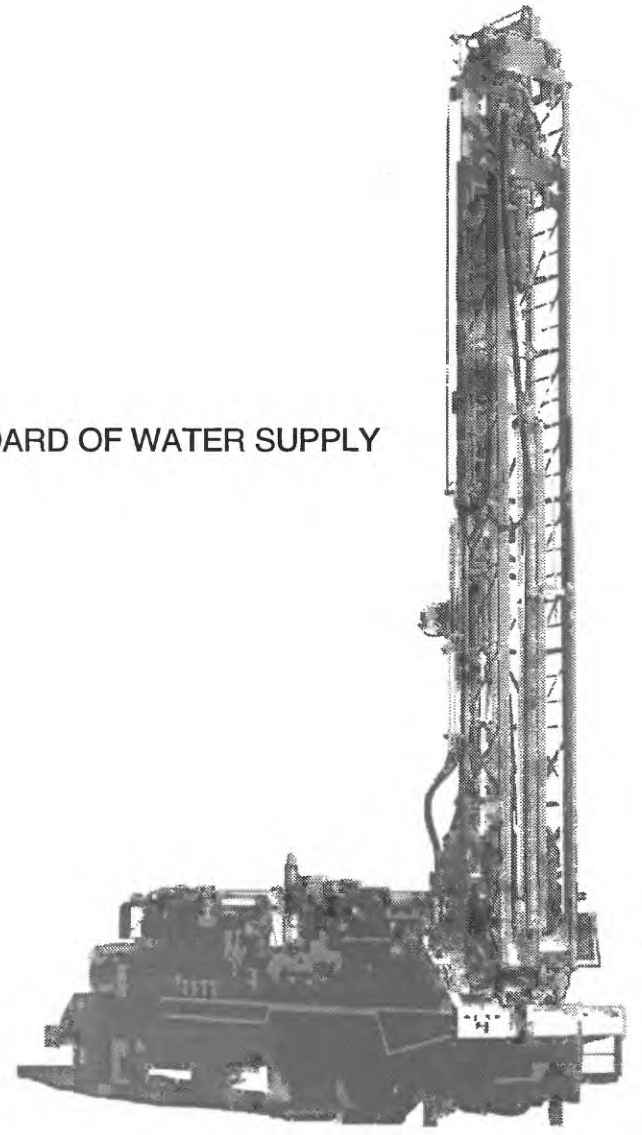
DRILLING AND CONSTRUCTION DATA FOR WELL 3-3407-37, KIIKII EXPLORATORY WELL, OAHU, HAWAII

U.S. GEOLOGICAL SURVEY

Open-File Report 96-426



Prepared in cooperation with the

CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY

CONTENTS

FIGURES

TABLES

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.

Drilling and Construction Data for Well 3-3407-37, Kiikii Exploratory Well, Oahu, Hawaii

By Todd K. Presley and Delwyn S. Oki

Abstract

The Kiikii exploratory well (State well number 3-3407-37) was drilled about 1.4 miles southwest of the town of Haleiwa and 4,000 feet west-southwest of Weed Circle. The well is on agricultural land in the Waialua ground-water area. The well penetrates through sedimentary deposits (caprock) and into the underlying basalt aquifer. Well-construction data, logs of drilling notes, and geologic descriptions for the samples 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 Kiikii exploratory well (State well number 3-3407-37). The well is about 4,000 ft west-southwest of Weed Circle and about 1.4 mi southwest of the town of Haleiwa (figs. 1 and 2). The purpose of the well is to measure the artesian head in the Waialua ground-water area (Rosenau and others, 1971; Dale, 1978; Hunt, in press). The well penetrates through the sedimentary deposits of the coastal confining unit, known locally as "caprock," into the basalt aquifer.

Regional Setting

The study area is located in north-central Oahu between the crests of the Koolau Range and the Waianae Range (fig. 1). Previous studies (Rosenau and others, 1971; Dale, 1978; Hunt, in press) that describe the physical and geological aspects of the study area are summarized here. The mountain ranges are the eroded remnants of two shield volcanoes. 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 Kawailoa 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 Kawailoa 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, Kawailoa and Mokuleia ground-water areas is 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

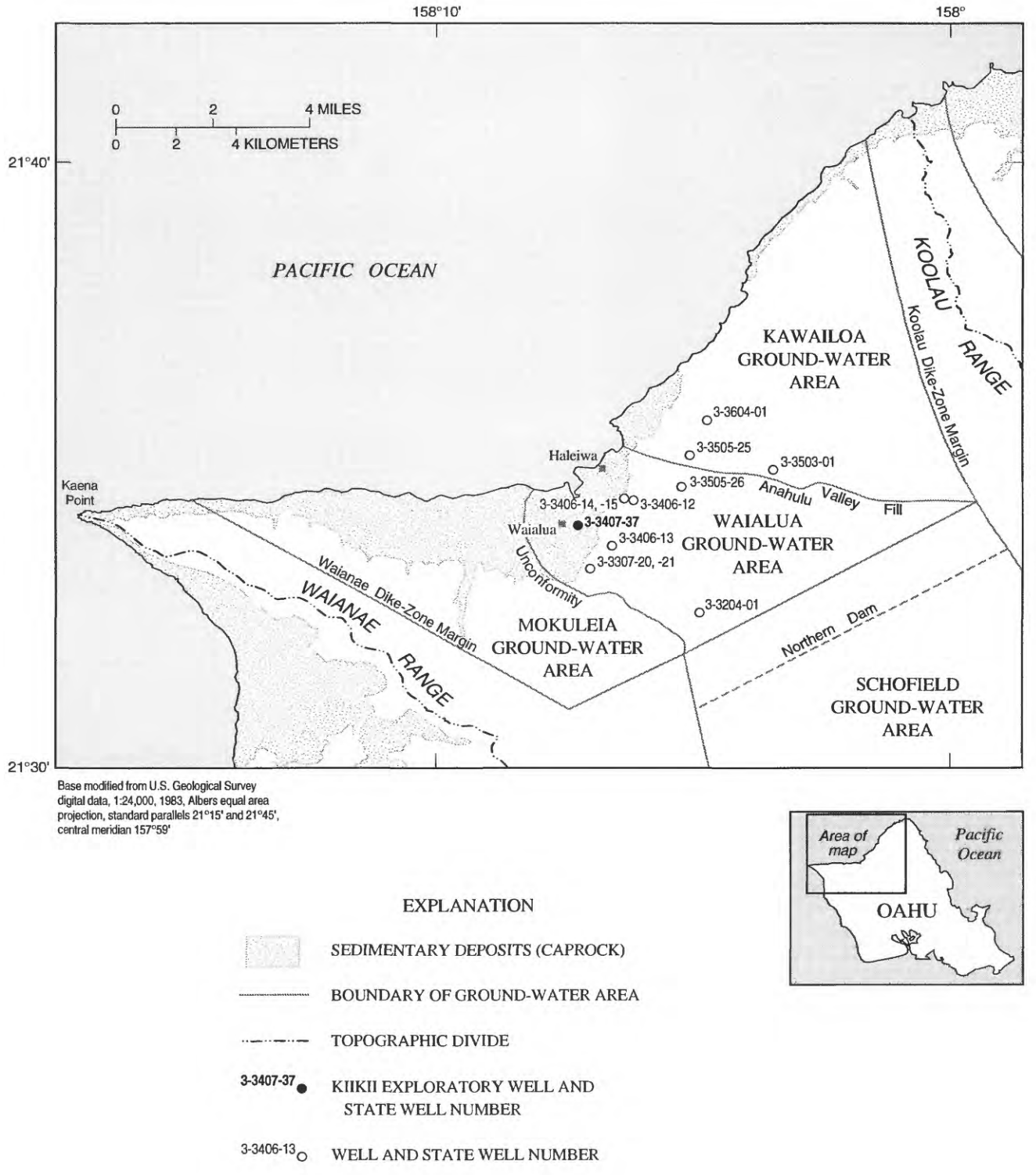


Figure 1. Ground-water areas of north-central Oahu (modified from Hunt, in press) and wells drilled during the study, Hawaii.

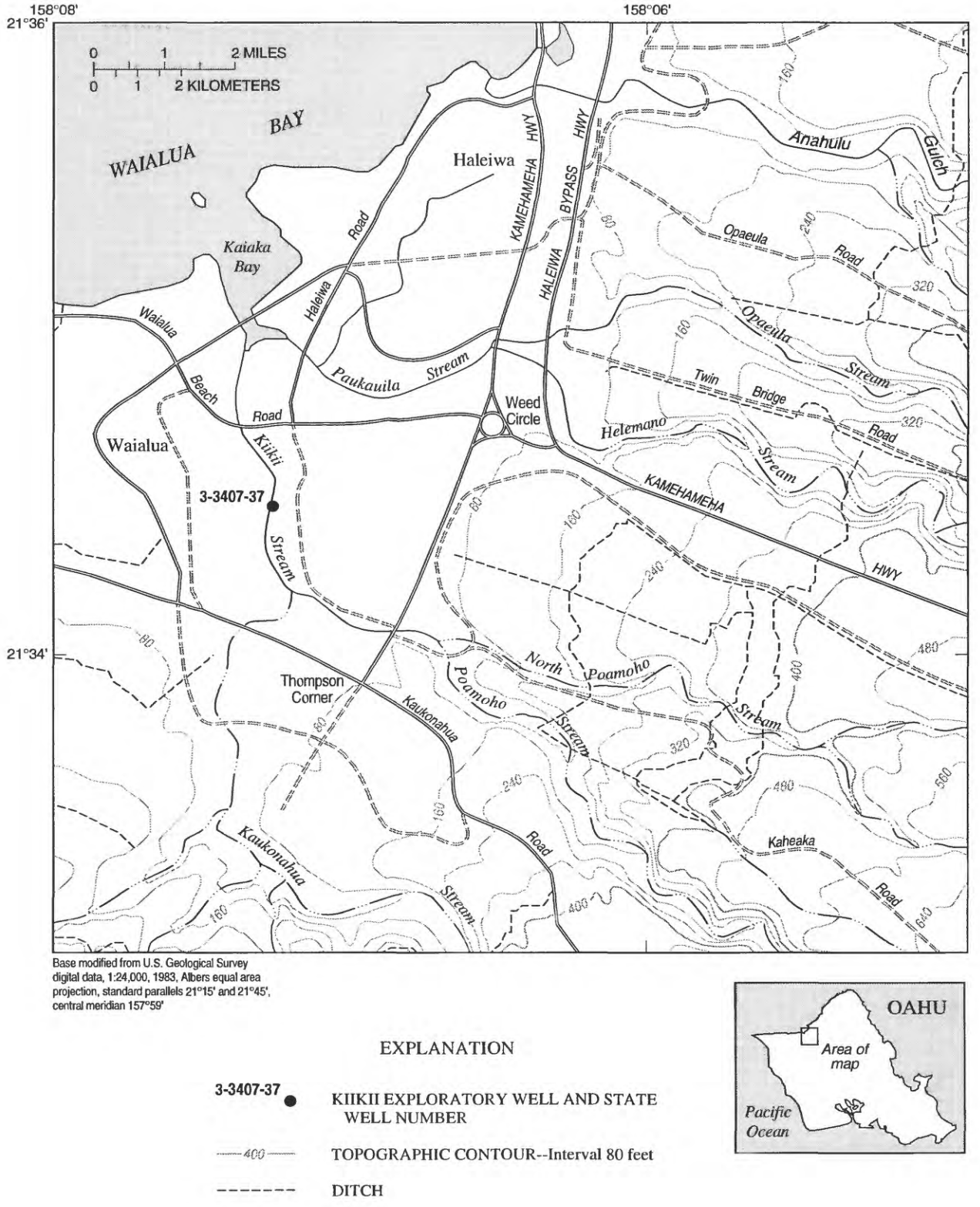


Figure 2. Location of Kiikii exploratory well, Oahu, Hawaii.

preparing the drill site. The USGS also thanks the Castle and Cooke Land Company for permission to drill on their land.

DRILLING AND CONSTRUCTION DATA

The Kiikii exploratory well (State well number 3-3407-37) is on the periphery of a sugarcane field near the bank of the Kiikii Stream. 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 and an 8 5/8-in. outside-diameter casing-advance drilling 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 in the area of the drill site is about 5 ft. A 17 1/2-in. diameter hole was drilled 121 ft to an elevation of about -115 ft. The hole penetrated unstable alluvial material. A 12 3/4-in. outside-diameter casing was driven to an elevation of -98 ft, and in the process of driving the casing, a flowing artesian condition developed. At this point, the 8 5/8-in. outside-diameter casing-advance system was used to deepen the well to the basalt through the soft and incompetent alluvium. The 8 5/8-in. outside-diameter casing was advanced to an elevation of -115 ft. To insure that the basalt aquifer had been penetrated, a 6 3/4-in. diameter hole was drilled inside the 8 5/8-in. outside-diameter casing to an elevation of -125 ft. To eliminate leakage within and into the caprock, the 123/4-in. outside-diameter casing was removed and the annulus between the 8 5/8-in. outside-diameter casing and the 17 1/2-in. diameter hole was grouted using bentonite and cement. A plug formed in the bottom of the 8 5/8-in. outside-diameter casing during the grouting process. Once the cement had hardened, the hole was drilled through the cement plug to the -135 ft elevation using a 6 3/4-in. diameter drill bit where the artesian condition was re-established. The well was then cased with 4 1/2-in. outside-diameter PVC casing. A 20-ft section of 4 1/2-in. outside-diameter PVC screen with 0.02-in. horizontal slots was installed at the bottom of the casing.

Samples of the materials expelled by the circulation system while drilling were collected every 5 ft when possible. 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 10 ft of dark-red clay, 20 ft of sticky, brown clay and 50 ft of brown, silty clay. Between depths of 130 and 140 ft, slightly weathered vesicular basalt was penetrated.

The measuring point (elevation 14.68 ft) for water-level determination is located on the west side of the aluminum well-cap bracket affixed to the top of the 8 5/8-in. outside-diameter steel surface casing. An additional reference mark (elevation 5.62 ft) for the well site is located on the top of a stainless steel 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, including the Kiikii exploratory well (3-3407-37), were drilled in the Waialua ground-water area, and three wells 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 monitoring effort for the project (unpublished data in files of the USGS, Honolulu). Data were collected using electronic data loggers coupled to shaft encoder-float systems or pressure transducers.

REFERENCES CITED

Dale, R.H., 1978, A ground-water inventory of the Waialua basal-water body, island of Oahu, Hawaii: U.S. Geological Survey Open-File Report 78-24, 71 p.

Hunt, C.D., Jr., in press, Geohydrology of the island of Oahu, Hawaii: U.S. Geological Survey Professional Paper 1412-B.

Rosenau, J.C., Lubke, E.R., and Nakahara, R.H., 1971, Water resources of north-central Oahu, Hawaii: U.S. Geological Survey Water-Supply Paper 1899-D, 40 p.

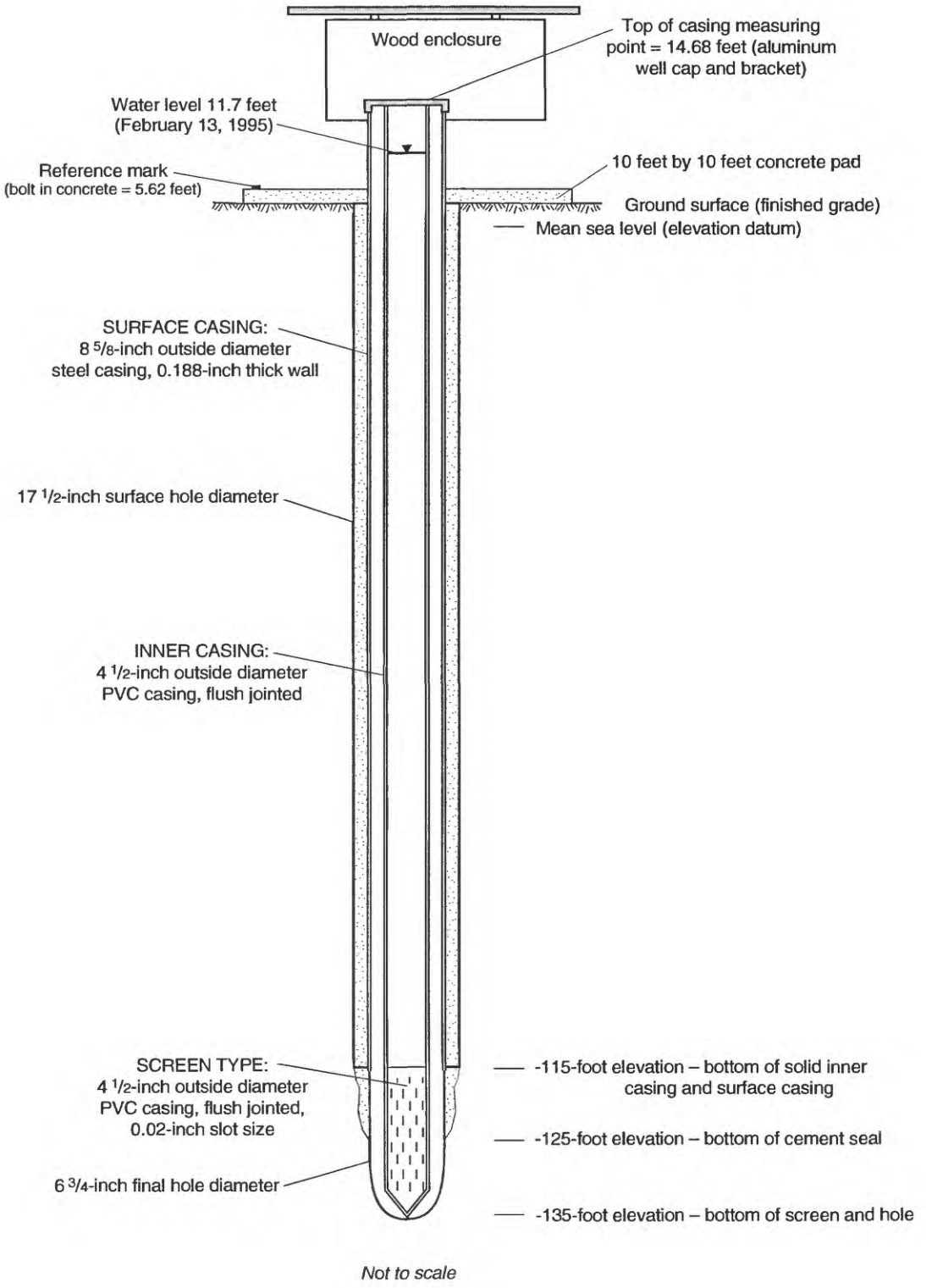


Figure 3. Construction details for Kiikii exploratory well (State well number 3-3407-37), Oahu, Hawaii.

Table 1. Construction data for Kiikii exploratory well, Oahu, Hawaii.
[Elevation datum is mean sea level]

Well name	Kiikii exploratory well
State well number	3-3407-37
Latitude and longitude	21°34'28"N, 158°07'16"W
Hawaii tax map key number	6-6-23-3
Landowner	Castle and Cooke Land Company
Leaseholder	Waialua Sugar Company
Well completed	April 21, 1994
Working days to complete	27 days
Drillers	Wayne Heick, Fred Thibedeau; USGS
Surface hole diameter	17 1/2 in.
Bottom of surface casing elevation	-115 ft
Surface casing diameter and type	8 5/8-in. od steel, 0.188-in. thick wall
Bottom of cement seal elevation	-125 ft
Final hole diameter	6 3/4 in.
Bottom of well elevation	-135 ft
Open interval elevations	-125 ft to -135 ft
Inner casing diameter and type	4 1/2-in. od PVC, flush-jointed
Screen type	4 1/2-in. od PVC, flush-jointed, 0.02-in. horizontal slots
Screened interval elevations	-115 ft to -135 ft
Reference mark elevation (bolt)	5.62 ft
Top of casing measuring point elevation	14.68 ft (top of aluminum well-cap bracket)
Water level and date of measurement	11.70 ft on February 13, 1995

Table 2. Geologic log for Kiikii exploratory well (State well number 3-3407-37), Oahu, Hawaii.
[Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Sample description	Comments
0 to 5	5 to 0	Dark, reddish-brown clay	Mud
5 to 10	0 to -5	Dark, reddish-brown clay	Mud
10 to 24	-5 to -19	Dark-brown, sticky clay	
24 to 30	-19 to -25	Dark-brown clay	
30 to 40	-25 to -35	Brown, silty clay	
40 to 50	-35 to -45	Brown, silty clay	
50 to 60	-45 to -55	Brown, silty clay	
60 to 70	-55 to -65	Brown, silty clay	
70 to 80	-65 to -75	Brown, silty clay	Slightly darker than above
80 to 90	-75 to -85	Brown, silty clay	Similar to above
123 to 127	-118 to -122	Brownish-grey, friable saprolite	
130 to 140	-125 to -135	Grey, slightly weathered, vesicular basalt	

Table 3. Driller's log for the Kiikii exploratory well (State well number 3-3407-37), Oahu, Hawaii.
[Elevation datum is mean sea level]

Depth below grade (feet)	Elevation (feet)	Description
0 to 5	5 to 0	Black, moist clay
5 to 50	0 to -45	Black, silty sand; wet, very mucky
50 to 118	-45 to -113	Gravel and silt; very unstable hole
118 to 140	-113 to -135	Basalt; artesian water at 121 ft.

Table 4. Construction data 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	Kaheaka 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	Opaeula 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 data for wells drilled during the study, Oahu, Hawaii--Continued

State well number	Well name	Bottom of surface casing elevation (feet)	Surface casing outside diameter (inch)	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	
										Height above sea level (feet)	Date and time
3-3204-01	Kaheaka 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 17:20
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 15:51
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 15:51
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 12:09
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 14:45
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 12:26
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 12:28
3-3407-37	Kiikii exploratory well	-115	8 5/8	6 3/4	-135	-125 to -135	4 1/2, steel	-115 to -135	14.68 (top of casing)	11.70	Feb. 13, 1995 13:44
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 13:54
3-3505-25	North Lower Anahulu exploratory well	182	8 5/8	7 7/8	-18	182 to -18	4 1/2, PVC	22 to -18	234.24 (top of casing)	4.75	Feb.14, 1995 15:08
3-3505-26	Opaeula 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 11:14
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 14:18