow system.

[1] "Near" is defined as less than two cavity radii from the nuclear test to the top of the water table. The cavity is the void that results from the instantaneous meltdown of the rock after a nuclear test.

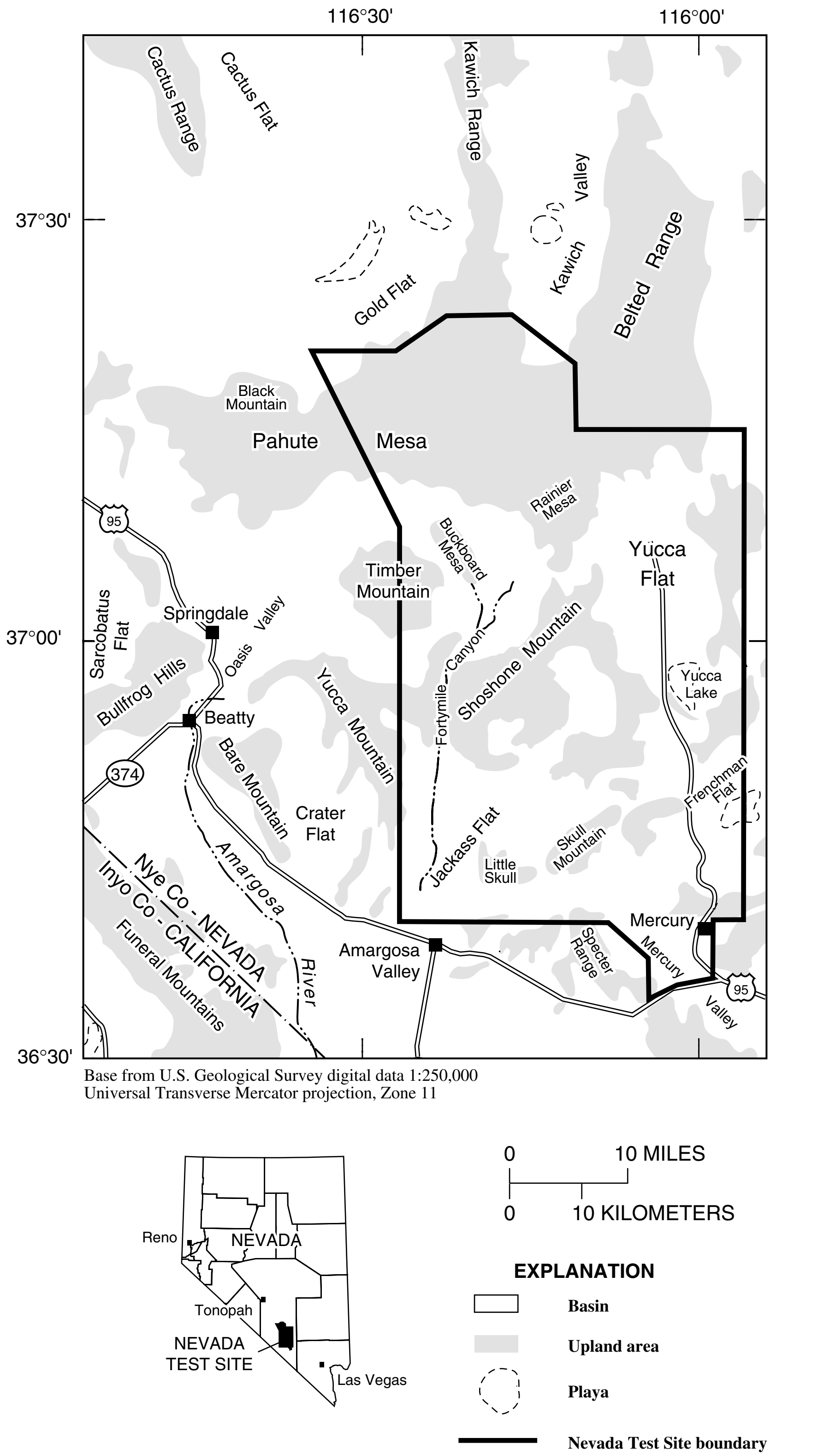

Figure 1. Regional features near Pahute Mesa and the Nevada Test Site, southern Nevada (modified from Laczniak and others, 1996, fig. 1).

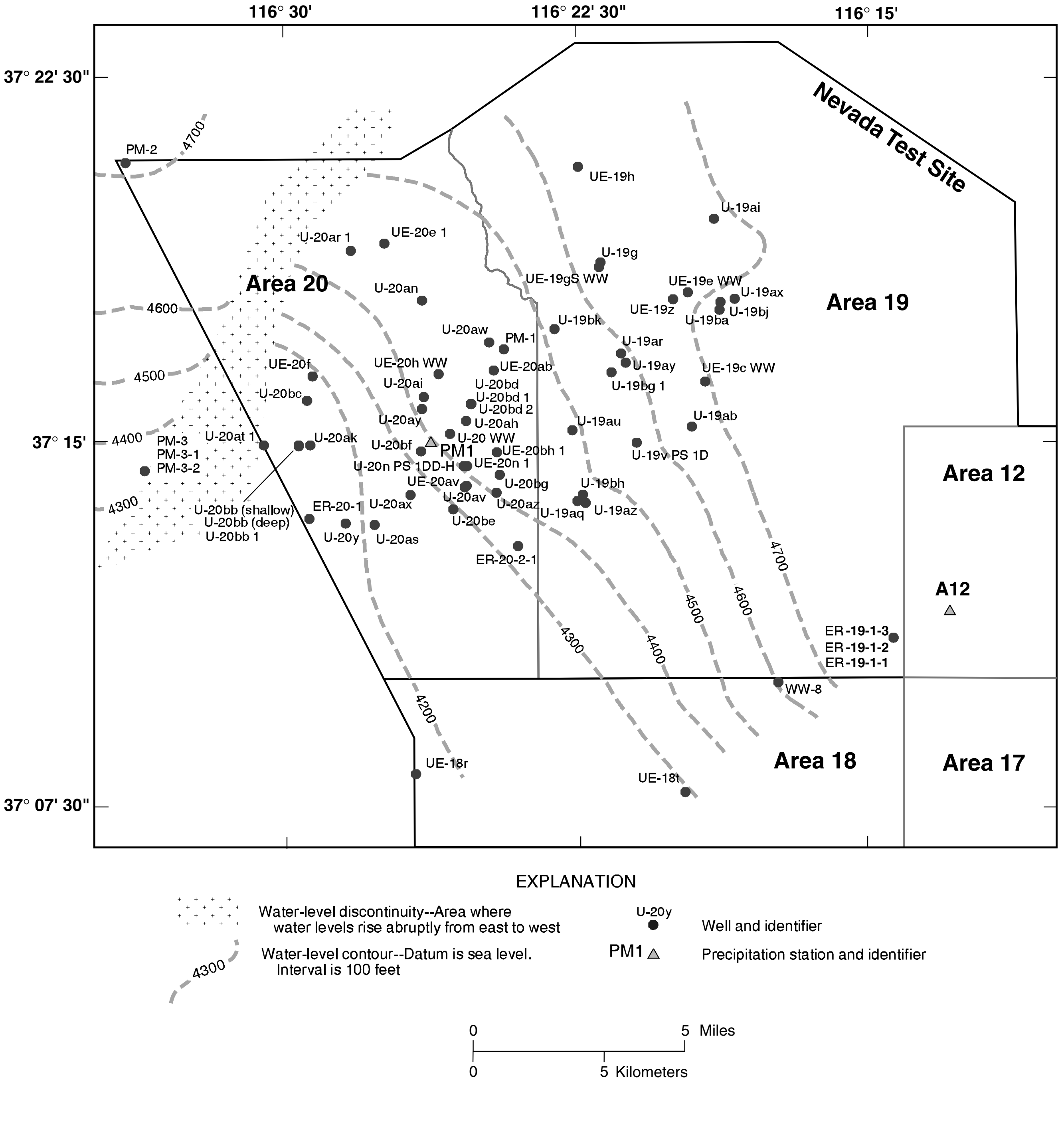

Figure 2. Selected wells and precipitation stations and regional ground-water levels on Pahute Mesa and vicinity, Nevada Test Site. Water-level contours and discontinuity from O'Hagan and Laczniak (1996).

Purpose and Scope

The purpose of this report is to compile and quality assure water-level data at wells throughout Pahute Mesa and vicinity. As part of the quality assurance, ancillary data pertinent to computing hydraulic heads in wells are compiled and analyzed. These include well completion and measuring-point data, and other information related to hole completion and water properties (such as water temperature). Quality-assured water-level data at each well were analyzed for variability and for hydrologically significant trends. For those wells with significant water-level trends, an attempt was made to identify the cause.

Water-level data from 1963 to 1998 were compiled for 65 observation wells on Pahute Mesa and vicinity in the northwestern part of the Nevada Test Site (fig. 2). Well information including altitudes, depths, open intervals, and stratigraphy of the open interval are provided in table 1.

Hydrogeology

Pahute Mesa is an elevated plateau ranging from about 5,000 to 8,000 ft above sea level. Four hydrographic areas (HA)[2] comprise the plateau—Buckboard Mesa HA to the south, Oasis Valley HA to the southwest, Gold Flat HA to the northwest, and Kawich Valley HA to the northeast. The geographic features for which the HA's are named (fig. 1) generally define their location.

Pahute Mesa is composed of Miocene-age volcanic rocks. Multiple eruptions from several calderas at or near Pahute Mesa have produced volcanic deposits that are thousands of feet thick. No borehole drilled in Pahute Mesa has yet penetrated the entire section of volcanic rocks[3], although many holes from 4,000 to as deep as 13,686 ft deep have been drilled (Blankennagel and Weir, 1973, table 2). Because of the vast thickness of volcanic rocks underlying Pahute Mesa, these rocks form the principal aquifers and confining units in the area and are the primary control on the ground-water flow system. Principal stratigraphic units in open intervals of wells on Pahute Mesa that occur below the water table are listed in table 2.

The hydraulic properties of the volcanic rocks underlying Pahute Mesa were described by Blankennagel and Weir (1973). Most of the ground-water flow in the volcanic rocks is fracture flow. Rhyolite lavas and partly to densely welded ash-flow tuffs are the principal volcanic-rock aquifers. Rhyolite lavas generally have the highest permeabilities but, in a regional sense, may be restricted areally and in thickness. Welded ash-flow tuffs are slightly less permeable than the lavas but are widespread and thick; therefore, they may provide lateral continuity for water to move through the regional flow system. Nonwelded ash-flow and ash-fall tuffs are generally considered confining units, especially when they are zeolitized. These nonwelded tuffs have low fracture porosity and permeability because they are less likely to fracture than the welded tuffs, and when they do, the fractures are likely to reseal.

The primary sources of recharge to Pahute Mesa are infiltration of precipitation and subsurface inflow (Blankennagel and Weir, 1973). An estimated 3,150 acre-ft/yr of water is recharged to Pahute and Rainier Mesas through precipitation, with the higher altitudes of the mesas receiving greater amounts of recharge (Blankennagel and Weir, 1973, table 6). Subsurface inflow from the north, derived from ranges such as the Kawich Range and other ranges further north and west, contributes an estimated 5,500 acre-ft/yr (Blankennagel and Weir, 1973, p. B20).

Ground water flows south-southwest across most of Areas 19 and 20 (fig. 2)[4]. Ground water flowing past the southern margins of Pahute Mesa ultimately discharges at either Oasis Valley (about 25 mi to the southwest), Alkali Flat (about 70 mi to the south), or Death Valley (about 60 mi to the southwest) (Laczniak and others, 1996, p. 40).

Horizontal ground-water gradients across the study area are typically 25 to 100 ft/mi (O'Hagan and Laczniak, 1996). Vertical ground-water gradients generally change from variable or no gradient to

[2] Formal hydrographic areas in Nevada were delineated systematically by the U.S. Geological Survey and Nevada Division of Water Resources in the late 1960's (Rush, 1968; Cardinalli and others, 1968) for scientific and administrative purposes. The official hydrographic-area names, numbers, and geographic boundaries continue to be used in Geological Survey scientific reports and Division of Water Resources administrative activities.

[3] Well ER-19-1-1, which penetrates below the volcanic rocks, is located between Rainier and Pahute Mesas.

[4] The limitations of the data used to construct the ground-water flow map presented in figure 2, such as constraints on the lateral and vertical distribution of wells, are discussed by O'Hagan and Laczniak (1996). In general, the flow map was intended to represent a "coherent surface from which to generalize the regional occurrence and movement of ground water" (O'Hagan and Laczniak, 1996).

Table 1. Characteristics of selected wells on Pahute Mesa and vicinity, Nevada Test Site

Land-surface altitude: Altitude relative to sea level.
Open interval: Area of well that is open to aquifer and where, if saturated, ground water may enter well. Open interval typically consists of open borehole and(or) well screen.
Stratigraphy of open interval below saturated zone: Mch, Chainman Shale; pre-Tb, pre-Belted Range Group volcanics; Ta, Calico Hills Formation; Tb, Belted Range Group; Tc, Crater Flat Group; Tm, Timber Mountain Group; Tp, Paintbrush Group.

USGS well name	USGS site identification number [1]	Nevada Test Site hole name [2]	Latitude (ddmmss)	Longitude (dddmmss)	Land-surface altitude (feet)	Depth drilled	Top of open interval	Bottom of open interval	Stratigraphy of open interval below saturated zone	Water-level trends analyzed
						(feet below land surface)				
Area 18										
UE-18r	370806116264001	UE-18r	370805	1162641	5,538	5,004	1,629	5,004	Tm	yes
UE-18t	370741116194501	UE-18t	370741	1161945	5,201	2,600	1,896	2,600	Tm	yes
WW-8	370956116172101	Water Well 8	370956	1161721	5,695	5,499	1,250	1,780	Tb	yes
Area 19										
ER-19-1-1 (deep)	371043116142101	ER-19-1	371043	1161421	6,140	3,595	3,210	3,560	Mch	no
ER-19-1-2 (middle)	371043116142102	ER-19-1	371043	1161421	6,140	3,595	2,550	2,738	pre-Tb	no
ER-19-1-3 (shallow)	371043116142103	ER-19-1	371043	1161421	6,140	3,595	1,301	1,422	pre-Tb	no
U-19ab	371512116193101	U-19ab	371512	1161931	6,928	2,250	58	2,250	Tc	no
U-19ai	371929116185501	U-19ai	371929	1161855	6,742	2,075	77	2,075	Tb	no
U-19aq	371341116222901	U-19aq	371341	1162229	6,798	2,175	50	2,175	Tp	no
U-19ar	371643116212001	U-19ar	371643	1162120	6,707	2,200	77	2,200	Tp	no
U-19au	371509116223601	U-19au	371509	1162236	6,534	2,200	54	2,200	Ta	no
U-19ax	371750116182401	U-19ax	371750	1161824	6,986	2,200	59	2,200	Tc	no
U-19ay	371632116211301	U-19ay	371632	1162113	6,712	2,156	59	2,156	Tp	no
U-19az	371339116221601	U-19az	371339	1162216	6,753	2,130	77	2,130	Tp	yes
U-19ba	371746116184601	U-19ba	371746	1161846	7,037	2,177	69	2,177	Tc	no
U-19bg 1	371620116213501	U-19bg #1	371620	1162135	6,694	2,250	74	2,250	Tp, Ta	no
U-19bh	371349116222001	U-19bh	371349	1162220	6,768	2,148	70	2,148	Tp	yes
U-19bj	371736116184701	U-19bj	371736	1161847	7,035	2,153	57	2,153	Tc	yes
U-19bk	371714116230301	U-19bk	371714	1162303	6,670	2,198	57	2,198	no data	yes
U-19g	371836116215101	U-19g	371836	1162151	6,734	3,292	3,231	3,250	Tc, Tb	no
U-19v PS 1D [3]	371453116205751	U-19v PS #1D	371453	1162057	6,842	3,837	3,618	3,627	Ta, Tc	yes
UE-19c WW	371608116191002	UE-19c Water Well	371608	1161910	7,033	8,489	2,421	8,489	Tb	yes
UE-19e WW	371750116195901	UE-19e/Inst.	371750	1161959	6,919	6,005	2,475	6,005	Tc, Tb	no
UE-19gS WW	371830116215303	UE-19gS	371830	1162153	6,719	7,500	2,650	7,500	Tc, Tb	no
UE-19h	372034116222504	UE-19h	372034	1162225	6,780	3,705	2,050	2,283	Tb	yes
UE-19z	371758116193601	UE-19z/Inst.	371758	1161936	6,888	2,800	81	2,800	Tc	no

Table 1. Characteristics of selected wells on Pahute Mesa and vicinity, Nevada Test Site—Continued

USGS well name	USGS site identification number [1]	Nevada Test Site hole name [2]	Latitude (ddmmss)	Longitude (dddmmss)	Land-surface altitude (feet)	Depth drilled (feet below land surface)	Top of open interval (feet below land surface)	Bottom of open interval (feet below land surface)	Stratigraphy of open interval below saturated zone	Water-level trends analyzed
Area 20										
ER-20-1	371321116292301	ER-20-1	371321	1162929	6,181	2,065	1,940	2,065	Tp	yes
ER-20-2-1	371246116240101	ER-20-2 #1	371246	1162401	6,670	2,524	2,303	2,524	Ta	yes
PM-1	371649116242102	Pahute Mesa Ex. Hole #1	371649	1162421	6,558	7,858	7,543	7,731	Tb, pre-Tb	yes
PM-2	372042116340501	Pahute Mesa Ex. Hole #2	372042	1163405	5,592	8,788	2,506	8,788	pre-Tb	yes
U-20 WW	371505116254501	U-20 Water Well	371505	1162545	6,468	3,268	2,271	3,268	Ta	yes
U-20ah	371521116252001	U-20ah	371521	1162520	6,445	2,300	60	2,300	Ta	no
U-20ai	371551116262501	U-20ai	371551	1162625	6,503	2,154	56	2,154	Ta	no
U-20ak	371452116292101	U-20ak	371452	1162921	6,235	2,100	58	2,100	Tp	no
U-20an	371750116262701	U-20an	371750	1162627	6,462	2,026	59	2,026	Ta	no
U-20ar 1	371852116281701	U-20ar #1/Inst.	371852	1162817	6,319	2,285	109	2,285	Tm, Ta	no
U-20as	371313116274201	U-20as	371313	1162742	6,227	2,100	69	2,100	Tp	no
U-20at 1	371452116303301	U-20at 1	371452	1163033	6,241	2,197	79	2,197	no data	no
U-20av	371359116252301	U-20av	371359	1162523	6,464	2,100	77	2,100	Tp	no
U-20aw	371658116244401	U-20aw	371658	1162444	6,585	2,100	52	2,100	Ta	no
U-20ax	371350116264701	U-20ax	371350	1162647	6,536	2,200	62	2,200	Ta	yes
U-20ay	371536116262801	U-20ay	371536	1162628	6,520	2,100	58	2,100	Ta	no
U-20az	371352116243401	U-20az	371352	1162434	6,573	2,250	40	2,250	Ta	no
U-20bb (shallow)	371452116293901	U-20bb	371452	1162939	6,226	1,900	36	1,900	Tm	no
U-20bb (deep)	371452116293902	U-20bb	371452	1162939	6,226	2,220	36	2,220	Tm, Tp	no
U-20bb 1	371452116293903	U-20bb #1	371451	1162939	6,226	2,345	62	2,345	Tp	no
U-20bc	371547116292601	U-20bc	371547	1162926	6,146	2,000	40	2,000	Tm	no
U-20bd	371542116251203	U-20bd	371542	1162512	6,486	2,261	49	2,261	Tp, Ta	no
U-20bd 1	371542116251301	U-20bd #1	371542	1162513	6,486	2,402	114	2,402	Tp, Ta	no
U-20bd 2	371542116251202	U-20bd #2	371542	1162512	6,487	2,450	60	2,450	Tp, Ta	no
U-20be	371332116254101	U-20be	371332	1162541	6,492	2,220	51	2,220	Ta	yes
U-20bf	371444116263001	U-20bf	371444	1162630	6,522	2,250	48	2,250	Ta	yes
U-20bg	371414116242901	U-20bg	371414	1162429	6,567	2,200	58	2,200	Ta	yes
U-20n PS 1DD-H[3]	371425116252401	U-20n PS #1DD-H	371425	1162524	6,468	4,253	2,577	2,869	Tm, Ta	yes
U-20y	371315116282701	U-20y	371315	1162827	6,257	2,602	52	2,602	Tp	no
UE-20ab	371623116243701	UE-20ab	371623	1162437	6,581	2,550	59	2,550	Ta	no

Table 1. Characteristics of selected wells on Pahute Mesa and vicinity, Nevada Test Site—Continued

USGS well name	USGS site identification number [1]	Nevada Test Site hole name [2]	Latitude (ddmmss)	Longitude (dddmmss)	Land-surface altitude (feet)	Depth drilled (feet below land surface)	Top of open interval (feet below land surface)	Bottom of open interval (feet below land surface)	Stratigraphy of open interval below saturated zone	Water-level trends analyzed
Area 20—Continued										
UE-20av	371401116252001	UE-20av	371401	1162520	6,458	2,614	133	2,614	Tm, Tp, Ta	no
UE-20bh 1	371442116243301	UE-20bh #1	371442	1162433	6,637	2,810	1,936	2,810	Ta	yes
UE-20e 1	371901116272501	UE-20e #1	371901	1162725	6,297	6,395	1,500	6,395	Ta, Tc, Tb	no
UE-20f	371617116291701	UE-20f	371617	1162917	6,116	13,686	4,456	13,686	Tc, Tb, pre Tb	no
UE-20h WW	371618116260201	UE-20h Emplacement Hole	371619	1162602	6,557	7,207	2,506	7,207	Ta, Tc	no
UE-20n 1	371425116251902	UE-20n #1	371425	1162519	6,461	3,300	2,282	2,834	Ta	yes
Off site										
PM-3	371421116333702	Pahute Mesa #3	371421	1163337	5,823	3,019	1,473	3,019	Tm, Tp, Ta, Tc, Tb, pre-Tb	yes
PM-3-1	371421116333703	Pahute Mesa #3	371421	1163337	5,823	3,019	1,872	2,192	Tp	yes
PM-3-2	371421116333704	Pahute Mesa #3	371421	1163337	5,823	3,019	1,379	1,687	Tm	yes

[1] The U.S. Geological Survey system for site-identification is based on the latitude-longitude grid. Each site is identified by a unique 15-digit number: the first six digits denote degrees, minutes, and seconds of latitude; the next seven digits denote degrees, minutes, and seconds of longitude; and the last two digits are the sequence number of the well or test hole within the 1-second grid of latitude and longitude. The assigned number is retained as a permanent identifier even if a more precise latitude and longitude are later determined. To determine the geographic location of a well or test hole, the latitude and longitude coordinates should be used rather than the site identifier.

[2] Official Nevada Test Site hole names are assigned to test holes according to the type of hole drilled, site location (NTS area number), and sequence code for consecutive order in which the hole was drilled or redrilled. Holes drilled on the Nevada Test Site begin with the letter “U”. Exploratory holes, drilled to assess material properties within a defined area, are designated with an “E” following the “U.” The “U” or “UE” are followed by a dash (-), NTS area number, and sequence code (letters “a-z, aa-az, ba-bz, ..., za-zz”). The suffix “PS” indicates a post-shot hole, the suffix “Inst.” indicates an instrumented hole, and the suffix “#” followed by a number indicates a satellite hole. Exceptions to the standard naming convention are wells beginning with “ER,” which indicates an environmental restoration well, and wells beginning with “Pahute Mesa” that have the suffix “#” followed by a number, which indicates the number of the hole rather than a satellite hole.

[3] Depth drilled and open intervals are corrected for hole slant.

Table 2. Principal stratigraphic units and lithologies in open intervals of wells on Pahute Mesa and vicinity, Nevada Test Site (modified from Laczniak and others, 1996, table 1)

Geologic system	Stratigraphic unit	Principal lithology
Tertiary	Timber Mountain Group (Tm)	Variably welded ash-flow tuff and rhyolite lava
	Paintbrush Group (Tp)	Variably welded ash-flow tuff and rhyolite lava
	Calico Hills Formation (Ta)	Rhyolite lava and nonwelded tuff
	Crater Flat Group (Tc)	Variably welded ash-flow tuff and rhyolite lava
	Belted Range Group (Tb)	Variably welded ash-flow tuff and rhyolite lava
	pre-Belted Range Group volcanics [1]	Variably welded ash-flow tuff and rhyolite lava
Mississippian	Chainman Shale (Mch)	Siltstone

[1] This stratigraphic unit is a generic category, not used in Laczniak and others (1996), that includes all Tertiary volcanic rocks units older than the Belted Range Group.

downward in most of Area 19 beginning at depths greater than 2,500 ft below the top of the saturated zone. In the western part of Area 19 and in Area 20, ground-water gradients are generally upward below these same depths (Blankennagel and Weir, 1973, fig. 10). In some areas of Pahute Mesa, anomalously high water levels (relative to regional water levels) are common in shallow wells (O'Hagan and Laczniak, 1996).

Acknowledgments

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WATER-LEVEL MEASUREMENTS

Periodic measurements of water levels in wells on Pahute Mesa have been collected by the USGS since the early 1960's and are maintained in the USGS National Water Information System (NWIS) database. Hydrographs showing periodic measurements of water levels from 65 wells on or near Pahute Mesa are presented in appendix 1; locations of these wells are on figure 2. Wells in appendix 1 are presented in the same order as they are listed in table 1—that is, they are ordered alphabetically within each NTS area number. Water levels are shown as depths below land surface. The land-surface altitudes of all wells listed in table 1 were surveyed as part of well construction and are rounded to the nearest foot of the reported value. Some boreholes on Pahute Mesa contain multiple piezometers or completion intervals, each piezometer or interval consisting of a discrete open interval in the borehole. These discrete open intervals are referred to as "wells" in this report. The 65 wells were chosen for inclusion in this report based on two arbitrary criteria. The criteria were: (1) a minimum of three water-level measurements for a well, and (2) the first and last measurement had to span at least 1 month. These criteria excluded from this report about 30 wells on Pahute Mesa with limited water-level data that are currently in the NWIS database.

Periodic water-level measurements were collected manually by the USGS using calibrated electric-cable units (also known as iron-horse and wire-line devices), calibrated electric tapes, or rarely, a calibrated steel tape. A description of each of these instruments is given by Wood and Reiner (1996, p. 6). Most measurements prior to 1996 were made with an electric-cable unit, whereas more recent measurements were typically made using electric tapes. The tapes and cable units are calibrated annually with a 2,000-ft steel reference tape. The steel reference tape is calibrated periodically by the National Institute of Standards and Technology, and over the period of water-level measurements, has shown an error of 0.23 ft or less over the 2,000-ft length. The water levels in this report are rounded to the nearest tenth of a foot of the reported value. Rounding to the nearest tenth of a foot is not meant to imply the absolute accuracy of the depth-to-water measurements, which varies from well to well but is generally within a foot or less of the true depth. Rather, water-level depths were rounded to a tenth of a foot to maintain relative changes in water levels which might be helpful in trend analysis.

In addition to the USGS water-level measurements, supplemental water levels determined from fluid-density geophysical logs are stored in the NWIS database. These data have been provided by private contractors working at NTS, and are reported to the nearest foot below land surface. The accuracy of these water-level measurements is difficult to verify, primarily because (1) the actual land-surface datum used for each measurement is uncertain, (2) a small chance exists that the fluid level measured was not the water level, and (3) the fluid measurements were not required to be extremely accurate for the purposes for which they were used. In general, the water-level measurements from the geophysical logs are considered to have an accuracy of 1 to 2 ft.

Water-level fluctuations on a smaller, more refined scale were examined in well PM-2 using a pressure transducer and electronic data logger. Hourly water-level and barometric data were collected in well PM-2 from August 1996 through September 1998. The water-level data are maintained in the USGS NWIS database. Transducer data are calibrated periodically with manual water-level measurements using a calibrated tape.

Quality-Assurance Flags

Most of the water-level data used in this report were quality assured prior to this study in preparation for inclusion in USGS data reports or as a prerequisite to being entered into NWIS. However, as a part of this study, data were rechecked for errors, especially water levels that appeared on hydrographs as outliers. Water levels that were not necessarily in error but which did not represent static conditions, did not appear to be representative of water levels in the regional aquifer system (as defined by O'Hagan and Laczniak, 1996), or required some other qualification were flagged to provide an explanation as to what the measurement represents (table 3, appendix 2). Water levels affected by a nuclear test (flagged "N") are discussed in a later section of the report ("Seismic Events and Underground Nuclear Tests"). The remaining quality-assurance flags are discussed here.

Table 3. Quality-assurance flags used to qualify water levels in wells on Pahute Mesa and vicinity, Nevada Test Site

Flag	Description
A	Anomalous value
AT	Water level does not agree with second access tube in same open interval
C	Water level affected by well construction
D	Dry hole
H	Static water level in well is above regional ground-water level
L	Static water level in well is below regional ground-water level
N	Water level affected by nuclear test
R	Water level affected by pumping or recently pumped well
X	Water level corrected for borehole deviation

Most of the non-static water levels in appendix 2 are flagged as affected by pumping of the well prior to or during the measurement ("R" flag) or equilibration of water levels after well construction or development ("C" flag). Water levels affected by pumping typically occurred in water-supply wells. Water levels affected by well construction may show a rising or falling trend that can last for hours to years before water levels stabilize. Wells in which the permeability of the water-producing zones is low or wells open to perched zones with limited water supplies are especially susceptible to the effects of well construction. Brikowski and others (1993) note that in drilling an emplacement hole on Pahute Mesa, "several million liters" of water may be introduced to the formation. This drilling water or water draining down the borehole from a perched zone may cause artificially high water levels in a well that may take a long time to dissipate in a low-permeability formation. For example, artificially high water levels in wells U-20ax and U-20be dropped more than 40 ft in the first 4 months after well completion; water levels in well U-20ax took approximately 10 months to fully equilibrate (appendixes 1 and 2). In contrast to artificially high water levels in the vicinity of a well after drilling, water levels may be artificially low following dewatering of the formation during well development. In well U-19bh, an artificially low water level rose about 40 ft in the first 6 months after the well was developed. From 1992 to 1998, water levels in well U-19bh rose an additional 12 ft (appendixes 1 and 2)—most likely the result of continued equilibration after well construction. In addition to well U-19bh, seven other wells in appendix 2—ER-19-1-2, U-19ax, U-19bh, U-20az, U-20bb (shallow), U-20bb (deep), and UE-20ab—do not have a water-level measurement that represents conditions after the well equilibrated from well construction (that is, all water levels for these wells are flagged with a "C").

Water levels that were elevated above or depressed below regional ground-water levels by more than 75 ft were flagged with an "H" or "L", respectively. Elevated water levels, which are common in wells on some areas of Pahute Mesa (Blankennagel and Weir, 1973; Brikowski and others, 1993; O'Hagan and Laczniak, 1996), may result from upward or downward hydraulic gradients, perched or semi-perched conditions, or other local conditions near the well. Most of the elevated water levels that are noted by O'Hagan and Laczniak (1996) were found in shallow wells (less than 500 ft of water above the bottom of the open interval). Because aquifers with elevated water levels may be isolated from the regional flow system, water levels in these aquifers may not be useful for providing information about long-term trends in ground-water levels or for determining regional directions of ground-water flow. Static water levels in 14 of the 65 wells listed in appendix 1 are greater than about 75 ft above regional water levels drawn by O'Hagan and Laczniak (1996); water levels in 11 of these wells are greater than 150 ft above the regional water levels. Only one of the wells listed in appendix 1, ER-19-1-1, is greater than 75 ft below regional water levels. Determining wells with water levels that differ by moderate amounts (less than 75 ft) from regional water levels is difficult with the present well network.

Boreholes with large borehole deviations (flagged with an "X") have measured depths to water that are greater than the true depth to water. Large borehole deviations, resulting in large water-level corrections, were found in both post-shot holes (U-19v PS 1D and U-20n PS 1DD-H) included in this report. These holes were intentionally drilled at a slant into or near test-hole cavities. Water levels in these two post-shot holes (appendixes 1 and 2) have been corrected for borehole deviations using the following two equations:

$$tvd = 0.9338md \tag{1}$$

for all measured water levels in well U-19v PS 1D,

$$tvd = 0.9361(md - 2{,}050) + 2{,}005.88 \tag{2}$$

for measured water levels in well U-20n PS 1DD-H from 2,050 to 2,100 ft below land surface

where *tvd* is the slant-corrected true vertical depth of the water, in feet, and

md is the measured depth of the water, in feet.

Equation 1 was derived by triangulating to the water-level depth from a top and a bottom hole location. Equation 2 was derived by triangulating to the water-level depth using gyroscopic survey measurements taken at 50-ft increments. Slant-hole corrections to water levels in well U-19v PS 1D have ranged from 144 to 217 ft (depending on the water-level depth), whereas, corrections to well U-20n PS 1DD-H have ranged from 46 to 47 ft. Small deviations from vertical in a borehole may have little effect on water levels and no practical effect on calculations of head in the aquifer or on determinations of water-level trends. A survey of readily available documentation of borehole deviations from about 25 percent of the non-post-shot wells listed in table 1 indicated measured depths at the water table ranged from near zero to 0.5 ft greater than true vertical depths. Corrections of this magnitude were not applied to water levels and are not considered important when constructing a potentiometric map of the study area or when determining trends.

The completion interval for well ER-19-1-2 (middle) has two access tubes (small and large) that can be used to measure water levels. Because the tubes are supposed to access the same open interval, the water levels are expected to be identical. However, for an unknown reason, possibly an obstruction in the open interval separating one access tube from the other, the water levels differ by about 6 ft. These water levels are flagged "AT" to indicate the discrepancy. Only water levels from the large access tube are entered into the NWIS database.

Some water levels are flagged as anomalous ("A" flag) or dry ("D" flag). Anomalous values indicate water levels that are either unexplained outliers (possibly bad data or an unknown condition affecting the water level) or short-term fluctuations that are not part of a regional long-term trend. For example, in well PM-2, a 15-ft rise in water level was measured in 1993 (appendix 1) that was not detected in other wells in the area; the rise was attributed to either localized recharge in a crater created by the Schooner test about 900 ft southeast of well PM-2 or possibly seepage down the borehole (Russell and Locke, 1997, p. 3; appendix 1). Only one well, U-19ax, has water-level measurements that indicate a dry hole.

Temperature Effects

Water levels in a well can be affected by the temperature of the water in the well. An anomalously high water temperature will result in water that has a relatively low density. For a given pressure head, warm (low density) water causes the water level in a well to rise higher than it would with "normal-temperature" water; likewise, cool (high density) water will cause the water level to be lower.

In some cases, water levels may need to be corrected for spatial and temporal variations in water temperature. Correcting for spatial differences in temperature among wells can be important when comparing heads for hydraulic-gradient calculations. Where ground-water gradients are low relative to the magnitude of temperature corrections, uncorrected hydraulic heads in wells may result in determinations of erroneous directions of ground-water flow. Temporal variations of water temperature in a well must be kept in mind when determining the cause of a water-level trend in that well. A decreasing or increasing water temperature with time, which might occur because of a nearby nuclear test or changes in natural hydrothermal gradients on Pahute Mesa, will cause an apparent decreasing or increasing water-level trend.

Adjusting water levels for temperature effects, or more precisely, density effects, requires information that is not available for most wells on Pahute Mesa. Although temperature is likely to be the most important factor affecting borehole fluid density in wells on Pahute Mesa, other factors such as dissolved and suspended solids, nonaqueous phase liquids (most likely associated with drilling of a well or leakage of oil from pumps), the compressibility of water caused by pressure from the overlying water column, and gravitational effects can influence the density. To adjust for temperature effects, the zone or zones of inflow to the well must be known, and a temperature distribution in the well from the point of lowest inflow to the top of the water column is needed. Determining the zone(s) of inflow is especially critical in wells with several thousand feet of open hole because correcting the density of the entire open hole (which is necessary if the water is entering from the bottom of the hole) compared to correcting the density of water only above the open interval (which is necessary when most or all water is entering near the top) can make a large difference in the final adjustment.

Water levels in appendix 2 were not flagged to indicate temperature effects because of insufficient data. Most wells on Pahute Mesa do not have accurate information on zones of inflow to the well in combination with an adequate vertical temperature profile of the hole. To be adequate for temperature corrections, the profile must extend from the top of the water column to the lowest zone of inflow and must be made after the water in the well equilibrates with formation water temperatures. In addition, water temperature is not measured with each water-level measurement. Therefore, temperature corrections of water levels with time are not possible with most historical data.

A cursory examination of about 30 wells on Pahute Mesa with available water-level and temperature data indicate that water levels in most wells would not be greatly affected by temperature if corrected to 95°F. Wells with large corrections (greater than 10 ft) are those with long water columns (greater than 1,500 ft of water above the assumed point of inflow) in combination with mean water-column temperatures exceeding 105°F. Examples of wells with potentially large corrections are PM-2, UE-20f, and U-19v PS 1D. Temperature corrections of water levels in wells with less than 1,000 ft of water above the bottom of the open interval[5] (see appendix 2) are likely to be relatively small, regardless of the temperature of the water. In contrast to this cursory examination of water-level corrections, adjustments of water levels in boreholes on Pahute Mesa for temperature effects was examined by Pottorff and others (1987). In this more comprehensive study of temperature data, they calculated water-level adjustments to 37 boreholes on Pahute Mesa, including 8 boreholes used in this study, using temperature log data. Differences between measured and temperature-corrected water levels ranged from about 0 to 50 ft. Pottorff and others corrected water levels to standard temperature (60°F); however, correcting water levels to a higher temperature more typical of temperatures on the mesa, as was done in the cursory examination for this report, would result in much smaller adjustments to most heads. Pottorff and others also corrected the entire water-column length in each borehole, from the top of the water to the bottom of the borehole, which also would potentially over-correct the water levels.

The potential effect on water levels from water-temperature variations with time is illustrated with well PM-1. In this well, where the maximum water-level fluctuation is about 7 ft (appendix 1), a small change in

[5] The length of the water column above the bottom of the open interval is provided in appendix 2 to indicate the maximum water-column length that could be affected by temperature (and therefore, the maximum temperature correction that might be applied), assuming the point of inflow to the well was at the bottom of the open interval.

water temperature over several years could have caused the 7-ft change in water level. Well PM-1 has approximately 5,450 ft of water above the top of the open interval and 5,630 ft of water above the bottom of the open interval. According to Blankennagel and Weir (1973, table 8), the temperature in well PM-1 was 149.9^{o}F about 77 ft below the bottom of the open interval and the water in the well had an estimated temperature gradient of 1.22^{o}F/100 ft. This gradient would result in temperatures of 80.2^{o}F at the top of the water column, 146.7^{o}F at the top of the open interval, and a mean water-column temperature above the open interval of about 113.5^{o}F. The following equation, described by Winograd (1970), can be used to calculate a water-level change resulting from a temperature change:

$$n'/n = s/s' \qquad (3)$$

where n' is the length of water column above the point of inflow after a given temperature change;
n is the measured water column length above the point of inflow (assumed to be the top of the open interval, in this example);
s is the specific weight (or density) of water in the column at the mean water-column temperature and hydrostatic pressure; and
s' is the specific weight (or density) of water at the new temperature and identical hydrostatic pressure.

For the purposes of the following example, the density of distilled water for a given temperature at 1 bar, obtained from Lide (1992, p. 6–10), will be used.

The density of water, s, in well PM-1 at a mean temperature of 113.5^{o}F is 0.9900 gm/cc (grams per cubic centimeter). Assuming that the mean temperature in the well rose 5^{o}F to 118.5^{o}F, the new density of water, s', would be 0.9888 gm/cc. The measured water-column length above the assumed point of inflow, n, is 5,450 ft. Solving the above equation for n', the length of the water column after a 5^{o}F rise in temperature would be 5,456.6 ft, resulting in an increase in water level of 6.6 ft.

SOURCES OF WATER-LEVEL FLUCTUATIONS

Water-level fluctuations in wells on Pahute Mesa are caused by a number of natural and human factors. Natural factors include infiltration of precipitation, barometric pressure, Earth tides, and seismic events caused by tectonic activity. Human factors include ground-water pumpage, underground nuclear testing, and recovery from drilling effects. Some of these factors, such as infiltration of precipitation have relatively slow response times but may cause long-term changes in water levels. Other factors, such as seismic events, are relatively instantaneous but generally have no lasting effect on water levels.

Precipitation

The climate at the NTS is arid to semi-arid. Precipitation is controlled largely by altitude with greater amounts of precipitation falling in high-altitude regions. Precipitation monitoring stations maintained by the National Oceanic and Atmospheric Administration (NOAA) are located on Pahute Mesa (PM1)[6], at an altitude of 6,550 ft, and on Rainier Mesa (A12), at an altitude of 7,490 ft (fig. 2) (Douglas Soule', National Oceanic and Atmospheric Administration, written commun., 1999). Mean annual precipitation at the Rainier Mesa station (13.2 in/yr) was about 1.7 times greater than at the Pahute Mesa station (7.7 in/yr) for 1964–94. Annual precipitation and cumulative departure from normal precipitation at these two stations for 1964–98 are shown in figure 3. The plot of cumulative departure from normal precipitation on Pahute Mesa shows excess precipitation from 1982 to 1984 (cumulative departure line has positive slope), variable precipitation from 1985 to 1987, and in general, a precipitation deficit from 1988 to 1996.

D'Agnese and others (1997, p. 54–55) mapped large parts of Pahute and Rainier Mesas that are within the boundaries of the NTS as having moderate ground-water recharge potentials; recharge in these areas was estimated to be 7 to 25 percent of precipitation using a modified empirical precipitation–recharge relation developed by Maxey and Eakin (1949). Other areas near Pahute Mesa mapped with moderate to high recharge potentials include Kawich Range to the north, Belted Range to the northeast, and Timber and Shoshone Mountains to the south. Much of the surrounding area that comprises the Death Valley regional ground-water flow system is assumed to have little or no recharge potential.

[6] The precipitation station, PM1, is not at the same location as well PM-1.

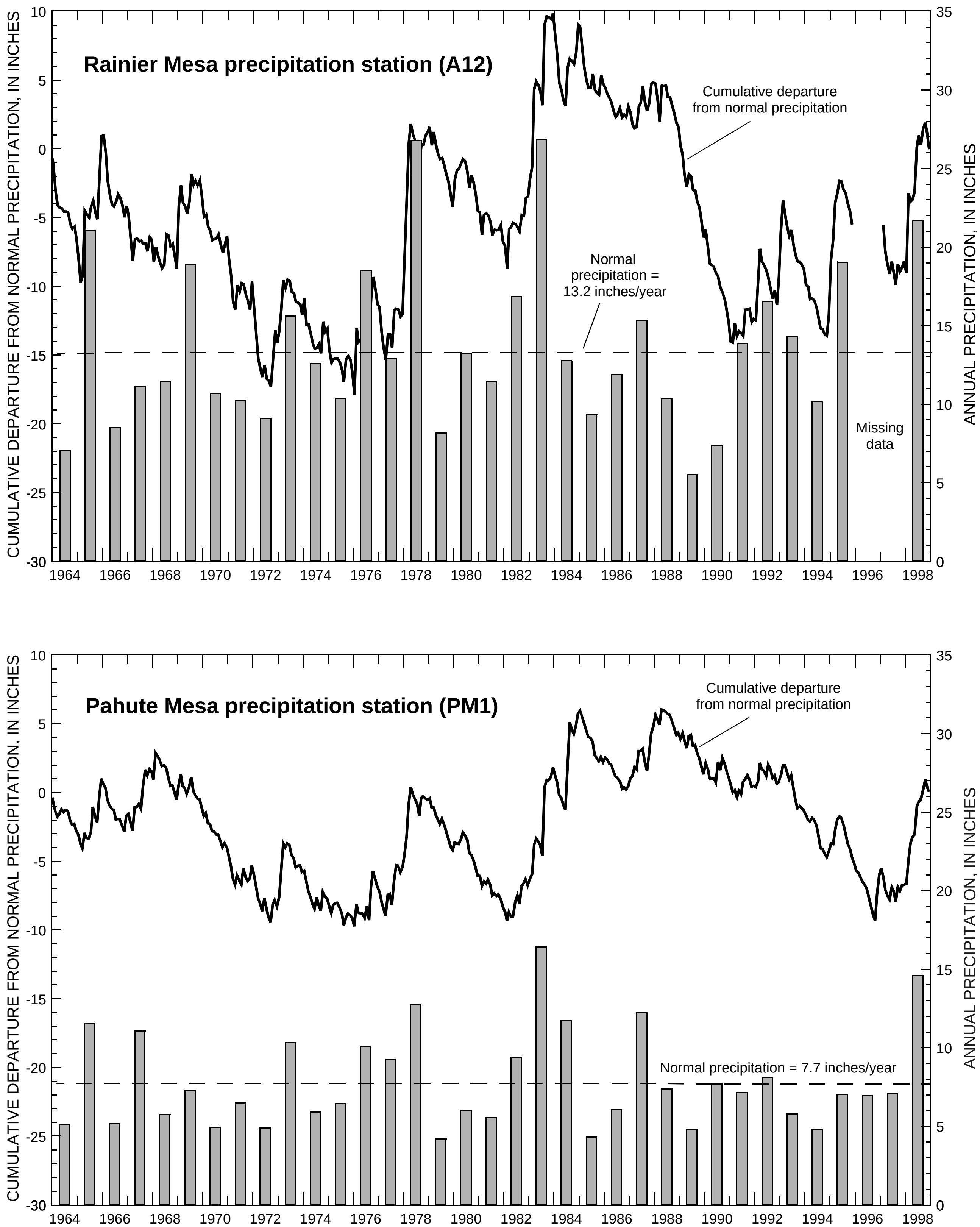

Figure 3. Annual precipitation and cumulative departure from normal precipitation on Rainier and Pahute Mesas, Nevada Test Site, 1964-98. See figure 2 for locations of precipitation sites. (Data from National Oceanic and Atmospheric Administration, written commun., 1999).

Depth to water beneath Pahute Mesa is typically 1,800 to 2,400 ft below land surface. Considering the substantial depth to water, short-term seasonal fluctuations in precipitation on Pahute Mesa are not likely to have an effect on water levels. Long-term fluctuations in precipitation (such as multiple years of below-average precipitation) on Pahute Mesa and on recharge areas to the north may affect water levels. In shallow alluvial aquifers in east-central Nevada, water levels have shown a response to long-term (10 years) drier- or wetter-than-normal periods of precipitation (Dettinger and Schaefer, 1995). In deeper aquifers (greater than 1,000 ft below land surface), water levels also may show evidence of responding to drier- or wetter-than-normal periods of precipitation. On the east side of the NTS, water levels in the regional Paleozoic carbonate aquifer may correlate, after a lag time of about 3 years, to departures from normal precipitation (Daniel Bright, U.S. Geological Survey, written commun., 1999). Southwest of Pahute Mesa, at Yucca Mountain, Lehman and Brown (1996) suggested precipitation as a possible cause of apparent cyclic water-level fluctuations in wells penetrating volcanic rocks at depths of 1,200 to 4,000 ft.

Barometric Pressure and Earth Tides

Changes in barometric pressure and Earth tides affect water levels in wells screened in confined aquifers under Pahute Mesa. Most of the change in water level from barometric fluctuations is caused by changes in air pressure translated down the open well rather than through the unsaturated zone. Typically, an increase in barometric pressure will cause a lower water level, and a decrease will result in a higher water level. This relation is clearly illustrated in continual water levels from well PM-2, in which the barometric pressure is almost a mirror-image of the water level (fig. 4). Nearly all the short-term water-level fluctuations in this well, which are typically several tenths of a foot in magnitude, are caused by changes in barometric pressure.

Seasonal differences in barometric pressure can affect water levels, resulting in higher water levels in the winter and lower levels in the summer. In addition, the magnitude of short-term fluctuations in water levels caused by barometric pressure tend to be greater in the winter than in the summer. Long-term (10-year) trends in water levels, however, are not likely to be caused by barometric pressure. At a meteorological site near Mercury on the south end of the NTS, barometric pressure did not substantially change from 1986 to 1996 (Daniel Bright, U.S. Geological Survey, written commun., 1999).

Earth tides are caused by the forces exerted on the Earth's surface by the Moon and the Sun. Changes in ground-water level resulting from Earth tides are actual diurnal fluctuations of the head in the aquifer. As a result of Earth tides, water levels will peak near moonrise and moonset, and be lowest near the upper and lower culmination of the Moon (Ferris and others, 1962). The effects of Earth tides on water levels in well PM-2 are evident on the water-level plot (fig. 4) that was corrected for the effects of barometric pressure. (Water levels were corrected for barometric-pressure changes using a method outlined by Brassington, 1988, p. 81–84.) Earth tides cause water levels in well PM-2 to fluctuate several hundredths of a foot, which is about an order of magnitude less than fluctuations caused by barometric pressure.

Seismic Events and Underground Nuclear Tests

During the last 50 years, earthquakes on Pahute Mesa have been caused by nuclear tests and tectonic activity. Through September 1992, 828 underground nuclear tests were detonated at the NTS (U.S. Department of Energy, 1994). Of these, 85 were beneath Pahute Mesa (table 4) and 62 were beneath Rainier Mesa. Nuclear tests beneath Pahute Mesa were detonated between 1965 and 1992 in volcanic rocks; most were near (within two cavity radii) or below the water table. Most large-yield tests (200 kilotons and larger) done at the NTS were beneath Pahute Mesa (Laczniak and others, 1996). Tests beneath Rainier Mesa were typically small (less than 20 kilotons) and above the water table. In addition to earthquakes caused by nuclear testing, natural earthquakes have occurred on Pahute Mesa, which lies in the tectonically active Basin and Range Physiographic Province.

From 1950 to 1998, approximately 350 earthquakes of magnitude 4–5, 155 earthquakes of magnitude 5–6, and 19 earthquakes of magnitude 6 or greater occurred within about a 70-mi radius of the NTS (University of Nevada, Reno, Seismological Laboratory, 1998). Most of these recorded earthquakes, especially those greater than 5, occurred as a result of nuclear tests in the underground test areas of the NTS.

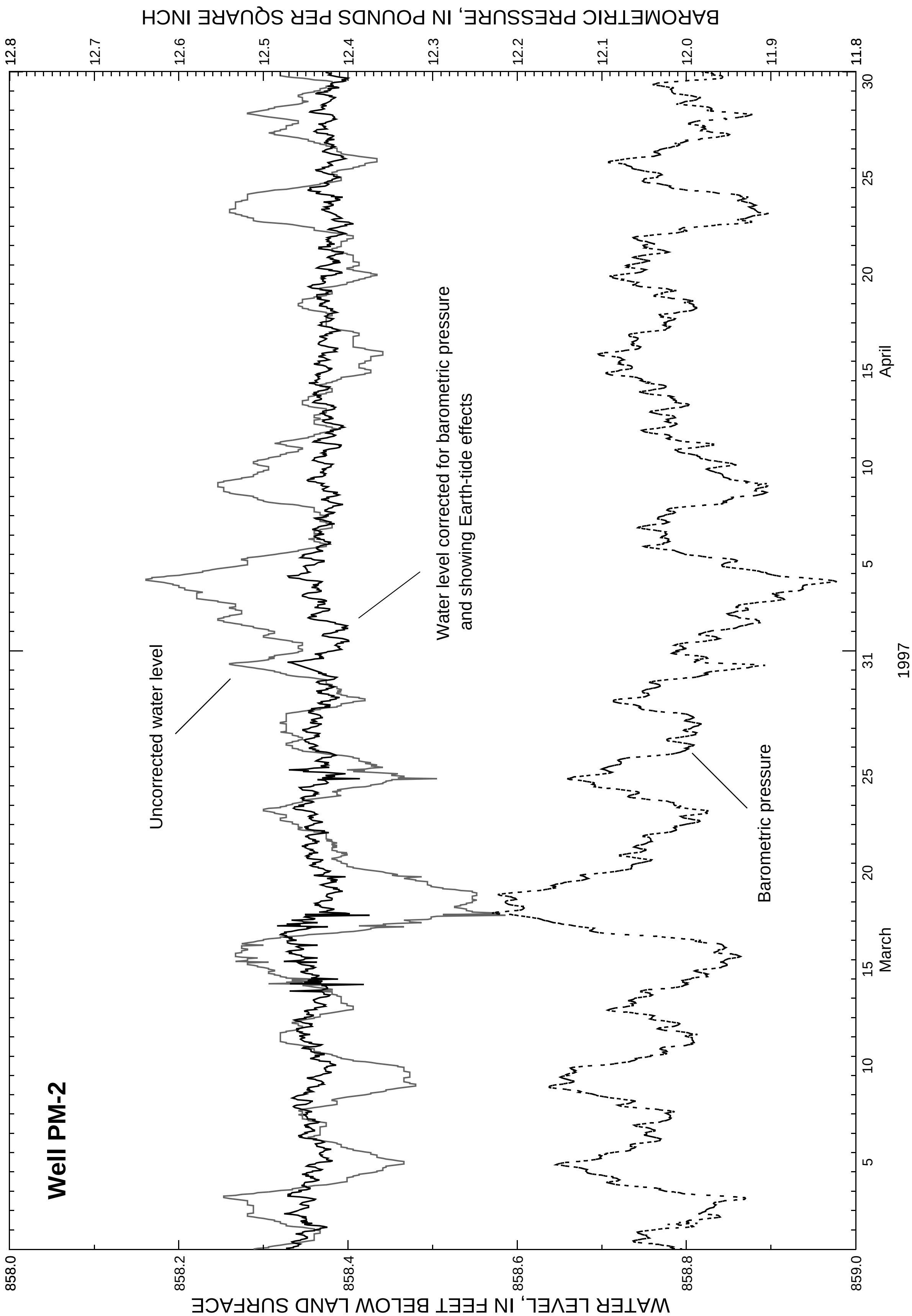

Figure 4. Response of water level to barometric pressure and Earth tides in well PM-2, March 1-April 30, 1997, Pahute Mesa, Nevada Test Site.

Table 4. Characteristics of nuclear tests on Pahute Mesa, Nevada Test Site, 1965–92

[Nuclear test data from Laczniak and others, 1996; Earthquake magnitudes from University of Nevada, Reno, Seismological Laboratory, 1998; Land-surface altitude relative to sea level; Burial depth relative to land surface; n.d., no data; <, less than; >, greater than]

Hole name	Test name	Latitude	Longitude	Land-surface altitude (feet)	Test date	Announced yield (kilotons)	Burial depth (feet)	Earthquake magnitude
U-19aa	Sheepshead	371345	1162151	6,758	09-26-1979	20 – 150	2,100	5.60
U-19ab [1]	Towanda	371512	1161931	6,928	05-02-1985	20 – 150	2,180	5.78
U-19ac	Tierra	371653	1161819	7,038	12-15-1984	20 – 150	2,100	5.46
U-19ad	Chancellor	371622	1162118	6,692	09-01-1983	143	2,051	5.45
U-19ae	Nebbiolo	371410	1162213	6,775	06-24-1982	20 – 150	2,100	5.70
U-19af	Galveston	371423	1162204	6,710	09-04-1986	< 20	1,598	3.50
U-19ai[1]	Serpa	371929	1161855	6,742	12-17-1980	20 – 150	1,880	5.10
U-19aj	Harzer	371812	1161932	6,891	06-06-1981	20 – 150	2,090	5.56
U-19ak	Hosta	372053	1161858	6,898	02-12-1982	20 – 150	2,100	5.67
U-19an	Labquark	371800	1161827	6,978	09-30-1986	20 – 150	2,021	5.57
U-19aq[1]	Lockney	371341	1162229	6,799	09-24-1987	20 – 150	2,020	5.76
U-19ar[1]	Cybar	371643	1162120	6,707	07-17-1986	119	2,060	5.78
U-19aS	Scotch	371630	1162212	6,761	05-23-1967	155	3,207	5.70
U-19au[1]	Alamo	371509	1162236	6,534	07-07-1988	< 150	2,040	5.66
U-19ax[1]	Kearsarge	371750	1161824	6,986	08-17-1988	< 150	2,020	5.58
U-19ay[1]	Amarillo	371632	1162113	6,712	06-27-1989	20 – 150	2,100	n.d.
U-19az[1]	Houston	371339	1162216	6,753	11-14-1990	20 – 150	1,949	n.d.
U-19b	Halfbeak	371857	1161756	6,791	06-30-1966	365	2,689	n.d.
U-19ba[1]	Bexar	371746	1161846	7,037	04-04-1991	20 – 150	2,065	n.d.
U-19bg	Junction	371621	1162135	6,691	03-26-1992	20 – 150	2,040	5.20
U-19c	Rickey	371554	1161853	7,032	06-15-1968	20 – 200	2,242	n.d.
U-19d	Chartreuse	372053	1161919	6,861	05-06-1966	73	2,187	n.d.
U-19e	Muenster	371748	1161959	6,920	01-03-1976	200 – 1,000	4,765	6.30
U-19f	Inlet	371330	1162203	6,734	11-20-1975	200 – 1,000	2,687	6.00
U-19g[1]	Estuary	371836	1162151	6,734	03-09-1976	200 – 500	2,848	6.00
U-19i	Sled	371501	1162049	6,836	08-29-1968	20 – 200	2,391	n.d.
U-19L	Stinger	371957	1161838	6,766	03-22-1968	20 – 200	2,191	n.d.
U-19n	Scroll	372016	1162232	6,754	04-23-1968	< 20	735	n.d.
U-19p	Pool	371521	1161943	6,899	03-17-1976	200 – 500	2,885	6.10
U-19q	Camembert	371644	1162207	6,758	06-26-1975	200 – 1,000	4,300	6.20
U-19t	Emmenthal	371717	1161751	6,991	11-02-1978	< 20	1,890	4.30
U-19u	Mast	372101	1161913	6,873	06-19-1975	200 – 1,000	2,990	6.10
U-19v	Almendro	371442	1162046	6,876	06-06-1973	200 – 1,000	3,490	6.10
U-19x	Backbeach	371401	1162206	6,781	04-11-1978	20 – 150	2,205	5.50
U-19yS	Panir	371633	1162126	6,694	08-31-1978	20 – 150	2,234	5.60
U-19zS	Fondutta	371759	1161936	6,888	04-11-1978	20 – 150	2,077	5.30
U-20a	Buteo	371434	1162551	6,520	05-12-1965	< 20	2,282	n.d.
U-20a #1	Duryea	371434	1162551	6,520	04-14-1966	70	1,784	n.d.
U-20aa	Colby	371822	1162817	6,337	03-14-1976	500 – 1,000	4,178	6.30
U-20ab	Farm	371624	1162437	6,581	12-16-1978	20 – 150	2,260	5.50

Table 4. Characteristics of nuclear tests on Pahute Mesa, Nevada Test Site, 1965–92—Continued

Hole name	Test name	Latitude	Longitude	Land-surface altitude (feet)	Test date	Announced yield (kilotons)	Burial depth (feet)	Earthquake magnitude
U-20ac	Colwick	371454	1162521	6,473	04-26-1980	20 – 150	2,077	5.60
U-20ad	Pepato	371723	1162719	6,366	06-11-1979	20 – 150	2,234	5.50
U-20ae	Tafi	371523	1162839	6,189	07-25-1980	20 – 150	2,231	5.70
U-20af	Kash	371654	1162714	6,360	06-12-1980	20 – 150	2,116	5.60
U-20ag	Molbo	371328	1162746	6,234	02-12-1982	20 – 150	2,093	5.45
U-20ah[1]	Gibne	371521	1162520	6,445	04-25-1982	20 – 150	1,870	5.47
U-20ai[1]	Jefferson	371551	1162625	6,503	04-22-1986	20 – 150	1,998	5.40
U-20aj	Cabra	371802	1162736	6,345	03-26-1983	20 – 150	1,780	5.20
U-20ak[1]	Salut	371452	1162921	6,235	06-12-1985	20 – 150	1,995	5.56
U-20aL	Egmont	371612	1162951	6,124	12-09-1984	20 – 150	1,791	5.58
U-20am	Kappeli	371604	1162438	6,593	07-25-1984	20 – 150	2,100	5.35
U-20an[1]	Serena	371750	1162627	6,462	07-25-1985	20 – 150	1,959	5.25
U-20ao	Goldstone	371416	1162822	6,279	12-28-1985	20 – 150	1,801	5.35
U-20ap	Bodie	371547	1162442	6,621	12-13-1986	20 – 150	2,083	5.57
U-20aq	Darwin	371553	1163004	6,155	06-25-1986	20 – 150	1,801	5.57
U-20ar	Kernville	371852	1162817	6,319	02-15-1988	20 – 150	1,777	5.36
U-20as[1]	Belmont	371313	1162742	6,227	10-16-1986	20 – 150	1,985	5.68
U-20at	Delamar	371452	1163033	6,240	04-18-1987	20 – 150	1,785	5.57
U-20av[1]	Hardin	371359	1162523	6,464	04-30-1987	20 – 150	2,051	5.56
U-20aw[1]	Contact	371658	1162444	6,585	06-22-1989	20 – 150	1,785	n.d.
U-20ay[1]	Comstock	371536	1162628	6,520	06-02-1988	< 150	2,035	5.46
U-20az[1]	Barnwell	371352	1162434	6,573	12-08-1989	20 – 150	1,971	n.d.
U-20b	Pipkin	371524	1162627	6,534	10-08-1969	200 – 1,000	2,046	5.50
U-20bb[1]	Tenabo	371452	1162939	6,226	10-12-1990	20 – 150	1,969	n.d.
U-20bc[1]	Hornitos	371547	1162926	6,146	10-31-1989	20 – 150	1,850	n.d.
U-20bd[1]	Bullion	371542	1162512	6,486	06-13-1990	20 – 150	2,211	n.d.
U-20be[1]	Hoya	371332	1162541	6,492	09-14-1991	20 – 150	2,159	3.24
U-20bf[1]	Montello	371444	1162630	6,522	04-16-1991	20 – 150	2,105	n.d.
U-20c	Benham	371353	1162825	6,281	12-19-1968	1,150	4,600	6.40
U-20d	Knickerbocker	371453	1162849	6,252	05-26-1967	76	2,069	5.50
U-20e	Jorum	371851	1162738	6,316	09-16-1969	< 1,000	3,809	6.30
U-20f	Fontina	371617	1162918	6,117	02-12-1976	200 – 1,000	3,999	6.30
U-20g	Greeley	371807	1162430	6,470	12-20-1966	870	3,991	3.90
U-20i	Boxcar	371744	1162721	6,370	04-26-1968	1,300	3,825	6.30
U-20k	Palanquin	371649	1163125	6,194	04-14-1965	4.3	281	n.d.
U-20L	Cabriolet	371651	1163052	6,197	01-26-1968	2.3	170	n.d.
U-20m	Handley	371802	1163203	5,903	03-26-1970	> 1,000	3,967	6.50
U-20n	Cheshire	371434	1162513	6,477	02-14-1976	200 – 500	3,829	6.00
U-20p	Stilton	372024	1163122	5,559	06-03-1975	20 – 200	2,400	6.00
U-20t	Chateaugay	371444	1162858	6,245	06-28-1968	20 – 200	1,992	n.d.
U-20u	Schooner	372036	1163357	5,562	12-08-1968	30	365	n.d.
U-20v	Purse	371658	1163002	6,088	05-07-1969	20 – 200	1,965	5.80
U-20y[1]	Tybo	371315	1162827	6,257	05-14-1975	200 – 1,000	2,510	6.00
U-20z	Kasseri	371724	1162442	6,509	10-28-1975	200 – 1,000	4,150	6.40
UE-20h[1,2]	Rex	371619	1162602	6,557	02-24-1966	19	2,202	n.d.

[1] Hole has associated water levels presented in this report.
[2] Emplacement Hole (formerly designated as UE-20h Ex. Hole).

Of the 19 recorded earthquakes with a magnitude greater than or equal to 6.0, 17 coincide with nuclear detonations on Pahute Mesa (table 4).

Earthquakes caused by tectonic or nuclear-test activity result in energy waves being propagated through the ground. As the series of waves pass through the earth, ground-water levels may be temporarily affected. This phenomenon was documented at Yucca Mountain following a 7.5-magnitude earthquake that occurred in 1992 in Landers, Calif., and a 5.6-magnitude earthquake, occurring a day later, under Little Skull Mountain at the southern end of the NTS—the largest recorded natural earthquake within the NTS boundary (O'Brien, 1993, p. 9). Small to moderate fluctuations (several inches to 3 ft) in ground-water levels lasting for less than an hour to as much as 6 months were recorded. The long-term changes in water levels near Yucca Mountain were believed to be caused by a change in the regional strain field from the nearby Little Skull Mountain earthquake. Because earthquakes typically only cause small short-term fluctuations in water levels, wells that are monitored infrequently (monthly or less often) will rarely show evidence of these fluctuations. Only wells with continual water-level recorders, such as well PM-2 which has 2 years of record, are likely to document an earthquake. On Pahute Mesa, no observed water-level fluctuations were attributed to an earthquake caused by tectonic activity.

The magnitude and duration of changes in water levels and hydraulic properties caused by nuclear tests under Pahute Mesa are affected by the size of, and distance from, a test. Wells in close proximity to a test may have more pronounced and long-lasting effects. Close to a detonation, changes in rock permeability, storativity, fluid pressures, and temperature can cause large changes in water levels that sometimes last for years before equilibrium is once again reached (Laczniak and others, 1996). In the case of well U-19v PS 1D, which is a re-entry hole into the U-19v test-hole cavity caused by the June 6, 1973, Almendro test (table 4), the water level declined in excess of 800 ft shortly after the test as a result of expulsion of ground water from the test cavity. The water level rose about 200 ft above pre-shot levels following the test, rising 1,029 ft from September 1973 to September 1998 (see well hydrograph U-19v PS 1D in appendix 1) as a result of slow infilling of the test cavity. Further from a detonation, water levels are affected less but changes still can be relatively large. For example, the Benham nuclear test registered as a magnitude 6.4 earthquake (U-20c, table 4). Approximately a month following the test, the water level in well UE-20f (about 3 mi from the shot hole) was still elevated about 50 ft (fig. 5). Six years later, the water level remained 17 ft above the pre-shot water level. However, with two additional large detonations (Jorum and Handley) occurring in the vicinity of well UE-20f within 1.5 years of the Benham test, the water-level

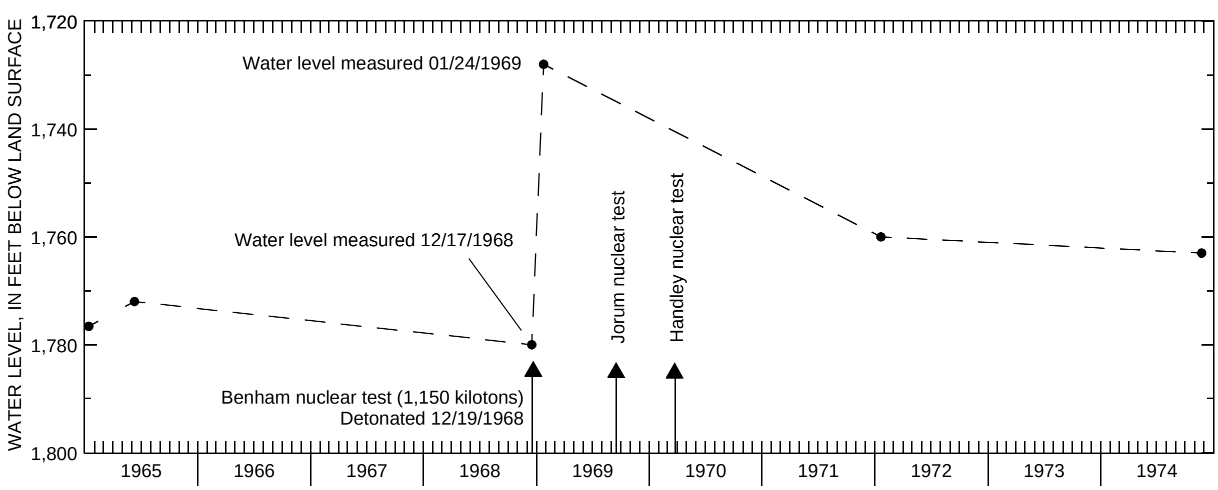

Figure 5. Potential effect on the water level in well UE-20f from the Benham nuclear test, Pahute Mesa, Nevada Test Site.

pattern shown in figure 5 is more complicated than presented. Sustained effects on water levels in well UE-20f from the Jorum nuclear test were noted by Dudley and others (1971, p. 49). Dudley and others also documented short-term (4 hours) oscillations in the confined fluid pressure in well UE-20f after the Handley test. Amplitudes of fluid-pressure oscillations, measured in feet of water, were from 15 to more than 300 ft. After 2 months, the pressure response indicated the water level was still elevated about 4 ft; however, this was reported to be in the range of instrument error.

Because most of the wells on Pahute Mesa do not have water-level records going back to the 1960's and 1970's, determining how many water levels might be affected by past nuclear tests is difficult. Without pre-test baseline water levels, it is extremely difficult to determine if a water level might be elevated several feet to more than 100 ft because of a past nuclear test. Also, without baseline data, distinguishing between a declining water-level trend that is the result of a 20- to 30-year-old nuclear test and a decline caused by some other factor is not easy. As an example of the difficulty in determining the cause of an anomalously high water level, well U-19ab has a water level that is elevated about 250 ft above regional levels. This water level may be from a shallow localized flow system or from a perched aquifer, in which water levels are naturally elevated above the regional flow system. High water levels might be expected in a well such as U-19ab, which only penetrates about 225 ft of saturated material, and which, except for a 10-ft interval of densely welded tuff, consists exclusively of low-permeability non-welded tuffs in the lower 700 ft of the well. These tuffs may impede recharge water moving downward into the regional aquifer, which would result in steep downward hydraulic gradients and a naturally elevated water level. Alternatively, the water level in well U-19ab, which was drilled in 1979, may be elevated because of the nearby (0.25 mi) Pool nuclear test, which was detonated in 1976. Other wells with elevated water levels that are within 1 mi of a large nuclear test (resulting in a magnitude 6.0 or greater earthquake) include U-19aq, U-19az, U-19bh, U-19v PS 1D, and U-20bc. Water levels in many wells on Pahute Mesa, however, are not elevated and within 1 mi of a large nuclear test.

Pumpage

Seven wells (designated with a "WW" in their name) on or near Pahute Mesa have been used for water withdrawal at the NTS. Total annual and monthly withdrawal data from 1983 to 1998 for the Pahute Mesa area are shown in figure 6. Withdrawals from 1963 to 1998 (excluding 1972–82 for which no data is available) for the three largest-producing wells are shown in figure 7 (D.B. Wood, U.S. Geological Survey, written commun., 1999). These three wells, WW-8, UE-19c WW, and U-20 WW, have supplied most of the water for Pahute Mesa activities. The remaining four wells—UE-19e WW, UE-19gS WW, U-20a 2 WW, and UE-20h WW—were only pumped for 1 to 4 years and have not been used since 1967. Total withdrawal from these wells was approximately 125 million gallons (Wood and Reiner, 1996, table 3; D.B. Wood, U.S. Geological Survey, written commun., 1999).

Between 1983 and 1998, approximately 2.29 billion gallons (7,030 acre-feet) of water were withdrawn from volcanic aquifers on or near Pahute Mesa. Water use generally rose from 1983 to 1989; peak annual use was 305 million gallons in 1989 (fig. 6). From 1989 to 1998, water use has generally declined. A large decline in 1993 marked the first full year after a ban on nuclear testing at the NTS. In 1998, water use was only 10 percent of peak use in 1989.

ANALYSIS OF WATER LEVELS

Water levels from 25 wells were analyzed for trends (table 5). Some of the trends were then quantitatively or qualitatively correlated with potential factors causing these trends. The purpose of the trend analysis was to determine if a net upward or downward change in water level occurred during the selected period of record. The wells selected for trend analysis have multiple years of periodic water-level record. Most wells (19) have 5 years or more of record. In addition, 18 of the 25 wells include recent (1998) data. Water-level data used in the trend analysis are shown with filled symbols on plots in appendix 1. Data not used in the trend analysis consisted of some isolated data points, early water levels affected by well construction (except for well U-19bh), water levels affected by pumping, and anomalous levels. Additionally, water-level data computed from geophysical logs were not used for trend analysis because of the low precision of the data.

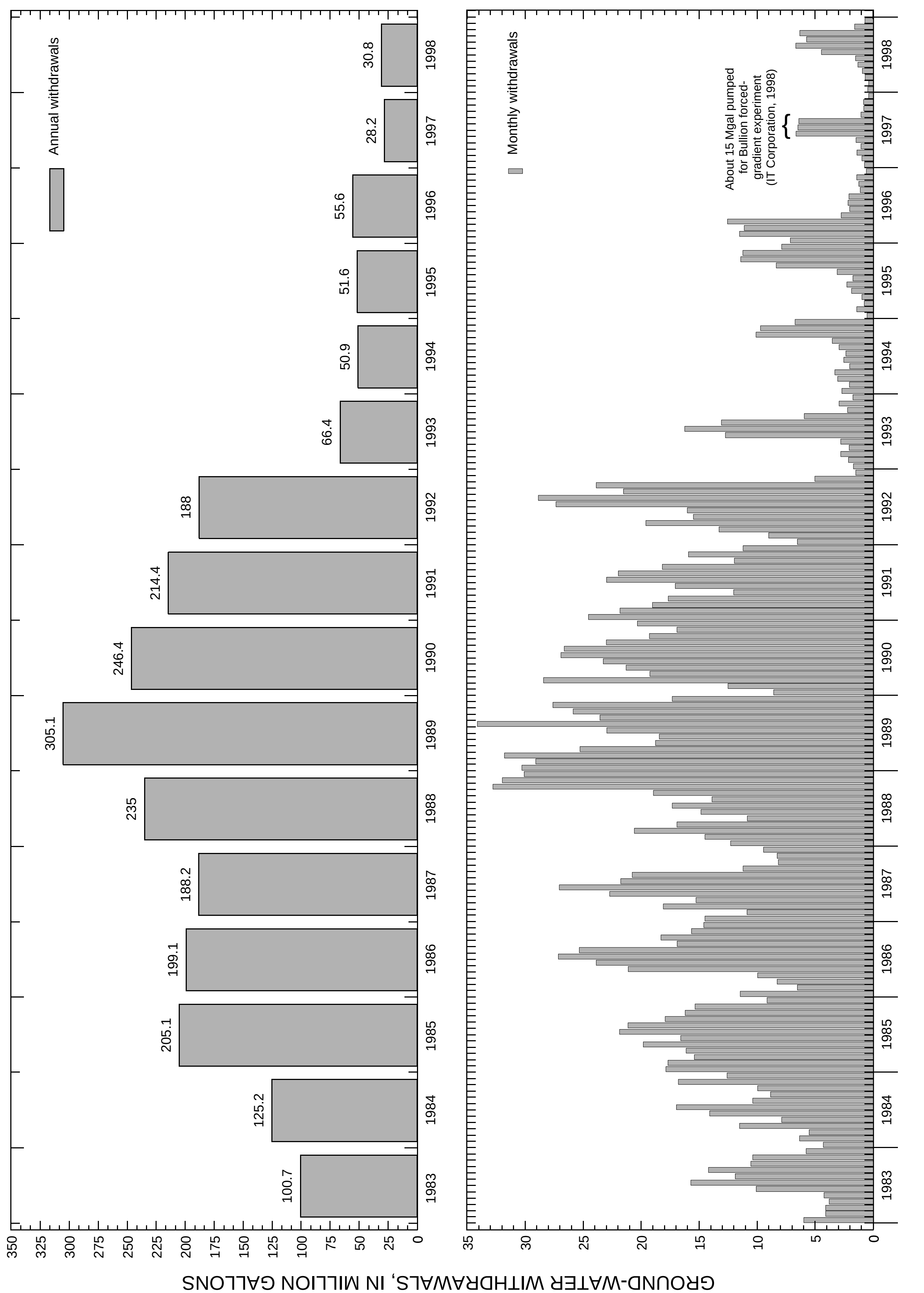

Figure 6. Annual and monthly ground-water withdrawals on Pahute Mesa and vicinity, Nevada Test Site, 1983-98.

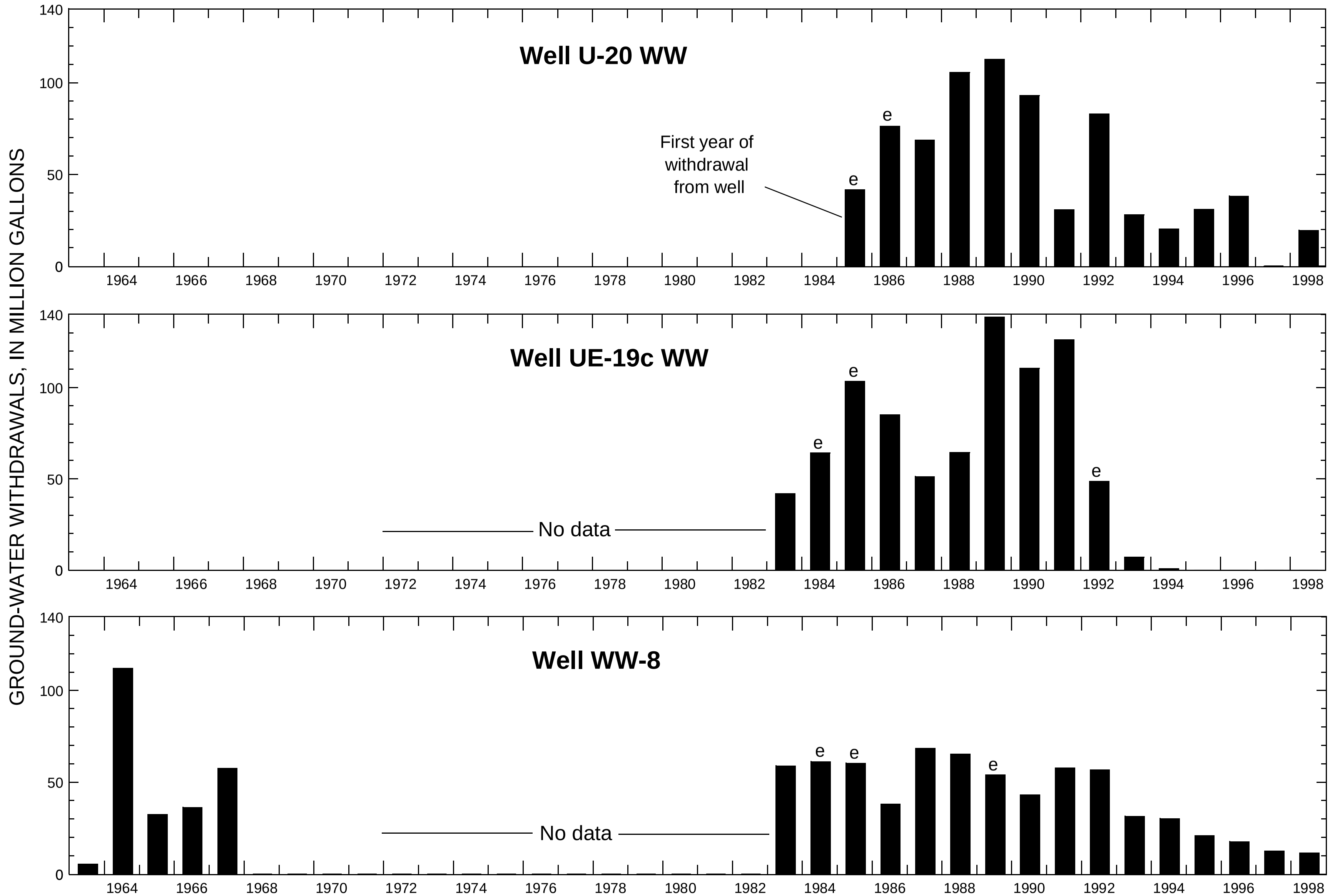

Figure 7. Annual ground-water withdrawals from water-supply wells U-20 WW, UE-19c WW, and WW-8 on Pahute Mesa and vicinity, Nevada Test Site, 1963-98. (Withdrawals estimated from totalizing flowmeter data; an “e” above bar indicates data contain estimated records.)

Table 5. Analysis of water-level trends, using the Kendall-Theil robust line method, in selected wells on Pahute Mesa and vicinity, Nevada Test Site

Level of significance (p): Probability that water-level changes are due to chance rather than a trend; p-values less than 0.05 are considered statistically significant, p-values less than 0.001 are highly significant; <, less than.
Slope: Estimate of slope in the trend line using the Kendall-Theil robust line method; slope not estimated if trend is not statistically significant or slope of trend appears nonlinear.
Hydrologically significant trend: Considered hydrologically significant if the level of significance is less than 0.05 and change in slope is more than 1 foot over the period of record; up, water level rising; down, water level declining.

Well name	Period of record analyzed	Level of significance (p)	Slope (feet per year)	Hydrologically significant trend
UE-18r	1986-98	<0.001	+ 0.12	up
UE-18t	1978-98	< .001	+ .04	none
WW-8	1971-95	.27	not estimated	none
U-19az	1989-90	.063	not estimated	none
U-19bh	1992-98	< .001	+1.2	up
U-19bj	1993-98	< .001	-.43	down
U-19bk	1992-98	.069	not estimated	none
U-19v PS 1D	1973-98	< .001	not estimated	up
UE-19c WW	1995-98	.012	+.19	none
UE-19h	1992-98	.71	not estimated	none
ER-20-1	1995-98	.59	not estimated	none
ER-20-2-1	1996-98	< .001	-.37	none
PM-1 all data	1988-98	< .001	not estimated	up
early data	1988-94	< .001	+1.2	up
recent data	1993-98	.002	-.38	down
PM-2 periodic data	1983-98	< .001	-.05	none
continual data	1996-98	< .001	not estimated	none
U-20 WW	1985-98	.86	not estimated	none
U-20ax	1988-92	.23	not estimated	none
U-20be	1990-91	< .001	-1.9	down
U-20bf	1989-90	< .001	-4.3	down
U-20bg	1991-98	< .001	-1.1	down
U-20n PS 1DD-H	1985-98	< .001	-1.2	down
UE-20bh 1	1991-98	< .001	-.94	down
UE-20n 1	1987-98	< .001	-1.2	down
PM-3	1988-91	.23	not estimated	none
PM-3-1	1992-98	< .001	+.35	up
PM-3-2	1992-98	< .001	+.33	up

To test for a monotonic relation of water-level change with time, the slope of a Kendall-Theil robust line was calculated and tested for significance (Helsel and Hirsch, 1992, p. 266–74). The Kendall-Theil method was chosen as an alternative to simple linear regression because some of the data sets did not meet the test assumptions for linear regression (that is, the data were non-linear, or the residuals were non-normal, auto correlated, or the variance was not constant). The Kendall-Theil method is a non-parametric trend test that consists of two parts. The first part is a robust test that determines if a significant upward or downward change in water level has occurred over the period of record. The first part of the method does not imply anything about the magnitude of the change in water level or whether the change in water level is linear. The second part of the method gives an estimate of the best-fit robust line through the water-level data and represents the average linear change in water level for the period of record. The slope of the line is computed by calculating the slopes for all possible pairs of water levels and then selecting the median slope. In cases where a data set appeared non-linear, such as the hydrograph for well U-19v PS 1D, no best-fit line was estimated for the data. The Kendall-Theil method is slightly less powerful than simple linear regression when the data meet all assumptions of normality. However, when data are not normally distributed or are auto-correlated, the Kendall-Theil method gives a much better estimate of slope (Helsel and Hirsch, 1992, p. 268). Because the Kendall-Theil method is robust, each data point is given equal treatment. Where data are irregularly spaced in time (for example, see hydrograph for well U-19v PS 1D), specific time periods may be over-represented on the overall trend simply because they have more data points per unit time than other parts of the hydrograph. A 95-percent confidence level was used in the test for the statistical significance of an upward or downward change in water level. Additionally, for a statistically significant trend to be considered hydrologically significant, a minimum of 1 ft of water-level change over the period of record was required. This arbitrary criteria was used as a conservative measure to filter out changes in water levels that might be the result of measurement error resulting from the different accuracies of the measurement devices used.

Results of the trend analysis are shown in table 5. Thirteen wells had at least one hydrologically significant trend (figs. 8 and 9). The largest change in water levels occurred in well U-19v PS 1D (fig. 8) as a result of the Almendro nuclear test. Water, initially expelled from the test cavity by the detonation, rose 1,029 ft in 25 years as a result of slow infilling of water back into the test cavity. The rising trend in well U-19bh (fig. 8) may be an artifact of well construction; however, the trend also could be the result of some other factor such as the Inlet nuclear test that occurred in 1975 less than 0.5 mi to the southeast. Likely explanations for trends in the remaining 12 wells are changes in precipitation patterns that affect recharge rates to the ground-water system, pumping effects from water-supply well U-20 WW, or a combination of these two factors.

Well U-20 WW had a 27-ft decline in water level from 1985 to 1995 due to pumping followed by about a 5-ft rise in level from 1996 to 1998 during a period of no pumping (fig. 9). This water-level decline and subsequent rise are based on measurements made when the pump was off. Water levels in six observation wells show hydrologically significant water-level trends that may be influenced by pumping in well U-20 WW (fig. 9). These wells range from about 0.85 mi (UE-20n 1 and U-20n PS 1DD-H) to 1.8 mi (U-20be) from well U-20 WW. Two wells, U-20be and U-20bf, have less than 2 years of data; therefore, statistical correlations of this data with pumping in well U-20 WW were not attempted. The remaining four wells show declining water levels through 1995 or 1996 followed by stable or rising water levels. Spearman correlation coefficients (Helsel and Hirsch, 1992, p. 217–218) were used to correlate water levels in these four wells with pumping from water-supply well U-20 WW.

Water levels could not be correlated directly with monthly withdrawal rates because of relatively long periods of no pumping interspersed with periods of pumping. Therefore, to correlate water levels with pumping, a value of "+1" was assigned to each month withdrawals were made from well U-20 WW and a value of "–1" was assigned to each month with little (less than 0.75 million gallons) or no withdrawals. Then, the change in water level between two consecutive measurements was correlated with the sum of the months of pumping (+1) and no pumping (–1) between the two water-level measurements. For example, for a set of water levels that respond to pumping, one would expect a decline in water level between two measurements to correlate with a large sum (that is, the sum of many months of pumping which were assigned "+1") and a rise in water level between two measurements to correlate with a small sum. Water-level data sets were filtered to about two water levels per year. This was

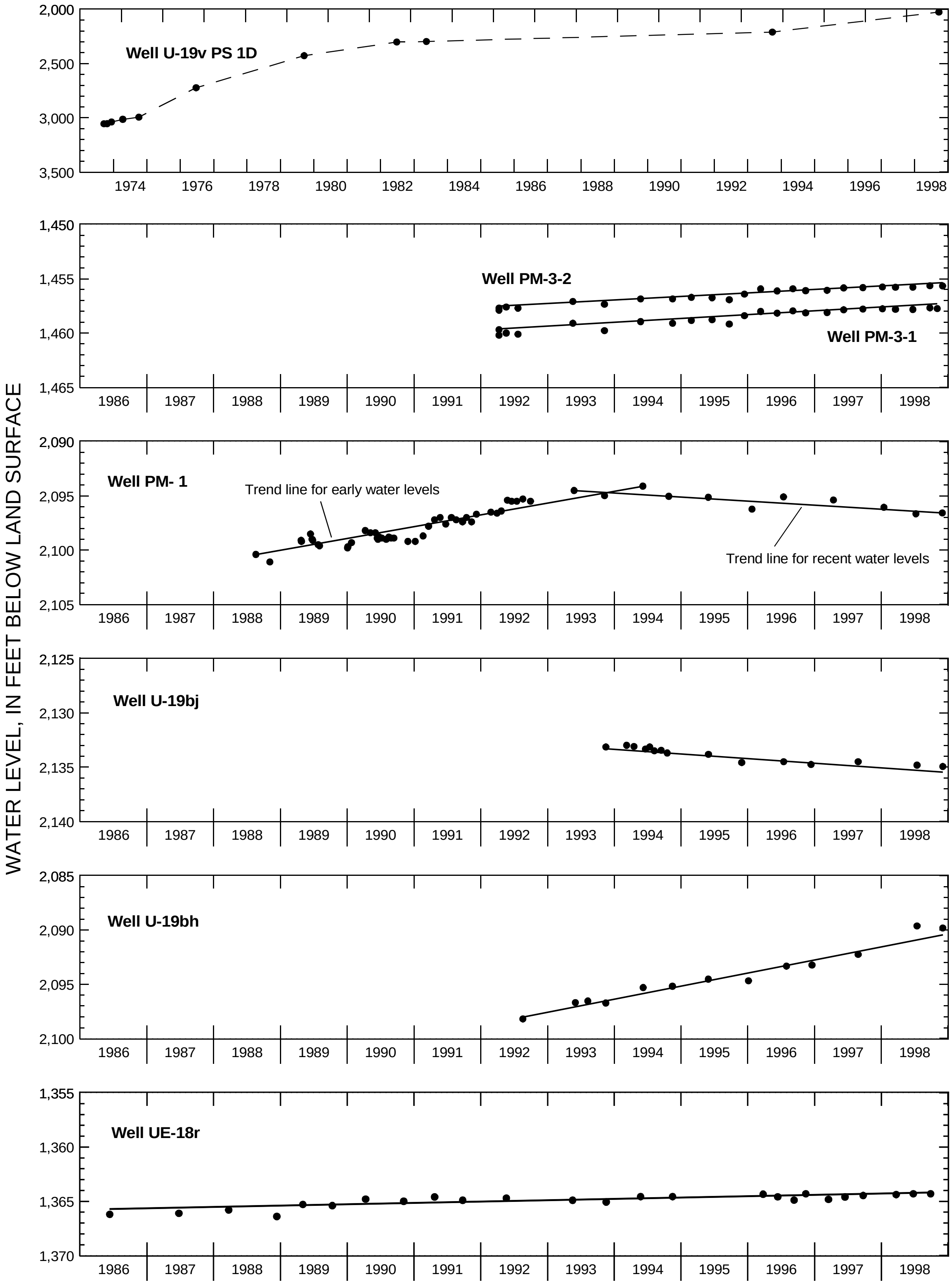

Figure 8. Hydrologically significant trends in water levels from selected wells on Pahute Mesa and vicinity, Nevada Test Site. (Scales are the same for all plots except U-19v PS 1D. Solid lines on lower five plots are Kendall-Theil robust trend lines.)

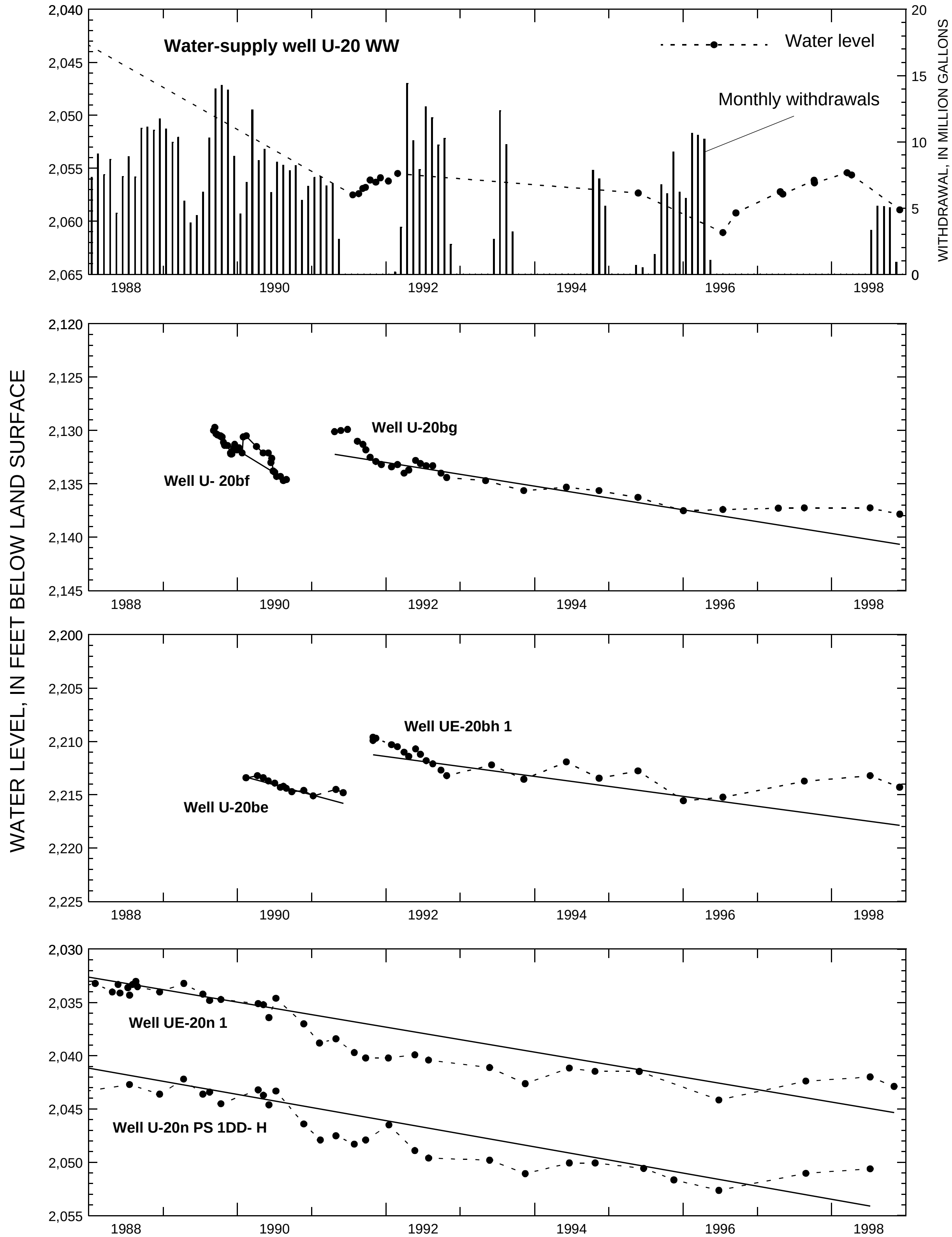

Figure 9. Selected wells on Pahute Mesa with water-level trends and their relation to pumping in well U-20 WW. (Solid lines on bottom three water-level plots are Kendall-Theil robust lines.)

done to improve the correlation by allowing sufficient time between measurements for larger scale changes to occur that might be associated with pumping.

Water levels in wells U-20bg, U-20n PS 1DD-H, UE-20bh 1, and UE-20n 1 were correlated with each other and with pumping in well U-20 WW. Correlations of water levels between well pairs indicate that the four wells all are strongly correlated with each other (Spearman's rho greater than 0.90[7]), with the exception of the correlation between wells U-20bg and U-20n PS 1DD-H (Spearman's rho = 0.84). Water levels in well UE-20bh 1 correlate the strongest with pumping in well U-20 WW (Spearman's rho = 0.78). Water levels in U-20bg, U-20n PS 1DD-H, and UE-20n 1 had poorer correlations (Spearman's rho = 0.48–0.54, p = 0.02–0.04). The lack of strong statistical correlation between water levels and pumping, despite the appearance of a correlation in figure 9, may be due to small data sets, a possible lagged response between pumping and water-level change, and other factors simultaneously influencing water levels, such as changes in precipitation.

Small-magnitude changes in water level occurring over periods of several months to several years commonly are masked by the effects of cyclic changes in air pressure and Earth tides. These small-scale changes in water level, which are difficult to distinguish with periodic data, can sometimes be seen with continual water-level data. As an example, figure 10 shows periodic water levels in well PM-2, measured approximately monthly, from mid-1996 to late 1998.

[7]The level of significance, p, is less than 0.01 for all correlations presented, unless otherwise specified.

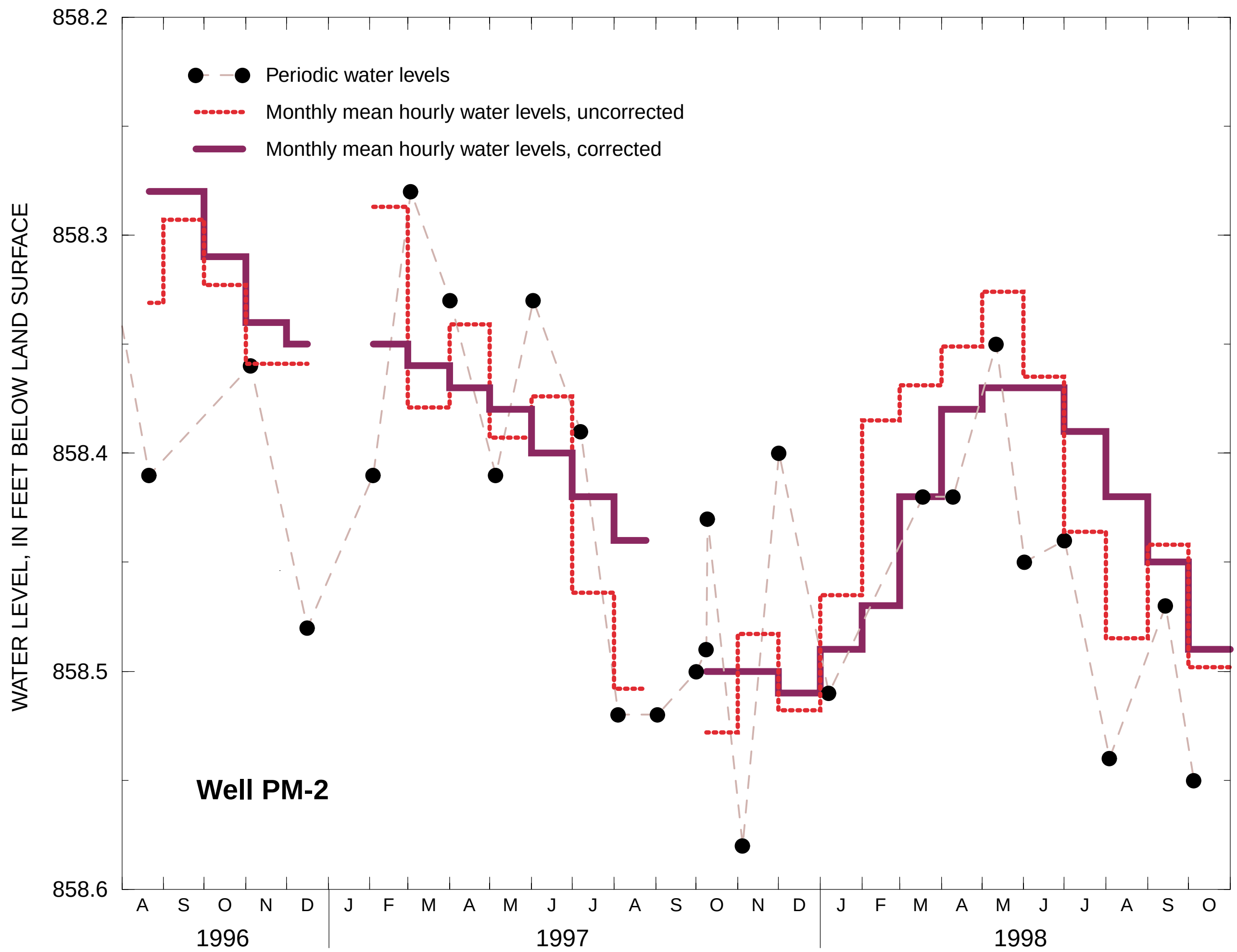

Figure 10. Relation of periodic water-level measurements in well PM-2 to corrected and uncorrected monthly mean water levels in well PM-2, 1996-98. Uncorrected monthly means computed from hourly measurements. Corrected monthly means computed from hourly measurements adjusted for effects of barometric pressure.

Changes occurring on a month-to-year scale are difficult to identify in the periodic water-level measurements primarily because of "barometric noise." Much of the short-term "noise" (hours to days) is removed from the water-level record by using hourly water-level data and calculating monthly means (fig. 10). However, to more adequately remove the effects of barometric pressure from the water-level record so that other influences can be seen, a barometric efficiency (the ratio of the change in water level to the change in barometric pressure) can be calculated. This efficiency, which was 0.41 for water levels in well PM-2, was used to remove the barometric effects from the hourly water-level record, as outlined by Brassington (1988, p. 81–84). These corrected water levels in well PM-2, when converted to monthly mean water levels (fig. 10), show a decline of about 0.2 ft from the end of 1996 to the end of 1997 and then a rise and decline of about 0.15 ft in 1998. These small-magnitude changes, apparent in the corrected monthly mean water-level record, may be caused by changes in recharge associated with seasonal differences in precipitation on Pahute Mesa or by seasonal changes in barometric pressure that were not removed from the water-level record.

SUMMARY

Periodic water-level data from 1963 to 1998 were compiled and quality assured for 65 observation wells and test holes throughout Pahute Mesa. Additionally, hourly water-level fluctuations from 1996 to 1998 were examined in well PM-2 using a pressure transducer and electronic data logger. As part of the quality assurance of all water levels, ancillary data pertinent to computing hydraulic heads in wells were compiled and analyzed. These include well completion and measuring-point data, and other information related to hole completion and water properties (such as water temperature). The 65 wells were chosen for inclusion in this report based on two arbitrary criteria. The criteria were (1) a minimum of three water-level measurements for a well and (2) the first and last measurement had to span at least 1 month.

Quality-assured water levels that were not necessarily in error but that did not represent static heads in the regional aquifer system or required some other qualification were flagged. Water levels flagged included those affected by pumping or well construction, water levels elevated above or depressed below regional ground-water levels by more than 75 ft, anomalous values, and water levels affected by nuclear tests or borehole deviations. Water levels affected by pumping typically occurred in water-supply wells. Water levels affected by well construction may show a rising or falling trend that can last for hours to years before equilibration with the head in the aquifer. Elevated water levels, which are common in wells on some areas of Pahute Mesa, may result from perched or semi-perched conditions, upward or downward hydraulic gradients, or local conditions near the well. Static water levels in 15 of the 65 wells for this report are greater than about 75 ft above or below regional water levels.

Because of insufficient data on temperature distribution and zones of inflow for most wells on Pahute Mesa, water levels were not flagged to indicate temperature effects. However, a cursory examination of about 30 wells with available water-level and temperature data indicate that water levels in most wells would not be significantly affected by temperature if corrected to 95^{o}F. Wells with large corrections (greater than 10 ft) are those with long water columns (greater than 1,500 ft of water above the assumed point of inflow) in combination with mean water-column temperatures exceeding 105^{o}F.

Water-level fluctuations in wells on Pahute Mesa are caused by several natural or human factors. Natural factors include infiltration of precipitation, barometric pressure, Earth tides, and earthquakes. Human factors include ground-water pumpage and underground nuclear testing.

On Pahute Mesa, no observed water-level fluctuations were attributed to an earthquake caused by tectonic activity. The magnitude and duration of changes in water levels caused by nuclear tests under Pahute Mesa are affected by the size of, and distance from, a test. In the immediate vicinity of a detonation, water-level changes can be large (hundreds of feet). Further from a detonation, water levels are affected less but changes still can be relatively large (tens of feet). Because most of the wells on Pahute Mesa do not have water-level records going back to the 1960's and 1970's, determining water levels which might be affected by past nuclear tests is difficult.

Seven wells on or near Pahute Mesa have been used for water withdrawal at the NTS. Between 1983 and 1998, approximately 2.29 billion gallons (7,030 acre-feet) of water were withdrawn from volcanic aquifers on or near Pahute Mesa. Water use generally rose from 1983 to 1989 and declined through 1998. Three wells, WW-8, UE-19c WW, and U-20 WW, have supplied most of the water for Pahute Mesa activities.

Water levels from 25 wells were analyzed for variability and for hydrologically significant trends. Some of the trends were quantitatively or qualitatively correlated with potential factors causing the trends. The wells selected for trend analysis have multiple years of water-level record.

Thirteen wells had at least one hydrologically significant trend. The largest change in water levels (1,029 ft in 25 years) occurred in well U-19v PS 1D as a result of the Almendro nuclear test. Likely explanations for trends in most of the wells are changes in precipitation patterns that affect recharge rates to the ground-water system, pumping effects from water-supply well U-20 WW, or a combination of these two factors.

Well U-20 WW had a 27-ft decline in water level from 1985 to 1995 due to pumping followed by about a 5-ft increase in level from 1996 to 1998 during a period of no pumping. Water levels in six observation wells show water-level trends that may be influenced by pumping in well U-20 WW. These wells range from about 0.85 mi to 1.8 mi from well U-20 WW. Four wells with at least 8 years of record show declining water levels through 1995 or 1996 followed by stable or rising water levels.

Small-magnitude changes in water level occurring over periods of several months to several years commonly are masked by the effects of cyclic changes in air pressure and Earth tides. These small-scale changes in water level, which are difficult to distinguish with periodic data, can sometimes be seen with continual water-level data.

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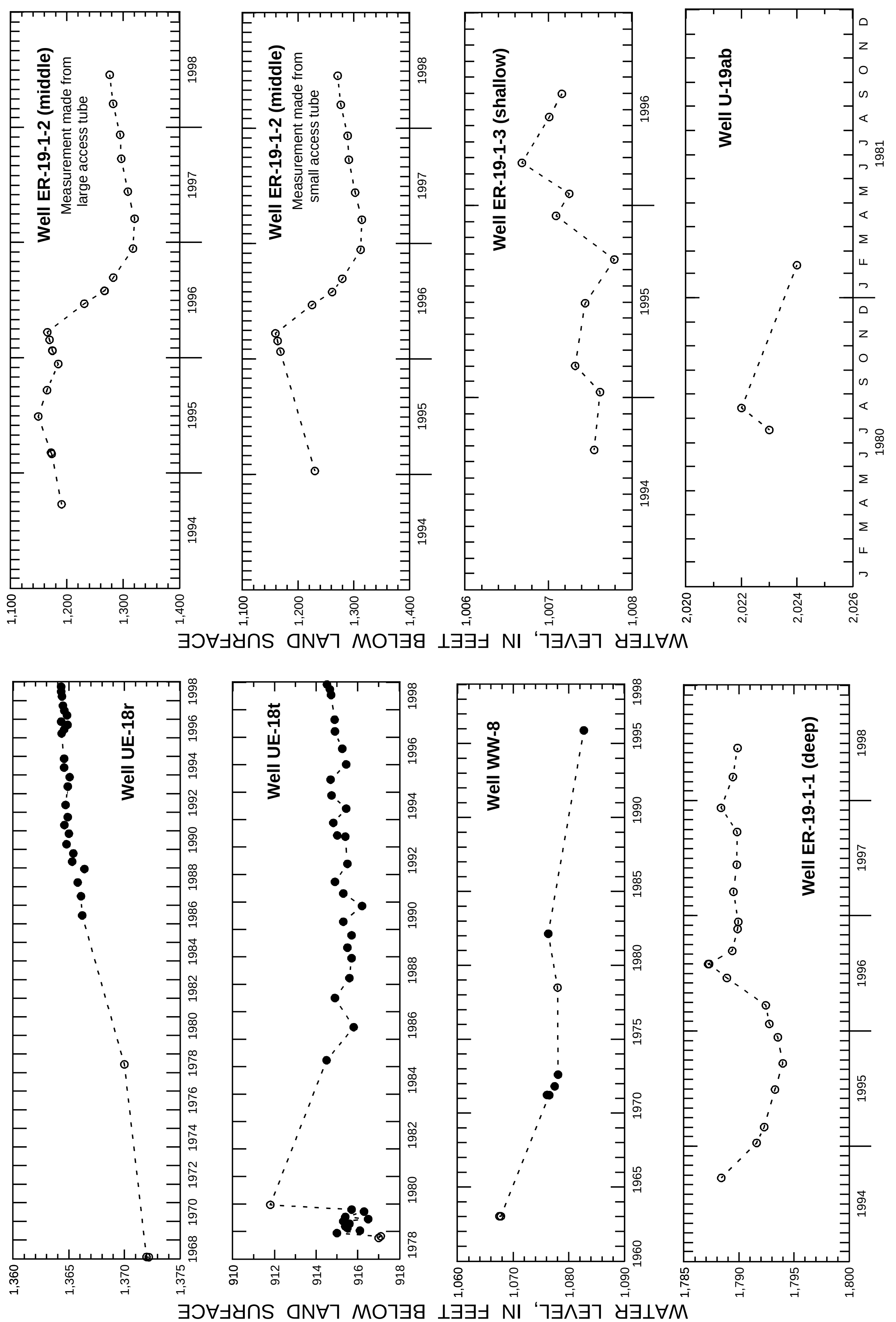
Water level being measured in well PM-2 on Pahute Mesa, 1999 (Photograph by Gary Otto, U.S. Geological Survey).

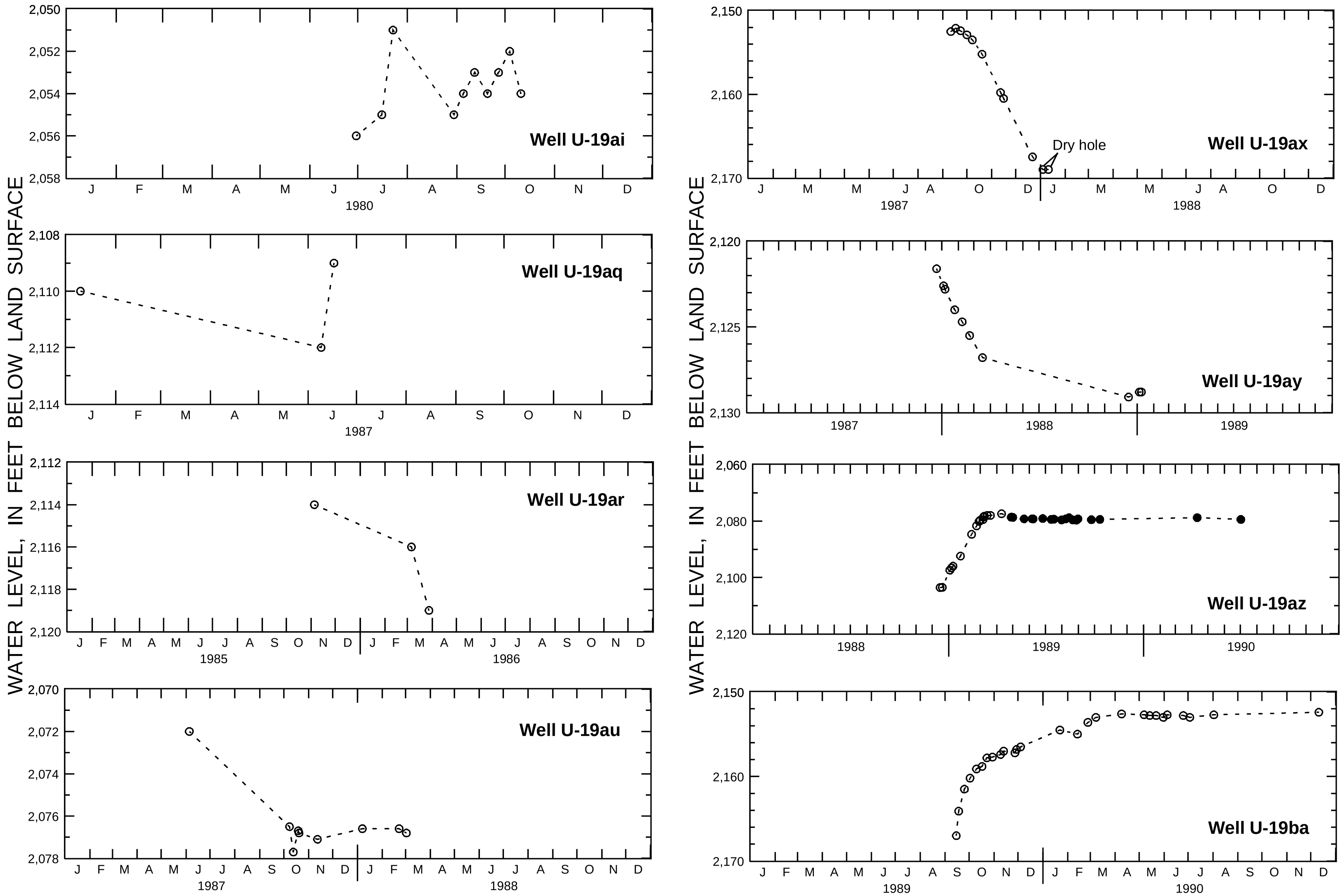
Water level being measured in water-supply well U-20 WW on Pahute Mesa, 1999 (Photograph by Gary Otto, U.S. Geological Survey).

Water level being measured in well U-19bj on Pahute Mesa, 1999 (Photograph by Gary Otto, U.S. Geological Survey).

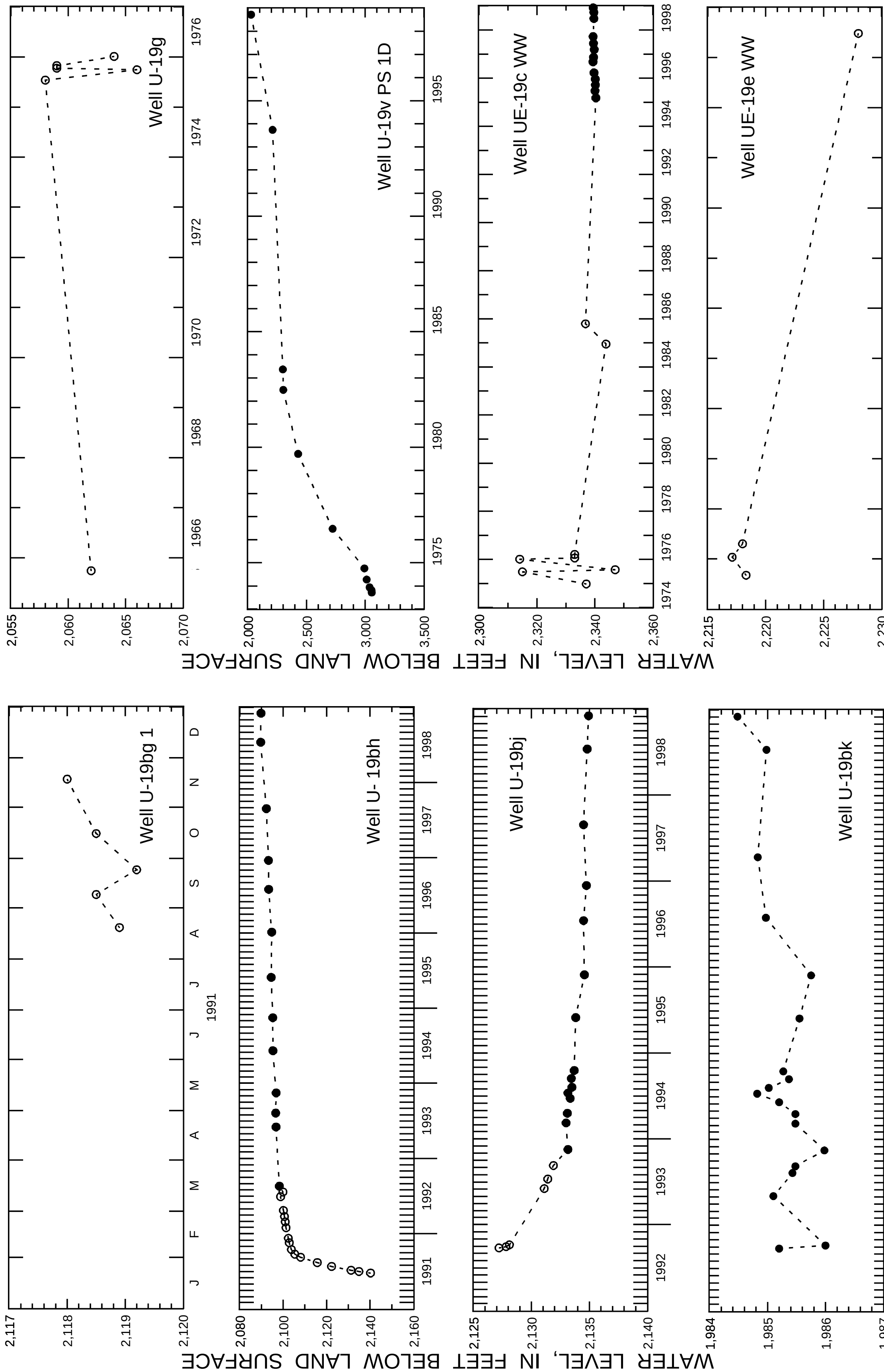
Appendixes



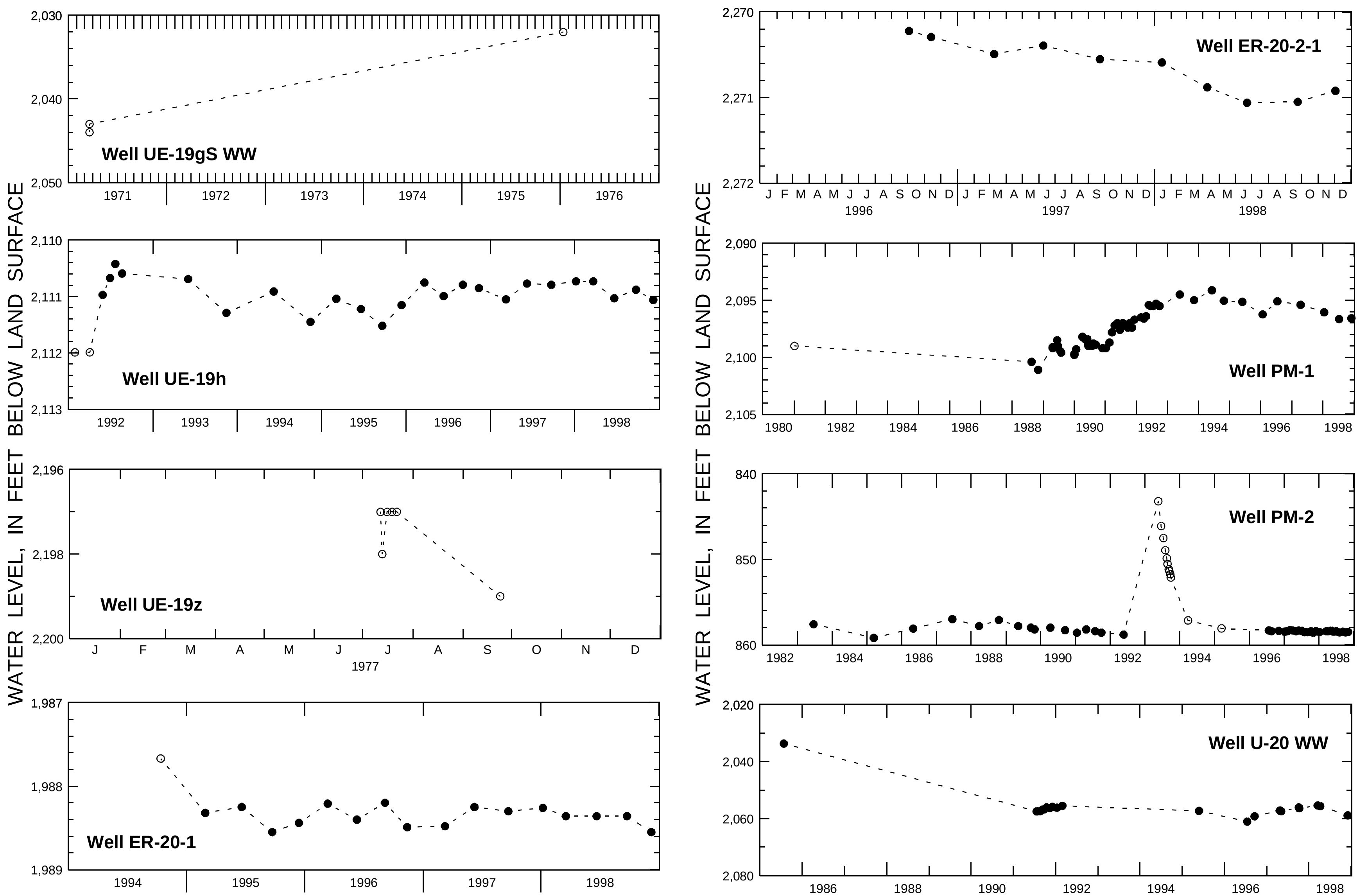
Appendix 1. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site. Water levels used for trend analysis are denoted with a filled circle. Note: Horizontal and vertical scales are different for each hydrograph and were set to maximize detail on individual plots.



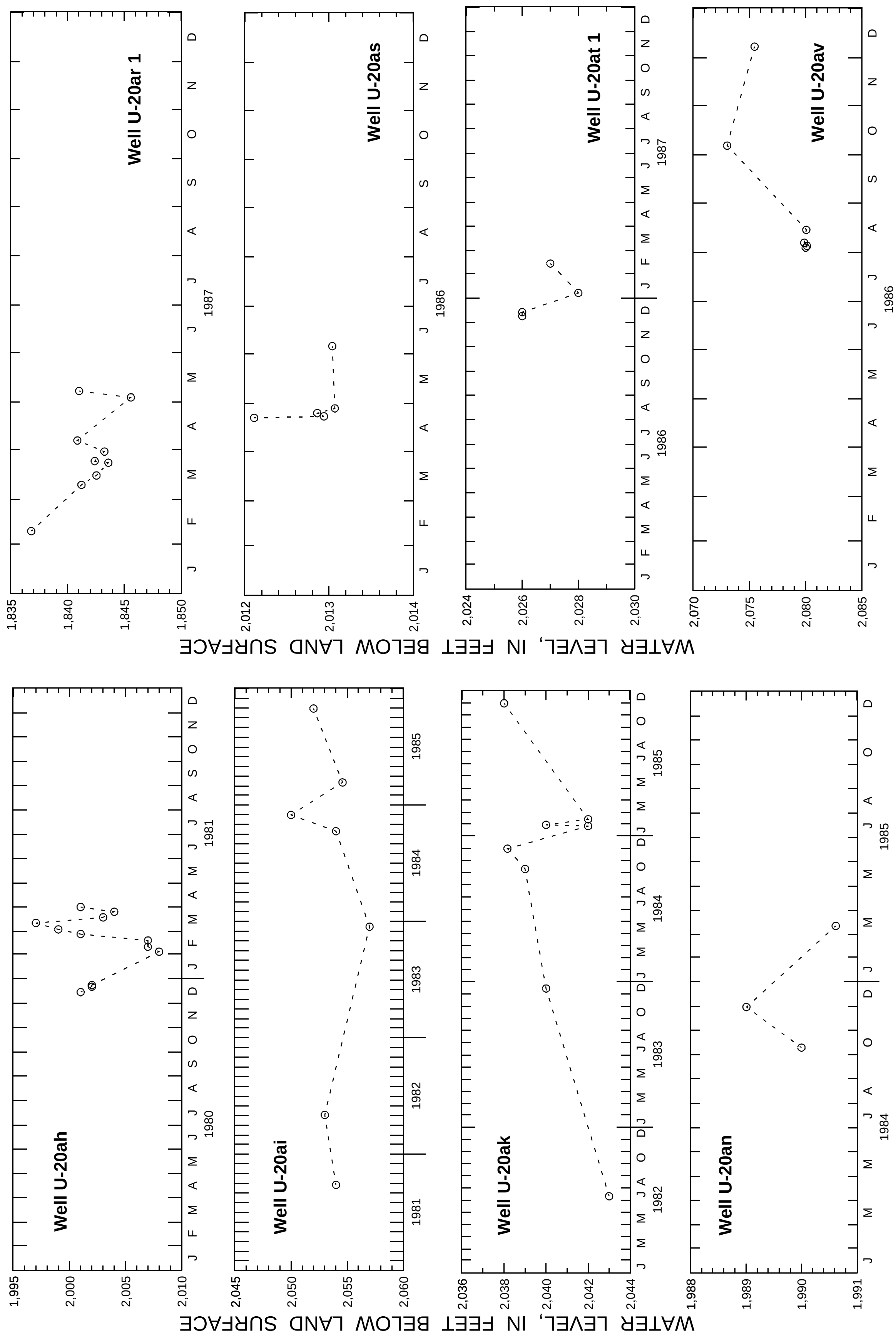
Appendix 1. Continued.



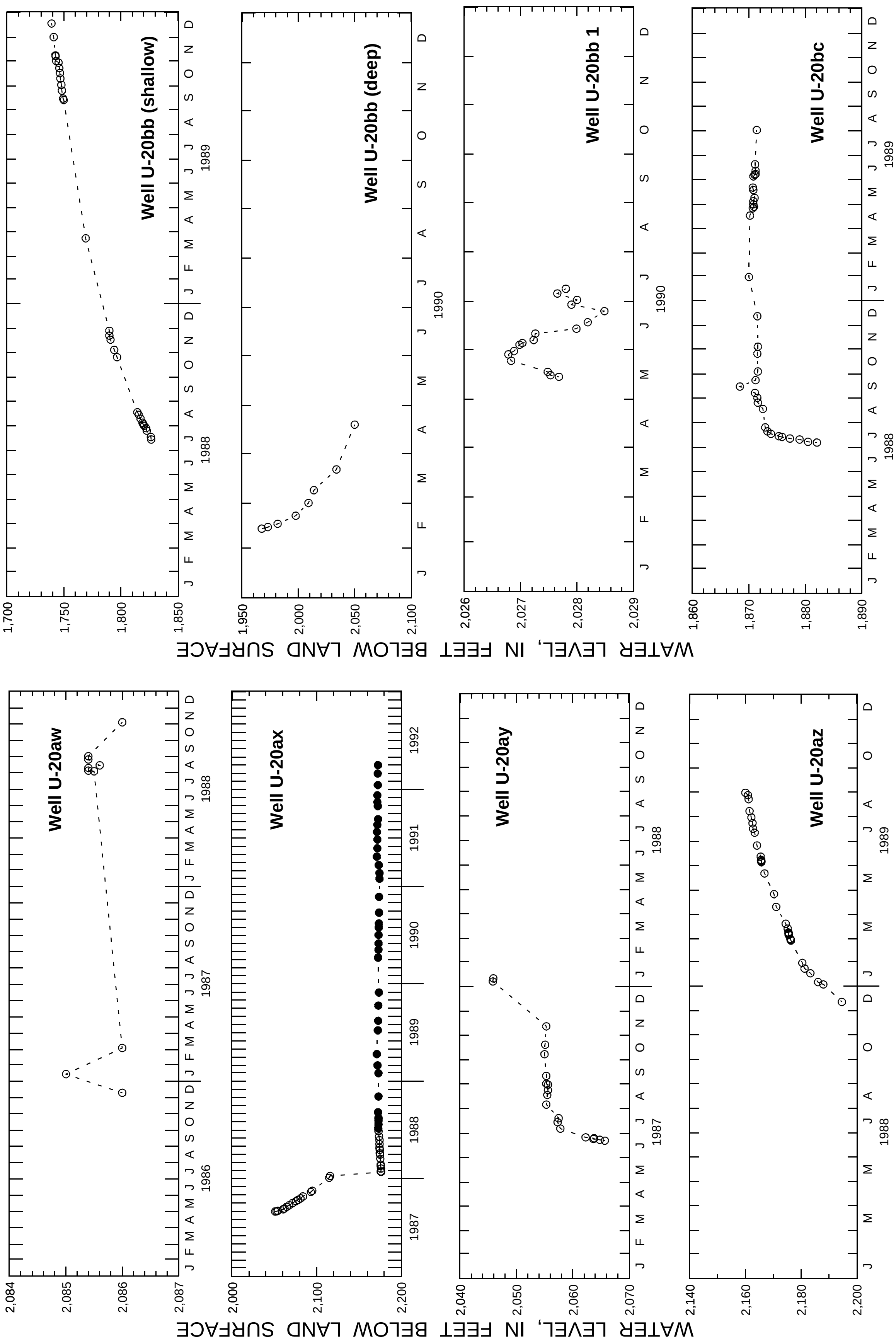
Appendix 1. Continued.



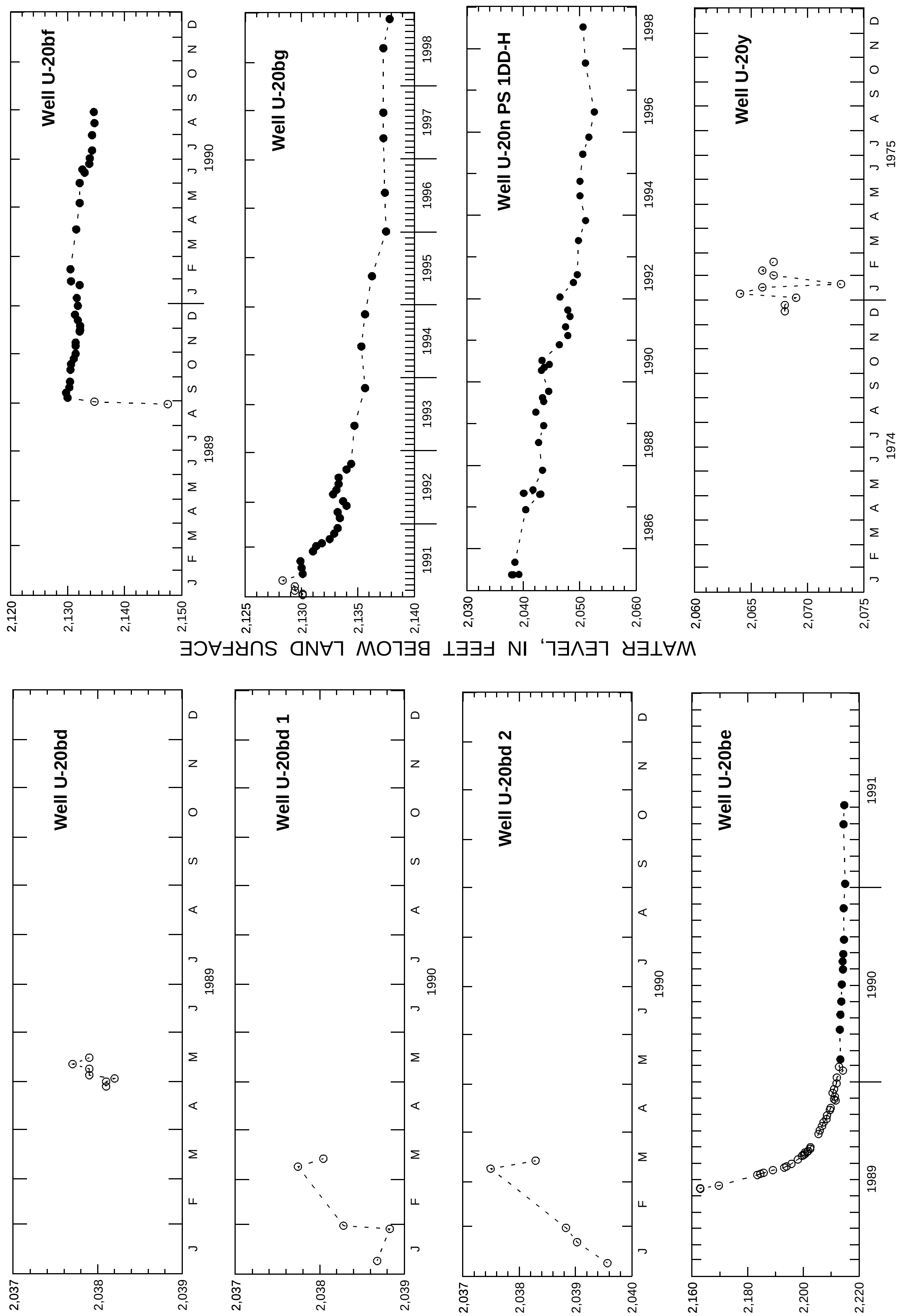
Appendix 1. Continued.



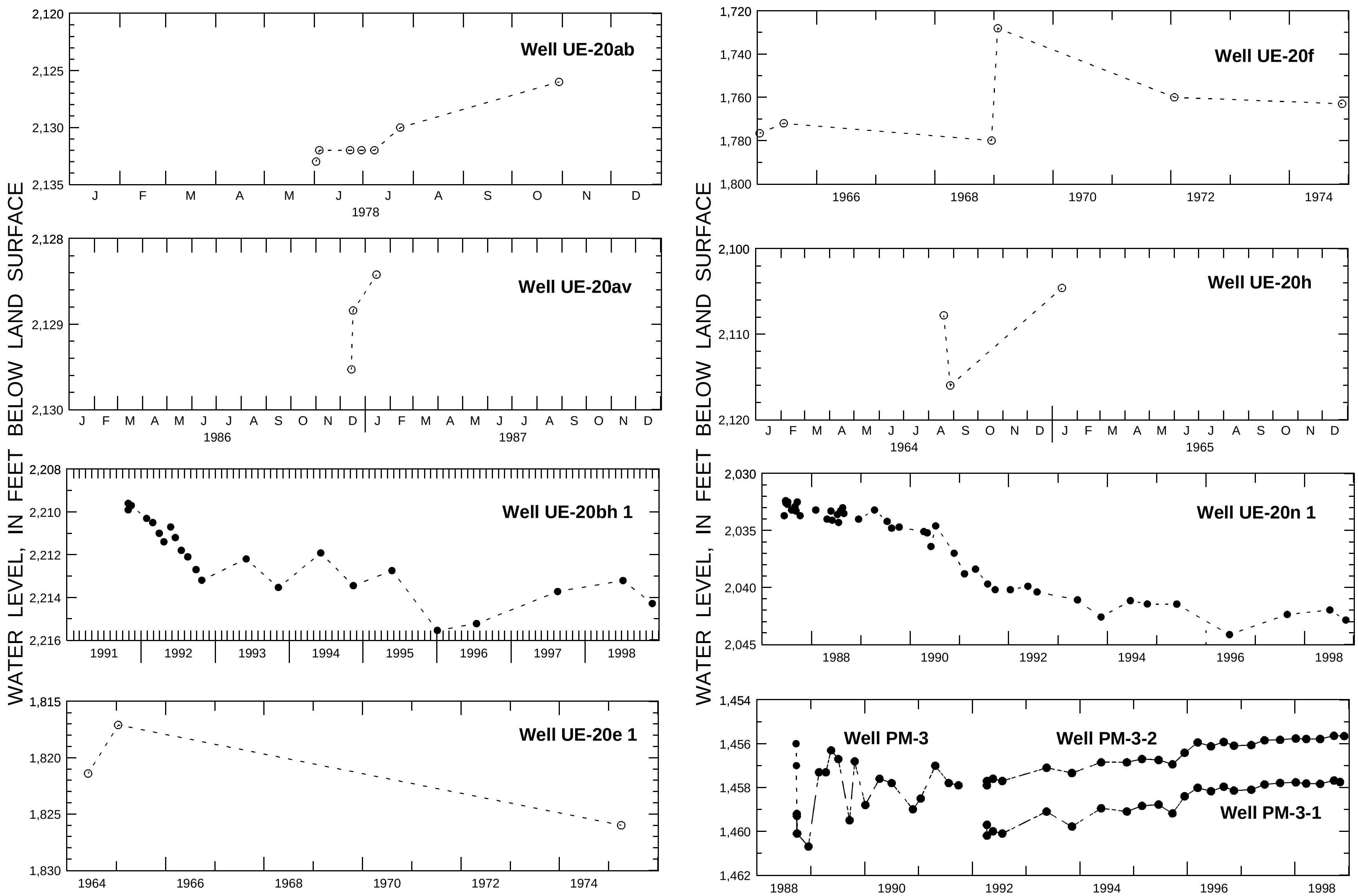
Appendix 1. Continued.



Appendix 1. Continued.



Appendix 1. Continued.



Appendix 1. Continued.

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98

Method used to determine depth to water: L, interpreted from geophysical log; R, reported, method not known; S, calibrated steel-tape measurement; T, calibrated electric tape; V, calibrated electric cable (wire line or iron horse).
Quality-assurance flag: A, anomalous value; AT, water level does not agree with second access tube in same open interval; C, affected by well construction, queried where uncertain; D, dry hole; H or L, static water level in well is elevated above (H) or depressed below (L) regional ground-water level; R, well pumping or recently pumped; N, water level affected by nuclear test; X, water level corrected for borehole deviation; --, no flag applied.
Water above bottom of open interval: length of water column in well from top of water to bottom of open interval listed in table 1.

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
UE-18r	370806116264001	01-29-1968	1,372.2	4,166	V	R	3,632
		01-31-1968	1,372	4,166	V	R	3,632
		06-11-1978	1,370	4,168	L	--	3,634
		06-12-1986	1,366.2	4,172	V	--	3,638
		06-25-1987	1,366.1	4,172	V	--	3,638
		03-23-1988	1,365.8	4,172	V	--	3,638
		12-12-1988	1,366.4	4,172	V	--	3,638
		05-03-1989	1,365.3	4,173	V	--	3,639
		10-12-1989	1,365.4	4,173	V	--	3,639
		04-12-1990	1,364.8	4,173	V	--	3,639
		11-06-1990	1,365.0	4,173	V	--	3,639
		04-24-1991	1,364.6	4,174	V	--	3,639
		09-25-1991	1,364.9	4,173	V	--	3,639
		05-21-1992	1,364.7	4,174	V	--	3,639
		05-18-1993	1,364.9	4,173	V	--	3,639
		11-18-1993	1,365.1	4,173	V	--	3,639
		05-25-1994	1,364.6	4,174	V	--	3,639
		11-16-1994	1,364.6	4,174	V	--	3,639
		03-25-1996	1,364.3	4,174	T	--	3,640
		06-13-1996	1,364.6	4,174	T	--	3,639
		09-11-1996	1,364.9	4,173	V	--	3,639
		11-14-1996	1,364.3	4,174	T	--	3,640
		03-18-1997	1,364.8	4,173	T	--	3,639
		06-16-1997	1,364.6	4,174	T	--	3,639
		09-24-1997	1,364.5	4,174	T	--	3,640
		03-23-1998	1,364.4	4,174	T	--	3,640
		06-25-1998	1,364.3	4,174	T	--	3,640
		09-28-1998	1,364.3	4,174	T	--	3,640
		12-14-1998	1,364.2	4,174	T	--	3,640
UE-18t	370741116194501	10-06-1978	917.0	4,284	V	C?	1,683
		10-06-1978	917.0	4,284	V	C?	1,683
		10-26-1978	917.1	4,284	V	C?	1,683
		12-08-1978	915.0	4,286	V	--	1,685
		01-10-1979	916.1	4,285	V	--	1,684

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
UE-18t	370741116194501	02-14-1979	915.5	4,286	V	--	1,685
		03-06-1979	915.4	4,286	V	--	1,685
		04-13-1979	915.6	4,285	V	--	1,684
		05-15-1979	915.3	4,286	V	--	1,685
		06-13-1979	916.5	4,285	V	--	1,684
		07-13-1979	915.4	4,286	V	--	1,685
		09-20-1979	916.3	4,285	V	--	1,684
		10-18-1979	915.7	4,285	V	--	1,684
		12-20-1979	911.8	4,289	V	A	1,688
		03-26-1985	914.5	4,287	V	--	1,686
		06-10-1986	915.8	4,285	V	--	1,684
		07-02-1987	914.9	4,286	V	--	1,685
		03-23-1988	915.6	4,285	V	--	1,684
		12-12-1988	915.7	4,285	V	--	1,684
		05-03-1989	915.5	4,286	V	--	1,685
		10-12-1989	915.7	4,285	V	--	1,684
		04-12-1990	915.3	4,286	V	--	1,685
		11-06-1990	916.2	4,285	V	--	1,684
		04-24-1991	915.3	4,286	V	--	1,685
		09-25-1991	914.9	4,286	V	--	1,685
		05-21-1992	915.5	4,286	V	--	1,685
		05-18-1993	915.4	4,286	V	--	1,685
		06-02-1993	915.0	4,286	S	--	1,685
		11-18-1993	914.8	4,286	V	--	1,685
		05-25-1994	915.4	4,286	V	--	1,685
		11-16-1994	914.7	4,286	V	--	1,685
		06-16-1995	914.7	4,286	V	--	1,685
		01-04-1996	915.4	4,286	V	--	1,685
		07-30-1996	915.3	4,286	V	--	1,685
		03-18-1997	914.9	4,286	T	--	1,685
		08-20-1997	914.9	4,286	T	--	1,685
		07-15-1998	914.7	4,286	T	--	1,685
		09-28-1998	914.7	4,286	T	--	1,685
		12-01-1998	914.5	4,286	T	--	1,685
WW- 8	370956116172101	01-09-1963	1,067.5	4,628	V	--	713
		01-10-1963	1,067.8	4,627	V	--	712
		03-21-1971	1,076.5	4,619	V	--	704
		03-24-1971	1,076.1	4,619	V	--	704
		10-25-1971	1,077.5	4,618	V	--	703
		08-07-1972	1,078.1	4,617	V	--	702
		06-29-1978	1,078	4,617	L	--	702
		02-17-1982	1,076.3	4,619	V	--	704
		11-21-1995	1,082.7	4,612	T	--	697

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
ER-19-1-1 (deep)	371043116142101	09-22-1994	1,788.4	4,351	V	C,L	1,772
		01-11-1995	1,791.6	4,348	V	C,L	1,768
		03-02-1995	1,792.3	4,348	V	C,L	1,768
		06-29-1995	1,793.3	4,347	V	C,L	1,767
		09-20-1995	1,794.0	4,346	V	C,L	1,766
		12-12-1995	1,793.5	4,346	T	C,L	1,766
		01-23-1996	1,792.8	4,347	T	C,L	1,767
		03-22-1996	1,792.4	4,347	T	C,L	1,768
		06-17-1996	1,788.9	4,351	T	C,L	1,771
		07-31-1996	1,787.2	4,353	V	C,L	1,773
		07-31-1996	1,787.3	4,353	T	C,L	1,773
		09-11-1996	1,789.4	4,350	V	L	1,771
		11-19-1996	1,789.9	4,350	T	L	1,770
		12-12-1996	1,789.9	4,350	V	L	1,770
		03-17-1997	1,789.5	4,350	T	L	1,771
		06-11-1997	1,789.8	4,350	T	L	1,770
		09-23-1997	1,789.8	4,350	T	L	1,770
		12-08-1997	1,788.4	4,351	T	L	1,772
		03-16-1998	1,789.5	4,350	T	L	1,771
		06-16-1998	1,789.9	4,350	T	L	1,770
ER-19-1-2 (middle)	371043116142102	09-23-1994	1,190.5	4,949	V	C, AT	1,548
(large access tube)		03-02-1995	1,173.2	4,967	V	C, AT	1,565
		03-02-1995	1,173.2	4,967	V	C, AT	1,565
		03-06-1995	1,171.9	4,968	V	C, AT	1,566
		06-29-1995	1,149.1	4,991	V	C, AT	1,589
		09-20-1995	1,164.7	4,975	V	C, AT	1,573
		12-12-1995	1,184.7	4,955	T	C, AT	1,553
		01-23-1996	1,174.3	4,966	T	C, AT	1,564
		01-24-1996	1,174.1	4,966	T	C, AT	1,564
		02-27-1996	1,169.2	4,971	T	C, AT	1,569
		03-22-1996	1,165.3	4,975	T	C, AT	1,573
		06-20-1996	1,231.0	4,909	T	C, AT	1,507
		07-31-1996	1,266.8	4,873	V	C, AT	1,471
		07-31-1996	1,267.2	4,873	T	C, AT	1,471
		09-11-1996	1,282.5	4,857	V	C, AT	1,456
		12-12-1996	1,317.8	4,822	V	C, AT	1,420
		03-17-1997	1,320.7	4,819	T	C, AT	1,417
		06-11-1997	1,308.5	4,831	T	C, AT	1,430
		09-23-1997	1,296.9	4,843	T	C, AT	1,441
		12-08-1997	1,294.7	4,845	T	C, AT	1,443
		03-16-1998	1,282.2	4,858	T	C, AT	1,456
		06-16-1998	1,276.2	4,864	T	C, AT	1,462

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
ER-19-1-2 (middle)	No site id	01-11-1995	1,230.2	4,910	V	C, AT	1,508
(small access tube)		01-24-1996	1,168.2	4,972	V	C, AT	1,570
		02-27-1996	1,163.2	4,977	V	C, AT	1,575
		03-22-1996	1,159.2	4,981	V	C, AT	1,579
		06-20-1996	1,225.1	4,915	V	C, AT	1,513
		07-31-1996	1,261.3	4,879	V	C, AT	1,477
		09-11-1996	1,279.4	4,860	V	C, AT	1,459
		12-12-1996	1,312.6	4,827	V	C, AT	1,425
		03-17-1997	1,314.8	4,825	T	C, AT	1,423
		06-11-1997	1,302.6	4,837	T	C, AT	1,435
		09-23-1997	1,291.2	4,849	T	C, AT	1,447
		12-08-1997	1,289.2	4,851	T	C, AT	1,449
		03-16-1998	1,276.8	4,863	T	C, AT	1,461
		06-16-1998	1,271.2	4,869	T	C, AT	1,467
ER-19-1-3 (shallow)	371043116142103	09-23-1994	1,007.6	5,132	V	H	414
		01-11-1995	1,007.6	5,132	V	H	414
		03-02-1995	1,007.3	5,132	V	H	415
		06-29-1995	1,007.4	5,132	V	H	415
		09-20-1995	1,007.8	5,132	V	H	414
		12-12-1995	1,007.1	5,133	T	H	415
		01-23-1996	1,007.3	5,133	T	H	415
		03-22-1996	1,006.7	5,133	T	H	415
		06-17-1996	1,007.0	5,133	T	H	415
		07-31-1996	1,007.2	5,133	T	H	415
U -19ab	371512116193101	07-17-1980	2,023	4,905	L	H	227
		08-14-1980	2,022	4,906	L	H	228
		02-11-1981	2,024	4,904	L	H	226
U -19ai	371929116185501	06-30-1980	2,056	4,686	L	--	19
		07-16-1980	2,055	4,687	L	--	20
		07-23-1980	2,051	4,691	L	--	24
		08-30-1980	2,055	4,687	L	--	20
		09-05-1980	2,054	4,688	L	--	21
		09-12-1980	2,053	4,689	L	--	22
		09-20-1980	2,054	4,688	L	--	21
		09-27-1980	2,053	4,689	L	--	22
		10-04-1980	2,052	4,690	L	--	23
		10-11-1980	2,054	4,688	L	--	21
U -19aq	371341116222901	01-10-1987	2,110	4,689	L	H	65
		06-09-1987	2,112	4,687	L	H	63
		06-17-1987	2,109	4,690	L	H	66

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -19ar	371643116212001	11-05-1985	2,114	4,592	R	C?	86
		03-06-1986	2,116	4,590	R	C?	84
		03-28-1986	2,119	4,587	R	C?	81
U -19au	371509116223601	06-05-1987	2,072	4,462	L	C?	128
		10-08-1987	2,076.5	4,458	V	--	124
		10-13-1987	2,077.7	4,456	V	--	122
		10-19-1987	2,076.7	4,457	V	--	123
		10-20-1987	2,076.8	4,457	V	--	123
		11-12-1987	2,077.1	4,457	V	--	123
		01-07-1988	2,076.6	4,457	V	--	123
		02-22-1988	2,076.6	4,457	V	--	123
		03-02-1988	2,076.8	4,457	V	--	123
U -19ax	371750116182401	09-11-1987	2,152.5	4,833	V	C,H	48
		09-17-1987	2,152.1	4,833	V	C,H	48
		09-23-1987	2,152.4	4,833	V	C,H	48
		10-01-1987	2,152.9	4,833	V	C,H	47
		10-08-1987	2,153.5	4,832	V	C,H	47
		10-20-1987	2,155.2	4,830	V	C,H	45
		11-12-1987	2,159.8	4,826	V	C,H	40
		11-16-1987	2,160.5	4,825	V	C,H	40
		12-22-1987	2,167.5	4,818	V	C,H	33
		01-04-1988	dry at depth of 2,169		V	D,H	
		01-11-1988	dry at depth of 2,170		V	D,H	
U -19ay	371632116211301	12-22-1987	2,121.6	4,590	V	C	34
		01-04-1988	2,122.6	4,589	V	C	33
		01-07-1988	2,122.8	4,589	V	C	33
		01-25-1988	2,124.0	4,588	V	C	32
		02-08-1988	2,124.7	4,587	V	C	31
		02-22-1988	2,125.5	4,587	V	C	31
		03-17-1988	2,126.8	4,585	V	C	29
		12-16-1988	2,129.1	4,583	V	--	27
		01-05-1989	2,128.8	4,583	V	--	27
		01-09-1989	2,128.8	4,583	V	--	27
U -19az	371339116221601	12-16-1988	2,103.6	4,649	V	C,H	26
		12-20-1988	2,103.5	4,649	V	C,H	27
		01-03-1989	2,097.4	4,655	V	C,H	33
		01-06-1989	2,096.6	4,656	V	C,H	33
		01-09-1989	2,096.0	4,657	V	C,H	34
		01-23-1989	2,092.4	4,660	V	C,H	38
		02-13-1989	2,084.7	4,668	V	C,H	45
		02-22-1989	2,081.7	4,671	V	C,H	48
		02-27-1989	2,080.1	4,673	V	C,H	50
		02-28-1989	2,079.9	4,673	V	C,H	50

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -19az	371339116221601	03-01-1989	2,079.7	4,673	V	C,H	50
		03-06-1989	2,079.5	4,673	V	C,H	51
		03-07-1989	2,078.6	4,674	V	C,H	51
		03-08-1989	2,078.3	4,675	V	C,H	52
		03-09-1989	2,078.4	4,674	V	C,H	52
		03-14-1989	2,078.0	4,675	V	C,H	52
		03-20-1989	2,078.0	4,675	V	C,H	52
		04-10-1989	2,077.4	4,675	V	C,H	53
		04-28-1989	2,078.6	4,674	V	H	51
		05-01-1989	2,078.7	4,674	V	H	51
		05-22-1989	2,079.2	4,674	V	H	51
		06-06-1989	2,079.2	4,674	V	H	51
		06-08-1989	2,079.2	4,674	V	H	51
		06-26-1989	2,079.1	4,674	V	H	51
		07-12-1989	2,079.4	4,673	V	H	51
		07-17-1989	2,079.3	4,674	V	H	51
		07-31-1989	2,079.6	4,673	V	H	50
		08-08-1989	2,079.2	4,674	V	H	51
		08-14-1989	2,078.8	4,674	V	H	51
		08-21-1989	2,079.6	4,673	V	H	50
		08-28-1989	2,079.7	4,673	V	H	50
		08-31-1989	2,079.2	4,674	V	H	51
		09-25-1989	2,079.5	4,673	V	H	51
		10-11-1989	2,079.4	4,673	V	H	51
		04-11-1990	2,078.8	4,674	V	H	51
		07-02-1990	2,079.4	4,673	V	H	51
U -19ba	371746116184601	09-15-1989	2,167.0	4,870	V	C,H	10
		09-18-1989	2,164.1	4,873	V	C,H	13
		09-25-1989	2,161.5	4,876	V	C,H	16
		10-02-1989	2,160.2	4,877	V	C,H	17
		10-10-1989	2,159.1	4,878	V	C,H	18
		10-17-1989	2,158.8	4,878	V	C,H	18
		10-23-1989	2,157.8	4,879	V	C,H	19
		10-30-1989	2,157.7	4,880	V	C,H	19
		11-09-1989	2,157.4	4,880	V	C,H	20
		11-13-1989	2,157.0	4,880	V	C,H	20
		11-27-1989	2,157.2	4,880	V	C,H	20
		11-29-1989	2,156.8	4,880	V	C,H	20
		12-04-1989	2,156.5	4,881	V	C,H	21
		01-22-1990	2,154.5	4,883	V	C,H	23
		02-13-1990	2,155.0	4,882	V	C,H	22

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -19ba	371746116184601	02-26-1990	2,153.6	4,884	V	C,H	23
		03-08-1990	2,153.0	4,884	V	C,H	24
		04-09-1990	2,152.6	4,885	V	H	24
		05-07-1990	2,152.7	4,885	V	H	24
		05-14-1990	2,152.8	4,884	V	H	24
		05-22-1990	2,152.8	4,884	V	H	24
		05-31-1990	2,153.0	4,884	V	H	24
		06-05-1990	2,152.7	4,885	V	H	24
		06-25-1990	2,152.8	4,884	V	H	24
		07-03-1990	2,153.0	4,884	V	H	24
		08-02-1990	2,152.7	4,885	V	H	24
		12-11-1990	2,152.4	4,885	V	H	25
U -19bg 1	371620116213501	08-20-1991	2,118.9	4,575	V	--	131
		09-09-1991	2,118.5	4,575	V	--	132
		09-24-1991	2,119.2	4,575	V	--	131
		10-16-1991	2,118.5	4,575	V	--	132
		11-18-1991	2,118	4,576	V	--	132
U -19bh	371349116222001	06-24-1991	2,140.2	4,628	V	C,H	8
		07-02-1991	2,134.9	4,633	V	C,H	13
		07-08-1991	2,131.2	4,637	V	C,H	17
		07-26-1991	2,122.3	4,646	V	C,H	26
		08-14-1991	2,115.7	4,652	V	C,H	32
		09-09-1991	2,108.0	4,660	V	C,H	40
		09-24-1991	2,105.3	4,663	V	C,H	43
		10-16-1991	2,103.8	4,664	V	C,H	44
		11-18-1991	2,102.8	4,665	V	C,H	45
		12-10-1991	2,102.4	4,666	V	C,H	46
		01-30-1992	2,101.3	4,667	V	C,H	47
		02-27-1992	2,101.0	4,667	V	C,H	47
		03-24-1992	2,100.6	4,667	V	C,H	47
		04-23-1992	2,100.1	4,668	V	C,H	48
		06-29-1992	2,098.8	4,669	V	C,H	49
		07-22-1992	2,099.9	4,668	V	C,H	48
		08-19-1992	2,098.2	4,670	V	C,H	50
		06-02-1993	2,096.7	4,671	V	C,H	51
		08-09-1993	2,096.5	4,671	V	C,H	51
		11-15-1993	2,096.7	4,671	V	C,H	51
		06-08-1994	2,095.3	4,673	V	C,H	53
		11-15-1994	2,095.2	4,673	V	C,H	53
		05-30-1995	2,094.5	4,673	V	C,H	53
		01-05-1996	2,094.7	4,673	V	C,H	53
		07-31-1996	2,093.3	4,675	V	C,H	55

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -19bh	371349116222001	12-18-1996	2,093.2	4,675	V	C,H	55
		08-27-1997	2,092.3	4,676	T	C,H	56
		07-15-1998	2,089.6	4,678	T	C,H	58
		12-03-1998	2,089.8	4,678	T	C,H	58
U -19bj	371736116184701	09-24-1992	2,127.2	4,908	V	C,H	26
		09-29-1992	2,127.8	4,907	V	C,H	25
		10-07-1992	2,128.1	4,907	V	C,H	25
		06-03-1993	2,131.1	4,904	V	C,H	22
		07-14-1993	2,131.4	4,904	V	C,H	22
		09-09-1993	2,131.9	4,903	V	C,H	21
		11-16-1993	2,133.1	4,902	V	H	20
		03-09-1994	2,133.0	4,902	V	H	20
		04-19-1994	2,133.1	4,902	V	H	20
		06-21-1994	2,133.3	4,902	V	H	20
		07-14-1994	2,133.1	4,902	V	H	20
		08-08-1994	2,133.5	4,902	V	H	20
		09-14-1994	2,133.4	4,902	V	H	20
		10-18-1994	2,133.7	4,901	V	H	19
		05-31-1995	2,133.8	4,901	V	H	19
		11-29-1995	2,134.6	4,900	V	H	18
		07-16-1996	2,134.5	4,901	T	H	19
		12-12-1996	2,134.7	4,900	V	H	18
		08-27-1997	2,134.5	4,901	T	H	19
		07-15-1998	2,134.8	4,900	T	H	18
		12-03-1998	2,134.9	4,900	T	H	18
U -19bk	371714116230301	09-24-1992	1,985.2	4,685	V	H	213
		10-07-1992	1,986.0	4,684	V	H	212
		05-05-1993	1,985.1	4,685	V	H	213
		08-11-1993	1,985.4	4,685	V	H	213
		09-09-1993	1,985.5	4,684	V	H	213
		11-15-1993	1,986.0	4,684	V	H	212
		03-09-1994	1,985.5	4,684	V	H	213
		04-19-1994	1,985.5	4,684	V	H	213
		06-08-1994	1,985.2	4,685	V	H	213
		07-14-1994	1,984.8	4,685	V	H	213
		08-08-1994	1,985.0	4,685	V	H	213
		09-14-1994	1,985.4	4,685	V	H	213
		10-17-1994	1,985.3	4,685	V	H	213
		05-30-1995	1,985.6	4,684	V	H	212
		11-29-1995	1,985.8	4,684	V	H	212
		07-31-1996	1,985.0	4,685	V	H	213
		04-14-1997	1,984.8	4,685	T	H	213
		07-15-1998	1,985.0	4,685	T	H	213
		12-03-1998	1,984.5	4,685	T	H	214

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -19g	371836116215101	09-27-1965	2,062	4,672	L	--	1,188
		07-16-1975	2,058	4,676	L	--	1,192
		09-30-1975	2,066	4,668	L	--	1,184
		10-11-1975	2,059	4,675	L	--	1,191
		10-29-1975	2,059	4,675	L	--	1,191
		01-04-1976	2,064	4,670	L	--	1,186
U -19v PS 1D	371453116205751	09-18-1973	3,055	3,787	R	N,X,H	572
		10-23-1973	3,055	3,788	R	N,X,H	573
		12-10-1973	3,038	3,804	R	N,X,H	589
		04-12-1974	3,013	3,829	R	N,X,H	614
		10-04-1974	2,994	3,848	R	N,X,H	633
		06-22-1976	2,723	4,119	R	N,X,H	904
		09-18-1979	2,428	4,414	R	N,X,H	1,199
		06-26-1982	2,302	4,540	R	N,X,H	1,325
		05-17-1983	2,297	4,545	R	N,X,H	1,330
		09-27-1993	2,210	4,632	R	N,X,H	1,417
		09-22-1998	2,026	4,816	R	N,X,H	1,601
UE-19c WW	371608116191002	12-23-1974	2,337	4,696	L	--	6,152
		06-26-1975	2,315	4,718	L	A	6,174
		07-28-1975	2,347	4,686	L	R	6,142
		01-05-1976	2,314	4,719	L	A	6,175
		01-22-1976	2,333	4,700	L	A	6,156
		03-15-1976	2,333	4,700	L	--	6,156
		12-12-1984	2,343.8	4,689	V	--	6,145
		10-15-1985	2,336.7	4,696	V	--	6,152
		03-06-1995	2,340.3	4,693	V	--	6,149
		06-21-1995	2,340.0	4,693	V	--	6,149
		09-21-1995	2,340.2	4,693	V	--	6,149
		12-14-1995	2,340.1	4,693	T	--	6,149
		03-22-1996	2,339.7	4,693	T	--	6,149
		09-04-1996	2,339.4	4,694	T	--	6,150
		11-14-1996	2,339.6	4,694	T	--	6,149
		03-10-1997	2,339.8	4,693	T	--	6,149
		06-11-1997	2,339.5	4,694	T	--	6,149
		09-22-1997	2,339.4	4,694	T	--	6,150
		06-22-1998	2,339.7	4,693	T	--	6,149
		09-24-1998	2,339.6	4,693	T	--	6,149
		12-03-1998	2,339.4	4,694	T	--	6,150
UE-19e WW	371750116195901	09-03-1964	2,218.3	4,700	V	--	3,787
		01-13-1965	2,217.1	4,702	V	--	3,788
		04-21-1965	2,218	4,701	R	--	3,787
		06-26-1975	2,228	4,691	L	--	3,777

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
UE-19gS WW	371830116215303	03-20-1971	2,044	4,675	V	--	5,456
		03-20-1971	2,043.0	4,676	V	--	5,457
		01-13-1976	2,032	4,687	L	--	5,468
UE-19h	372034116222504	01-29-1992	2,112.0	4,668	V	C	171
		04-02-1992	2,112.0	4,668	V	C	171
		05-28-1992	2,111.0	4,669	V	--	172
		06-29-1992	2,110.7	4,669	V	--	172
		07-22-1992	2,110.4	4,670	V	--	173
		08-20-1992	2,110.6	4,670	V	--	172
		06-02-1993	2,110.7	4,669	V	--	172
		11-15-1993	2,111.3	4,669	V	--	172
		06-08-1994	2,110.9	4,669	V	--	172
		11-14-1994	2,111.5	4,669	V	--	172
		03-06-1995	2,111.0	4,669	V	--	172
		06-21-1995	2,111.2	4,669	V	--	172
		09-21-1995	2,111.5	4,669	V	--	171
		12-14-1995	2,111.2	4,669	T	--	172
		03-22-1996	2,110.8	4,669	T	--	172
		06-13-1996	2,111.0	4,669	T	--	172
		09-04-1996	2,110.8	4,669	T	--	172
		11-13-1996	2,110.9	4,669	T	--	172
		03-10-1997	2,111.1	4,669	T	--	172
		06-09-1997	2,110.8	4,669	T	--	172
		09-22-1997	2,110.8	4,669	T	--	172
		01-07-1998	2,110.7	4,669	T	--	172
		03-23-1998	2,110.7	4,669	T	--	172
		06-22-1998	2,111.0	4,669	T	--	172
		09-24-1998	2,110.9	4,669	T	--	172
		12-08-1998	2,111.1	4,669	T	--	172
UE-19z	371758116193601	07-12-1977	2,197	4,691	L	--	603
		07-13-1977	2,198	4,690	L	--	602
		07-16-1977	2,197	4,691	L	--	603
		07-19-1977	2,197	4,691	L	--	603
		07-22-1977	2,197	4,691	L	--	603
		09-24-1977	2,199	4,689	L	--	601
ER-20-1	371321116292301	10-12-1994	1,987.7	4,193	V	C?	77
		02-27-1995	1,988.3	4,193	V	--	77
		06-20-1995	1,988.3	4,193	V	--	77
		09-22-1995	1,988.6	4,192	V	--	76
		12-14-1995	1,988.4	4,192	T	--	77

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
ER-20-1	371321116292301	03-12-1996	1,988.2	4,193	T	--	77
		06-10-1996	1,988.4	4,193	T	--	77
		09-05-1996	1,988.2	4,193	T	--	77
		11-13-1996	1,988.5	4,192	T	--	77
		03-10-1997	1,988.5	4,192	T	--	77
		06-09-1997	1,988.3	4,193	T	--	77
		09-22-1997	1,988.3	4,193	T	--	77
		01-07-1998	1,988.3	4,193	T	--	77
		03-19-1998	1,988.4	4,193	T	--	77
		06-22-1998	1,988.4	4,193	T	--	77
		09-24-1998	1,988.4	4,193	T	--	77
		12-08-1998	1,988.6	4,192	T	--	76
ER-20-2-1	371246116240101	10-03-1996	2,270.2	4,400	T	--	254
		11-13-1996	2,270.3	4,400	T	--	254
		03-10-1997	2,270.5	4,400	T	--	254
		06-09-1997	2,270.4	4,400	T	--	254
		09-22-1997	2,270.6	4399	T	--	253
		01-15-1998	2,270.6	4399	T	--	253
		04-09-1998	2,270.9	4399	T	--	253
		06-22-1998	2,271.1	4399	T	--	253
		09-24-1998	2,271.1	4399	T	--	253
		12-03-1998	2,270.9	4399	T	--	253
PM- 1	371649116242102	01-04-1981	2,099	4,459	L	--	5,632
		08-19-1988	2,100.4	4,457	V	--	5,631
		11-04-1988	2,101.1	4,457	V	--	5,630
		04-24-1989	2,099.1	4,459	V	--	5,632
		04-25-1989	2,099.2	4,459	V	--	5,632
		06-14-1989	2,098.5	4,459	V	--	5,633
		06-23-1989	2,099.0	4,459	V	--	5,632
		06-26-1989	2,099.1	4,459	V	--	5,632
		07-26-1989	2,099.5	4,458	V	--	5,632
		08-02-1989	2,099.6	4,458	V	--	5,631
		01-03-1990	2,099.8	4,458	V	--	5,631
		01-04-1990	2,099.7	4,458	V	--	5,631
		01-24-1990	2,099.3	4,459	V	--	5,632
		04-09-1990	2,098.2	4,460	V	--	5,633
		05-08-1990	2,098.4	4,459	V	--	5,633
		06-04-1990	2,098.4	4,459	V	--	5,633
		06-14-1990	2,098.9	4,459	V	--	5,632
		06-18-1990	2,099.0	4,459	V	--	5,632
		06-25-1990	2,098.8	4,459	V	--	5,632
		07-09-1990	2,098.9	4,459	V	--	5,632

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
PM- 1	371649116242102	08-02-1990	2,099.0	4,459	V	--	5,632
		08-16-1990	2,098.8	4,459	V	--	5,632
		08-29-1990	2,098.9	4,459	V	--	5,632
		09-13-1990	2,098.9	4,459	V	--	5,632
		11-29-1990	2,099.2	4,459	V	--	5,632
		01-08-1991	2,099.2	4,459	V	--	5,632
		02-20-1991	2,098.7	4,459	V	--	5,632
		03-22-1991	2,097.8	4,460	V	--	5,633
		04-23-1991	2,097.2	4,461	V	--	5,634
		05-24-1991	2,097.0	4,461	V	--	5,634
		06-24-1991	2,097.6	4,460	V	--	5,633
		07-25-1991	2,097.0	4,461	V	--	5,634
		08-20-1991	2,097.2	4,461	V	--	5,634
		09-24-1991	2,097.4	4,460	V	--	5,634
		10-15-1991	2,097.0	4,461	V	--	5,634
		11-12-1991	2,097.4	4,460	V	--	5,634
		12-09-1991	2,096.7	4,461	V	--	5,634
		02-26-1992	2,096.5	4,461	V	--	5,635
		03-30-1992	2,096.6	4,461	V	--	5,634
		04-23-1992	2,096.4	4,461	V	--	5,635
		05-26-1992	2,095.4	4,462	V	--	5,636
		06-18-1992	2,095.5	4,462	V	--	5,636
		07-17-1992	2,095.5	4,462	V	--	5,636
		08-19-1992	2,095.3	4,463	V	--	5,636
		09-30-1992	2,095.5	4,462	V	--	5,636
		05-26-1993	2,094.5	4,463	V	--	5,637
		11-09-1993	2,095.0	4,463	V	--	5,636
		06-06-1994	2,094.1	4,464	V	--	5,637
		10-26-1994	2,095.0	4,463	V	--	5,636
		05-30-1995	2,095.1	4,463	V	--	5,636
		01-24-1996	2,096.2	4,462	V	--	5,635
		07-15-1996	2,095.1	4,463	T	--	5,636
		04-14-1997	2,095.4	4,462	T	--	5,636
		01-15-1998	2,096.1	4,462	T	--	5,635
		07-09-1998	2,096.7	4,461	T	--	5,634
		12-01-1998	2,096.6	4,461	T	--	5,634
PM- 2	372042116340501	06-20-1983	857.6	4,734	V	--	7,930
(Note: Hourly water-level data collected in well PM-2 from 08/21/1996 to 11/04/1998)		03-13-1985	859.2	4,733	V	--	7,929
		05-01-1986	858.1	4,734	V	--	7,930
		06-16-1987	857.0	4,735	V	--	7,931
		03-23-1988	857.8	4,734	V	--	7,930

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
PM- 2	372042116340501	10-17-1988	857.1	4,735	V	--	7,931
		05-09-1989	857.8	4,734	V	--	7,930
		09-20-1989	858.0	4,734	V	--	7,930
		10-27-1989	858.2	4,734	V	--	7,930
		04-11-1990	858.0	4,734	V	--	7,930
		09-13-1990	858.3	4,734	V	--	7,930
		01-15-1991	858.6	4,733	V	--	7,929
		04-24-1991	858.2	4,734	V	--	7,930
		07-25-1991	858.4	4,733	V	--	7,930
		09-30-1991	858.6	4,733	V	--	7,929
		05-20-1992	858.8	4,733	V	--	7,929
		05-20-1993	843.2	4,749	V	A	7,945
		06-18-1993	846.1	4,746	V	A	7,942
		07-12-1993	847.5	4,744	V	A	7,941
		08-02-1993	848.9	4,743	V	A	7,939
		08-17-1993	849.9	4,742	V	A	7,938
		08-24-1993	850.5	4,741	S	A	7,937
		09-07-1993	851.2	4,741	T	A	7,937
		09-14-1993	851.4	4,740	T	A	7,937
		09-23-1993	851.7	4,740	T	A	7,936
		09-27-1993	852.1	4,740	T	A	7,936
		03-28-1994	857.2	4,735	T	A	7,931
		03-14-1995	858.1	4,734	T	A	7,930
		07-25-1996	858.3	4,733	T	--	7,930
		08-21-1996	858.4	4,733	T	--	7,930
		11-04-1996	858.4	4,733	T	--	7,930
		01-07-1997	858.5	4,733	T	--	7,930
		02-03-1997	858.4	4,733	T	--	7,930
		03-03-1997	858.3	4,734	T	--	7,930
		04-01-1997	858.3	4,733	T	--	7,930
		05-05-1997	858.4	4,733	T	--	7,930
		06-02-1997	858.3	4,733	T	--	7,930
		07-07-1997	858.4	4,733	T	--	7,930
		08-04-1997	858.5	4,733	T	--	7,929
		09-02-1997	858.5	4,733	T	--	7,929
		10-01-1997	858.5	4,733	T	--	7,930
		10-08-1997	858.5	4,733	T	--	7,930
		10-09-1997	858.4	4,733	T	--	7,930
		11-04-1997	858.6	4,733	T	--	7,929
		12-01-1997	858.4	4,733	T	--	7,930

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
PM- 2	372042116340501	01-07-1998	858.5	4,733	T	--	7,929
		03-18-1998	858.4	4,733	T	--	7,930
		04-09-1998	858.4	4,733	T	--	7,930
		05-11-1998	858.4	4,733	T	--	7,930
		06-01-1998	858.5	4,733	T	--	7,930
		07-01-1998	858.4	4,733	T	--	7,930
		08-03-1998	858.5	4,733	T	--	7,929
		09-14-1998	858.5	4,733	T	--	7,930
		10-05-1998	858.6	4,733	T	--	7,929
		11-04-1998	858.5	4,733	T	--	7,930
U -20 WW	371505116254501	07-25-1985	2,033.7	4,434	V	--	1,234
		07-22-1991	2,057.5	4,411	V	--	1,211
		08-20-1991	2,057.4	4,411	V	--	1,211
		09-09-1991	2,056.9	4,411	V	--	1,211
		09-23-1991	2,056.8	4,411	V	--	1,211
		10-15-1991	2,056.1	4,412	V	--	1,212
		11-12-1991	2,056.3	4,412	V	--	1,212
		12-05-1991	2,055.9	4,412	V	--	1,212
		01-13-1992	2,056.2	4,412	V	--	1,212
		02-28-1992	2,055.5	4,413	V	--	1,213
		10-17-1994	2,752.1	3,716	V	R	516
		10-19-1994	2,748.4	3,720	V	R	520
		10-20-1994	2,064.3	4,404	V	R	1,204
		10-26-1994	2,734.9	3,733	V	R	533
		10-31-1994	2,631.0	3,837	V	R	637
		05-26-1995	2,057.3	4,411	V	--	1,211
		07-15-1996	2,061.1	4,407	T	--	1,207
		09-17-1996	2,059.2	4,409	T	--	1,209
		04-23-1997	2,057.2	4,411	T	--	1,211
		05-06-1997	2,057.4	4,411	T	--	1,211
		10-07-1997	2,056.1	4,412	T	--	1,212
		10-08-1997	2,056.4	4,412	T	--	1,212
		10-09-1997	2,056.4	4,412	T	--	1,212
		03-18-1998	2,055.4	4,413	T	--	1,213
		04-09-1998	2,055.6	4,412	T	--	1,212
		08-03-1998	2,399.2	4,069	T	R	869
		12-02-1998	2,058.9	4,409	T	R	1,209
U -20ah	371521116252001	12-15-1980	2,001	4,444	L	--	299
		12-22-1980	2,002	4,443	L	--	298
		12-24-1980	2,002	4,443	L	--	298
		02-04-1981	2,008	4,437	L	--	292
		02-10-1981	2,007	4,438	L	--	293

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -20ah	371521116252001	02-18-1981	2,007	4,438	L	--	293
		02-26-1981	2,001	4,444	L	--	299
		03-04-1981	1,999	4,446	L	--	301
		03-12-1981	1,997	4,448	L	--	303
		03-19-1981	2,003	4,442	L	--	297
		03-26-1981	2,004	4,441	L	--	296
		04-01-1981	2,001	4,444	L	--	299
U -20ai	371551116262501	09-26-1981	2,054	4,449	L	--	100
		05-03-1982	2,053	4,450	L	--	101
		12-15-1983	2,057	4,446	L	--	97
		10-10-1984	2,054	4,449	L	--	100
		11-30-1984	2,050.0	4,453	V	--	104
		03-12-1985	2,054.6	4,448	V	--	99
		10-30-1985	2,052	4,451	L	--	102
U -20ak	371452116292101	07-11-1982	2,043	4,192	L	--	57
		12-15-1983	2,040	4,195	L	--	60
		10-10-1984	2,039	4,196	L	--	61
		11-30-1984	2,038.2	4,197	V	--	62
		01-26-1985	2,042	4,193	L	--	58
		01-29-1985	2,040	4,195	L	--	60
		02-12-1985	2,042	4,193	L	--	58
		11-30-1985	2,038	4,197	V	--	62
U -20an	371750116262701	10-10-1984	1,990	4,472	L	--	36
		11-30-1984	1,989.0	4,473	V	--	37
		03-12-1985	1,990.6	4,471	V	--	35
U -20ar 1	371852116281701	02-09-1987	1,836.8	4,482	V	--	448
		03-10-1987	1,841.2	4,478	V	--	444
		03-16-1987	1,842.6	4,476	V	--	442
		03-24-1987	1,843.6	4,475	V	--	441
		03-25-1987	1,842.4	4,477	V	--	443
		03-31-1987	1,843.3	4,476	V	--	442
		04-07-1987	1,840.9	4,478	V	--	444
		05-04-1987	1,845.6	4,473	V	--	439
		05-08-1987	1,841.0	4,478	V	--	444
U -20as	371313116274201	04-22-1986	2,012.1	4,215	V	C?	88
		04-23-1986	2,012.9	4,214	V	--	87
		04-25-1986	2,012.9	4,214	V	--	87
		04-28-1986	2,013.1	4,214	V	--	87
		06-06-1986	2,013.0	4,214	V	--	87

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20at 1	371452116303301	12-09-1986	2,026	4,215	L	--	171
		12-14-1986	2,026	4,215	L	--	171
		01-07-1987	2,028	4,213	L	--	169
		02-13-1987	2,027	4,214	L	--	170
U -20av	371359116252301	08-04-1986	2,080.0	4,384	V	--	20
		08-05-1986	2,080.1	4,384	V	--	20
		08-07-1986	2,079.9	4,384	V	--	20
		08-15-1986	2,080.1	4,384	V	--	20
		10-07-1986	2,073	4,391	L	--	27
		12-08-1986	2,075.5	4,389	V	--	25
U -20aw	371658116244401	12-10-1986	2,086	4,499	L	--	14
		01-14-1987	2,085	4,500	L	--	15
		03-04-1987	2,086	4,499	L	--	14
		08-04-1988	2,085.5	4,500	V	--	15
		08-05-1988	2,085.4	4,500	V	--	15
		08-10-1988	2,085.4	4,500	V	--	15
		08-15-1988	2,085.6	4,499	V	--	14
		08-26-1988	2,085.4	4,500	V	--	15
		09-01-1988	2,085.4	4,500	V	--	15
		11-04-1988	2,086.0	4,499	V	--	14
U -20ax	371350116264701	08-31-1987	2,050.8	4,485	V	C, H	149
		09-01-1987	2,052.5	4,484	V	C, H	148
		09-02-1987	2,054.0	4,482	V	C, H	146
		09-08-1987	2,060.2	4,476	V	C, H	140
		09-11-1987	2,062.1	4,474	V	C, H	138
		09-17-1987	2,064.5	4,472	V	C, H	136
		09-23-1987	2,067.4	4,469	V	C, H	133
		10-01-1987	2,071.6	4,465	V	C, H	128
		10-08-1987	2,075.4	4,461	V	C, H	125
		10-13-1987	2,078.1	4,458	V	C, H	122
		10-19-1987	2,080.8	4,455	V	C, H	119
		10-26-1987	2,083.8	4,452	V	C, H	116
		11-12-1987	2,093.1	4,443	V	C, H	107
		11-16-1987	2,094.8	4,441	V	C, H	105
		01-04-1988	2,114.8	4,421	V	C, H	85
		01-11-1988	2,115.9	4,420	V	C, H	84
		01-26-1988	2,176.3	4,360	V	C, H	24
		01-27-1988	2,176.0	4,360	V	C, H	24
		01-28-1988	2,176.2	4,360	V	C, H	24
		02-08-1988	2,176.2	4,360	V	C, H	24
		02-18-1988	2,175.8	4,360	V	C, H	24
		02-22-1988	2,175.9	4,360	V	C, H	24
		03-15-1988	2,175.5	4,361	V	C, H	25
		03-31-1988	2,175.1	4,361	V	C, H	25
		04-05-1988	2,174.8	4,361	V	C, H	25

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20ax	371350116264701	04-18-1988	2,174.8	4,361	V	C, H	25
		04-25-1988	2,174.4	4,362	V	C, H	26
		05-09-1988	2,174.4	4,362	V	C, H	26
		05-24-1988	2,174.3	4,362	V	C, H	26
		06-07-1988	2,173.8	4,362	V	C, H	26
		06-27-1988	2,173.4	4,363	V	C, H	27
		07-07-1988	2,172.9	4,363	V	H	27
		07-21-1988	2,173.1	4,363	V	H	27
		08-03-1988	2,173.2	4,363	V	H	27
		08-10-1988	2,173.2	4,363	V	H	27
		08-15-1988	2,173.3	4,363	V	H	27
		09-06-1988	2,172.7	4,363	V	H	27
		11-04-1988	2,173.1	4,363	V	H	27
		01-30-1989	2,173.1	4,363	V	H	27
		03-01-1989	2,172.1	4,364	V	H	28
		04-12-1989	2,171.2	4,365	V	H	29
		07-10-1989	2,172.4	4,364	V	H	28
		08-15-1989	2,172.8	4,363	V	H	27
		10-11-1989	2,172.9	4,363	V	H	27
		11-29-1989	2,173.7	4,362	V	H	26
		04-09-1990	2,172.7	4,363	V	H	27
		05-08-1990	2,173.1	4,363	V	H	27
		06-01-1990	2,173.4	4,363	V	H	27
		07-03-1990	2,173.3	4,363	V	H	27
		07-31-1990	2,173.5	4,363	V	H	27
		08-15-1990	2,173.6	4,363	V	H	26
		09-25-1990	2,173.9	4,362	V	H	26
		11-23-1990	2,173.8	4,362	V	H	26
		01-30-1991	2,174.3	4,362	V	H	26
		02-20-1991	2,174.3	4,362	V	H	26
		03-22-1991	2,173.5	4,363	V	H	27
		04-23-1991	2,171.2	4,365	V	H	29
		05-24-1991	2,172.0	4,364	V	H	28
		06-26-1991	2,172.0	4,364	V	H	28
		07-24-1991	2,171.4	4,365	V	H	29
		08-20-1991	2,172.0	4,364	V	H	28
		09-10-1991	2,172.6	4,364	V	H	27
		10-29-1991	2,172.4	4,364	V	H	28
		11-13-1991	2,172.0	4,364	V	H	28
		12-09-1991	2,171.9	4,364	V	H	28
		01-16-1992	2,172.5	4,364	V	H	28
		02-28-1992	2,172.2	4,364	V	H	28
		03-31-1992	2,172.6	4,364	V	H	27

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -20ay	371536116262801	06-22-1987	2,065.7	4,455	V	C	34
		06-23-1987	2,064.8	4,456	V	C	35
		06-24-1987	2,063.7	4,457	V	C	36
		06-25-1987	2,063.8	4,457	V	C	36
		06-26-1987	2,062.3	4,458	V	C	38
		07-07-1987	2,057.8	4,463	V	C	42
		07-15-1987	2,057.3	4,463	V	C	43
		07-20-1987	2,057.5	4,463	V	C	43
		08-06-1987	2,055.3	4,465	V	--	45
		08-18-1987	2,055.5	4,465	V	--	45
		08-24-1987	2,055.6	4,465	V	--	44
		08-31-1987	2,055.6	4,465	V	--	44
		09-01-1987	2,055.3	4,465	V	--	45
		09-11-1987	2,055.3	4,465	V	--	45
		10-08-1987	2,055.0	4,466	V	--	45
		10-20-1987	2,055.1	4,465	V	--	45
		11-12-1987	2,055.3	4,465	V	--	45
		01-07-1988	2,045.8	4,475	V	A	54
		01-11-1988	2,045.9	4,475	V	A	54
U -20az	371352116243401	12-12-1988	2,194.7	4,378	V	C	55
		01-03-1989	2,188.0	4,385	V	C	62
		01-06-1989	2,186.1	4,387	V	C	64
		01-17-1989	2,183.4	4,390	V	C	67
		01-23-1989	2,181.3	4,392	V	C	69
		01-30-1989	2,180.5	4,392	V	C	70
		02-27-1989	2,176.4	4,397	V	C	74
		02-28-1989	2,176.3	4,397	V	C	74
		03-01-1989	2,176.2	4,397	V	C	74
		03-06-1989	2,175.6	4,397	V	C	74
		03-07-1989	2,175.6	4,397	V	C	74
		03-08-1989	2,175.6	4,397	V	C	74
		03-09-1989	2,175.5	4,397	V	C	75
		03-14-1989	2,175.2	4,398	V	C	75
		03-20-1989	2,174.5	4,398	V	C	76
		04-10-1989	2,171.1	4,402	V	C	79
		04-26-1989	2,170.3	4,403	V	C	80
		05-22-1989	2,166.9	4,406	V	C	83
		06-05-1989	2,165.8	4,407	V	C	84
		06-06-1989	2,165.8	4,407	V	C	84
		06-07-1989	2,165.6	4,407	V	C	84
		06-08-1989	2,165.7	4,407	V	C	84
		06-12-1989	2,165.5	4,407	V	C	85
		06-26-1989	2,164.2	4,409	V	C	86
		07-12-1989	2,163.4	4,410	V	C	87

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20az	371352116243401	07-17-1989	2,162.8	4,410	V	C	87
		07-24-1989	2,162.6	4,410	V	C	87
		07-31-1989	2,162.2	4,411	V	C	88
		08-08-1989	2,161.5	4,411	V	C	89
		08-23-1989	2,161.2	4,412	V	C	89
		08-28-1989	2,160.9	4,412	V	C	89
		08-31-1989	2,160.0	4,413	V	C	90
U -20bb (shallow)	371452116293901	07-15-1988	1,826.6	4,400	V	C, H	73
		07-18-1988	1,826.3	4,400	V	C, H	74
		07-26-1988	1,822.7	4,404	V	C, H	77
		07-29-1988	1,822.2	4,404	V	C, H	78
		08-01-1988	1,820.3	4,406	V	C, H	80
		08-03-1988	1,819.7	4,407	V	C, H	80
		08-05-1988	1,819.0	4,407	V	C, H	81
		08-10-1988	1,817.2	4,409	V	C, H	83
		08-15-1988	1,815.7	4,411	V	C, H	84
		08-18-1988	1,814.5	4,412	V	C, H	86
		10-26-1988	1,796.6	4,430	V	C, H	103
		11-04-1988	1,794.1	4,432	V	C, H	106
		11-17-1988	1,790.9	4,435	V	C, H	109
		11-22-1988	1,789.8	4,437	V	C, H	110
		11-28-1988	1,789.8	4,437	V	C, H	110
		03-24-1989	1,769.1	4,457	V	C, H	131
		09-13-1989	1,749.8	4,477	V	C, H	150
		09-15-1989	1,749.3	4,477	V	C, H	151
		09-25-1989	1,748.1	4,478	V	C, H	152
		10-02-1989	1,747.7	4,479	V	C, H	152
		10-10-1989	1,746.8	4,480	V	C, H	153
		10-17-1989	1,746.4	4,480	V	C, H	154
		10-23-1989	1,745.9	4,480	V	C, H	154
		10-30-1989	1,745.3	4,481	V	C, H	155
		11-01-1989	1,743.0	4,483	V	C, H	157
		11-07-1989	1,742.7	4,484	V	C, H	157
		11-08-1989	1,742.5	4,484	V	C, H	158
		12-01-1989	1,741.0	4,485	V	C, H	159
		12-18-1989	1,739.1	4,487	V	C, H	161
U -20bb (deep)	371452116293902	02-13-1990	1,967.4	4,259	V	C	253
		02-14-1990	1,972.9	4,253	V	C	247
		02-16-1990	1,981.5	4,245	V	C	239
		02-21-1990	1,997.7	4,229	V	C	222
		03-01-1990	2,009.0	4,217	V	C	211
		03-09-1990	2,013.7	4,213	V	C	206
		03-22-1990	2,033.8	4,193	V	C	186
		04-19-1990	2,050	4,176	R	C	170

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20bb 1	371452116293903	05-15-1990	2,027.7	4,198	V	--	317
		05-16-1990	2,027.5	4,198	V	--	317
		05-18-1990	2,027.5	4,199	V	--	318
		05-25-1990	2,026.8	4,199	V	--	318
		05-29-1990	2,026.8	4,199	V	--	318
		05-31-1990	2,026.9	4,199	V	--	318
		06-04-1990	2,027.0	4,199	V	--	318
		06-05-1990	2,027.0	4,199	V	--	318
		06-07-1990	2,027.2	4,199	V	--	318
		06-11-1990	2,027.3	4,199	V	--	318
		06-14-1990	2,028.0	4,198	V	--	317
		06-18-1990	2,028.2	4,198	V	--	317
		06-25-1990	2,028.5	4,198	V	--	317
		06-29-1990	2,027.9	4,198	V	--	317
		07-02-1990	2,028.0	4,198	V	--	317
		07-06-1990	2,027.7	4,198	V	--	317
		07-09-1990	2,027.8	4,198	V	--	317
U -20bc	371547116292601	07-07-1988	1,882.1	4,264	V	C, H	118
		07-08-1988	1,880.5	4,266	V	C, H	120
		07-11-1988	1,879.0	4,267	V	C, H	121
		07-12-1988	1,877.3	4,269	V	C, H	123
		07-14-1988	1,875.9	4,270	V	C, H	124
		07-15-1988	1,875.3	4,271	V	C, H	125
		07-18-1988	1,873.9	4,272	V	C, H	126
		07-21-1988	1,873.3	4,273	V	C, H	127
		07-26-1988	1,872.9	4,273	V	C, H	127
		08-18-1988	1,872.5	4,274	V	C, H	128
		08-26-1988	1,871.6	4,275	V	H	128
		09-01-1988	1,871.5	4,275	V	H	129
		09-07-1988	1,871.1	4,275	V	H	129
		09-15-1988	1,868.4	4,278	V	H	132
		09-23-1988	1,871.2	4,275	V	H	129
		10-04-1988	1,871.6	4,275	V	H	128
		10-26-1988	1,871.5	4,275	V	H	129
		11-04-1988	1,871.6	4,275	V	H	128
		12-12-1988	1,871.5	4,275	V	H	129
		01-30-1989	1,870.0	4,276	V	H	130
		04-17-1989	1,870.2	4,276	V	H	130
		04-26-1989	1,870.7	4,276	V	H	129
		04-28-1989	1,870.9	4,275	V	H	129
		05-01-1989	1,870.8	4,275	V	H	129
		05-05-1989	1,870.8	4,275	V	H	129

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -20bc	371547116292601	05-09-1989	1,871.0	4,275	V	H	129
		05-19-1989	1,870.8	4,275	V	H	129
		05-22-1989	1,870.7	4,276	V	H	129
		06-05-1989	1,870.8	4,275	V	H	129
		06-07-1989	1,871.0	4,275	V	H	129
		06-08-1989	1,871.2	4,275	V	H	129
		06-12-1989	1,871.2	4,275	V	H	129
		06-20-1989	1,871.1	4,275	V	H	129
		08-02-1989	1,871.4	4,275	V	H	129
U -20bd	371542116251203	04-28-1989	2,038.1	4,448	V	--	223
		05-01-1989	2,038.1	4,448	V	--	223
		05-03-1989	2,038.2	4,448	V	--	223
		05-05-1989	2,037.9	4,448	V	--	223
		05-09-1989	2,037.9	4,448	V	--	223
		05-12-1989	2,037.7	4,448	V	--	223
		05-16-1989	2,037.9	4,448	V	--	223
U -20bd 1	371542116251301	01-09-1990	2,038.7	4,447	V	--	363
		01-29-1990	2,038.8	4,447	V	--	363
		01-31-1990	2,038.3	4,447	V	--	364
		03-09-1990	2,037.7	4,448	V	--	364
		03-14-1990	2,038.0	4,447	V	--	364
U -20bd 2	371542116251202	01-09-1990	2,039.6	4,447	V	C?	410
		01-22-1990	2,039.0	4,448	V	C?	411
		01-31-1990	2,038.8	4,448	V	C?	411
		03-09-1990	2,037.5	4,450	V	--	413
		03-14-1990	2,038.3	4,449	V	--	412
U -20be	371332116254101	06-14-1989	2,163.0	4,329	V	C	57
		06-15-1989	2,162.9	4,329	V	C	57
		06-20-1989	2,169.6	4,322	V	C	50
		07-10-1989	2,183.5	4,308	V	C	37
		07-12-1989	2,184.6	4,307	V	C	35
		07-14-1989	2,185.8	4,306	V	C	34
		07-19-1989	2,189.1	4,303	V	C	31
		07-24-1989	2,193.2	4,298	V	C	27
		07-26-1989	2,194.0	4,298	V	C	26
		07-31-1989	2,195.8	4,296	V	C	24
		08-08-1989	2,198.1	4,294	V	C	22
		08-15-1989	2,199.6	4,292	V	C	20
		08-16-1989	2,200.2	4,291	V	C	20
		08-18-1989	2,200.6	4,291	V	C	19
		08-21-1989	2,200.6	4,291	V	C	19

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20be	371332116254101	08-22-1989	2,201.4	4,290	V	C	19
		08-24-1989	2,201.8	4,290	V	C	18
		08-28-1989	2,202.5	4,289	V	C	18
		08-31-1989	2,202.6	4,289	V	C	17
		09-25-1989	2,205.5	4,286	V	C	15
		10-02-1989	2,206.0	4,286	V	C	14
		10-10-1989	2,206.8	4,285	V	C	13
		10-17-1989	2,207.3	4,284	V	C	13
		10-23-1989	2,208.4	4,283	V	C	12
		10-30-1989	2,208.6	4,283	V	C	11
		11-09-1989	2,209.6	4,282	V	C	10
		11-13-1989	2,209.9	4,282	V	C	10
		11-27-1989	2,211.7	4,280	V	C	8
		11-29-1989	2,211.1	4,281	V	C	9
		12-04-1989	2,211.4	4,280	V	C	9
		12-11-1989	2,210.6	4,281	V	C	9
		12-18-1989	2,211.1	4,281	V	C	9
		12-29-1989	2,212.0	4,280	V	C	8
		01-09-1990	2,212.1	4,280	V	C	8
		01-22-1990	2,214.3	4,277	V	C	6
		01-29-1990	2,212.9	4,279	V	C	7
		02-12-1990	2,213.4	4,278	V	--	7
		04-09-1990	2,213.2	4,278	V	--	7
		05-07-1990	2,213.4	4,278	V	--	7
		06-01-1990	2,213.7	4,278	V	--	6
		07-03-1990	2,213.9	4,278	V	--	6
		07-31-1990	2,214.3	4,277	V	--	6
		08-15-1990	2,214.2	4,277	V	--	6
		08-29-1990	2,214.4	4,277	V	--	6
		09-25-1990	2,214.7	4,277	V	--	5
		11-23-1990	2,214.6	4,277	V	--	5
		01-08-1991	2,215.1	4,277	V	--	5
		04-30-1991	2,214.5	4,277	V	--	6
		06-05-1991	2,214.8	4,277	V	--	5
U -20bf	371444116263001	08-28-1989	2,147.6	4,375	V	C	102
		08-31-1989	2,134.7	4,388	V	C	115
		09-05-1989	2,130.0	4,392	V	--	120
		09-11-1989	2,129.7	4,393	V	--	120
		09-18-1989	2,130.3	4,392	V	--	120
		09-25-1989	2,130.4	4,392	V	--	120
		10-10-1989	2,130.5	4,392	V	--	120
		10-17-1989	2,130.6	4,392	V	--	119
		10-24-1989	2,131.1	4,391	V	--	119
		10-30-1989	2,131.4	4,391	V	--	119

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
U -20bf	371444116263001	11-09-1989	2,131.4	4,391	V	--	119
		11-13-1989	2,131.4	4,391	V	--	119
		11-27-1989	2,132.1	4,390	V	--	118
		11-29-1989	2,132.2	4,390	V	--	118
		12-04-1989	2,132.2	4,390	V	--	118
		12-11-1989	2,131.8	4,391	V	--	118
		12-18-1989	2,131.3	4,391	V	--	119
		12-29-1989	2,131.8	4,391	V	--	118
		01-08-1990	2,131.6	4,391	V	--	118
		01-24-1990	2,132.1	4,390	V	--	118
		01-29-1990	2,130.6	4,392	V	--	119
		02-13-1990	2,130.5	4,392	V	--	120
		04-04-1990	2,131.5	4,391	V	--	119
		05-07-1990	2,132.1	4,390	V	--	118
		06-01-1990	2,132.1	4,390	V	--	118
		06-14-1990	2,133.0	4,389	V	--	117
		06-18-1990	2,132.6	4,390	V	--	117
		06-25-1990	2,133.8	4,389	V	--	116
		07-02-1990	2,133.9	4,388	V	--	116
		07-12-1990	2,134.3	4,388	V	--	116
		07-31-1990	2,134.3	4,388	V	--	116
		08-15-1990	2,134.7	4,388	V	--	115
		08-29-1990	2,134.6	4,388	V	--	115
U -20bg	371414116242901	01-08-1991	2,130.1	4,437	V	C	70
		01-14-1991	2,130.1	4,437	V	C	70
		01-30-1991	2,129.4	4,438	V	C	71
		02-20-1991	2,129.4	4,438	V	C	71
		03-22-1991	2,128.3	4,439	V	C	72
		04-23-1991	2,130.1	4,437	V	--	70
		05-24-1991	2,130.0	4,437	V	--	70
		06-26-1991	2,129.9	4,437	V	--	70
		08-14-1991	2,131.0	4,436	V	--	69
		09-10-1991	2,131.3	4,436	V	--	69
		09-24-1991	2,131.8	4,435	V	--	68
		10-15-1991	2,132.5	4,435	V	--	68
		11-12-1991	2,132.9	4,434	V	--	67
		12-09-1991	2,133.2	4,434	V	--	67
		01-28-1992	2,133.4	4,434	V	--	67
		02-27-1992	2,133.2	4,434	V	--	67
		03-30-1992	2,134.0	4,433	V	--	66
		04-22-1992	2,133.7	4,434	V	--	66
		05-26-1992	2,132.8	4,434	V	--	67
		06-18-1992	2,133.1	4,434	V	--	67

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20bg	371414116242901	07-17-1992	2,133.3	4,434	V	--	67
		08-18-1992	2,133.3	4,434	V	--	67
		09-28-1992	2,134.0	4,433	V	--	66
		10-26-1992	2,134.4	4,433	V	--	66
		05-05-1993	2,134.7	4,433	V	--	65
		11-09-1993	2,135.6	4,432	V	--	64
		06-06-1994	2,135.3	4,432	V	--	65
		11-14-1994	2,135.6	4,432	V	--	64
		05-24-1995	2,136.3	4,431	V	--	64
		01-03-1996	2,137.5	4,430	V	--	62
		07-15-1996	2,137.4	4,430	T	--	63
		04-14-1997	2,137.3	4,430	T	--	63
		08-20-1997	2,137.3	4,430	T	--	63
		07-09-1998	2,137.3	4,430	T	--	63
		12-02-1998	2,137.8	4,429	T	--	62
U -20n PS 1DD-H	371425116252401	05-17-1985	2,037.9	4,430	V	X	831
		05-17-1985	2,038.2	4,430	V	X	831
		05-20-1985	2,039.2	4,429	V	X	830
		09-03-1985	2,038.5	4,430	V	X	831
		12-08-1986	2,040.4	4,428	V	X	829
		04-21-1987	2,042.9	4,425	V	X	826
		04-24-1987	2,043.1	4,425	V	X	826
		05-01-1987	2,040.0	4,428	V	X	829
		05-01-1987	2,040.1	4,428	V	X	829
		06-01-1987	2,041.7	4,426	V	X	827
		11-19-1987	2,043.4	4,425	V	X	826
		07-19-1988	2,042.7	4,425	V	X	826
		12-14-1988	2,043.6	4,425	V	X	825
		04-11-1989	2,042.2	4,426	V	X	827
		07-14-1989	2,043.6	4,425	V	X	825
		08-16-1989	2,043.4	4,425	V	X	826
		10-11-1989	2,044.5	4,424	V	X	825
		04-12-1990	2,043.2	4,425	V	X	826
		05-08-1990	2,043.7	4,424	V	X	825
		06-04-1990	2,044.6	4,424	V	X	824
		07-09-1990	2,043.3	4,425	V	X	826
		11-23-1990	2,046.4	4,422	V	X	823
		02-12-1991	2,047.9	4,420	V	X	821
		04-30-1991	2,047.5	4,421	V	X	822
		07-29-1991	2,048.3	4,420	V	X	821
		09-23-1991	2,047.9	4,420	V	X	821
		01-16-1992	2,046.5	4,422	V	X	822
		05-22-1992	2,048.9	4,419	V	X	820
		07-29-1992	2,049.6	4,419	V	X	819
		05-25-1993	2,049.8	4,418	V	X	819

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
U -20n PS 1DD-H	371425116252401	11-16-1993	2,051.1	4,417	V	X	818
		06-21-1994	2,050.1	4,418	V	X	819
		10-26-1994	2,050.1	4,418	V	X	819
		06-21-1995	2,050.6	4,418	V	X	818
		11-17-1995	2,051.7	4,416	V	X	817
		06-25-1996	2,052.6	4,415	V	X	816
		08-27-1997	2,051.0	4,417	T	X	818
		07-09-1998	2,050.6	4,417	T	X	818
U -20y	371315116282701	12-18-1974	2,068	4,189	L	--	534
		12-26-1974	2,068	4,189	L	--	534
		01-04-1975	2,069	4,188	L	--	533
		01-09-1975	2,064	4,193	L	--	538
		01-17-1975	2,066	4,191	L	--	536
		01-21-1975	2,073	4,184	L	--	529
		02-01-1975	2,067	4,190	L	--	535
		02-07-1975	2,066	4,191	L	--	536
		02-18-1975	2,067	4,190	L	--	535
UE-20ab	371623116243701	06-02-1978	2,133	4,448	L	C	417
		06-04-1978	2,132	4,449	L	C	418
		06-23-1978	2,132	4,449	L	C	418
		06-30-1978	2,132	4,449	L	C	418
		07-08-1978	2,132	4,449	L	C	418
		07-24-1978	2,130	4,451	L	C	420
		10-30-1978	2,126	4,455	L	C	424
UE-20av	371401116252001	12-15-1986	2,129.5	4,328	V	--	484
		12-17-1986	2,128.8	4,329	V	--	485
		01-15-1987	2,128.4	4,330	V	--	486
UE-20bh 1	371442116243301	10-29-1991	2,209.6	4,427	V	--	600
		10-29-1991	2,209.9	4,427	V	--	600
		11-13-1991	2,209.7	4,427	V	--	600
		01-28-1992	2,210.3	4,427	V	--	600
		02-27-1992	2,210.5	4,427	V	--	600
		03-30-1992	2,211.0	4,426	V	--	599
		04-22-1992	2,211.4	4,426	V	--	599
		05-26-1992	2,210.7	4,426	V	--	599
		06-18-1992	2,211.2	4,426	V	--	599
		07-17-1992	2,211.8	4,425	V	--	598
		08-18-1992	2,212.1	4,425	V	--	598
		09-28-1992	2,212.7	4,424	V	--	597
		10-26-1992	2,213.2	4,424	V	--	597
		06-03-1993	2,212.2	4,425	V	--	598
		11-09-1993	2,213.5	4,423	V	--	596

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
UE-20bh 1	371442116243301	06-06-1994	2,211.9	4,425	V	--	598
		11-14-1994	2,213.5	4,424	V	--	597
		05-24-1995	2,212.8	4,424	V	--	597
		01-03-1996	2,215.6	4,421	V	--	594
		07-15-1996	2,215.2	4,422	T	--	595
		08-20-1997	2,213.7	4,423	T	--	596
		07-09-1998	2,213.2	4,424	T	--	597
		12-01-1998	2,214.3	4,423	T	--	596
UE-20e 1	371901116272501	06-04-1964	1,821.4	4,476	V	--	4,574
		01-14-1965	1,817.1	4,480	V	--	4,578
		04-05-1975	1,826	4,471	L	--	4,569
UE-20f	371617116291701	01-13-1965	1,776.6	4,340	V	H	11,909
		06-10-1965	1,772	4,344	V	H	11,914
		12-17-1968	1,780	4,336	L	H	11,906
		01-24-1969	1,728	4,388	L	N, H	11,958
		01-21-1972	1,760	4,356	L	N, H	11,926
		11-24-1974	1,763	4,353	L	N, H	11,923
UE-20h WW	371618116260201	08-20-1964	2,107.8	4,449	V	--	5,099
		08-28-1964	2,116	4,441	V	R	5,091
		01-13-1965	2,104.6	4,452	V	--	5,102
UE-20n 1	371425116251902	06-12-1987	2,033.7	4,427	V	--	800
		06-22-1987	2,032.4	4,428	V	--	802
		06-23-1987	2,032.4	4,428	V	--	802
		06-26-1987	2,032.6	4,428	V	--	801
		07-02-1987	2,032.5	4,428	V	--	802
		07-07-1987	2,032.7	4,428	V	--	801
		07-09-1987	2,032.5	4,428	V	--	802
		08-06-1987	2,033.2	4,428	V	--	801
		08-24-1987	2,033.2	4,428	V	--	801
		09-01-1987	2,032.9	4,428	V	--	801
		09-08-1987	2,033.3	4,427	V	--	801
		09-17-1987	2,032.5	4,428	V	--	802
		10-08-1987	2,033.7	4,427	V	--	800
		02-01-1988	2,033.2	4,428	V	--	801
		04-25-1988	2,034.0	4,427	V	--	800
		05-24-1988	2,033.3	4,427	V	--	801
		06-02-1988	2,034.1	4,427	V	--	800
		07-11-1988	2,033.6	4,427	V	--	800
		07-19-1988	2,034.3	4,426	V	--	800
		08-03-1988	2,033.3	4,427	V	--	801

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement					Water above bottom of open interval (feet)
		Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	
UE-20n 1	371425116251902	08-19-1988	2,033.0	4,428	V	--	801
		08-27-1988	2,033.5	4,427	V	--	801
		12-14-1988	2,034.0	4,427	V	--	800
		04-12-1989	2,033.2	4,428	V	--	801
		07-14-1989	2,034.2	4,427	V	--	800
		08-16-1989	2,034.8	4,426	V	--	799
		10-11-1989	2,034.7	4,426	V	--	799
		04-12-1990	2,035.1	4,426	V	--	799
		05-08-1990	2,035.2	4,426	V	--	799
		06-04-1990	2,036.4	4,424	V	--	798
		07-09-1990	2,034.6	4,426	V	--	799
		11-23-1990	2,037.0	4,424	V	--	797
		02-08-1991	2,038.8	4,422	V	--	795
		04-30-1991	2,038.4	4,422	V	--	796
		07-29-1991	2,039.7	4,421	V	--	794
		09-23-1991	2,040.2	4,421	V	--	794
		01-13-1992	2,040.2	4,421	V	--	794
		05-22-1992	2,039.9	4,421	V	--	794
		07-29-1992	2,040.4	4,420	V	--	794
		05-25-1993	2,041.1	4,420	V	--	793
		11-16-1993	2,042.6	4,418	V	--	791
		06-21-1994	2,041.2	4,420	V	--	793
		10-25-1994	2,041.5	4,419	V	--	793
		05-31-1995	2,041.5	4,419	V	--	793
		06-25-1996	2,044.2	4,417	V	--	790
		08-27-1997	2,042.4	4,418	T	--	792
		07-09-1998	2,042.0	4,419	T	--	792
		11-04-1998	2,042.9	4,418	T	--	791
PM- 3	371421116333702	09-21-1988	1,456	4,367	L	--	1,563
		09-23-1988	1,457	4,366	L	--	1,562
		09-26-1988	1,459.2	4,364	V	--	1,560
		09-26-1988	1,459.3	4,364	V	--	1,560
		09-26-1988	1,460.1	4,363	V	--	1,559
		09-28-1988	1,460.1	4,363	V	--	1,559
		12-14-1988	1,460.7	4,362	V	--	1,558
		02-23-1989	1,457.3	4,366	V	--	1,562
		04-11-1989	1,457.3	4,366	V	--	1,562
		05-17-1989	1,456.3	4,367	V	--	1,563
		07-05-1989	1,456.7	4,366	V	--	1,562
		09-20-1989	1,459.5	4,363	V	--	1,560
		10-24-1989	1,456.8	4,366	V	--	1,562
		01-05-1990	1,458.8	4,364	V	--	1,560
		04-11-1990	1,457.6	4,365	V	--	1,561

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
PM- 3	371421116333702	07-02-1990	1,457.8	4,365	V	--	1,561
		11-23-1990	1,459.0	4,364	V	--	1,560
		01-15-1991	1,458.5	4,364	V	--	1,561
		04-24-1991	1,457.0	4,366	V	--	1,562
		07-25-1991	1,457.8	4,365	V	--	1,561
		09-30-1991	1,457.9	4,365	V	--	1,561
PM- 3-1	371421116333703	04-10-1992	1,460.2	4,363	V	--	732
		04-10-1992	1,459.7	4,363	V	--	732
		05-20-1992	1,460.0	4,363	V	--	732
		07-23-1992	1,460.1	4,363	V	--	732
		05-20-1993	1,459.1	4,364	V	--	733
		11-08-1993	1,459.8	4,363	V	--	732
		05-25-1994	1,459.0	4,364	V	--	733
		11-16-1994	1,459.1	4,364	V	--	733
		02-27-1995	1,458.8	4,364	V	--	733
		06-20-1995	1,458.8	4,364	V	--	733
		09-22-1995	1,459.2	4,364	V	--	733
		12-14-1995	1,458.4	4,364	T	--	734
		03-12-1996	1,458.0	4,365	T	--	734
		06-10-1996	1,458.2	4,365	T	--	734
		09-04-1996	1,458.0	4,365	T	--	734
		11-13-1996	1,458.1	4,365	T	--	734
		03-10-1997	1,458.1	4,365	T	--	734
		06-09-1997	1,457.9	4,365	T	--	734
		09-22-1997	1,457.8	4,365	T	--	734
		01-07-1998	1,457.8	4,365	T	--	734
		03-19-1998	1,457.8	4,365	T	--	734
		06-22-1998	1,457.8	4,365	T	--	734
		09-24-1998	1,457.7	4,365	T	--	734
		11-03-1998	1,457.8	4,365	T	--	734
PM- 3-2	371421116333704	04-10-1992	1,457.7	4,365	V	--	229
		04-10-1992	1,457.9	4,365	V	--	229
		05-20-1992	1,457.6	4,365	V	--	229
		07-23-1992	1,457.7	4,365	V	--	229
		05-20-1993	1,457.1	4,366	V	--	230
		11-08-1993	1,457.3	4,365	V	--	230
		05-25-1994	1,456.9	4,366	V	--	230
		11-16-1994	1,456.9	4,366	V	--	230
		02-27-1995	1,456.7	4,366	V	--	230
		06-20-1995	1,456.7	4,366	V	--	230

Appendix 2. Water-level measurements for selected wells on Pahute Mesa and vicinity, Nevada Test Site, 1963-98--Continued

USGS well name	USGS site identification number	Water-level measurement: Date	Depth below land surface (feet)	Altitude (feet above sea level)	Method	Quality-assurance flag	Water above bottom of open interval (feet)
PM- 3-2	371421116333704	09-22-1995	1,456.9	4,366	V	--	230
		12-14-1995	1,456.4	4,366	T	--	231
		03-12-1996	1,455.9	4,367	T	--	231
		06-10-1996	1,456.1	4,367	T	--	231
		09-04-1996	1,455.9	4,367	T	--	231
		11-13-1996	1,456.1	4,367	T	--	231
		03-10-1997	1,456.1	4,367	T	--	231
		06-09-1997	1,455.8	4,367	T	--	231
		09-22-1997	1,455.8	4,367	T	--	231
		01-07-1998	1,455.8	4,367	T	--	231
		03-19-1998	1,455.8	4,367	T	--	231
		06-22-1998	1,455.8	4,367	T	--	231
		09-24-1998	1,455.6	4,367	T	--	231
		12-02-1998	1,455.7	4,367	T	--	231