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GEOHYDROLOGIC AND DRILL-HOLE DATA FOR TEST WELL USW H-3, YUCCA MOUNTAIN, NYE COUNTY, NEVADA

By

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TABLES

METRIC CONVERSION TABLE

For those readers who prefer to use inch-pound rather than metric units, conversion factors for the terms used in this report are listed below:

Metric unit	*Multiply by*	*To obtain inch-pound unit*
millimeter (mm)	3.937×10^{-2}	inch
kilometer (km)	6.214×10^{-1}	mile
cubic meter (m^3)	3.531×10^{1}	cubic foot
meter (m)	3.281	foot
liter per second (L/s)	1.585×10^{1}	gallon per minute
liter (L)	2.642×10^{-1}	gallon

National Geodetic Vertical Datum of 1929 (NVGD)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Mean Sea Level; it is referred to as sea level in this report.

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ABSTRACT

This report presents data collected to determine the hydraulic characteristics of rocks penetrated in test well USW H-3. The well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in a program conducted in cooperation with the U.S. Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for storage of high-level radioactive wastes. Data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, pumping, swabbing, and injection tests for the well are contained in this report.

INTRODUCTION

The U.S. Geological Survey has been conducting investigations at Yucca Mountain, Nevada, to evaluate the hydrologic and geologic suitability of this site for storing high-level nuclear waste in an underground mined repository. These investigations are part of the Nevada Nuclear Waste Storage Investigations conducted in cooperation with the U.S. Department of Energy, Nevada Operations Office. Test drilling has been a principal method of investigation. This report presents hydrologic information for test well USW H-3, one of several exploratory wells drilled into tuff in or near the southwestern part of the Nevada Test Site. As part of these investigations, data were published on a previously drilled exploratory well, test well USW H-1, by Rush and others (1983).

The test well is located in Nye County, Nevada, approximately 140 km northwest of Las Vegas in the southern part of the State (fig. 1). The well site is on the main north-south oriented ridge of Yucca Mountain, northwest of Jackass Flats (fig. 1). The well is approximately 7 km west of water-supply well J-13 and is at Nevada State Central Zone Coordinates N.756,542 and E.558,452. Altitude of the land surface at the well site is 1,483.2 m above sea level.

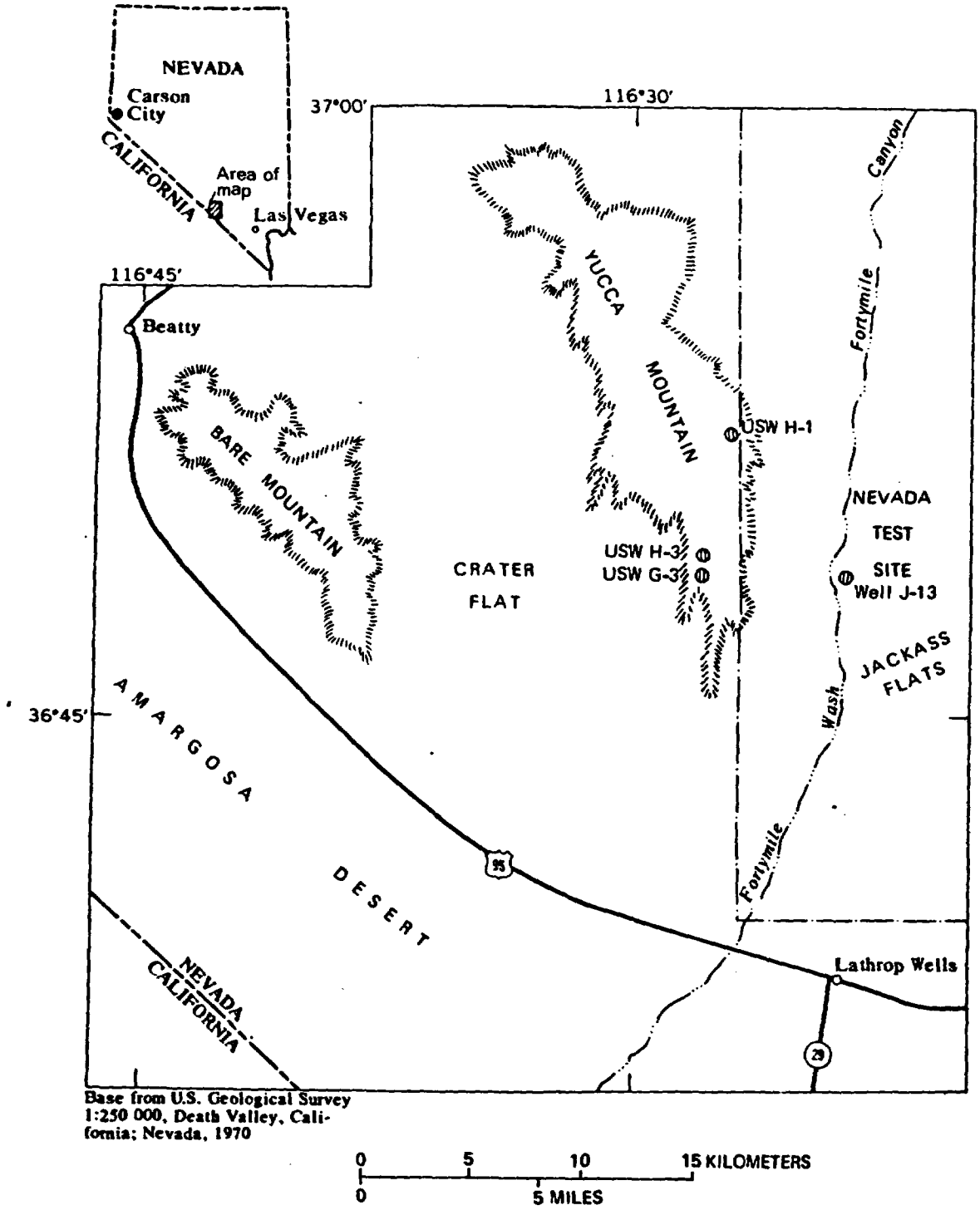

Figure 1.--Location of test well USW H-3 in southern Nevada and nearby wells and geographic features.

DRILLING OPERATIONS

Drilling of the well started on January 21, 1982; total depth of 1,219 m was reached on March 19, 1982. The rotary-drilling fluid was air foam that consisted of air, detergent, and water obtained from well J-13. The well did not deviate more than 2.75° from the vertical; the bottom of the well is 25 m west-northwest of the starting point at land surface. Bit and casing data for the well are listed in table 1. Detailed drilling history is contained in the files of the engineering contractor, Fenix and Scisson, Inc., Las Vegas, Nev.

Table 1.--*Bit and casing data*

Drilled interval (meters)	Bit diameter (millimeters)	Cased interval (meters)	Casing inside diameter (millimeters)
0- 9	914	0- 9	762
9- 40	660	0- 38	381
40- 808	375	0-792	253
808-1,219	222	1/	

1/ No casing set below a depth of 792 meters.

The 253-mm-diameter casing was tack cemented from about 772 to 792 m. The casing was perforated with approximately 7 shots per meter between depths of 754 and 792 m. The perforations were made before the pumping test but after the packer injection and swabbing tests and the borehole-flow survey.

LITHOLOGIC LOG

The lithology penetrated by the well, as determined from rock-bit cuttings collected at 3-m intervals of depth, is described in table 2. Ash-flow tuff is the predominant rock type, with thin, bedded or reworked tuff occurring between most of the major units. The tuff has various degrees of welding, as shown in figure 2. Correlations were made with core hole USW G-3, which is 1,147 m south of this well.

GEOPHYSICAL WELL LOGS

Several types of well logs were run in the well to obtain useful information for designing the hydraulic tests and sampling programs. The types of logs and the intervals they included are listed in table 3.

Table 2.--*Lithologic log*

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Paintbrush Tuff		
Tiva Canyon Member		
Tuff, ash-flow, light-gray, brownish-gray, light-brownish-gray, densely welded, devitrified; 1-2 percent phenocrysts (sanidine and plagioclase); contains lithophysal cavities(?) (interval from 112.8 to 115.8 m contains some black vitrophyric fragments).	106.7	106.7
Tuff, ash-flow, dark-yellowish-orange, partially welded to nonwelded, vitric, 1-2 percent phenocrysts (sanidine and plagioclase); contains black glass shards.	12.8	119.5
Bedded tuff		
Tuff, ash-fall, bedded, light-brown and yellowish-gray, both vitric and zeolitized(?); almost entirely composed of pumice fragments.	3.6	123.1
Topopah Spring Member		
Tuff, ash-flow, moderate-reddish-orange, partially to nonwelded, argillic; pumice, moderate-orange-pink and moderate-reddish-orange, argillic; 5 percent phenocrysts [sanidine, plagioclase, biotite, pyroxene(?)].	11.6	134.7
Tuff, ash-flow, grayish-red, densely welded, devitrified; 10-15 percent phenocrysts (sanidine, plagioclase, bronze biotite); interval from 137.2 to 140.2 m contains black vitrophyric fragments (upper few meters of interval probably upper vitrophyre of Topopah Spring Member--caprock).	8.6	143.3
Tuff, ash-flow, grayish-red, moderately welded, vapor-phase; pumice, dominantly light-gray, vapor-phase crystallization; 5-10 percent phenocrysts (sanidine, plagioclase, bronze biotite).	17.3	160.6

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Paintbrush Tuff--Continued		
Topopah Spring Member--Continued		
Tuff, ash-flow, light-brownish-gray and light-gray; 5-10 percent phenocrysts (sanidine, plagioclase); contains lithophysal cavities(?) (upper and lower contacts gradational).	46.7	207.3
Tuff, ash-flow, pale-yellowish-brown and grayish-orange, moderately to densely welded, devitrified; pumice, grayish-orange-pink; 1-2 percent phenocrysts (sanidine and plagioclase); contains some lithophysal cavities(?); lithophysae-poor interval (identified in television camera observations from 216.4 to 258.5 m).	112.7	320.0
Tuff, ash-flow, dark-yellowish-brown, densely welded, devitrified (slightly altered); 1 percent phenocrysts (sanidine and plagioclase); some of the pumice fragments altered to grayish-yellow-green.	43.9	363.9
Tuff, ash-flow, black (altered to a pale-yellowish-orange in upper 3.3 m), densely welded; vitrophyre.	17.7	381.6
Tuff, ash-flow, pale-yellowish-brown, pale-yellowish-orange, moderately to partially welded, vitric; pumice, pale-yellowish-orange, vitric; abundant black glass shards; 1 percent phenocrysts (no samples available from 417.6 to 426.7 m).	39.0	420.6
Tuff, ash-flow(?), nonwelded(?), predominantly composed of pale-yellowish-orange and grayish-orange, vitric pumice fragments; samples from 402.3 to 405.4 m contaminated, mainly composed of densely welded Topopah Spring Member; abrupt increase in lithic content from 422.8 to 424.3 m (no bedded material identified at base).	3.7	424.3

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Rhyolitic lavas and tuffs of Calico Hills (undivided)		
Tuffaceous beds of Calico Hills (informal usage)		
Tuff, ash-flow(?), composed of white to light-gray pumice fragments, vitric (samples from 432.8 to 435.9 m and 442.0 to 460.3 m are contaminated and composed almost entirely of densely welded Topopah Spring; density log and television camera observations indicate a bedded interval between 438.0 and 453.2 m).	28.9	453.2
Crater Flat Tuff		
Prow Pass Member		
Tuff, ash-flow, grayish-orange-pink, light-gray, pale-yellowish-orange, nonwelded, vitric and devitrified; 5-7 percent phenocrysts (sanidine, plagioclase, quartz, and biotite); rare pale-reddish-brown mudstone lithic fragments; sidewall samples collected at 472.4, 504.4, and 518.2 m.	66.2	519.4
Tuff, ash-flow, very light gray, yellowish-gray, grayish-orange-pink, and light-brown, nonwelded to partially welded, devitrified, some vapor-phase crystallization [slightly zeolitic(?)]; 10 percent phenocrysts (sanidine, plagioclase, quartz, and biotite); pale-reddish-brown and grayish-red mudstone lithic fragments	1.8	521.2
Tuff, ash-flow, grayish-orange-pink, nonwelded to partially welded, zeolitized; pumice, zeolitized, occasionally vitric; 10 percent phenocrysts (sanidine, plagioclase, quartz, and biotite); grayish-red mudstone lithic fragments; below 548.6 m nearly all pumice fragments are white to grayish-yellow, and moderate-orange-pink and appear zeolitized(?); sidewall samples collected at 548.6, 557.8, and 579.1 m; sidewall sample at 557.8 m consisted almost entirely of wallcake.	57.9	579.1

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Crater Flat Tuff--Continued		
Bedded tuff		
Tuff, bedded, reworked(?), grayish-yellow and moderate-orange-pink, zeolitized(?), dominantly subrounded, fine-grained pumice fragments.	2.2	581.3
Bullfrog Member		
Tuff, ash-flow, pale-yellowish-brown, partially welded, zeolitized(?), and argillic; pumice, white to yellowish-gray, zeolitized(?) and argillic; 5-10 percent phenocrysts (sanidine, quartz, plagioclase, and biotite).	10.0	591.3
Tuff, ash-flow, very light gray to yellowish-gray, partially welded, vapor-phase crystallization; pumice, white, very light gray to medium-light-gray, vapor-phase, 5-10 percent phenocrysts [sanidine, plagioclase, quartz, biotite, and hornblende(?)]; interval from 624.8 to 637.0 m contains pumice altered to a light brown; sidewall sample collected at 609.6 composed of densely welded ash-flow tuff fragments.	18.3	609.6
Tuff, ash-flow, light-brown to pale-brown, densely welded, devitrified; 10-15 percent phenocrysts (sanidine, plagioclase, quartz, biotite, and hornblende); contains spherulites; bit-cutting samples very contaminated with Topopah Spring Member cuttings from 707.1-713.2 m; sidewall samples collected at 635.5 and 662.9 m; sample at 662.9 m composed of wallcake.	98.5	708.1
Tuff, ash-flow, light-brownish-gray, light-olive-gray, and medium-light-gray, nonwelded to partially welded, devitrified; pumice, moderate-orange-pink, grayish-orange, devitrified; 15 percent phenocrysts [sanidine, quartz, plagioclase, biotite, and hornblende(?)]; interval from 725.4 to 762.0 m contaminated with densely welded cuttings from Topopah Spring Member; sidewall samples collected at 731.5, 740.7, 743.7, and 746.8 m; sample at 740.7 composed of wallcake.	38.4	746.5

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Crater Flat Tuff--Continued		
Bedded tuff		
Tuff, bedded, reworked, and ash-fall, grayish-yellow to moderate-reddish-orange, zeolitized(?) (contaminated samples).	8.5	755.0
Tram Member		
Tuff, ash-flow, light-brown, yellowish-gray, non-welded to partially welded, devitrified; pumice, white, devitrified; 7-10 percent phenocrysts (quartz, sanidine, plagioclase, and abundant biotite); sidewall samples collected at 759.0, 762.0, 777.2 m; sample at 777.2 m composed of wallcake.	34.4	789.4
Tuff, ash-flow, yellowish-gray, light-brownish-gray, partially welded, devitrified; pumice, light-brownish-gray, devitrified; 5-10 percent phenocrysts (quartz, plagioclase, sanidine, and biotite); unit contains few lithic fragments but many biotite fragments; sidewall sample collected to 792.5 m.	122.0	911.4
Tuff, ash-flow, grayish-orange-pink, pale-yellowish-brown, partially to moderately(?) welded, slightly argillic and zeolitic(?); pumice, white to grayish-orange, slightly argillic and zeolitic(?); 5-7 percent phenocrysts (quartz, sanidine, plagioclase, biotite), sparse lithic fragments.	6.0	917.4
Tuff, ash-flow, dark-greenish-gray to light-olive-gray, moderately welded, very indurated, moderately to very zeolitized(?) and silicified(?); 10 percent phenocrysts; sparse lithic fragments.	18.3	935.7
Tuff, ash-flow, light-brown, moderately welded, devitrified (slightly zeolitic and silicified); pumice, moderate-orange-pink, devitrified; 10 percent phenocrysts; sparse lithics.	3.7	939.4

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Crater Flat Tuff--Continued		
Tram Member--Continued		
Tuff, ash-flow, dark-greenish-gray to light-olive gray, moderately welded, very indurated, moderately to very zeolitized(?) and silicified(?); 10 percent phenocrysts; sparse lithic fragments.	11.0	950.4
Tuff, ash-flow, grayish-orange-pink to pale-yellow-brown, partially welded, devitrified; pumice, commonly white and moderate-pink (argillic?); 10-12 percent phenocrysts (quartz, sanidine, plagioclase, and biotite); sparse lithic fragments.	6.7	957.1
Tuff, ash-flow, pale-red, light-brownish-gray, nonwelded to partially welded, devitrified; pumice, white to light-gray, devitrified; 8-12 percent phenocrysts (quartz, sanidine, plagioclase, and biotite); abundant lithic fragments, commonly moderate red, rhyolitic.	67.0	1,024.1
Tuff, ash-flow, pale-brown, grayish-orange, grayish-yellow-green, and brownish-gray, partially welded, slightly to moderately zeolitized(?), slightly argillic; pumice, commonly grayish-yellow-green, pale-yellowish-orange, white; 5 percent phenocrysts; abundant lithic fragments, silicic to intermediate.	56.4	1,080.5
Tuff, ash-flow, light-olive-gray (bleached appearance), partially welded, partly zeolitic and argillic; pumice, grayish-yellow-green and moderate-yellow-green, white, argillic(?); 5 percent phenocrysts (conspicuous sphene); interval contains finely disseminated pyrite(?), dominantly in rhyolitic lithic fragments but also in groundmass.	15.3	1,095.8
Bedded tuff		
Tuff, bedded, reworked, moderate-yellow-green and grayish-green; pumice, commonly moderate-yellow-green zeolitic(?).	12.8	1,108.6

Table 2.--*Lithologic log*--Continued

Stratigraphy and lithologic description	Thickness of interval (meters)	Depth of interval (meters)
Lithic Ridge Tuff		
Tuff, ash-flow, light-olive-gray, partially welded, zeolitic(?) and argillic(?); pumice, light-gray and light-olive-gray, devitrified; 8-10 percent phenocrysts (quartz, sanidine, plagioclase, abundant biotite, and sparse sphene); sparse silicic to intermediate lithic fragments (zeolitization appears to increase downward).	110.4	1,219.0

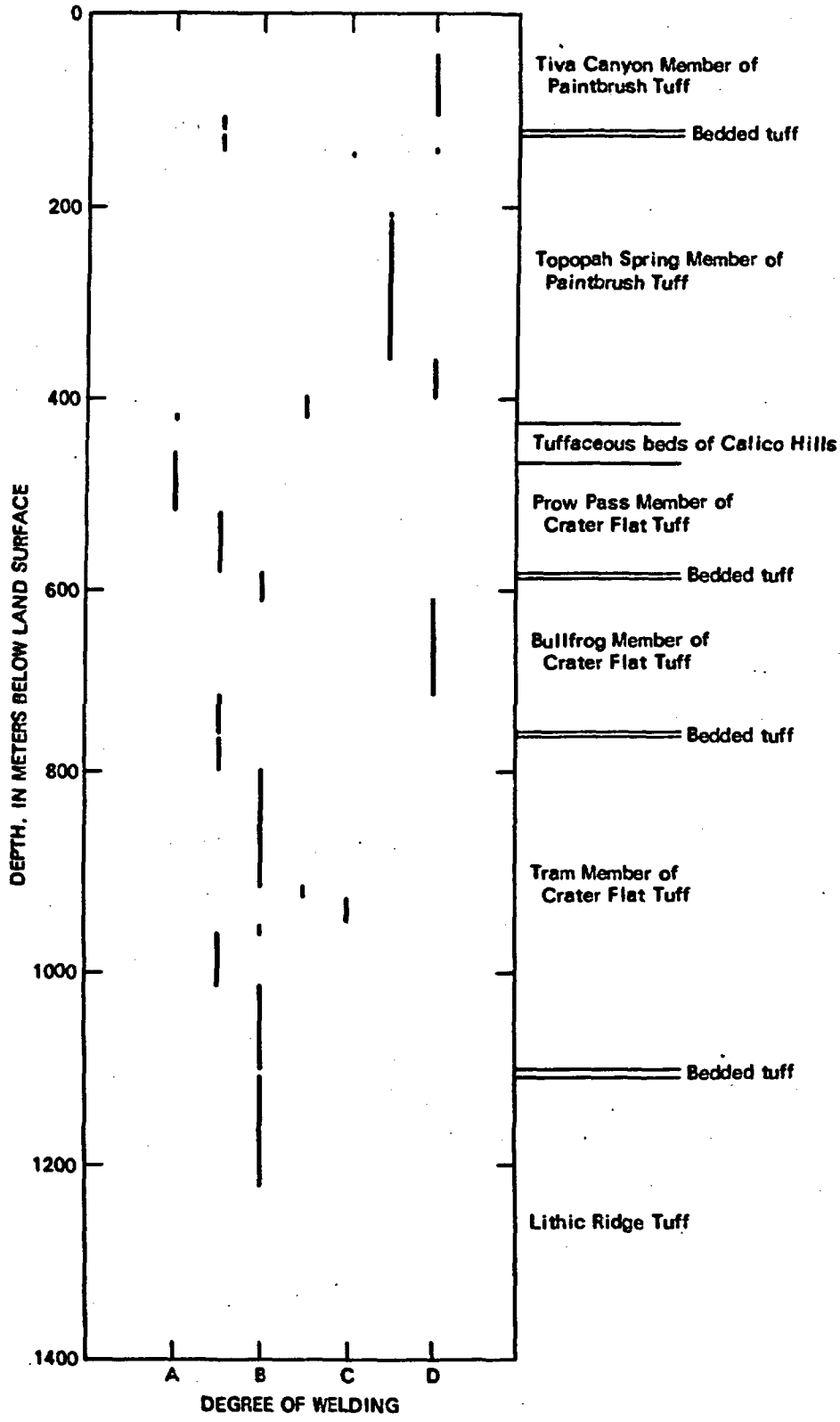

Figure 2.--Generalized degree of welding of rock penetrated by the well. (A, nonwelded; B, partially; C, moderately; D, densely)

Table 3.--*Geophysical well logs*

Geophysical log	Depth interval (meters)	Geophysical log	Depth interval (meters)
Density, borehole-compensated	31- 796	Fluid density for fluid location	15- 39
			716- 739
			741- 762
Density, borehole-compensated, and gamma ray	716-1,217		745- 757
			753- 774
			770- 786
Neutron, borehole-compensated	793-1,218		771- 796
			783- 796
			839- 853
Epithermal neutron porosity	18- 797		981-1,029
Epithermal neutron porosity and gamma ray	777-1,217	Caliper	3- 38
	774-1,217		3- 682
			15- 799
Gamma ray and neutron	7- 676		730-1,215
	777-1,215		
Gamma ray	31- 797		774-1,214
Magnetometer	0- 777	Television-camera videotape	0- 771
	0-1,217		
Vibroseis combo geophone survey and vertical-seismic profile	40- 792	Acoustic televiewer	793-1,216
	779-1,212	Acoustic, borehole-compensated, and gamma	793-1,216
Temperature	0-1,211		
3-D velocity	783-1,217		
Electric	777-1,216		
Induction	6- 37	Gyroscopic	0-1,212
	9- 671	Spectral	0-1,218
	38- 797		

The acoustic televiewer log, an acoustic travel-time log, was made to record lithophysae and such linear features as fractures and bedding planes. Because the log was directionally oriented, inclined fractures and their attitude could be identified. Lineations observed in this log are listed in table 4.

Caliper logs were run to determine the distribution of open-hole diameter with well depth. A summary of the hole gage is presented in table 5. Out-of-gage is defined for this report as a diameter 100 mm greater than the diameter of the bit used to drill the interval. Thick out-of-gage intervals commonly cannot be tested by inflatable packers because of the difficulty of seating packers, or because over-inflation results in packer rupture. Enlarged borehole zones resulting from rock fracturing also were identified from caliper logs (table 6). These are zones having irregular enlargements of a smaller diameter than the out-of-gage zones.

A television videotape of borehole conditions was made to a depth of 767 m, the water level in the well at the time of the log. The principal purpose of the log was to record the occurrence and nature of water seeps and fractures. Only one very small seep was observed, at a depth of 277 m in the Topopah Spring Member. The distribution of observed fractures is given in table 7.

HYDROLOGIC TESTING AND MONITORING

A summary of the types of hydraulic tests made in the well is presented in table 8. These tests and hydrologic monitoring activities are detailed below. No water samples were obtained from the well during the testing or drilling periods.

Radioactive-Tracer Flow Survey

A flow survey using a radioactive tracer, iodine-131, was made after the well had been drilled to a total depth and had been cased to 792 m, prior to perforation. This survey measures the vertical flow rate in the well during injection, and identifies rock zones through which the water flowed. The results of the survey are presented in figure 3.

Water Levels

Water-level observations and measurements were made during the drilling and testing periods in order to: (1) Locate any perched-water zones above the water table, (2) identify the depth at which water saturation occurs, (3) determine the composite hydraulic head in the well, and (4) identify hydraulic heads in various depth zones. Water-level measurements are listed in table 9.

Table 4.--*Lineations observed on acoustic-televiewer log for the water-filled part of the well*

Stratigraphic unit	Depth (meters)	Dip direction and angle from horizontal (degrees)
Tram Member of Crater Flat Tuff	821	Dipping southwestward
	835	Dipping southwestward
	859	Dipping west-southwestward
	862-868	Many lineations; mostly dipping southwestward
	874	Two lineations; dipping west-southwestward and east-northeastward
	878-888	Many lineations; dipping northeastward
	890	Dipping west-northwestward 74°
	891	Dipping west-southwestward 61°
	892	Dipping westward 82°
	893	Dipping west-southwestward
	897	Dipping west-southwestward 81°
	929	Two lineations; dipping west-southwestward 79°
	1,029	Dipping east-northeastward 77°
	1,030	Two lineations; dipping east-northeastward
	1,070	Dipping eastward 74°
	1,079	Dipping westward 72°
	1,084	Horizontal
	1,089	Dipping northeastward
Bedded tuff	1,104	Dipping northeastward 85°
	1,107	Dipping westward 82°

Table 5.--*Distribution of out-of-gage hole*

Stratigraphic unit	Part of unit out of gage (percent)	Location within stratigraphic unit
Tiva Canyon Member of Paintbrush Tuff[1/]	53	Mostly middle of unit
Bedded tuff	100	--
Topopah Spring Member of Paintbrush Tuff	49	Throughout unit
Tuffaceous beds of Calico Hills	80	All except lower 7 meters
Prow Pass Member of Crater Flat Tuff	16	In upper one-half of unit
Bedded tuff	69	In upper three-fourths of unit
Bullfrog Member of Crater Flat Tuff	15	In upper three-fourths of unit
Bedded tuff	0	--
Tram Member of Crater Flat Tuff	.5	At middle of unit
Bedded tuff	0	--
Lithic Ridge Tuff	0	--
Average for the well	24	

[1/] Below a depth of 9 meters.

Table 6.--*Enlarged borehole intervals possibly caused by fracturing*

[Based on caliper-log interpretations]

Stratigraphic unit	Depth interval (meters)	Interval thickness (meters)	Remarks for stratigraphic unit
Tiva Canyon Member of Paintbrush Tuff[1/]	9-101	92	Interval is all densely welded
Bedded tuff	-------	-------	No intervals identified in unit
Topopah Spring Member of Paintbrush Tuff	135-136	1	Some enlargement may be the result of abundant lithophysae
	164-187	23	
	246-282	36	
	302-353	51	
Tuffaceous beds of Calico Hills	439-440	1	----------
Prow Pass Member of Crater Flat Tuff	-------	--	No intervals identified in unit
Bedded tuff	580-581	1	----------
Bullfrog Member of Crater Flat Tuff	633-635	2	----------
	646-650	4	----------
Bedded tuff	-------	--	No interval identified in unit
Tram Member of Crater Flat Tuff	949-950	1	Interval is moderately welded
Bedded tuff	-------	--	No interval identified in unit
Lithic Ridge Tuff	-------	--	----Do.----------

[1/]Well cased to 9 meters.

Table 7.--*Fracture distribution observed with a down-hole television camera*

[Depth to water at time of log was 767 meters]

Depth (meters)	Description
	TIVA CANYON MEMBER OF PAINTBRUSH TUFF
0- 38	Well casing
38- 99	Highly fractured; high-angle fractures, northly strike
99-120	Minor fractures; high-angle fractures, northwesterly strike
	BEDDED TUFF
120-123	No fractures
	TOPOPAH SPRING MEMBER OF PAINTBRUSH TUFF
123-209	Minor fractures; high-angle fractures, north-northeasterly strike
209-236	Fractures increasing with depth from minor to abundant. Slickenside at 216-217 m.
236-245	Moderate fractures
245-255	Highly fractured; northeasterly strike
255-421	Minor fractures
421-424	No fractures
	TUFFACEOUS BEDS OF CALICO HILLS, PROW PASS MEMBER OF CRATER FLAT TUFF AND BEDDED TUFF
424-581	No fractures
	BULLFROG MEMBER OF CRATER FLAT TUFF
581-747	Minor fractures
	BEDDED TUFF
747-755	No fractures
	TRAM MEMBER OF CRATER FLAT TUFF
755-761	Minor fractures
761-767	No fractures

Table 8.--*Summary of hydraulic tests*

[Well cased to 792 meters]

Type of test and number	Date	Depth interval (meters)	Stratigraphic unit
Pumping 1	7-27-82	[1/]754-1,219	Tram Member of Crater Flat Tuff and underlying penetrated units
Injection 1	3-15-82	792- 850	Tram Member of Crater Flat Tuff
Injection 2	3-13-82	851- 917	Tram Member of Crater Flat Tuff and underlying penetrated units
Injection 3	3-12-82	911- 972	-----Do.----------
Injection 4	3-13-82	972-1,219	-----Do.----------
Injection 5	3-11-82	1,063-1,124	-----Do.----------
Injection 6	3-11-82	1,126-1,129	Lithic Ridge Tuff
Swabbing 1	3-06-82	972-1,219	Tram Member of Crater Flat Tuff and underlying penetrated units
Swabbing 2	3-10-82	1,063-1,124 m	-----Do.---------

[1/]Casing perforated from 754 to 792 m.

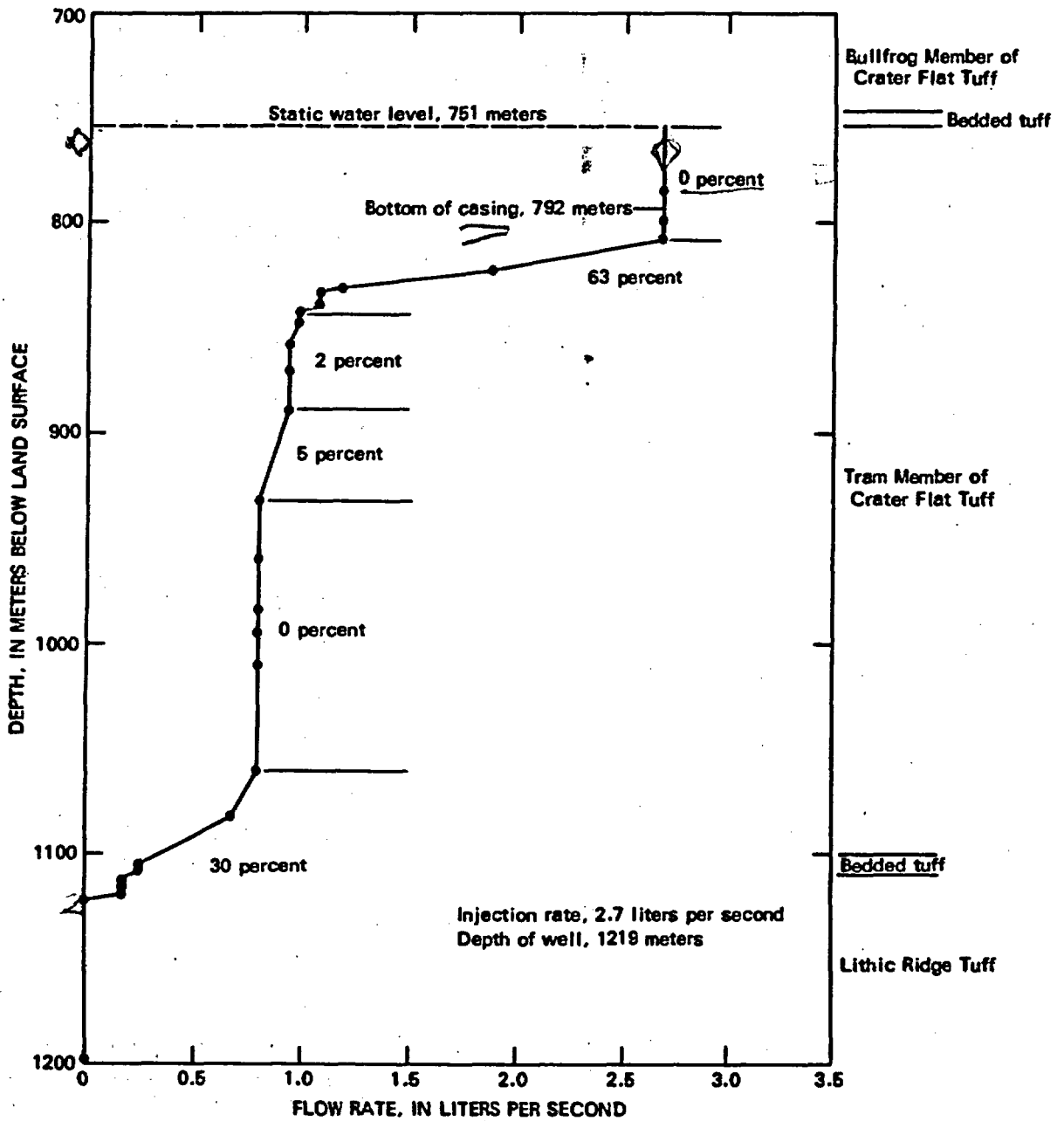

Figure 3.--Radioactive-tracer flow survey showing percent of injection rate by intervals.

Table 9.--*Water levels*

[Altitude of land surface at well is 1,483.2 meters; water level is accurate to ±0.5 meter. Water-level values have been adjusted for deviation of well from vertical]

Date	Depth zone (meters)	Water level in well (meters)		Remarks
		Depth to water from land surface	Altitude of water surface above sea level	
02-16-82	744- 753	-----	-----	Observed first indication of water in drilling fluid. Zone mostly bedded tuff.
03-03-82	792-1,219	753.9	729.3	Water level rising very slowly.
03-10-82	1,063-1,124	755.4	727.8	Water level rising very slowly at end of swabbing test.
03-15-82	792- 850	746.5	736.7	Water level declining slowly at end of injection test. Zone in upper part of Tram Member of Crater Flat Tuff.
03-16-82	910- 976	752.6	730.6	Water level rising very slowly. Tram Member of Crater Flat Tuff.
07-23-82	750-1,219	750.0	733.2	Casing perforated from 754 to 792 meters prior to this date. Entire saturated zone penetrated by well.
07-27-82	---Do.---	750.7	732.5	Entire saturated zone penetrated by well.
09-10-82	---Do.---	750.4	732.8	----------Do.----------
10-05-82	---Do.---	750.4	732.8	----------Do.----------
11-19-82	750-1,190	750.7	732.5	Entire saturated zone penetrated by well.
03-14-83	750-1,190	750.7	732.5	Zone does not include lower 29 meters of penetrated Lithic Ridge Tuff.
03-24-83	---Do.---	750.6	732.6	Static conditions.
03-31-83	---Do.---	750.7	732.5	----------Do.----------
04-07-83	---Do.---	750.6	732.6	----------Do.----------
04-13-83	---Do.---	750.7	732.5	----------Do.----------
04-26-83	---Do.---	749.9	732.3	----------Do.----------
06-08-83	---Do.---	750.6	732.6	----------Do.----------
06-25-83	---Do.---	750.9	732.3	----------Do.----------
07-09-83	---Do.---	750.9	732.3	----------Do.----------
08-31-83	---Do.---	750.6	732.6	----------Do.----------

Drilling-Fluid Use

To minimize the invasion and plugging of fracture and matrix porosity while drilling the well, a drilling fluid of air-foam was used that consisted of small quantities of detergent and water and large volumes of air. Approximately 20,000 L of detergent and 1,200,000 L of water were used during drilling. Variations in fluid use were recorded and are shown in figure 4.

Pumping Test

Following the perforation of the well casing from a depth of 754 to 792 m, a cyclic pumping test was made (fig. 5). Each cycle of pumping, at a rate of 2.8 L/s, was terminated when the water level in the well declined to the pump intake level. Water-level recovery data following the first drawdown cycle are shown in figure 6.

Injection Tests

Injection tests were made using inflatable packers to isolate test zones. Intervals tested are listed in table 8. Data for the six injection tests for the intervals between 792 and 1,219 m (total depth) are plotted in figures 7 through 12.

Swabbing Tests

Swabbing tests in the well were made prior to the pumping test to aid in pump-size selection. These tests consisted of multiple swabbing runs in the uncased part of the hole and an interval between two inflatable packers. Data for recovery of water level during the two swabbing tests are shown in figures 13 and 14. Intervals swabbed were 792 to 1,219 and 1,063 to 1,124 m, as listed in table 8.

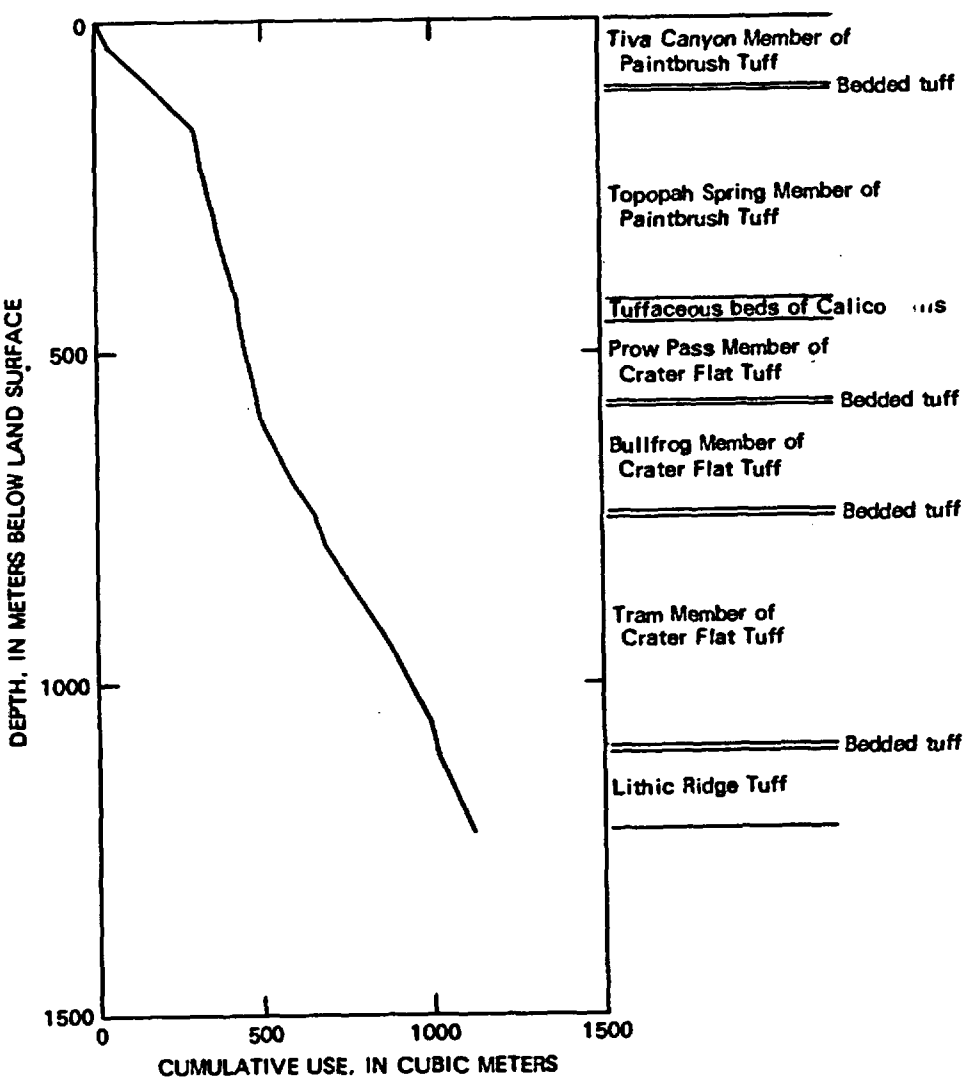

Figure 4.--Drilling-fluid use.

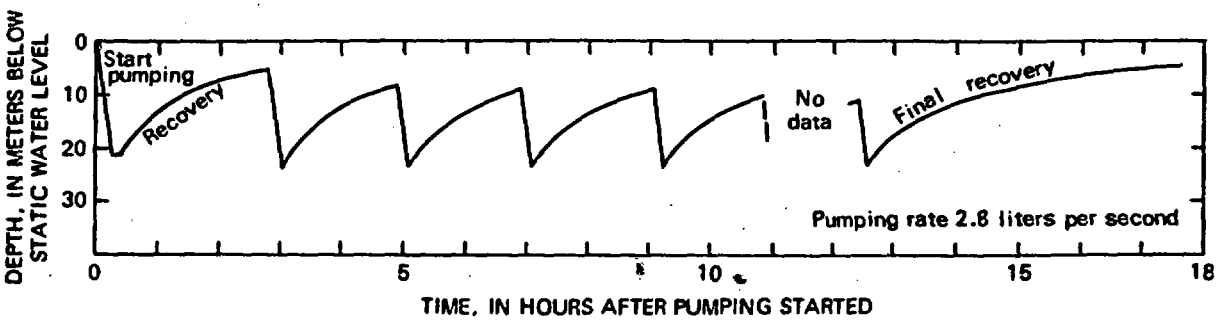

Figure 5.--Water-level drawdown and recovery during the pumping test.

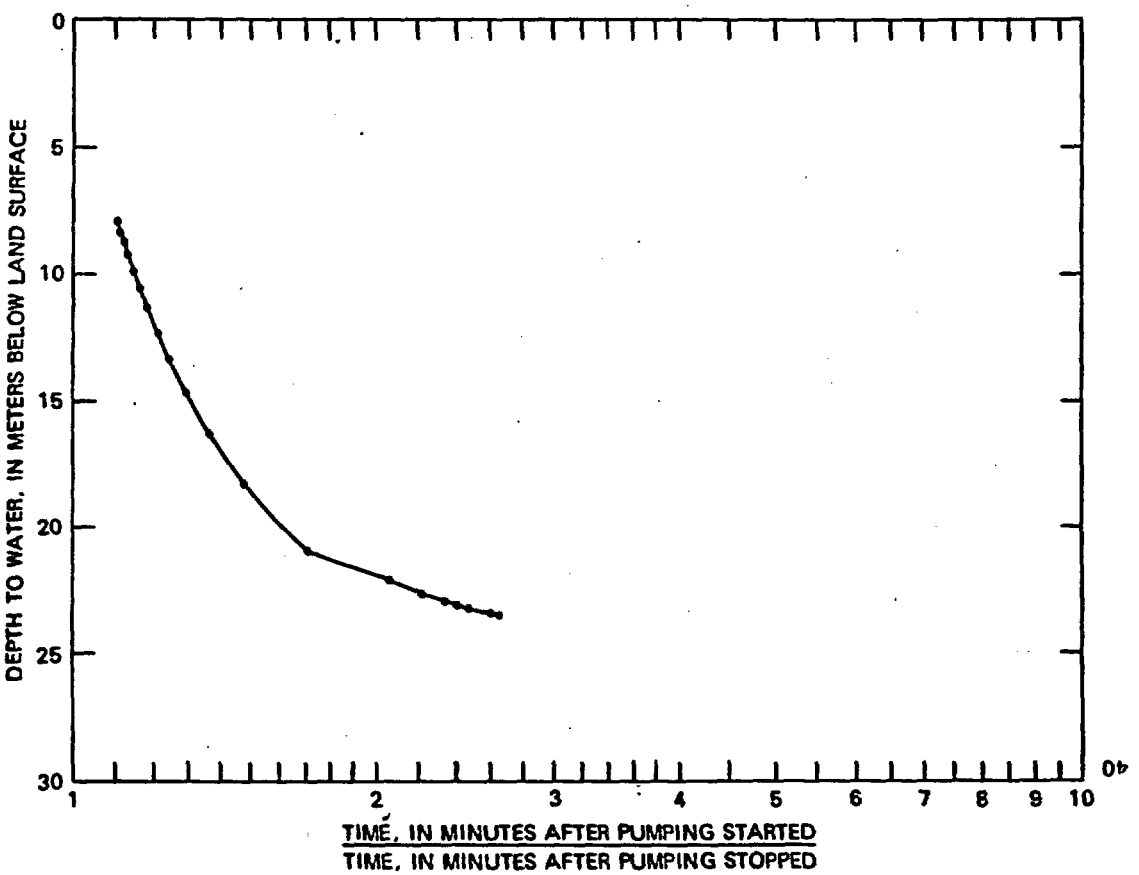

Figure 6.--Water-level recovery data following the first drawdown cycle of the pumping test.

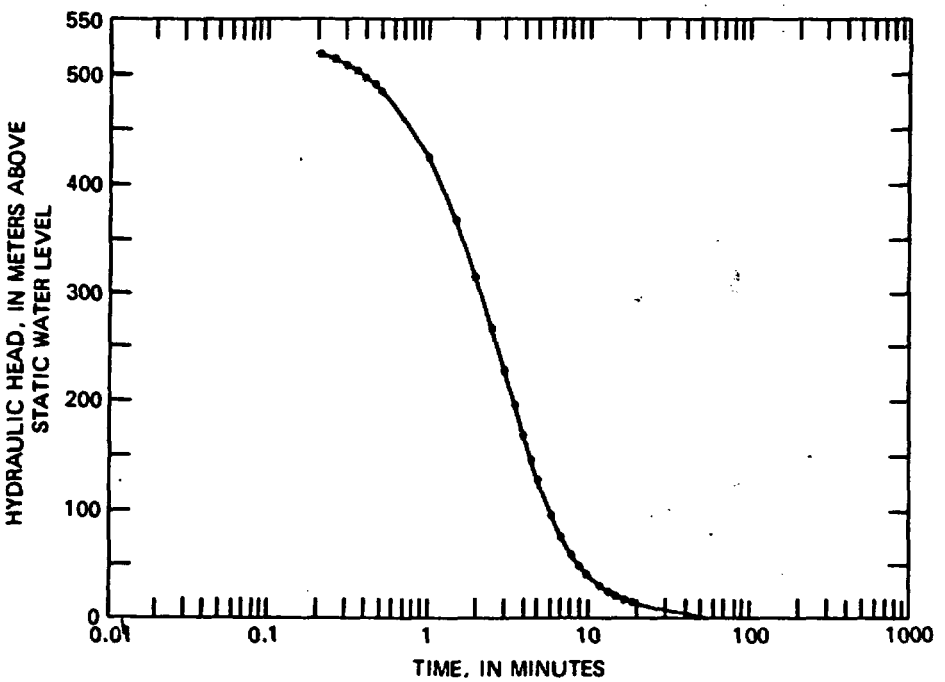

Figure 7.--Injection test 1.

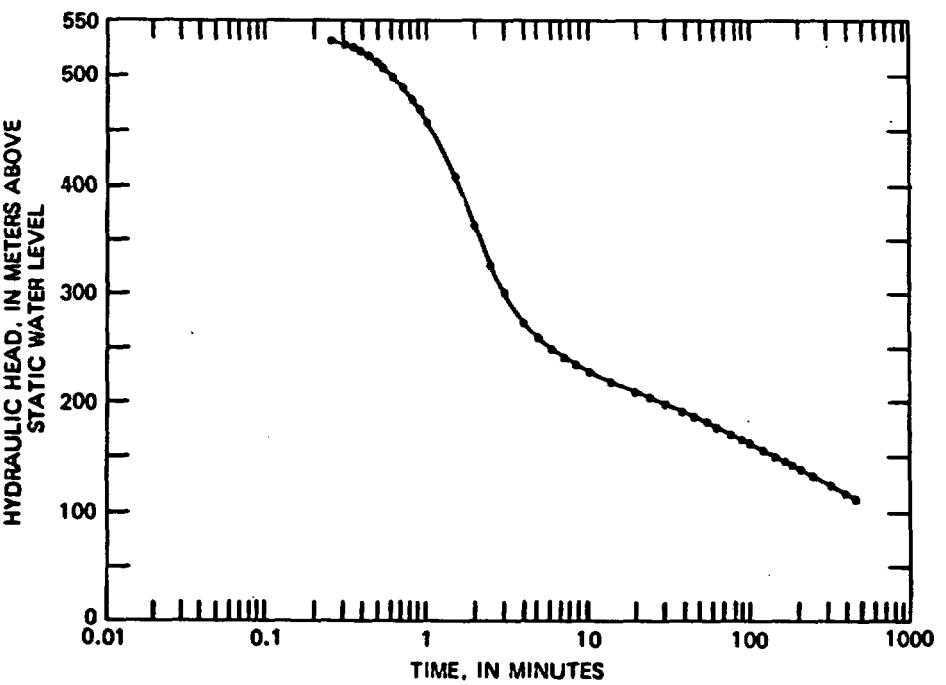

Figure 8.--Injection test 2.

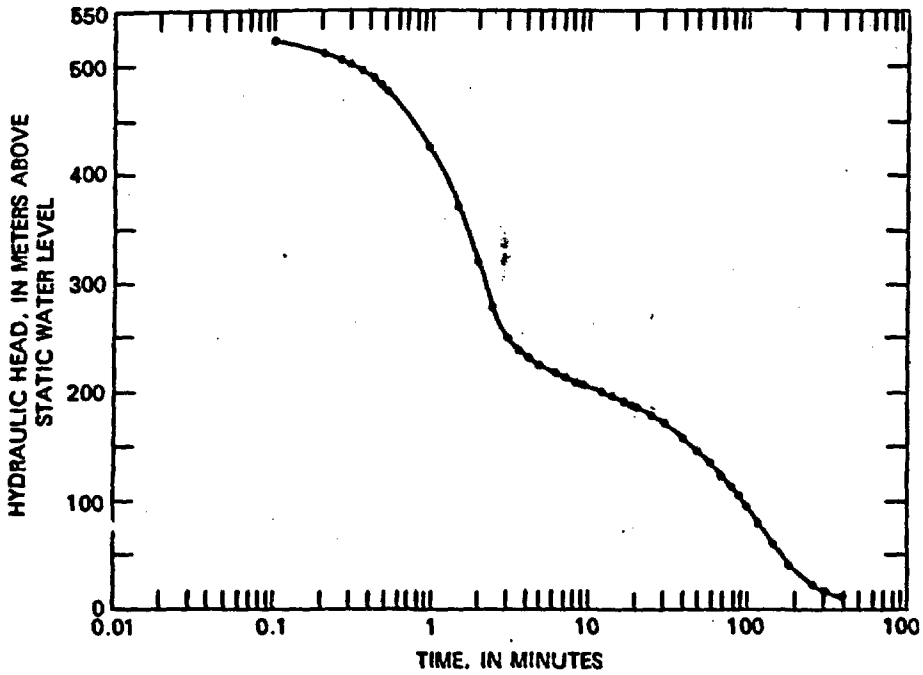

Figure 9.--Injection test 3.

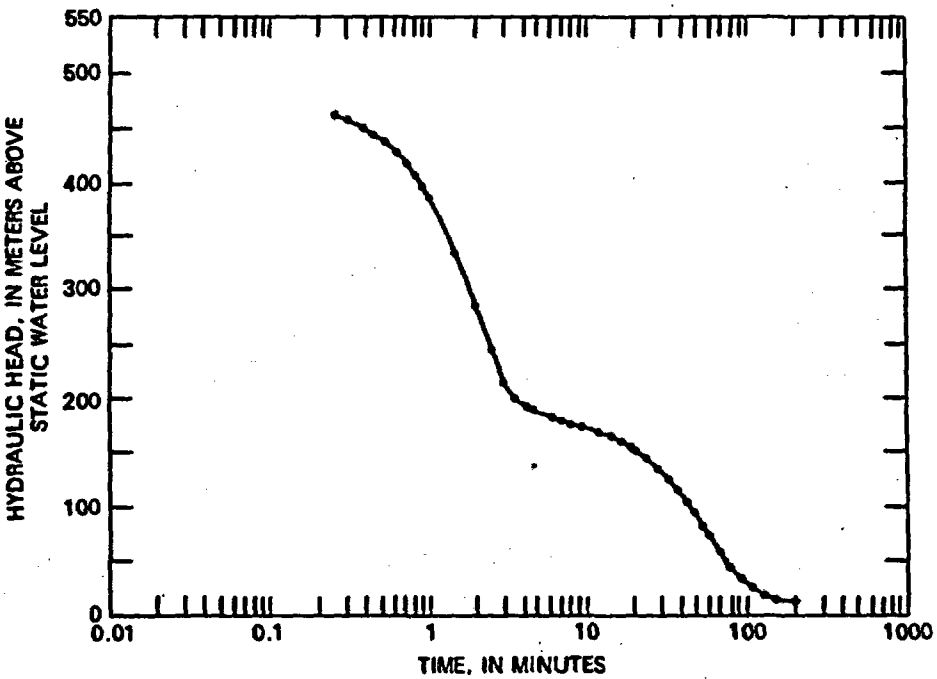

Figure 10.--Injection test 4.

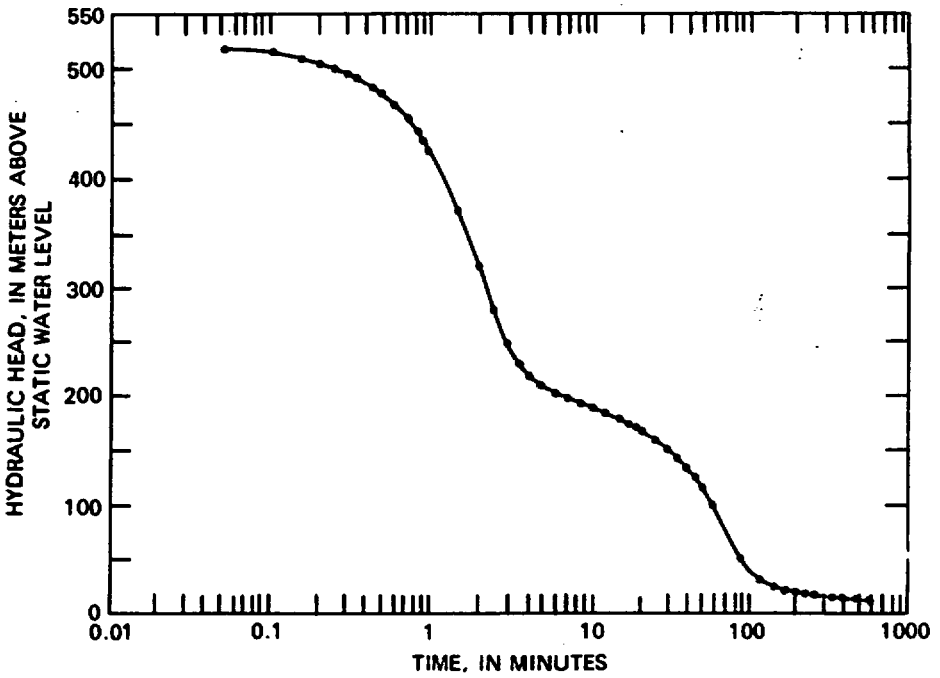

Figure 11.--Injection test 5.

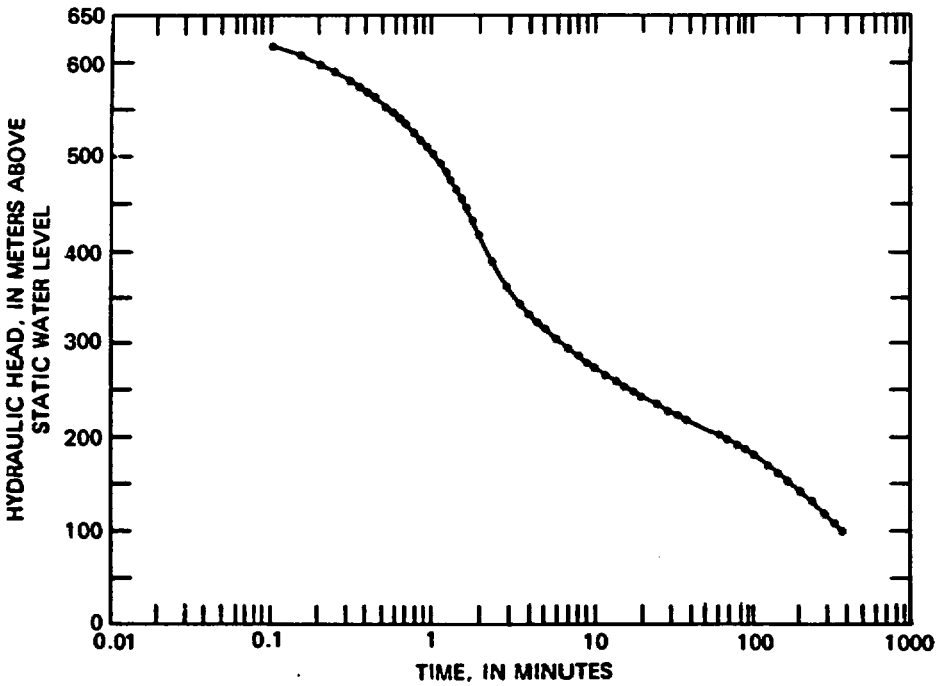

Figure 12.--Injection test 6.

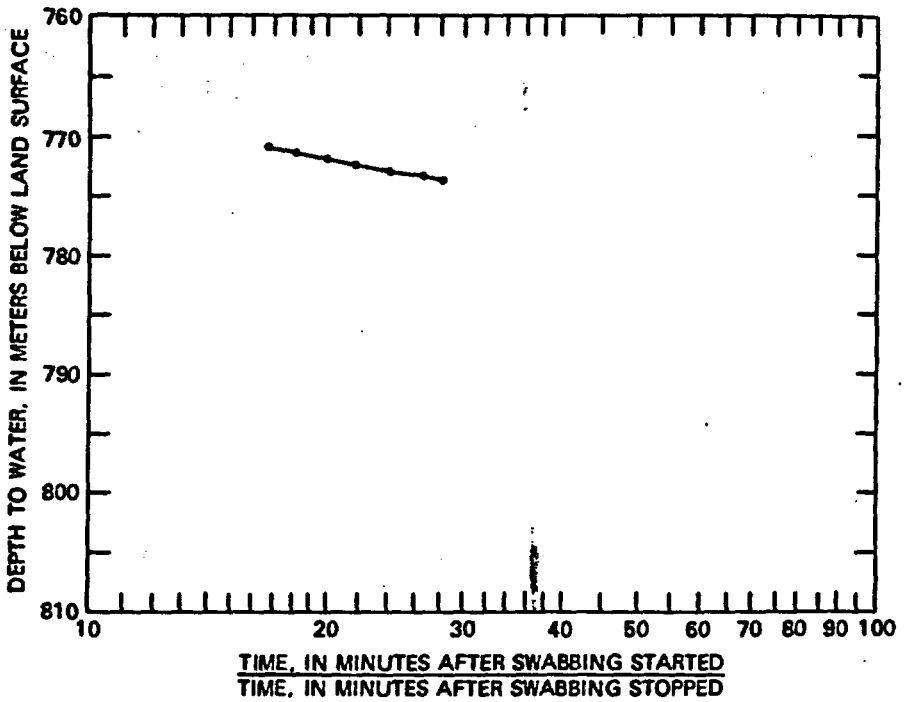

Figure 13.--Data for recovery of water level during swabbing test 1.

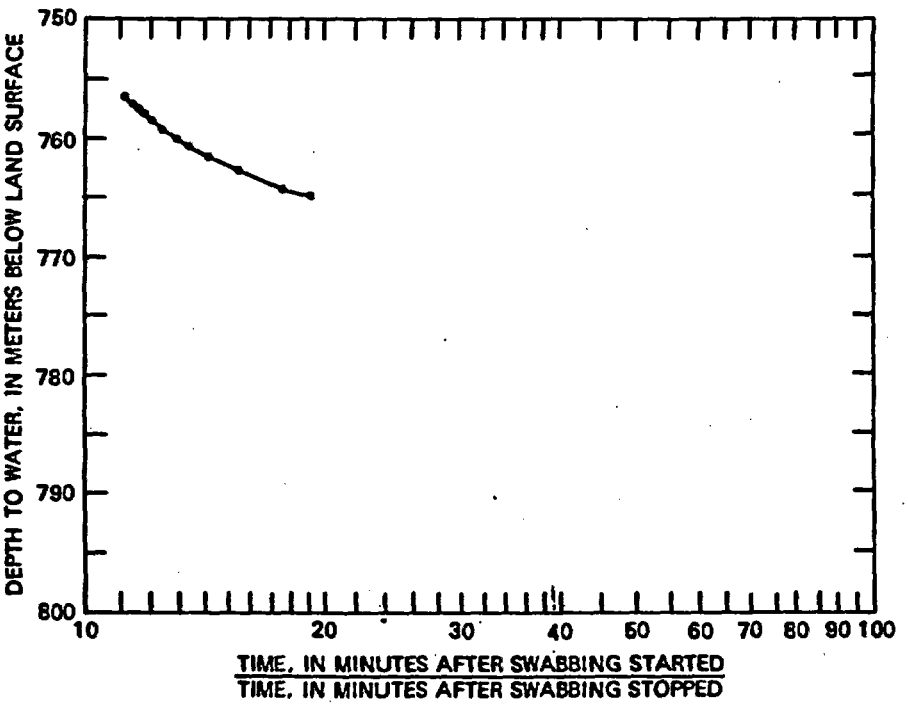

Figure 14.--Data for recovery of water level during swabbing test 2.

REFERENCE

Rush, F. E., Thordarson, William, and Bruckheimer, Laura, 1983, Geohydrologic and drill-hole data for test well USW H-1, adjacent to Nevada Test Site, Nye County, Nevada: U.S. Geological Survey Open-File Report 83-141, 38 p.

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GEOHYDROLOGIC AND DRILL-HOLE DATA FOR TEST WELL USW H-3, YUCCA MOUNTAIN, NYE COUNTY, NEVADA

by

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