UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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TEST MONITORING OF PROTOTYPE INJECTION WELL WAIALE, MAUI, HAWAII

Open-File Report 79-274

Prepared in cooperation with the
DEPARTMENT OF PUBLIC WORKS
COUNTY OF MAUI

Honolulu, Hawaii
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CONVERSION TABLE

Inch-pound units have been used throughout this report. The following table converts measurements in the inch-pound system to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	1233	cubic meter (m^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
pound-force per $inch^2$ (lbf/in^2)	6.895	kilopascal (kPa)

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ABSTRACT

A high-capacity prototype injection well was tested in the isthmus area of Maui. Pumping tests were made on April 14 and April 15, 1978, and 10 injection tests were made between May 12 and June 30, 1978.

Selected tests were monitored in order to obtain data which could be used to assess the effects of subsurface disposal on the ground water in the basal aquifer. Pumping and injection rates were measured. Basal-water head responses to pumping and injection were observed at the prototype well and at two observation wells located 435 and 6,100 feet from the prototype well. Water-quality samples were collected at the prototype well and the nearest observation well prior to testing. Samples of the injection water, as well as samples from the observation wells, were collected prior to and after the final test.

The head data and water-quality data are presented in this report.

INTRODUCTION

Background.--Injection wells have been used for disposal of storm runoff in the Wailuku-Kahului area of Maui since 1965 (Hargis and Peterson, 1970). Early in 1978, A & B Properties, Inc. drilled a prototype injection well to test the feasibility of high-capacity injection of storm runoff from a planned residential development. The U.S. Geological Survey, monitored head responses and water-quality changes resulting from selected pumping and injection tests conducted at the prototype well. Data were obtained at the prototype well and at two observation wells.

This work was done in cooperation with the County of Maui.

Physical setting.--The prototype injection well (well 5229-01) is just east of Waiale Reservoirs between Wailuku and Kahului. The site, at an altitude of 141 feet above mean sea level, is in the northern part of the Maui Isthmus, about 7,500 feet southwest of the shore of Kahului Harbor. A test boring (well 5329-18), located 435 feet north of the prototype well, was used as one observation well for the monitoring program. An existing injection well (well 5328-45) at Kahului sump 6,100 feet east of the prototype well was used as the other observation well. The well locations are shown in figure 1.

The study area is underlain by consolidated sand dune deposits ranging in thickness from about 75 feet near the prototype well to 2 feet at Kahului sump. Beneath the eolian deposits is a layer of sediments, consisting of silt, sand, and gravel, which is 80 feet thick near the prototype well and thins to 25 feet at Kahului sump. These sediments are underlain by basaltic lavas from Haleakala to an undetermined depth (Stephen P. Bowles, 1978, personal communication.). Simplified well logs are shown in figure 2.

Ground water in the area occurs as basal water. The basal-water head, during the period of testing, was about 3.8 feet above sea level in the test boring and about 3.1 feet above sea level in the injection well at Kahului sump. A previous basal-water head survey by Takasaki (1972), indicated that the hydraulic gradient in the area is generally easterly.

Purpose and scope.--The purpose of the monitoring effort was to collect and report data that could be used to assess the impact on the ground water in the area from the injection of urban storm runoff. The scope of the study included:

(1) Measurements of pumping and injection rates.

(2) Measurements of basal-water head response to pumping and injection at the prototype well and two available observation wells.

(3) Water-quality analyses of the injected water and water from the observation wells.

Acknowledgments.--The assistance of field personnel of A & B Properties, Inc., Belt, Collins and Associates, and Mr. Stephen P. Bowles, consulting hydrologist-geologist, was instrumental in the collection of the data presented in this report. The staff of the Maui Field Headquarters of the U.S. Geological Survey provided material, equipment, and long hours of service, sometimes extending late into the night.

MONITORING PROGRAM

Testing schedule.--The prototype well was tested by pumping, on April 14 and 15, 1978; this pumping also served to clean and develop the hole. Ten injection tests were performed on the prototype well between May 12 and July 21, 1978.

Monitoring stations.--The pumping rates of the prototype well were estimated by measuring the trajectory of full-pipe discharge from an 8-inch horizontal pipe. Injection water was delivered to the prototype well by a flume from the Waiale Reservoir. Injection rates were monitored at a Cipoletti weir equipped with a float-type, water-level recorder. The weir was about 100 feet upstream of the prototype well. Samples of injected water were collected between the weir and the prototype well for chemical and bacterial analyses.

Heads in the prototype well, were measured inside the casing by an airline with the bottom set at a depth of 170 feet below ground level or 33 feet below the static water level.

Two piezometers to measure heads were installed in the annular space outside the casing of the prototype well. One was inoperable from the onset and was presumed clogged. The other extended to 263 feet below the ground surface, and the bottom 10 feet were perforated. When the prototype well was pumped, head measurements were made with an electric probe. During injection heads could not be measured because of air discharging from the piezometer.

Before the casing was installed in the prototype well and prior to drilling the open-hole part of the well, samples of water were obtained from various depths with a Foerst-type, depth sampler.

After the well was completed and cased, the specific conductance of the water pumped from the open-hole part was measured. The specific conductance of the water (40,000 micromhos) was roughly equivalent to that of seawater.

During the injection test of June 30, 1978, water levels in the prototype well were measured by an airline with the bottom set at a depth of 162 feet below ground level or 25 feet below the static water level.

Water levels in the test boring (5329-18) were monitored with an electric probe, which followed the water surface automatically. The probe was connected to a continuous recorder and owing to the nature of the probe, a sensitivity of about 0.005 foot showed a distinctive step-like trace of the head. The recorder was adapted to produce a trace with a time scale of about 18.8 minutes per inch or 113 seconds per one-tenth-of-an-inch chart division.

The test boring was equipped with a 1-3/4-inch diameter (ID) casing and a special, small-diameter sampler was used. The sampler was constructed of 3/4-inch diameter copper tubing sealed at the bottom and equipped with a stopper at the top. The sampler was lowered to the desired depth with the stopper sealing the top. At the desired depth, the stopper was pulled by jerking the cable, thus allowing the water to enter the sampler, which was then raised to the surface.

The well at Kahului sump (5328-45) was equipped with a float-type, water-level recorder. Samples were obtained in this well by a Foerst-type, depth sampler.

DATA

A summary of the volumes of water injected during the tests is shown in table 1.

Table 2 presents a summary of the types of data collected at the various monitoring stations during the tests.

No head response was detectable in well 5328-45 at Kahului sump, as a result of pumping and injection at the prototype well.

Figures 3, 4, 5, 6, and 7 present the water-level response data from the prototype well and the test boring for the tests of April 14, April 15, May 12, and June 30.

Water-quality analyses of samples from the prototype well, the flume, the test boring, and the injection well at Kahului sump are presented in tables 3, 4, 5, and 6, respectively. In addition to the chemical and bacterial water-quality data indicated in table 2, physical properties measured in the field including specific conductance, pH, and temperature are given with the water-quality data.

REFERENCES

Hargis, D. R., and Peterson, F. L., 1970, Artificial recharge practices in Hawaii: Water Resources Research Center, University of Hawaii, Honolulu, Technical Report 43, 36 p.

Peterson, F. L., and Hargis, D. R.,1971, Effect of storm runoff disposal and other artificial recharge to Hawaiian Ghyben-Herzberg Aquifers: Water Resources Research Center, University of Hawaii, Honolulu, Technical Report 54, 51 p.

Stearns, H. T., and Macdonald, G. A., 1942, Geology and ground-water resources of the island of Maui, Hawaii: Hawaii Division of Hydrography Bulletin 7, 344 p.

Takasaki, K. J., 1972, Preliminary report on the water resources of central Maui: Hawaii Division of Water and Land Development Circular C62, 59 p.

Yamanaga, George, and Huxel, C. J., Jr., 1970, Preliminary report on the water resources of the Wailuku area, Maui: Hawaii Divi- Water and Land Development Circular C61, 43 p.

Table 1. Injection schedule for Waiale prototype well-testing program

Date	Time		Volume injected, in gallons	Remarks
	Begin	Cease		
5/12/78	1700	1825	266,000	Varied injection rate.
5/17/78	1601	1905	809,000	Do.
5/31/78	1625	1658	112,000	Do.
6/ 2/78	1545	1712	508,000	Do.
6/19/78	1640	1825	280,000	Do.
6/23/78	1522	1730	164,000	Do.
6/26/78	1451	1748	734,000	Do.
6/30/78	1544	1923	993,000	Steady injection rate.
7/10/78	1538	1550	57,000	Do.
7/21/78	1529	1958	934,000	Varied injection rate.

Table 2. Summary of types of data collected

Date	Test type	Monitoring station			
		Flume (injected water)	Prototype well	Test boring	Kahului Sump
2/17/78	None		Static water level		
3/13/78	None		Physical, chemical		
4/14/78	Pumping		Dynamic water level	Dynamic water level	Dynamic water level
4/15/78	Pumping		Dynamic water level, physical	Dynamic water level	Dynamic water level
5/ 8/78	None				Physical
5/10/78	None			Physical	
5/12/78	Injection		Dynamic water level	Dynamic water level	Dynamic water level
5/31/78	Injection	Physical			
6/ 2/78	Injection	Physical			
6/19/78	Injection	Physical			
6/26/78	Injection	Physical			
6/30/78	Injection	Physical		Physical, bacterial	Physical
7/10/78	Injection			Physical, bacterial	Physical
7/21/78	Injection	Physical, chemical, bacterial		Physical, chemical, bacterial	Physical, chemical, bacterial

Table 3. Water-quality data, Waiale prototype injection well

DATE	TIME	DEPTH TO TOP OF SAMPLE INTERVAL (FT)	DEPTH TO BOTTOM OF SAMPLE INTERVAL (FT)	SAMPLING DEPTH (FT)	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)
FEB								
15...	--	--	--	--	--	300	--	--
MAR								
13...	0835	--	--	160	22.0	1170	200	82
13...	0845	--	--	230	21.5	2050	320	210
13...	0900	--	--	250	21.5	2200	340	240
13...	0910	--	--	260	21.5	2320	--	--
13...	0915	--	--	270	21.5	2600	370	270
13...	0955	--	--	272	21.5	2700	400	300
APR								
15...	0757	291	428	--	21.5	40000	--	--
15...	0806	291	428	--	21.5	40000	--	--
15...	0813	291	428	--	21.5	40000	--	--
15...	0829	291	428	--	21.5	40000	--	--

Table 3. Water-quality data, Waiale prototype injection well--Continued

DATE	DIS-SOLVED CALCIUM (CA) (MG/L)	DIS-SOLVED MAGNESIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	DIS-SOLVED POTASSIUM (K) (MG/L)	BICARBONATE (HCO3) (MG/L)	ALKALINITY AS CACO3 (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)
FEB									
15...	--	--	--	--	--	--	--	--	--
MAR									
13...	26	32	140	69	4.3	8.4	140	110	40
13...	39	54	270	64	6.6	14	130	110	75
13...	44	56	290	64	6.8	14	120	98	86
13...	--	--	--	--	--	--	--	--	--
13...	45	63	330	65	7.4	16	120	98	88
13...	49	69	360	65	7.8	17	120	98	98
APR									
15...	--	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--	--

Table 3. Water-quality data, Waiale prototype injection well--Continued

DATE	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)
FEB								
15...	14	--	--	--	--	--	--	--
MAR								
13...	260	.5	61	648	2.3	.33	10	20
13...	540	.4	61	1130	2.3	.24	10	30
13...	550	.4	61	1170	2.3	.24	0	20
13...	--	--	--	--	--	--	--	--
13...	630	.3	60	1350	2.3	.24	0	30
13...	690	.3	59	1410	2.3	.23	10	40
APR								
15...	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--
15...	--	--	--	--	--	--	--	--

Table 4. Water-quality data, injected water

DATE	TIME	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	DISSOLVED CALCIUM (CA) (MG/L)	DISSOLVED MAGNESIUM (MG) (MG/L)	DISSOLVED SODIUM (NA) (MG/L)
MAY									
31...	1620	21.5	77	--	--	--	--	--	--
31...	1645	21.5	77	--	--	--	--	--	--
31...	1700	21.0	78	--	--	--	--	--	--
31...	1735	21.0	74	--	--	--	--	--	--
JUN									
02...	1555	22.0	77	--	--	--	--	--	--
02...	1601	21.5	74	--	--	--	--	--	--
02...	1620	21.5	70	--	--	--	--	--	--
02...	1630	21.5	72	--	--	--	--	--	--
02...	1724	21.5	70	--	--	--	--	--	--
02...	1754	21.0	70	--	--	--	--	--	--
19...	1703	20.5	54	--	--	--	--	--	--
26...	1710	21.0	62	7.6	--	--	--	--	--
30...	1550	22.0	116	7.8	--	--	--	--	--
30...	1620	22.5	65	--	--	--	--	--	--
30...	1630	--	63	--	--	--	--	--	--
30...	1705	22.5	66	7.6	--	--	--	--	--
30...	1715	22.5	63	--	--	--	--	--	--
30...	1730	22.5	63	--	--	--	--	--	--
30...	1800	--	63	--	--	--	--	--	--
30...	1830	22.5	63	--	--	--	--	--	--
30...	1913	22.5	63	--	--	--	--	--	--
JUL									
21...	1550	22.0	65	7.3	27	5	4.9	3.7	4.8
21...	1945	21.0	65	7.7	23	1	5.0	2.5	4.7

Table 4. Water-quality data, injected water--Continued

DATE	PERCENT SODIUM	SODIUM ADSORPTION RATIO	DISSOLVED POTASSIUM (K) (MG/L)	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	ALKALINITY AS CACO3 (MG/L)	CARBON DIOXIDE (CO2) (MG/L)	DISSOLVED SULFATE (SO4) (MG/L)	DISSOLVED CHLORIDE (CL) (MG/L)
MAY									
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
JUN									
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
JUL									
21...	27	.4	.8	27	0	22	2.2	2.0	6.5
21...	30	.4	.6	26	0	21	.8	2.0	6.4

Table 4. Water-quality data, injected water--Continued

DATE	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	FECAL COLI-FORM .7UM-MF (COL./ 100 ML)	FECAL STREP-TOCOCCI KF AGAR (COL. PER 100 ML)
MAY									
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
31...	--	--	--	--	--	--	--	--	--
JUN									
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
02...	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	440	570
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	940	710
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
JUL									
21...	.0	16	53	.12	.00	60	60	>2000	680
21...	.0	16	50	.06	.00	50	0	>2000	540

Table 5. Water-quality data, test boring

DATE	TIME	SAMPLING DEPTH (FT)	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	DISSOLVED CALCIUM (CA) (MG/L)	DISSOLVED MAGNESIUM (MG) (MG/L)	DISSOLVED SODIUM (NA) (MG/L)
MAY										
10...	1145	191	22.5	450	7.1	--	--	--	--	--
10...	1205	240	22.0	380	7.1	--	--	--	--	--
10...	1320	290	22.0	480	7.0	--	--	--	--	--
10...	1340	340	22.0	4500	7.0	--	--	--	--	--
10...	1430	390	22.5	6300	6.9	--	--	--	--	--
10...	1450	442	22.0	6350	7.0	--	--	--	--	--
JUN										
30...	1410	260	23.5	3750	7.2	--	--	--	--	--
JUL										
10...	1300	260	--	--	--	--	--	--	--	--
10...	1330	340	--	--	--	--	--	--	--	--
10...	1345	410	--	--	--	--	--	--	--	--
21...	1325	260	23.5	380	7.1	79	0	12	12	48
21...	1345	340	23.0	5600	7.2	710	600	71	130	880
21...	1400	410	23.0	11000	7.1	1200	1100	120	230	2100
21...	2040	260	23.0	465	7.2	97	0	14	15	65
21...	2100	340	22.5	6000	7.2	760	650	74	140	1000
21...	2115	410	22.5	11000	7.2	1300	1200	130	240	2100

Table 5. Water-quality data, test boring--Continued

DATE	PERCENT SODIUM	SODIUM ADSORPTION RATIO	DISSOLVED POTASSIUM (K) (MG/L)	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	ALKALINITY AS CACO3 (MG/L)	CARBON DIOXIDE (CO2) (MG/L)	DISSOLVED SULFATE (SO4) (MG/L)	DISSOLVED CHLORIDE (CL) (MG/L)
MAY									
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
JUN									
30...	--	--	--	--	--	--	--	--	--
JUL									
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
21...	55	2.3	3.7	160	0	130	20	9.7	28
21...	72	14	36	140	0	110	14	230	1600
21...	77	26	82	140	0	110	18	480	3700
21...	58	2.9	4.2	160	0	130	16	14	62
21...	73	16	41	140	0	110	14	250	1900
21...	76	25	87	140	0	110	14	510	3800

Table 5. Water-quality data, test boring--Continued

DATE	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	FECAL COLI-FORM .7UM-MF (COL./ 100 ML)	FECAL STREP-TOCOCCI KF AGAR (COL. PER 100 ML)
MAY									
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
JUN									
30...	--	--	--	--	--	--	--	<1	<1
JUL									
10...	--	--	--	--	--	--	--	<1	K1
10...	--	--	--	--	--	--	--	<1	K8
10...	--	--	--	--	--	--	--	<1	65
21...	.4	71	280	3.5	.32	20	0	<1	K4
21...	.2	60	3090	2.7	.23	10	0	<1	K2
21...	.3	56	6850	2.7	.26	20	30	<1	<1
21...	.4	71	341	3.6	.28	30	0	<1	K1
21...	.3	60	3550	2.7	.26	20	0	<1	<1
21...	.3	56	7000	2.6	.24	20	20	<1	K1

K Results based on colony count outside the acceptable range (nonideal colony count).

Table 6. Water-quality data, injection well at Kahului sump

DATE	TIME	SAMPLING DEPTH (FT)	TEMPERATURE (DEG C)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	DISSOLVED CALCIUM (CA) (MG/L)	DISSOLVED MAGNESIUM (MG) (MG/L)	DISSOLVED SODIUM (NA) (MG/L)
MAY										
08...	1010	130	23.0	32000	7.4	--	--	--	--	--
JUN										
30...	1345	130	22.5	27000	7.4	--	--	--	--	--
30...	2035	130	22.0	24000	7.4	--	--	--	--	--
JUL										
07...	1200	130	23.0	27000	7.6	--	--	--	--	--
10...	1230	130	23.5	34500	7.6	--	--	--	--	--
14...	1145	130	23.0	29000	7.5	--	--	--	--	--
21...	1245	130	23.0	31000	7.4	3400	3300	270	660	5700
21...	2155	130	21.5	25400	7.4	3900	3800	300	770	6000
31...	1245	130	23.0	27000	7.5	--	--	--	--	--
AUG										
04...	1020	130	22.5	30000	7.6	--	--	--	--	--
14...	1055	130	23.5	29050	7.5	--	--	--	--	--

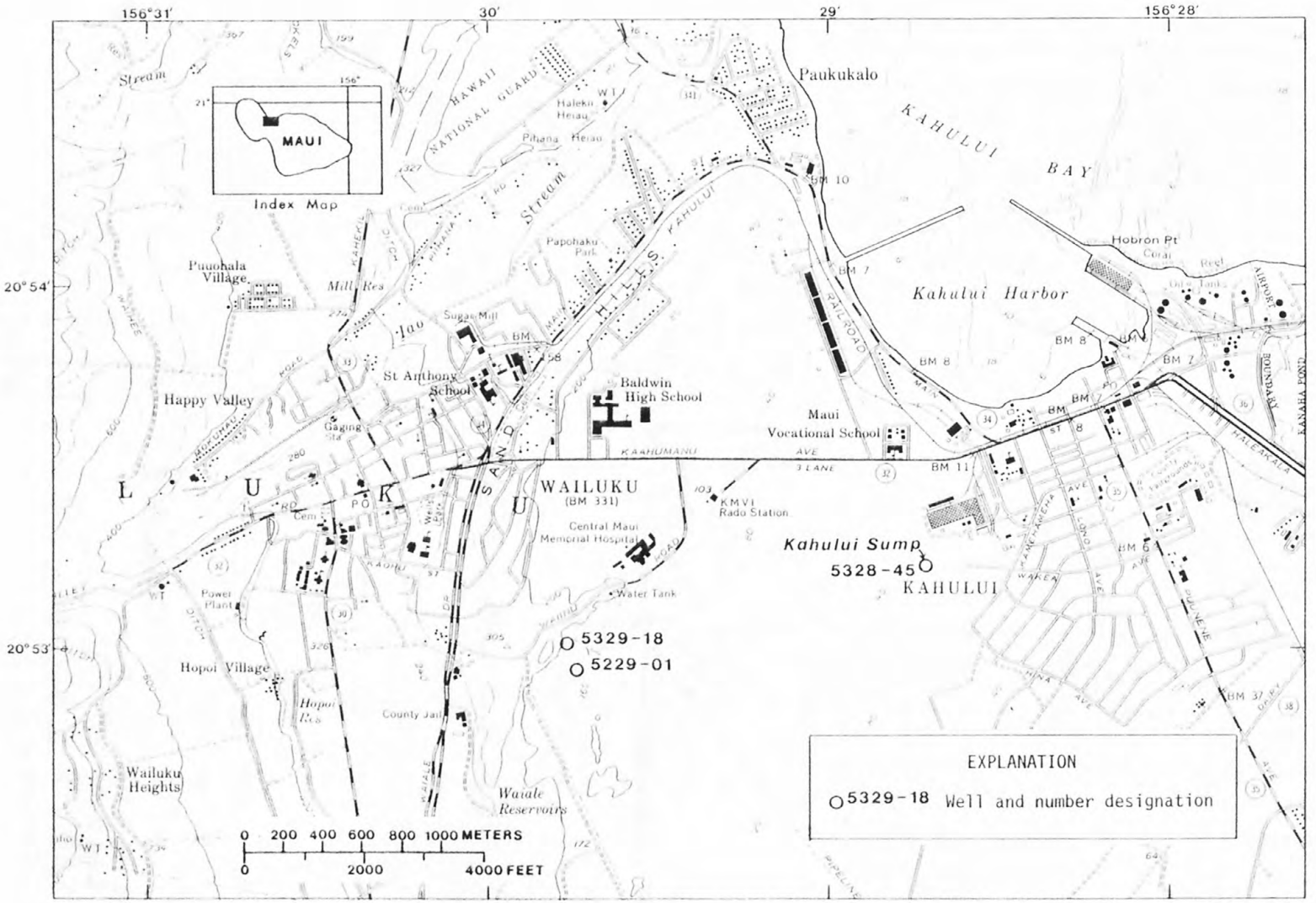
Table 6. Water-quality data, injection well at Kahului sump--Continued

DATE	PERCENT SODIUM	SODIUM ADSORPTION RATIO	DISSOLVED POTASSIUM (K) (MG/L)	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	ALKALINITY AS CACO3 (MG/L)	CARBON DIOXIDE (CO2) (MG/L)	DISSOLVED SULFATE (SO4) (MG/L)	DISSOLVED CHLORIDE (CL) (MG/L)
MAY									
08...	--	--	--	--	--	--	--	--	--
JUN									
30...	--	--	--	--	--	--	--	--	--
30...	--	--	--	--	--	--	--	--	--
JUL									
07...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--
21...	77	43	220	110	0	90	7.0	1400	10000
21...	76	42	250	100	0	82	6.4	1500	11000
31...	--	--	--	--	--	--	--	--	--
AUG									
04...	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--

Table 6. Water-quality data, injection well at Kahului sump--Continued

DATE	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	FECAL COLI-FORM .7UM-MF (COL./ 100 ML)	FECAL STREP-TOCOCCI KF AGAR (COL. PER 100 ML)
MAY									
08...	--	--	--	--	--	--	--	--	--
JUN									
30...	--	--	--	--	--	--	--	K4	47
30...	--	--	--	--	--	--	--	11	88
JUL									
07...	--	--	--	--	--	--	--	--	--
10...	--	--	--	--	--	--	--	K1	65
14...	--	--	--	--	--	--	--	--	--
21...	.1	34	18300	.08	.06	830	540	<1	24
21...	.1	35	19900	.10	.07	780	600	K6	24
31...	--	--	--	--	--	--	--	--	--
AUG									
04...	--	--	--	--	--	--	--	--	--
14...	--	--	--	--	--	--	--	--	--

K Results based on colony count outside the acceptable range (nonideal colony count).



Base from U.S. Geological Survey, 1955, scale: 1:24,000

Figure 1. Map showing well locations.

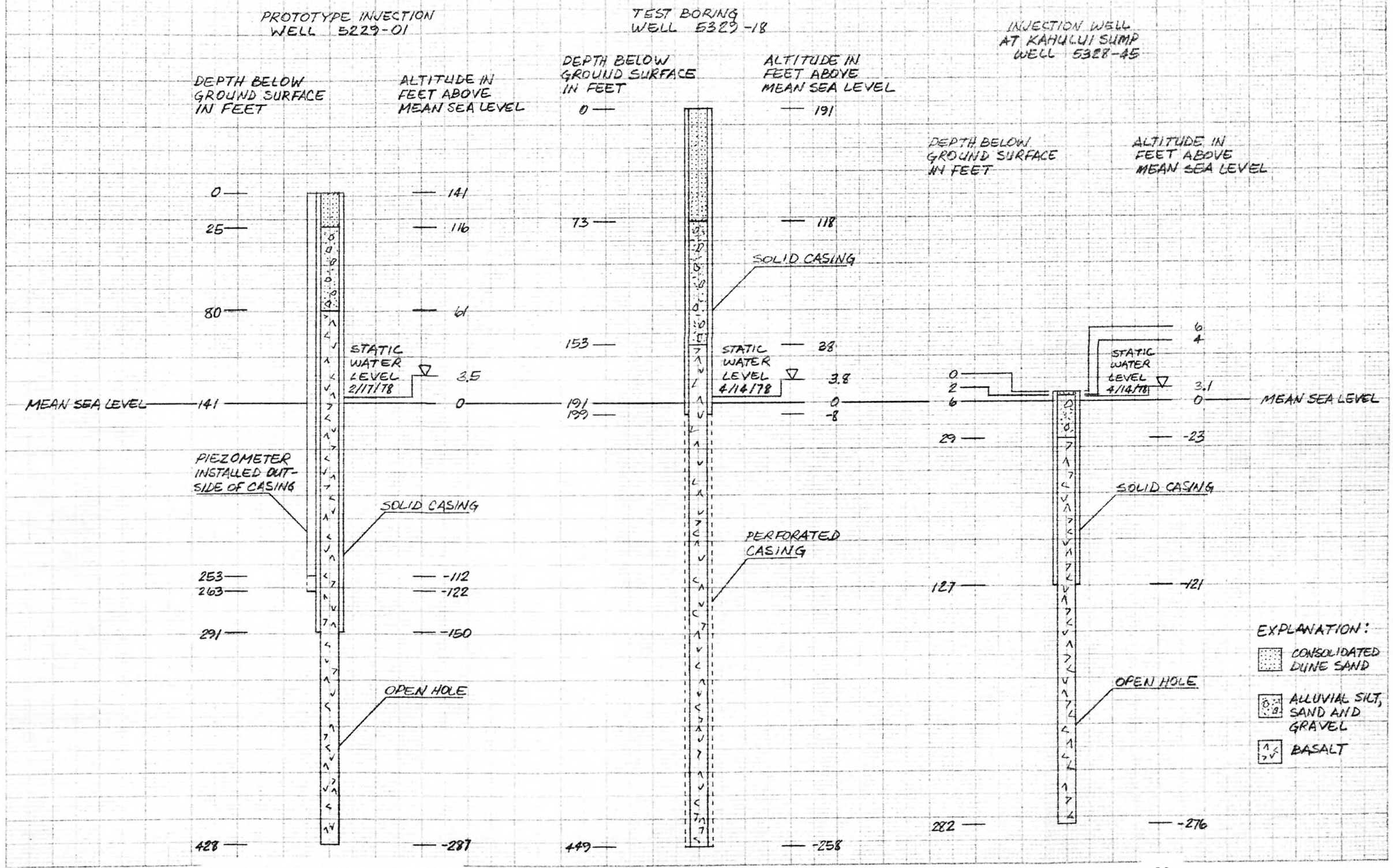


Figure 2. Simplified well logs.

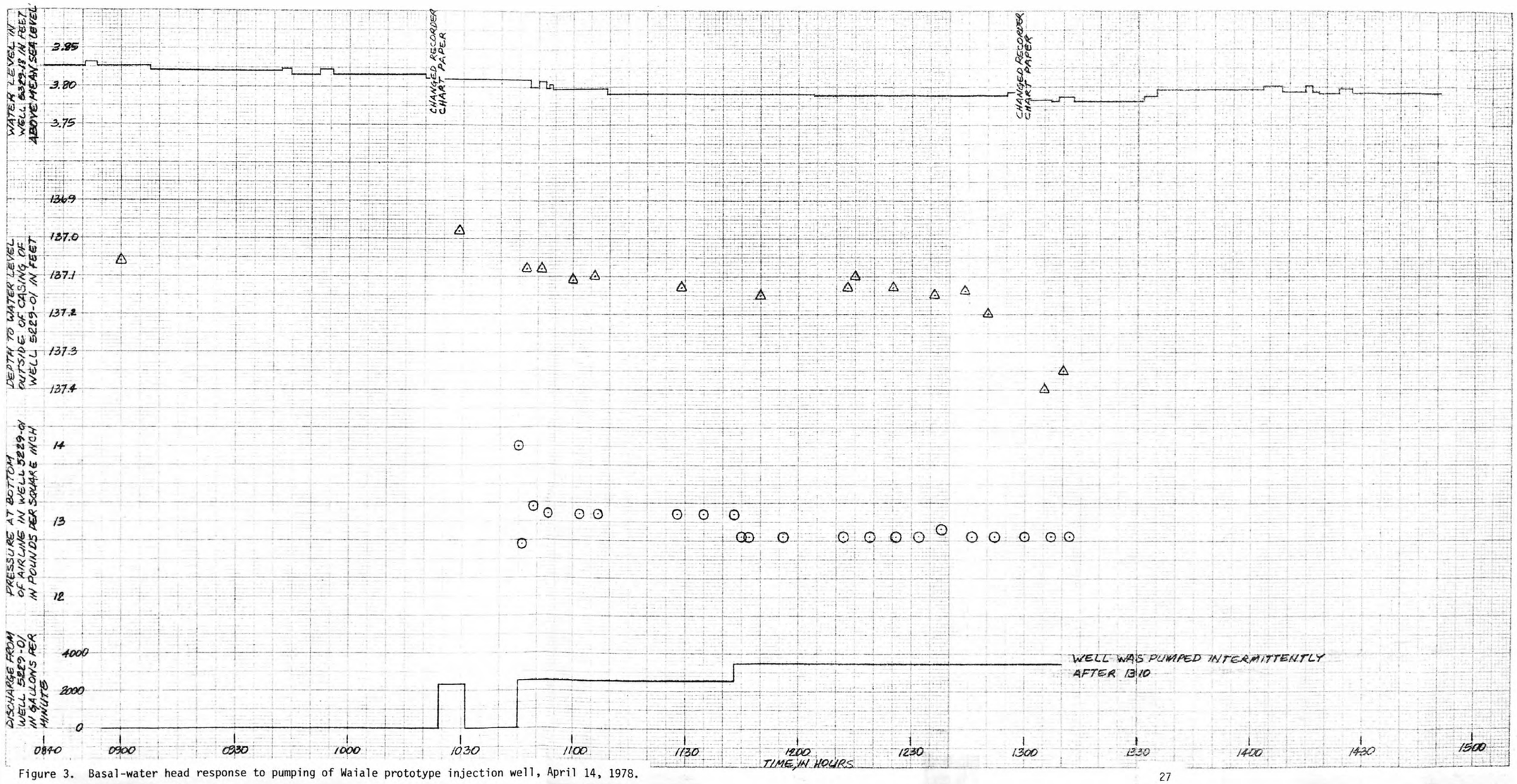


Figure 3. Basal-water head response to pumping of Waiale prototype injection well, April 14, 1978.

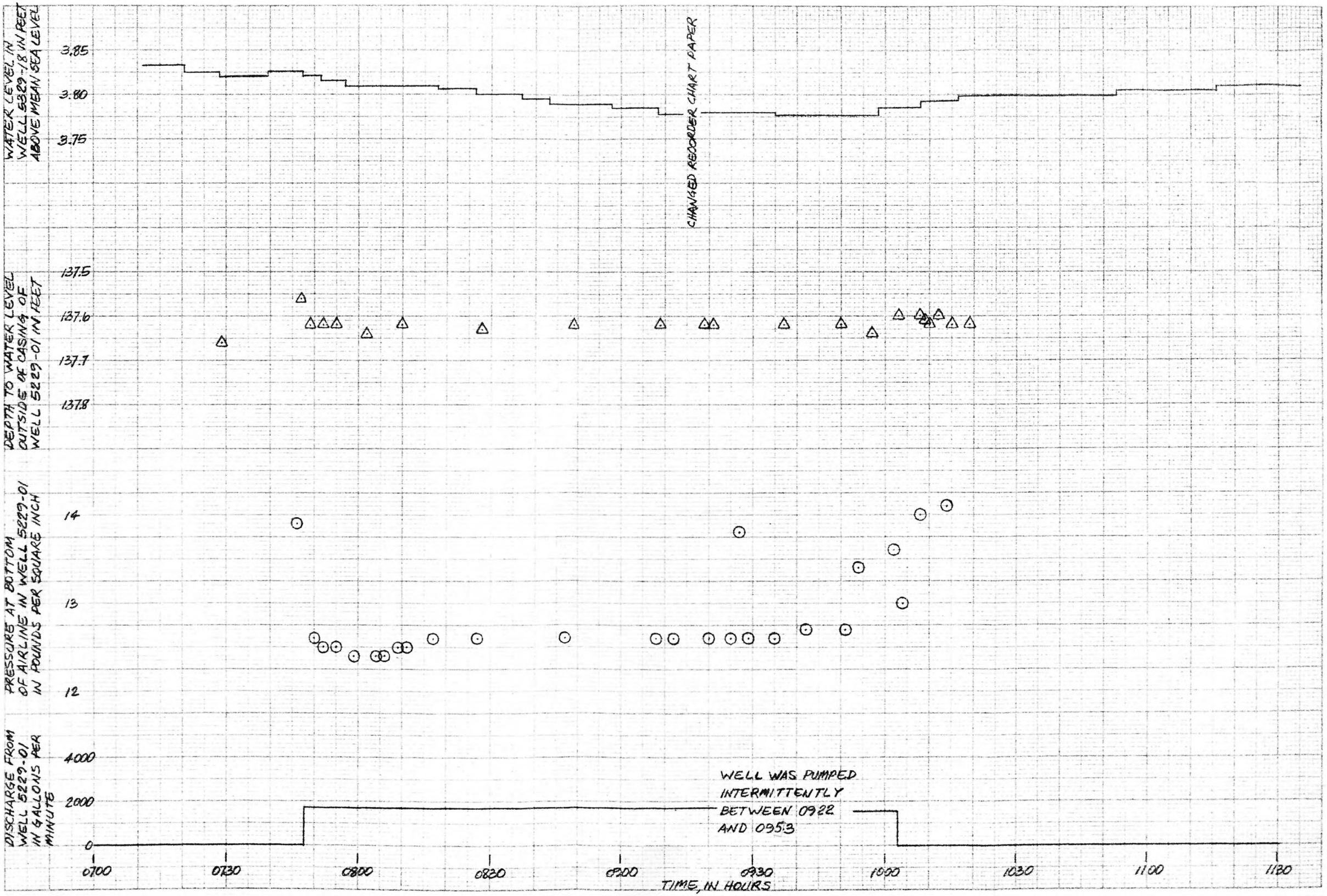


Figure 4. Basal-water head response to pumping of Waiale prototype injection well, April 15, 1978.

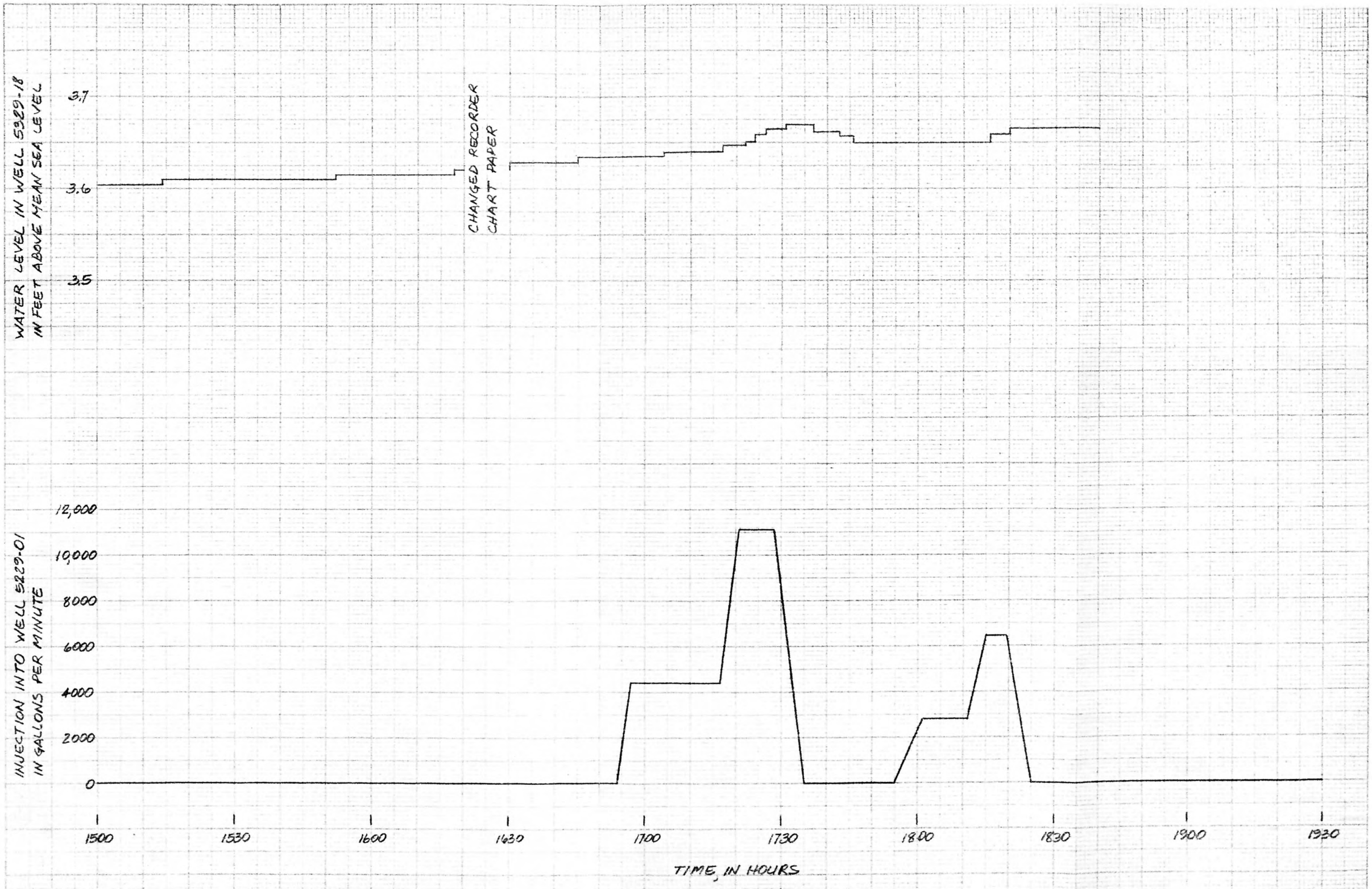


Figure 5. Basal-water head response to injection at Waiale prototype injection well, May 12, 1978.

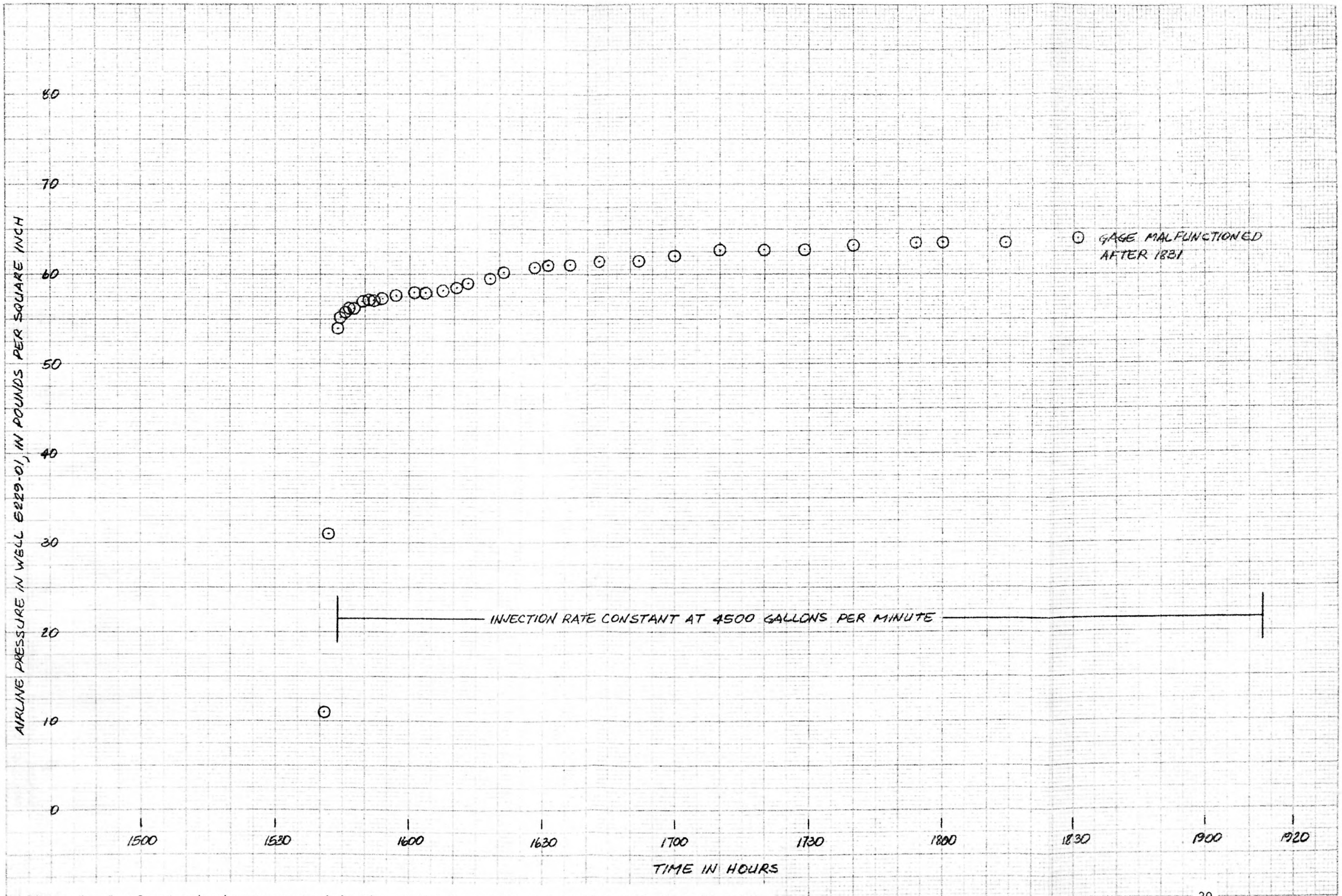


Figure 6. Basal-water head response to injection at Waiale prototype injection well, June 30, 1978.

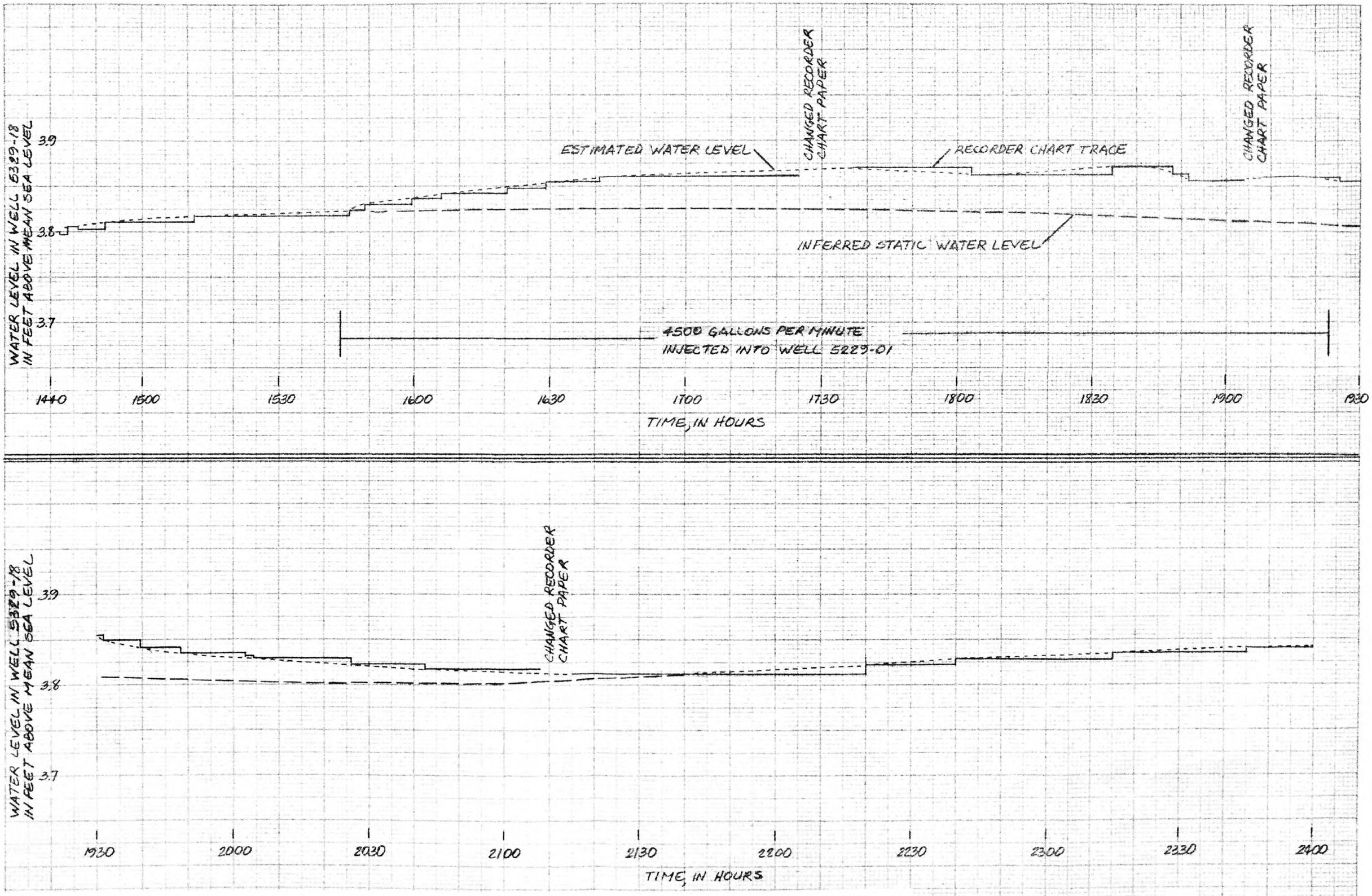


Figure 7. Basal-water head response at test boring due to injection at Waiale prototype injection well, June 30, 1978.