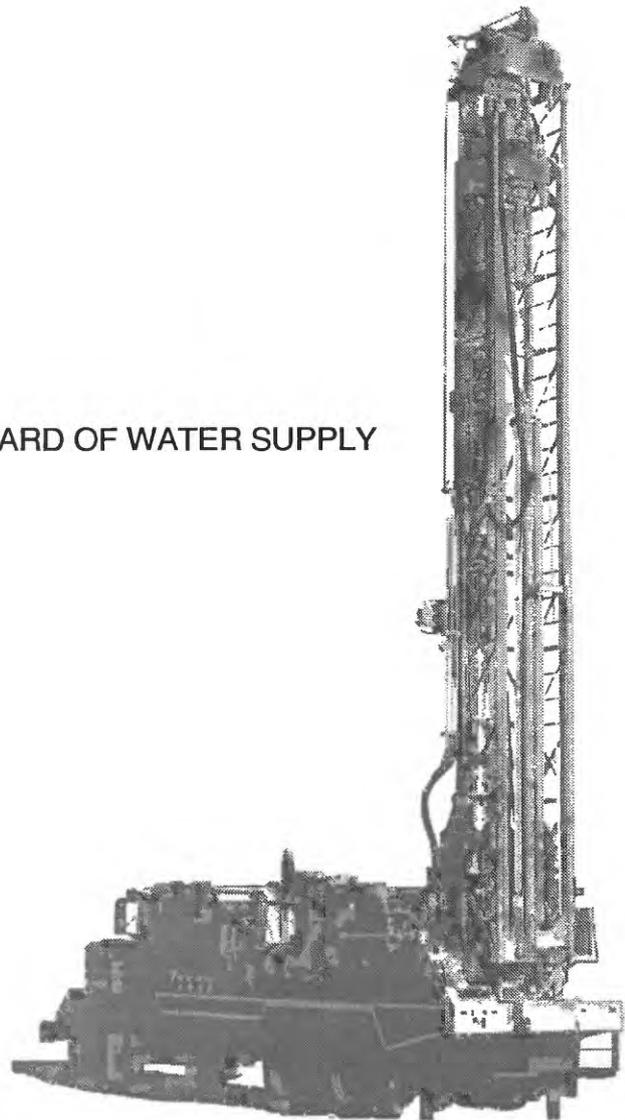


DRILLING, CONSTRUCTION, CALIPER-LOG, AND SPECIFIC-CONDUCTANCE DATA FOR WELL 3-3604-01, KAWAILOA DEEP MONITOR WELL, OAHU, HAWAII

U.S. GEOLOGICAL SURVEY

Open-File Report 96-430

Prepared in cooperation with the
CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY



U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

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CONTENTS

Abstract	1
Introduction	1
Regional Setting	1
Acknowledgments	4
Drilling, Construction, Caliper-Log, and Specific-Conductance Data	4
Additional Information	6
References Cited	6

FIGURES

1–2. Maps showing:

1. Ground-water areas of north-central Oahu and wells drilled during the study, Hawaii	2
2. Location of Kawailoa deep monitor well, Oahu, Hawaii	3
3. Diagram showing construction details for Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii	5

4–5. Graphs showing:

4. Caliper log for Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii	7
5. Specific-conductance log for Kawailoa deep monitor well (State well number 3-3604-01), May 17, 1994, Oahu, Hawaii	8

TABLES

1. Construction data for Kawailoa deep monitor well, Oahu, Hawaii	4
2. Geologic log for Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii	9
3. Driller's log for Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii	11
4. Construction data for wells drilled during the study, Oahu, Hawaii	13

Conversion Factors

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
inch (in.)	25.4	millimeter

Elevations in this report are referenced relative to mean sea level.

Specific conductance is given in microsiemens per centimeter ($\mu\text{S}/\text{cm}$) at 25° Celsius. Microsiemens per centimeter is numerically equal to micromhos per centimeter.

Drilling, Construction, Caliper-Log, and Specific-Conductance Data for Well 3-3604-01, Kawaihoa Deep Monitor Well, Oahu, Hawaii

By Todd K. Presley and Delwyn S. Oki

Abstract

The Kawaihoa deep monitor well (State well number 3-3604-01) was drilled about 1.9 miles east-northeast of the town of Haleiwa. The well is on agricultural land in the Kawaihoa ground-water area. The well penetrates through the freshwater lens and into the freshwater-saltwater transition zone to an elevation of -392 feet below mean sea level. Well-construction data, logs of drilling notes, geologic descriptions for the samples, specific-conductance and caliper-log data are presented for the well. The well is one of 12 exploratory wells drilled in the north-central Oahu area between July 1993 and May 1994 in cooperation with the Honolulu Board of Water Supply.

INTRODUCTION

Because of water-supply concerns associated with population increase on the island of Oahu, the Honolulu Board of Water Supply, in cooperation with the U.S. Geological Survey (USGS), conducted a study to assess the availability of ground water in north-central Oahu. This study included drilling 12 exploratory and monitoring wells between July 1993 and May 1994.

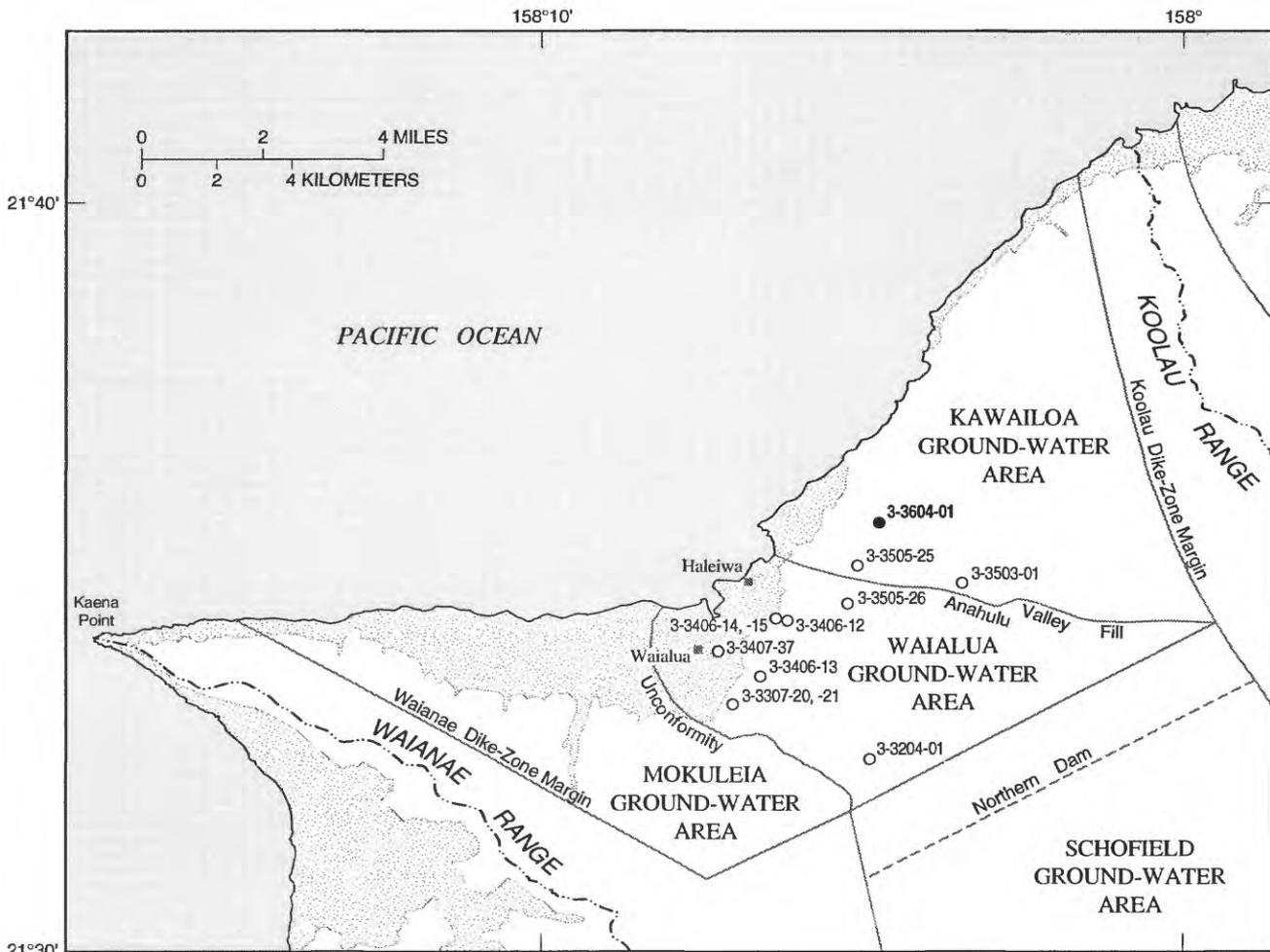
This report presents drilling data for the Kawaihoa deep monitor well (State well number 3-3604-01). The well is located about 1.9 mi east-northeast of the town of Haleiwa, about 14,000 ft northeast of Weed Circle and about 5,500 ft north of Anahulu Gulch (figs. 1 and 2). The purpose of the Kawaihoa deep monitor well is to estimate the thickness of the freshwater lens of the Kawaihoa ground-water area (Rosenau and others, 1971; Dale, 1978; Hunt, in press). Forty years prior to

the drilling of this well, well 3-3605-24, a deep observation well constructed with small plastic piezometers installed at different depths, provided information concerning chloride concentration at various depths within the freshwater lens. Well 3-3605-24 has since fallen into disrepair.

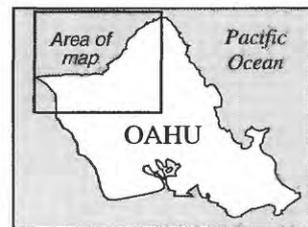
Regional Setting

The study area is located in north-central Oahu between the crests of the Koolau Range and the Waianae Range (fig. 1). The mountain ranges are the eroded remnants of two shield volcanoes. The mountain ranges are the eroded remnants of two shield volcanoes. The Mokuleia ground-water area lies within the basalt aquifer of the Koolau Volcano. Previous studies (Rosenau and others, 1971; Dale, 1978; Hunt, in press) that describe the physical and geological aspects of the ground-water area are summarized here. The Mokuleia and Waialua ground-water areas are separated by low-permeability paleosols and saprolite of the Waianae Volcano that lie below the geologic contact between the Waianae and Koolau Volcanoes. The Waialua and Kawaihoa ground-water areas are separated by alluvium and weathered basalt in and beneath Anahulu Gulch. Seaward flow of ground water in the Mokuleia and Waialua ground-water areas is impeded by a coastal confining unit that is composed of marine and terrestrial sediment known locally as "caprock." The caprock creates a confined artesian condition at low elevations near the shore. Further inland however, the aquifer is unconfined.

Water levels in the Waialua and Kawaihoa ground-water areas are about 12 ft and 4 ft above mean sea level, respectively. Water levels in the Mokuleia ground-water area are about 20 ft. Withdrawal from the Waialua, Kawaihoa and Mokuleia ground-water areas is



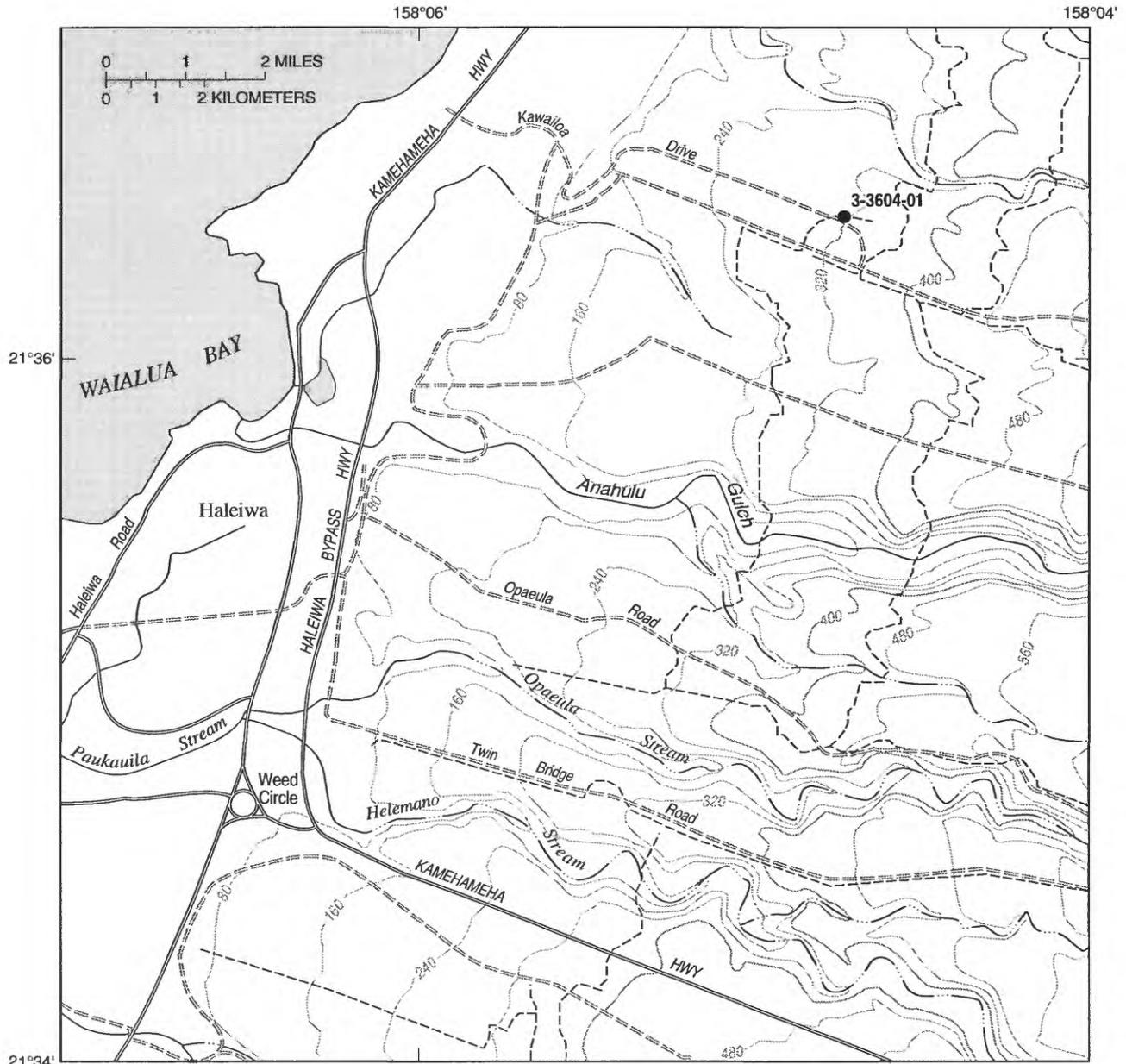
Base modified from U.S. Geological Survey digital data, 1:24,000, 1983, Albers equal area projection, standard parallels 21°15' and 21°45', central meridian 157°59'



EXPLANATION

-  SEDIMENTARY DEPOSITS (CAPROCK)
-  BOUNDARY OF GROUND-WATER AREA
-  TOPOGRAPHIC DIVIDE
-  3-3604-01 KAWAIOLOA DEEP MONITOR WELL AND STATE WELL NUMBER
-  3-3406-13 WELL AND STATE WELL NUMBER

Figure 1. Ground-water areas of north-central Oahu (modified from Hunt, in press) and wells drilled during the study, Hawaii.



Base modified from U.S. Geological Survey digital data, 1:24,000, 1983, Albers equal area projection, standard parallels 21°15' and 21°45', central meridian 157°59'

EXPLANATION

- 3-3604-01 KAWAILOA DEEP MONITOR WELL AND STATE WELL NUMBER
- 400 — TOPOGRAPHIC CONTOUR--Interval 80 feet
- - - - - DITCH

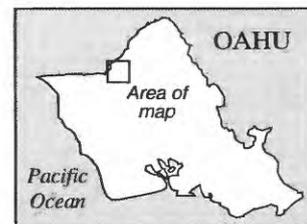


Figure 2. Location of Kawaiolo deep monitor well, Oahu, Hawaii.

primarily for sugarcane irrigation, although there are also several municipal wells and numerous small capacity private wells. Natural ground-water discharge occurs at springs and by subsurface flow through the caprock to the ocean (Rosenau and others, 1971).

Acknowledgments

The USGS gratefully acknowledges the Waialua Sugar Company for their assistance in identifying and preparing the drill site. The USGS also thanks the Bernice Pauahi Bishop Estate for permission to drill on their land.

DRILLING, CONSTRUCTION, CALIPER-LOG, AND SPECIFIC-CONDUCTANCE DATA

The Kawailoa deep monitor well (State well number 3-3604-01) is located along an unpaved access road between two sugarcane fields (fig. 2). The well site was chosen to maximize the distance from existing and possible future production wells. Well-construction data is provided in table 1 and construction details are shown in figure 3.

The well was drilled using an air-rotary system with flush-jointed 4 1/2-in. diameter drill pipe. Drilling foam and polymer were injected into the air-circulation system to assist the removal of drill cuttings and to stabilize the hole. The elevation of the ground surface in the area of the drill site is about 308 ft above mean sea level. A 12 1/4-in. diameter hole was drilled to an elevation of 240 ft and was cased with 69 ft of 8 5/8-in. outside-diameter steel casing with a 0.188-in. wall thickness. The annular space was grouted with cement to provide a surface seal. An eight-in. tri-cone tungsten-carbide button bit was then used to drill to an elevation of -42 ft. The water level in the well on September 5, 1993 was about 4 ft above sea level. The well subsequently caved and the bottom 15 ft of the well was lost. At this time, a private contractor installed a small pump to test water quality for the land owner and for the Waialua Sugar Company. Drilling resumed on November 17, 1993 and the caving zone was cemented. The well was cased with 6 5/8-in. outside-diameter steel casing to an elevation of 190 ft. A 6 1/4-in. diameter tri-cone rotary bit was used to drill to the final depth at an elevation of -392 ft. A caliper log was recorded before casing was installed, however, an obstructing rock at about the -332-ft elevation prevented the tool from reaching the bottom of the well. After the obstruction

Table 1. Construction data for Kawailoa deep monitor well, Oahu, Hawaii.
[Elevation datum is mean sea level; in., inch; ft, feet, od, outside diameter]

Well name	Kawailoa deep monitor well
State well number	3-3604-01
Latitude and longitude	21°36'24"N, 158°04'44"W
Hawaii tax map key number	6-1-05-1
Landowner	Bernice Pauahi Bishop Estate
Leaseholder	Waialua Sugar Company
Well completed	January 9, 1994
Working days to complete	28 days
Drillers	Fred Thibedeau and Wayne Heick; USGS
Surface hole diameter	12 1/4 in.
Bottom of surface casing elevation	240 ft
Surface casing diameter and type	8 5/8-in. od steel, 0.188-in. thick wall
Intermediate hole diameter	7 7/8 in.
Bottom of intermediate casing elevation	190 ft
Intermediate casing diameter and type	6 5/8-in. od steel, 0.188-in. thick wall
Final hole diameter	6 1/4 in.
Bottom of well elevation	-392 ft
Open interval elevations	190 ft to -392 ft
Screened interval elevations	10 ft to -392 ft
Inner casing diameter and type	4 1/2-in. od steel, flush-jointed
Screen type	4 1/2-in. od steel, slots cut longitudinally, 0.25 × 3.0 in.
Reference mark elevation (bolt)	308.29 ft
Top of casing measuring point elevation	309.01 ft. (to top of 4 1/2-in. od steel casing)
Water level and date of measurement	4.40 ft, February 14, 1995

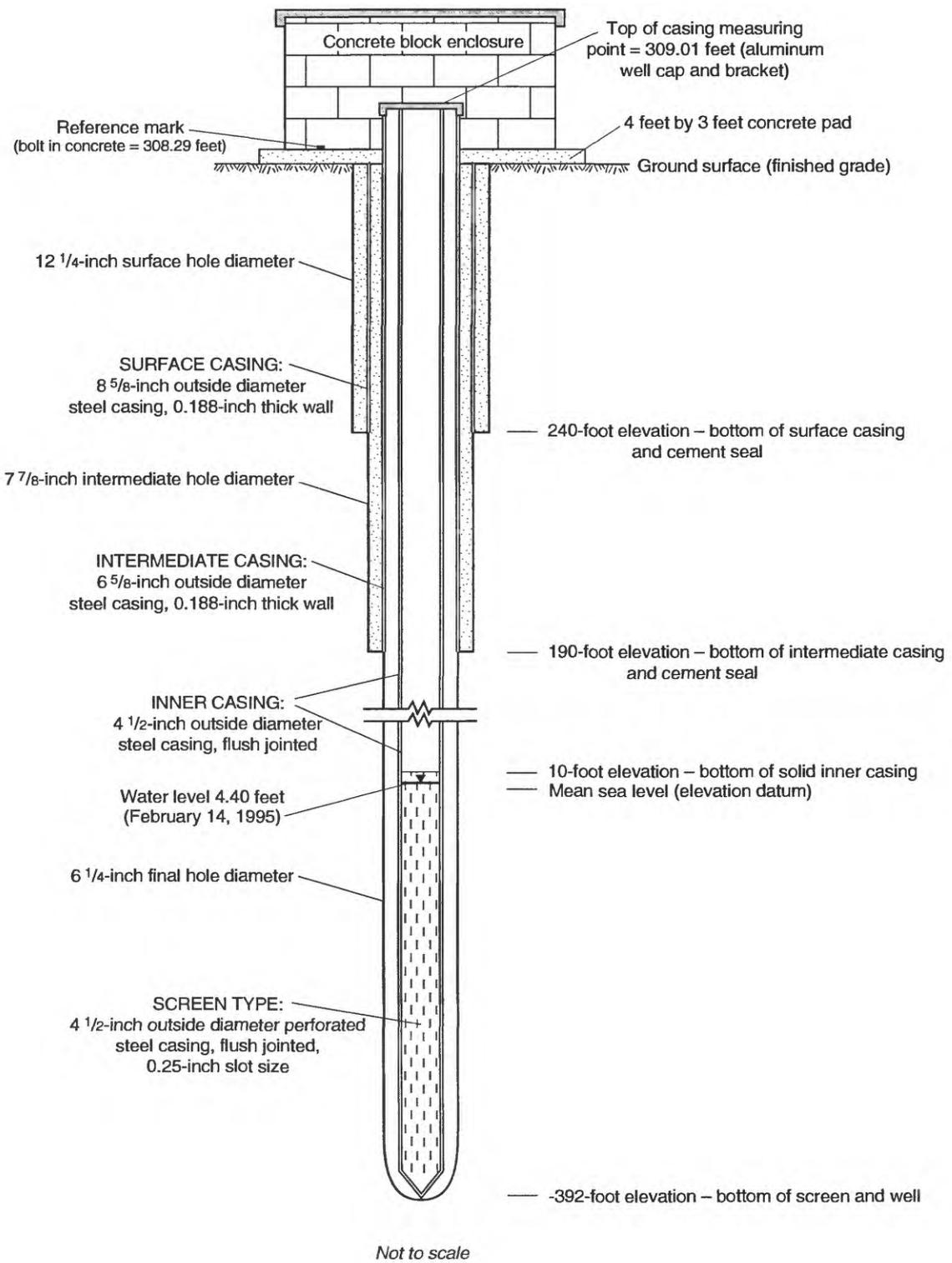


Figure 3. Construction details for Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii.

was removed, 4 1/2-in. outside-diameter flush-jointed steel casing was installed to the bottom of the hole. Slotted steel casing was installed below an elevation of 10 ft.

Geophysical logs of the well were recorded using a Well Reconnaissance logging unit for the caliper log, and a Mineral Logging Systems logging unit (operated by the Honolulu Board of Water Supply) with a Beckman Deepwell Solubridge downhole specific-conductance tool for the fluid conductance log.

The caliper log (fig. 4) shows many hole enlargements where the arms of the caliper tool extend to a diameter greater than the size of the drill bit between the -310 and 10-ft elevations. The caliper tool has three 16-in. spring-loaded arms that are extended when the tool is at the bottom of the hole. As the tool is raised, the logging unit records the extension of the arms as they drag against the walls of the bore. The caliper extension is an indication of hole diameter and wall smoothness, but the instrument does not measure these attributes directly. The maximum extension of the caliper arms is 32 in.

The specific-conductance log (fig. 5) increases from about 700 $\mu\text{S}/\text{cm}$ at the water table, about 4 ft above sea level, to slightly less than 3000 $\mu\text{S}/\text{cm}$ at an elevation of about -145 ft. The specific conductance increases between the elevations of -145 ft and -220 ft to about 50,000 mS/cm . The specific conductance was greater than 50,000 $\mu\text{S}/\text{cm}$ deeper than an elevation of -220 ft.

Samples of the materials expelled by the circulation system while drilling were collected every 5 ft. After reaching an elevation of -62 ft, the circulation was completely absorbed and no sample was recovered. The geologic log (geologic descriptions of the recovered samples from drilling) is presented in table 2, and the driller's log (driller's observations while drilling) is presented in table 3. From the surface, the bore penetrated about 15 ft of soil and 3 to 5 ft of saprolite. The remainder of the samples collected were basalt.

The measurement point (elevation 309.01 ft) for water-level determination is located on a V-notch filed into the northeast side of the inner 4 1/2-in. outside-diameter steel casing. An additional reference mark (elevation 308.29 ft) for the well site is located on the top of a stainless steel expansion bolt emplaced into the concrete pad surrounding the well.

ADDITIONAL INFORMATION

Information for the 12 wells drilled during the north-central Oahu study is listed in table 4. Nine of the wells were drilled in the Waialua ground-water area, and three wells, including the Kawailoa deep monitor well, were drilled north of Anahulu Gulch in the Kawailoa ground-water area. Water-level time-series data were collected for all of the wells drilled and for numerous other existing wells as part of the overall project monitoring effort (unpublished data in files of the USGS, Honolulu). Data were collected using electronic data loggers coupled to shaft encoder-float systems or pressure transducers.

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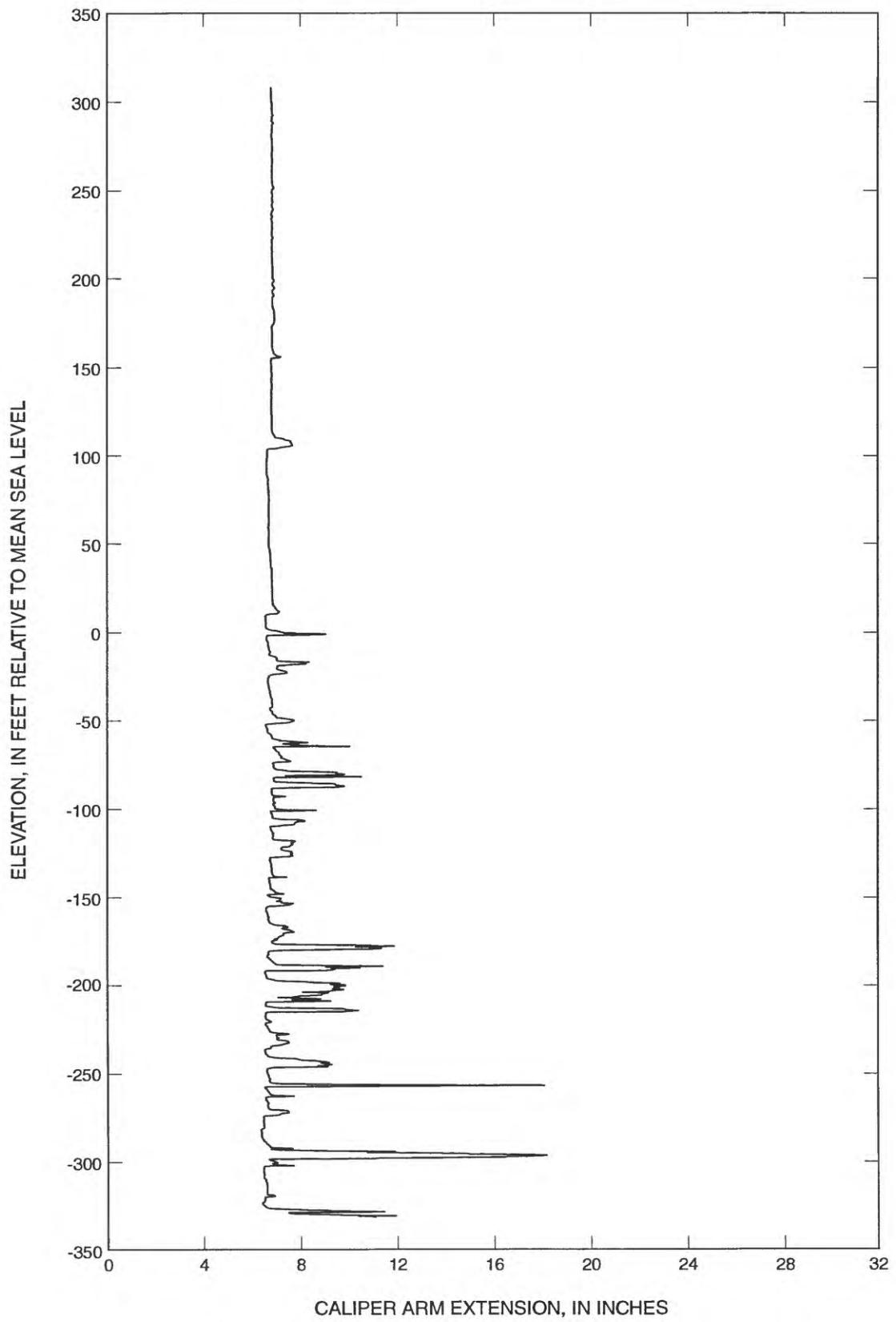


Figure 4. Caliper log for Kawaiiloa deep monitor well (State well number 3-3604-01), Oahu, Hawaii.

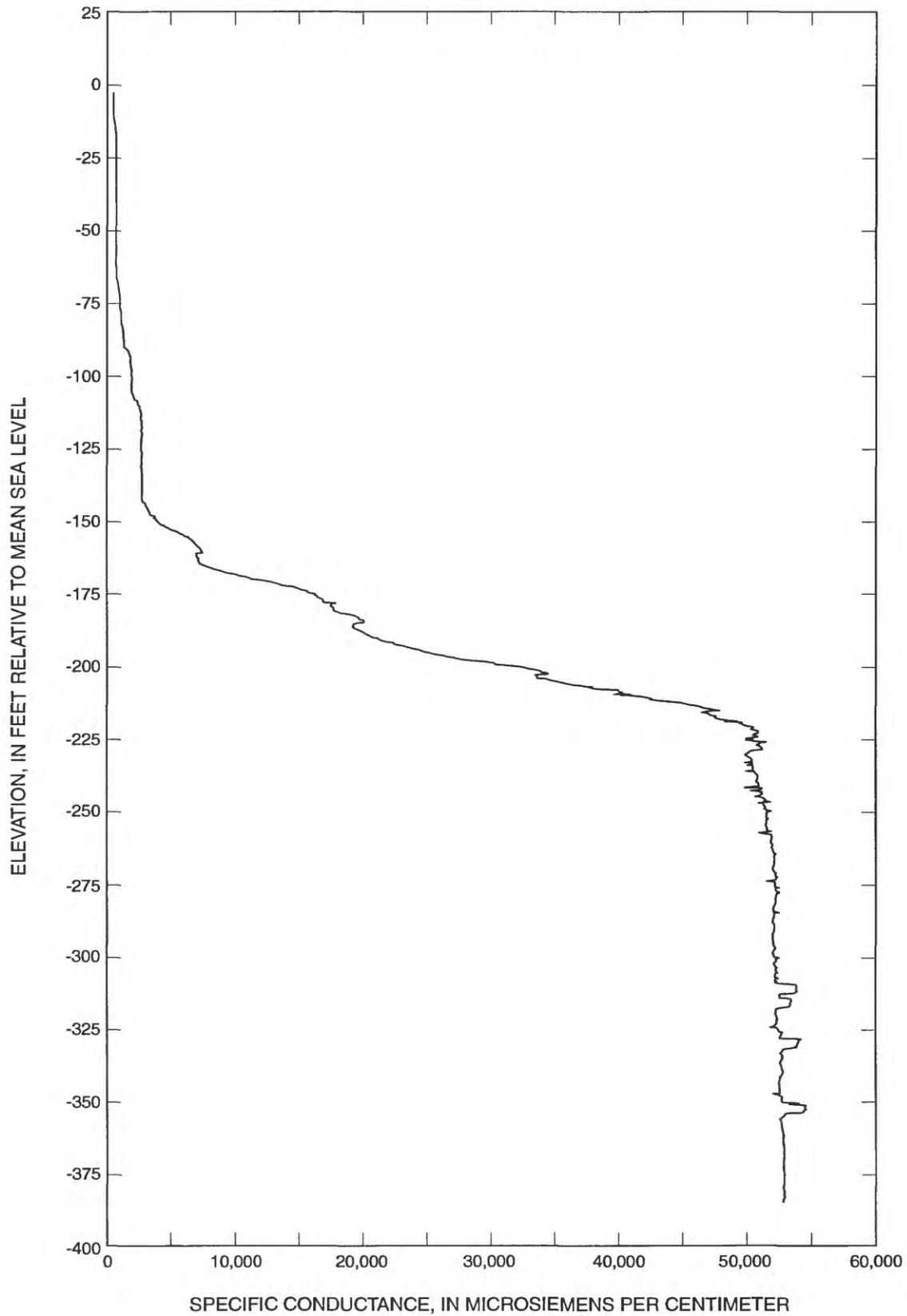


Figure 5. Specific conductance log for Kawailoa deep monitor well (State well number 3-3604-01), May 17, 1994, Oahu, Hawaii (data from the Honolulu Board of Water Supply).

Table 2. Geologic log of Kawaiioa deep monitor well (State well number 3-3604-01), Oahu, Hawaii
[Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Sample description	Comments
0 to 5	308 to 303	Red, hard soil	
5 to 10	303 to 298	Red, hard soil	
10 to 15	298 to 293	Red, hard soil	
15 to 20	293 to 288	Yellowish-brown saprolite; grey-blue, massive, nonvesicular, aphyric basalt	
20 to 25	288 to 283	Grey-blue, massive, nonvesicular, aphyric basalt	
25 to 30	283 to 278	Grey-blue, massive, nonvesicular, aphyric basalt	
30 to 35	278 to 273	Grey-blue, massive, nonvesicular, aphyric basalt; some red, oxidized, vesicular basalt	
35 to 40	273 to 268	Pinkish-grey, vesicular basalt	Fresh, hard
40 to 45	268 to 263	Grey, nonvesicular, massive basalt	
45 to 50	263 to 258	Grey, nonvesicular, massive basalt	
50 to 55	258 to 253	Dark-grey to reddish-grey, highly vesicular and nonvesicular rock	
55 to 60	253 to 248	Pinkish-grey, mostly vesicular basalt	Darker red-grey than above
60 to 65	248 to 243	Pinkish-grey, mostly vesicular basalt	
65 to 70	243 to 238	Pinkish-grey, mostly vesicular basalt	
70 to 75	238 to 233	Dark-grey, massive, aphyric basalt	
75 to 80	233 to 228	Dark-grey, massive, aphyric basalt	
80 to 85	228 to 223	Dark-grey, massive, aphyric basalt; some pieces of reddish-grey clinker	
85 to 90	223 to 218	No sample	
90 to 95	218 to 213	Reddish, vesicular, oxidized basalt	Clinker
95 to 100	213 to 208	No sample	
100 to 105	208 to 203	Reddish, vesicular, oxidized basalt	
105 to 110	203 to 198	Dark-grey, slightly vesicular, massive basalt; few pieces of vesicular material	Aa core
110 to 115	198 to 193	Dark-grey, very slightly vesicular, massive basalt	
115 to 120	193 to 188	Dark-grey, very slightly vesicular, massive basalt; some red clinker	
120 to 125	188 to 183	50% dark grey, very slightly vesicular, massive basalt; 50% red, oxidized clinker	Rare olivine
125 to 130	183 to 178	Red, oxidized, highly vesicular, basalt	Large chunks
130 to 135	178 to 173	Red, oxidized, highly vesicular, basalt	
135 to 140	173 to 168	Red, oxidized, highly vesicular, basalt	
140 to 145	168 to 163	Dark-grey, slightly vesicular basalt; some red clinker	
145 to 150	163 to 158	Dark-grey, slightly vesicular basalt; some red clinker	
150 to 155	158 to 153	Dark-grey, slightly vesicular basalt; some grey clinker	Large chunks
155 to 160	153 to 148	Red and grey, highly vesicular basalt	Large chunks
160 to 165	148 to 143	Red and grey, highly vesicular basalt; dark grey, nonvesicular basalt	
165 to 170	143 to 138	Grey and red, oxidized vesicular basalt	
170 to 175	138 to 133	Grey and red, oxidized vesicular basalt	
175 to 180	133 to 128	Grey and red, oxidized vesicular basalt	
180 to 185	128 to 123	Grey and red, oxidized vesicular basalt	
185 to 190	123 to 118	Grey and red, oxidized vesicular basalt	
190 to 195	118 to 113	Grey and red, oxidized vesicular basalt	
195 to 200	113 to 108	No sample	
200 to 205	108 to 103	No sample	
205 to 210	103 to 98	No sample	
210 to 215	98 to 93	Reddish-grey, highly vesicular basalt	
215 to 220	93 to 88	Reddish-grey, highly vesicular basalt	
220 to 225	88 to 83	Reddish-grey, highly vesicular basalt	
225 to 230	83 to 78	Reddish-grey, highly vesicular basalt	
230 to 235	78 to 73	Reddish-grey, highly vesicular basalt	Spherical pores
235 to 240	73 to 68	No sample	

Table 2. Geologic log of Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii--Continued
[Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Sample description	Comments
240 to 245	68 to 63	Reddish-grey, highly vesicular basalt	
245 to 250	63 to 58	Reddish-grey, highly vesicular basalt	
250 to 255	58 to 53	Reddish-grey, highly vesicular basalt	
255 to 260	53 to 48	No sample	
260 to 265	48 to 43	Dark reddish-grey, vesicular basalt	
265 to 270	43 to 38	Reddish-grey, highly vesicular basalt	
270 to 275	38 to 33	Reddish-grey (slightly redder than above), highly vesicular, basalt	
275 to 280	33 to 28	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
280 to 285	28 to 23	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
285 to 290	23 to 18	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
290 to 295	18 to 13	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
295 to 300	13 to 8	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
300 to 305	8 to 3	No sample	
305 to 310	3 to -2	Reddish-grey, highly vesicular basalt; some medium- grey, non-vesicular basalt	
310 to 315	-2 to -7	Reddish-grey, highly vesicular basalt	
315 to 320	-7 to -12	Reddish-grey, highly vesicular basalt	
320 to 325	-12 to -17	No sample	
325 to 330	-17 to -22	No sample	
330 to 335	-22 to -27	No sample	
335 to 340	-27 to -32	Reddish-grey, highly vesicular basalt	
340 to 345	-32 to -37	Reddish-grey to grey, vesicular and nonvesicular basalt	
345 to 356	-37 to -48	No sample	
356 to 370	-48 to -62	Light-grey, nonvesicular basalt	
no sample recovered after the 370-ft depth			

Table 3. Driller's log for the Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii
[Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Driller's notes
0 to 17	308 to 291	Saprolite
17 to 18	291 to 290	Grey, oxidized rock
18 to 23	290 to 285	Grey, hard rock
23 to 34	285 to 274	Grey, very hard rock
34 to 38	274 to 270	Brown, soft pahoehoe
38 to 44	270 to 264	Grey, hard rock
44 to 64	264 to 244	Grey-brown, soft weathered rock
64 to 81	244 to 227	Grey, hard rock
81 to 84	227 to 224	Void, circulation lost
84 to 89	224 to 219	Soft
89 to 90	219 to 218	Hard
90 to 102.5	218 to 205.5	Red clinker, regained circulation
102.5 to 107	205.5 to 201	Grey, hard rock
107 to 122	201 to 186	Grey, firm rock
122 to 127	186 to 181	Clinker, soft
127 to 129	181 to 179	Grey, hard rock
129 to 136	179 to 172	Grey, soft rock
136 to 141	172 to 167	Grey, firm rock
141 to 151	167 to 157	Soft rock, circulation lost
151 to 157	157 to 151	Firm but caving rock
157 to 164	151 to 144	Soft
164 to 186	144 to 122	Soft to very-soft, intermittent circulation
186 to 188	122 to 120	Void
188 to 192	120 to 116	Very soft, circulation lost
192 to 196	116 to 112	Medium-hard rock
196 to 203	112 to 105	Very soft rock, voids
203 to 207	105 to 101	medium-hard rock, regained circulation
207 to 210	101 to 98	Grey, hard rock
210 to 212	98 to 96	Medium-hard rock
212 to 236	96 to 72	Hard rock
236 to 238	72 to 70	Very soft rock
238 to 257	70 to 51	Firm to hard rock, regain circulation
257 to 269	51 to 39	Hard rock
269 to 277	39 to 31	Soft rock
277 to 286	31 to 22	Medium-hard rock
286 to 287	22 to 21	Hard rock
287 to 303	21 to 5	Soft rock
303 to 306	5 to 2	Medium-hard rock
306 to 307	2 to 1	Soft, possible water
307 to 325	1 to -17	Medium-hard rock
325 to 329	-17 to -21	Soft rock
329 to 333	-21 to -25	Hard rock
333 to 337	-25 to -29	Very soft, caving rock
337 to 341	-29 to -33	Medium-hard rock
341 to 345	-33 to -37	Hard rock
345 to 350	-37 to -42	Soft
350 to 372	-42 to -64	Hard, blue rock, no circulation
372 to 385	-64 to -77	Medium, fractured rock, no circulation
385 to 400	-77 to -92	Medium-soft, fractured rock, no circulation
400 to 433	-92 to -125	Soft, fractured rock
433 to 445	-125 to -137	Medium-hard rock, circulation regained
445 to 470	-137 to -162	Fractured, soft rock
470 to 475	-162 to -167	Hard rock
475 to 490	-167 to -182	Fractured, medium-hard rock

Table 3. Driller's log for the Kawailoa deep monitor well (State well number 3-3604-01), Oahu, Hawaii--Continued
 [Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Driller's notes
490 to 500	-182 to -192	Fractured rock
500 to 525	-192 to -217	Very soft, fractured rock
525 to 530	-217 to -222	Clinkers, cavity at 528 ft, soft
530 to 535	-222 to -227	Blue rock, medium-soft
535 to 550	-227 to -242	Very soft rock
550 to 562	-242 to -254	Medium-soft rock
562 to 565	-254 to -257	Void, tools dropped
565 to 570	-257 to -262	Medium-soft rock
570 to 600	-262 to -292	Very fractured rock
600 to 633	-292 to -325	Soft, fractured rock
633 to 655	-325 to -347	Medium rock
655 to 680	-347 to -372	Medium to hard rock
680 to 700	-372 to -392	Hard, competent rock

Table 4. Construction information for wells drilled during the study, Oahu, Hawaii

State well number	Well name	Latitude	Longitude	Hawaii state tax map key number	Landowner	Well completed	Working days to complete
3-3204-01	Kaheeka exploratory well	21°32'52"	158°04'52"	6-5-01-2	Castle and Cooke Land Company	March 2, 1994	16 days
3-3307-20	Thompson Corner exploratory well I	21°33'41"	158°07'02"	6-5-01-1	Castle and Cooke Land Company	July 9, 1993	14 days
3-3307-21	Thompson Corner exploratory well II	21°33'41"	158°07'02"	6-5-01-1	Castle and Cooke Land Company	August 9, 1993	15 days
3-3406-12	Twin Bridge Road deep monitor well	21°34'56"	158°06'10"	6-4-01-1	Castle and Cooke Land Company	March 9, 1994	27 days
3-3406-13	Kaamooloa exploratory well	21°34'06"	158°06'36"	6-5-01-2	Castle and Cooke Land Company	January 12, 1994	4 days
3-3406-14	Helemano exploratory well I	21°34'58"	158°06'21"	6-2-07-11	Castle and Cooke Land Company	October 15, 1993	11 days
3-3406-15	Helemano exploratory well II	21°34'58"	158°06'21"	6-2-07-11	Castle and Cooke Land Company	November 15, 1993	15 days
3-3407-37	Kiikii exploratory well	21°34'28"	158°07'16"	6-6-23-3	Castle and Cooke Land Company	April 21, 1994	27 days
3-3503-01	North Upper Anahulu exploratory well	21°35'30"	158°03'25"	6-2-09-1	Bishop Estate	May 5, 1994	8 days
3-3505-25	North Lower Anahulu exploratory well	21°35'45"	158°05'04"	6-2-09-1	Bishop Estate	December 23, 1993	7 days
3-3505-26	Opaepala exploratory well	21°35'11"	158°05'14"	6-2-10-1	Bishop Estate	October 4, 1993	10 days
3-3604-01	Kawailoa deep monitor well	21°36'24"	158°04'44"	6-1-05-1	Bishop Estate	January 9, 1994	28 days

Table 4. Construction information for wells drilled during the study, Oahu, Hawaii--Continued

State well number	Well name	Bottom of			Hole diameter (inch)	Bottom of well elevation (feet)	Open interval elevations (feet)	Inner casing outside diameter (inch) and type	Screened interval elevations (feet)	Measuring point elevation (feet)	Water level	
		surface casing elevation (feet)	Surface casing outside diameter (inch)	Height above sea level (feet)							Date and time	
3-3204-01	Kaheeka exploratory well	643	8 5/8	6 3/4	-55	643 to -55	4 1/2, steel	25 to -55	741.59 (top of casing)	12.44	Jan. 27, 1995	
3-3307-20	Thompson Corner exploratory well I	-65	12 5/8	12 1/4	-82	-65 to -82	12 5/8, steel	-65 to -82	99.10 (bolt)	11.32	Aug 5, 1993	
3-3307-21	Thompson Corner exploratory well II	17	8 5/8	7 7/8	-80	17 to -80	4 1/2, PVC	20 to -80	101.40 (top of casing)	11.29	Aug. 5, 1993	
3-3406-12	Twin Bridge Road deep monitor well	9	6 5/8	6 1/4	-596	9 to -596	4 1/2, steel	24 to -596	53.10 (top of casing)	11.10	Feb. 15, 1995	
3-3406-13	Kaamooloa exploratory well	10	6 5/8	6 1/4	-10	10 to -10	4 1/2, PVC	10 to -10	42.35 (top of casing)	11.87	Feb. 13, 1995	
3-3406-14	Helemano exploratory well I	-51	8 5/8	7 7/8	-78.5	-72 to -78.5	4 1/2, PVC	-68.5 to -78.5	13.79 (top of casing)	10.92	Feb. 15, 1995	
3-3406-15	Helemano exploratory well II	-52	8 5/8	7 7/8	-291	-271 to -291	4 1/2, steel	-271 to -291	14.41 (top of casing)	11.15	Feb. 15, 1995	
3-3407-37	Kiikii exploratory well	-115	8 5/8	17 1/2	-135	-125 to -135	4 1/2, steel	-115 to -135	14.68 (top of casing)	11.70	Feb. 13, 1995	
3-3503-01	North Upper Anahulu exploratory well	592	8 5/8	6 3/4	-103	592 to -103	4 1/2, steel	17 to -103	671.74 (top of casing)	7.15	Feb 14, 1995	
3-3505-25	North Lower Anahulu exploratory well	181	8 5/8	7 7/8	-20	181 to -20	4 1/2, PVC	20 to -20	234.24 (top of casing)	4.75	Feb. 14, 1995	
3-3505-26	Opaeuia exploratory well	229	6 5/8	6 1/4	-65	229 to -65	4 1/2, PVC	15 to -65	288.08 (top of casing)	10.52	Feb. 15, 1995	
3-3604-01	Kawailoa deep monitor well	190	6 5/8	6 1/4	-392	190 to -392	4 1/2, steel	9 to -391	309.01 (top of casing)	4.40	Feb. 14, 1995	