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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Albuquerque, New Mexico

Records of wells, test holes, springs, and surface-water stations in the Los Alamos area, New Mexico

Compiled by

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and William D. Purtymun

Open-file report

Prepared for and in cooperation with the U.S. Atomic Energy Commissic

and Groups H-6 and H-7 of the Los Alamos Scientific Laboratory

October 1966

9116

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XXVII. GUAJE AND LOS ALAMOS RESERVOIRS

Water from Guaje and Los Alamos Reservoirs was used for municipal and industrial use at Los Alamos during the early days of the Manhattan Project (Fig. XXVII-A). Use of the water from the reservoirs was discontinued in 1959 because of intermittent periods of turbidity caused by storm runoff and because of difficulties in maintaining bacteriological levels below the limits allowed for municipal supply.

Both of the reservoirs and adjacent areas are open for recreational use. Water from the reservoirs is available for irrigation of lawns and shrubs in the community and Laboratory. Parts of the water lines are above ground and are subject to freezing; thus, water use from the reservoirs is limited to the period from late spring to early fall.

Guaje Reservoir in upper Guaje Canyon has a capacity of 250 000 gallons and has a drainage area of 5.6 sq mi. The reservoir is for diversion rather than storage, as perennial flow is maintained by a spring in the canyon above the reservoir. Water flows by gravity through 6.8 miles of distribution lines to Los Alamos.

Los Alamos Reservoir in upper Los Alamos Canyon has a capacity of about 13 000 000 gallons and has a drainage area of 6.4 sq mi. Water flows by gravity through 2.6 miles of distribution lines to the townsite.

Since 1958, the water lines from both reservoirs have not been part of, or been connected to, the distribution system for the municipal water supply.

REFERENCES

Black and Veatch, "Report on Water Supply, Los Alamos Project, New Mexico," Consulting Engineers, Kansas City, Mo. Administrative Report to the U.S. Atomic Energy Commission (1951).

W. D. Purtymun, M. N. Maes, and S. G. McLin, "Water Supply at Los Alamos During 1988," Los Alamos National Laboratory report LA-11679-PR (1989).

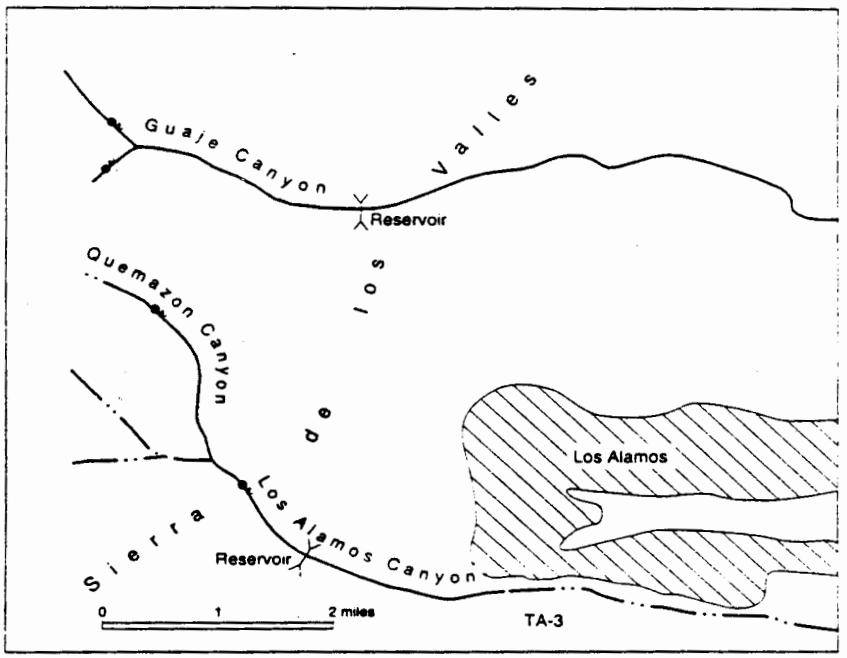


Fig. XXVII-A. Locations of Guaje and Los Alamos reservoirs.

TABLE XXVII-A. Locations and Elevations (NAD 1927)

Guaje Reservoir	N 1,794,000	E 471,600	8017 ft
Los Alamos Reservoir	N 1,777,200	E 468,600	7659 ft

XXV. TEST HOLES IN UPPER GUAJE CANYON

Two shallow test holes were drilled in upper Guaje Canyon between the Los Alamos and Guaje Faults in the fall of 1966 (Fig. XXV-A). The holes were drilled to determine the rock type and the depth of saturation between the two faults, and to explore the possibility of developing short-term high-yield wells.

Test hole 1 (elevation 7180 ft) was drilled to a depth of about 23 ft and was completed in the alluvium. The alluvium was saturated to near the stream level. Test hole 2 (elevation 7060 ft) was drilled to a depth of 103 ft, penetrating 17 ft of alluvium and 86 ft of the gravel of the Puye Conglomerate. The alluvium and gravel were saturated to near the stream level.

Both holes were cased with 2-in.-diam perforated plastic pipe; the depth and the length of the perforations are unknown. The test holes indicated a saturated thickness of the gravels penetrated; however, the saturated thickness is not sufficient to develop a high-yield well. Additional testing would be necessary to determine the total thickness of saturated gravels between the two faults.

REFERENCE

W. D. Purtymun, "Geohydrology of the Pajarito Plateau with Reference to Quality of Water 1949–1972," Los Alamos Scientific Laboratory internal document, 1975.

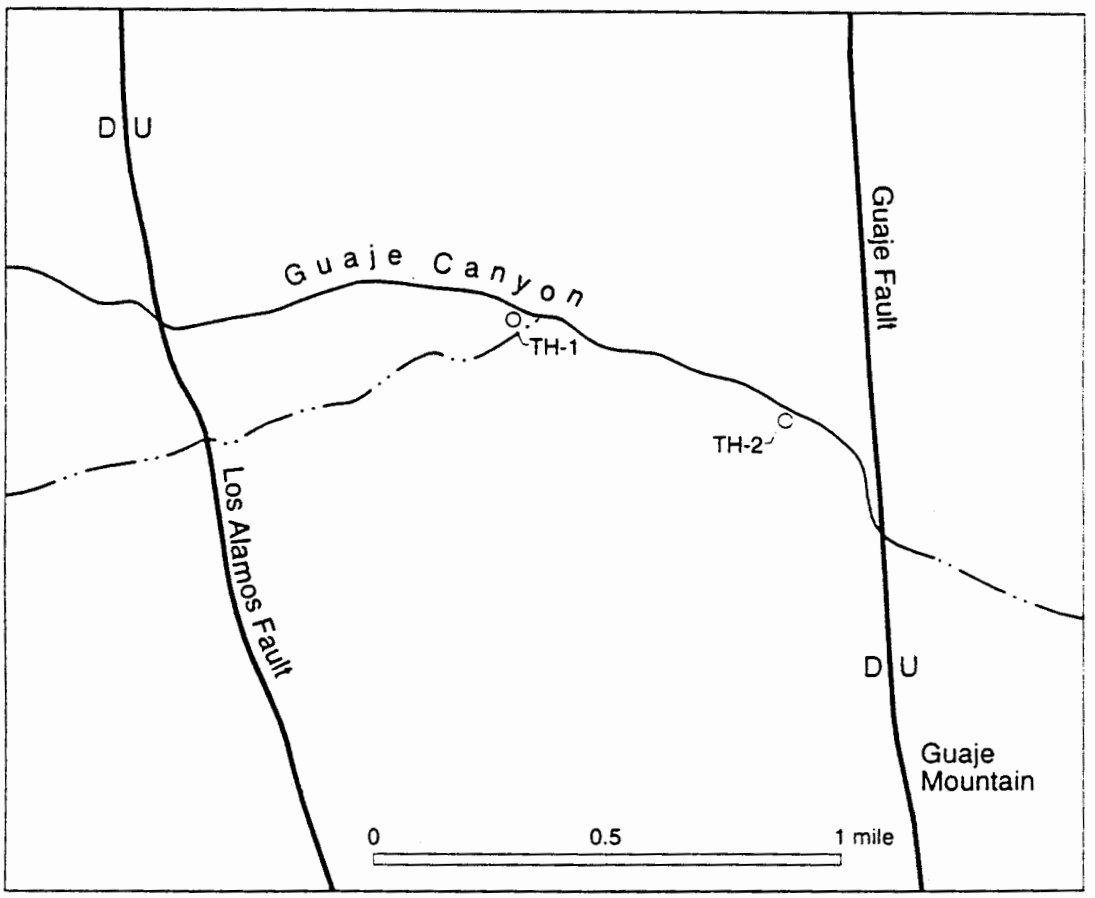


Fig. XXV-A. Location of test holes in upper Guaje Canyon.

TABLE XXV-A. Locations and Elevations (NAD 1927)

A. Test Hole 1	N 1,795,700	E 484,600	7180 ft
B. Test Hole 2	N 1,794,600	E 486,600	7060 ft

TABLE III-D. Locations and Elevations (NAD 1927)

A. Surface Water Stations

Acid Weir	N 1,778,600	E 484,100	6990 ft
Pueblo 1	N 1,778,800	E 484,400	6950 ft
Pueblo 2	N 1,777,300	E 494,000	6630 ft
Pueblo 3			
Otowi Seep	N 1,776,100	E 504,600	6470 ft
Hamilton Bend Spring	N 1,776,161	E 502,420	6500 ft

B. Springs, Observation Wells and Test Holes

AC-1	N 1,777,300	E 483,200	7160 ft
AC-2	N 1,777,500	E 483,200	7140 ft
AC-3 wet	N 1,777,900	E 483,200	7120 ft
AC-4 wet	N 1,778,000	E 483,100	7100 ft
AC-5 wet	N 1,778,200	E 483,500	7060 ft
PC-1 wet	N 1,778,800	E 483,900	6960 ft
PC-2 wet	N 1,778,700	E 484,600	6940 ft
PC-3 wet	N 1,778,600	E 485,900	6900 ft
PC-4 wet	N 1,778,900	E 488,200	6810 ft
PC-5	N 1,777,600	E 490,300	6720 ft
PC-6 wet	N 1,777,300	E 493,600	6660 ft
PC-6A	N 1,777,300	E 493,600	6660 ft
PC-7 wet	N 1,776,800	E 496,000	6610 ft
PC-8	N 1,775,800	E 502,200	6505 ft
PC-9	N 1,775,600	E 505,300	6450 ft
PC-10 wet	N 1,774,500	E 507,400	6420 ft
PC-11	N 1,773,800	E 508,000	6390 ft
PO-1	N 1,774,800	E 505,400	6460 ft
PO-1A	N 1,775,100	E 505,600	6442 ft
PO-1B	N 1,775,400	E 505,700	6641 ft
PO-1C	N 1,775,600	E 505,800	6446 ft
PO-1D	N 1,775,800	E 505,500	6450 ft
PO-2	N 1,775,500	E 504,900	6478 ft
PO-2A wet	N 1,775,600	E 505,000	6452 ft
PO-2B	N 1,175,700	E 505,100	6456 ft
PO-3 wet	N 1,775,600	E 502,200	6499 ft
PO-3A wet	N 1,775,800	E 502,200	6513 ft
PO-3B wet	N 1,776,000	E 502,200	6520 ft
PO-4 wet	N 1,775,600	E 500,800	6524 ft
PO-4A wet	N 1,775,700	E 500,800	6524 ft
PO-4B wet	N 1,775,900	E 500,900	6542 ft
PO-5	N 1,776,200	E 504,400	6475 ft
PO-6	N 1,776,600	E 504,200	6520 ft

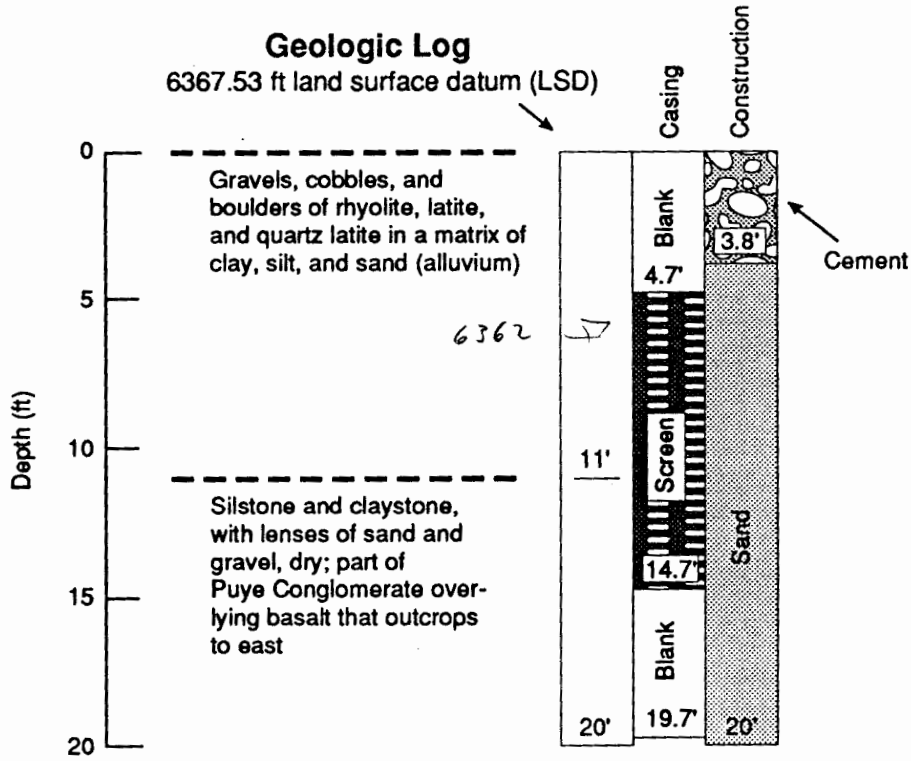


Fig. 2. Pueblo Canyon observation well APCO-1 (completed August 17, 1990, water level 6 ft).

6376
183
6213

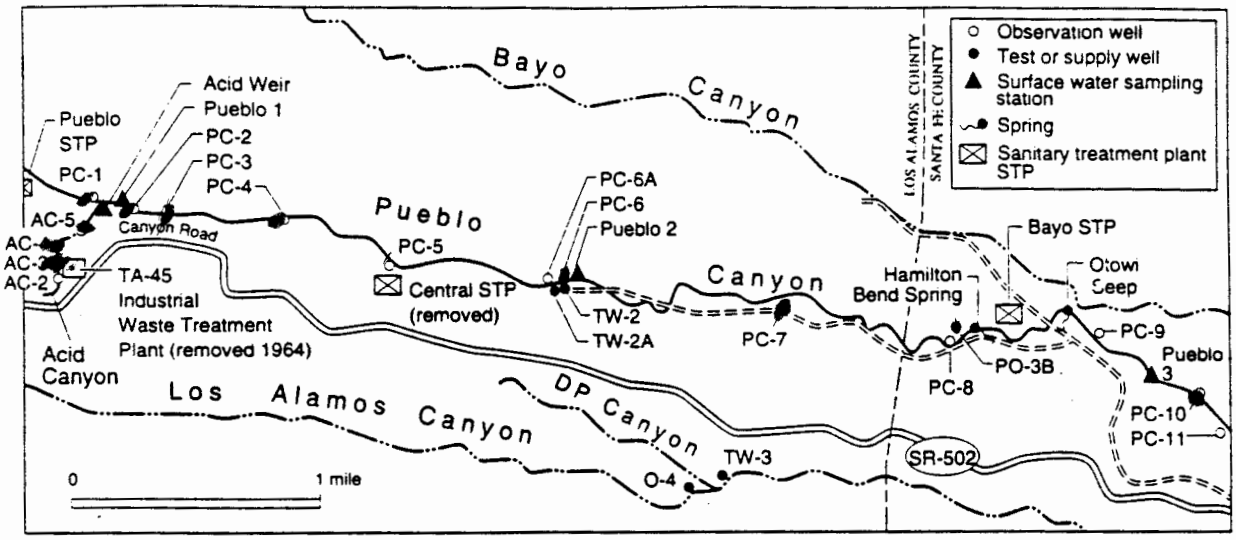


Fig. III-A. Generalized location of surface water sampling stations, shallow wells, and the spring sampling stations in Acid and Pueblo Canyons (Weir et al. 1963; Purtymun 1975).

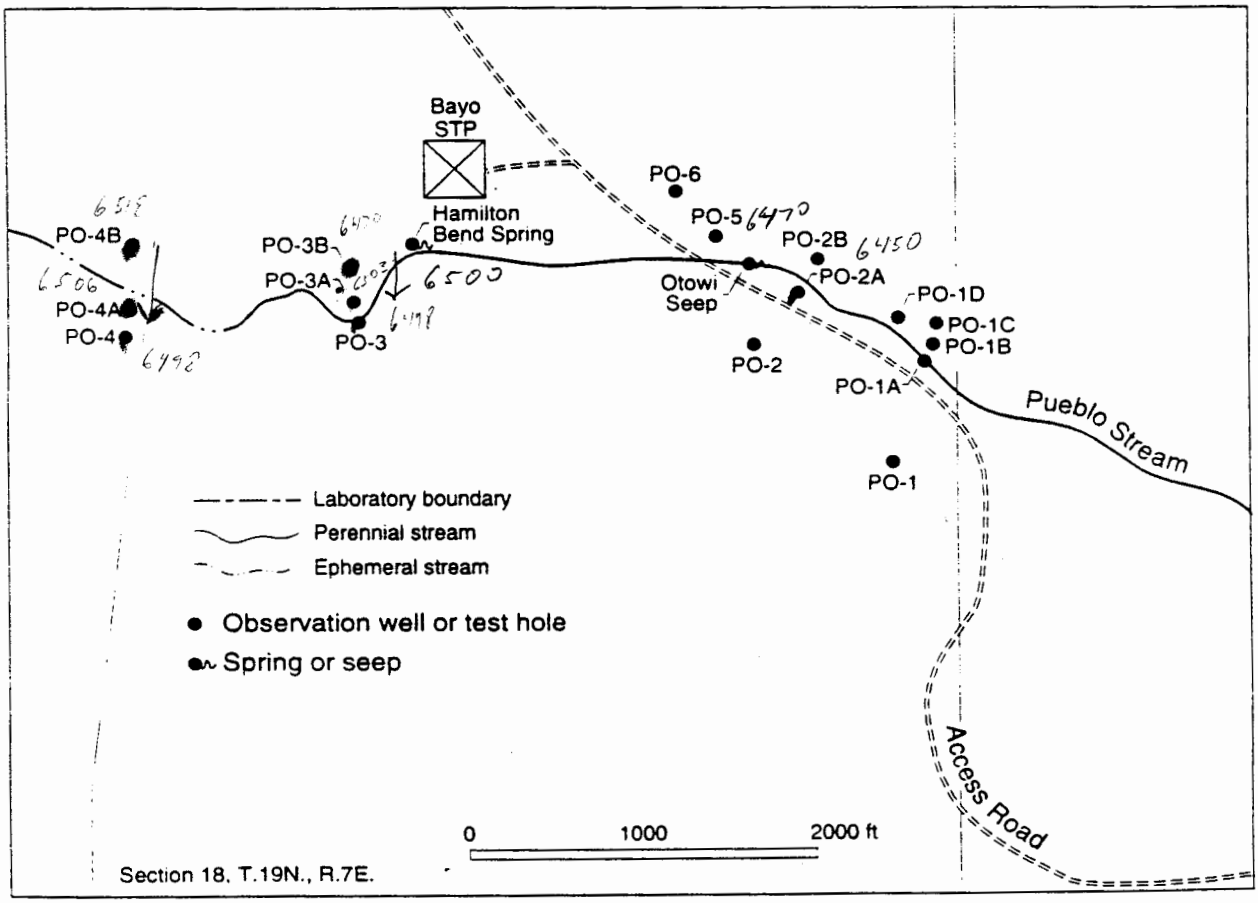
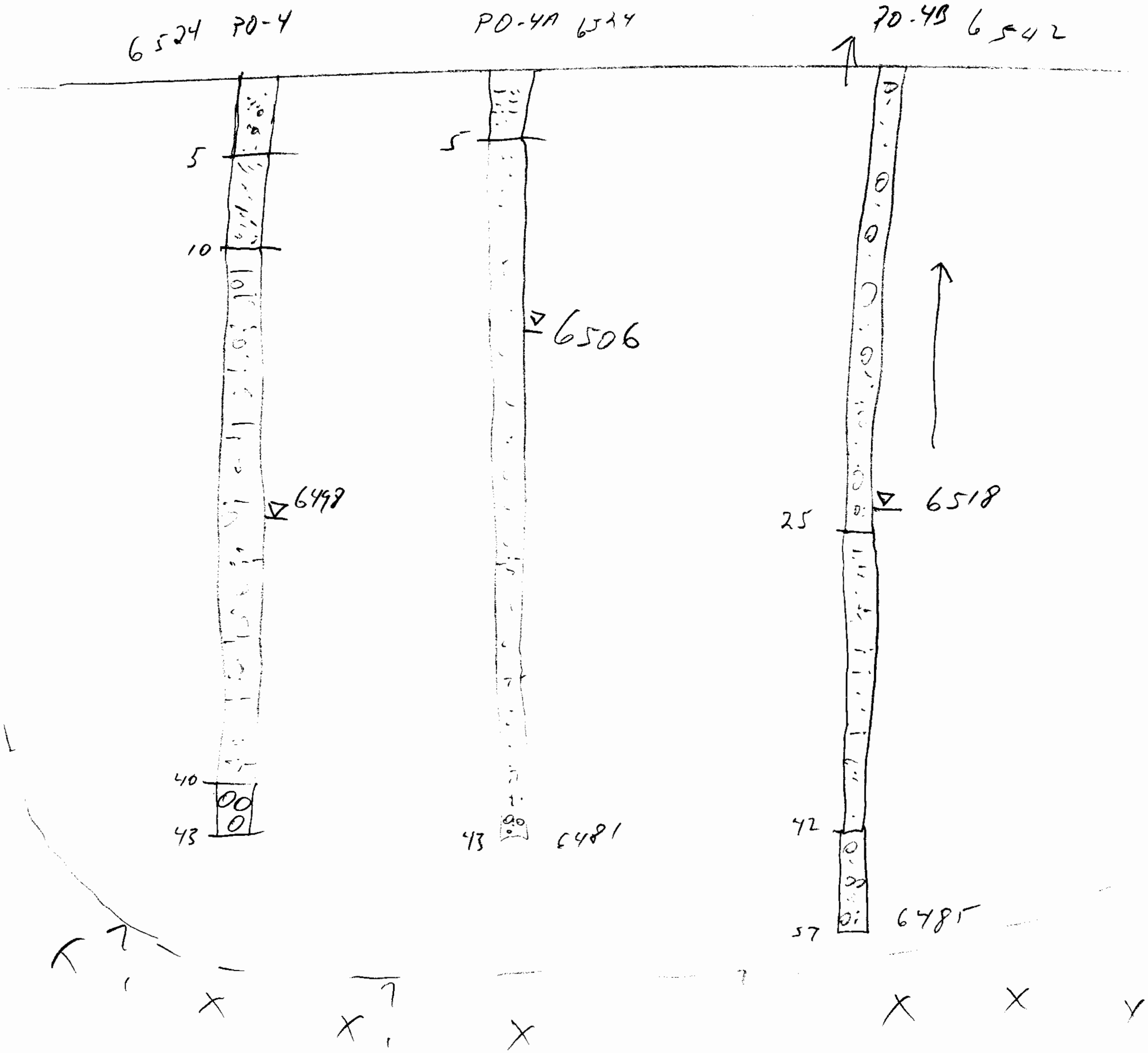


Fig. III-B. Location of observation wells and test holes in the vicinity of Hamilton Bend Spring and Otowi Seep in Pueblo Canyon (Abrahams 1966).


6524 PO-4
PO-4A 6524
PO-4B 6542
5
10
6498
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43
5
6506
43
6481
6518
25
42
57
6485

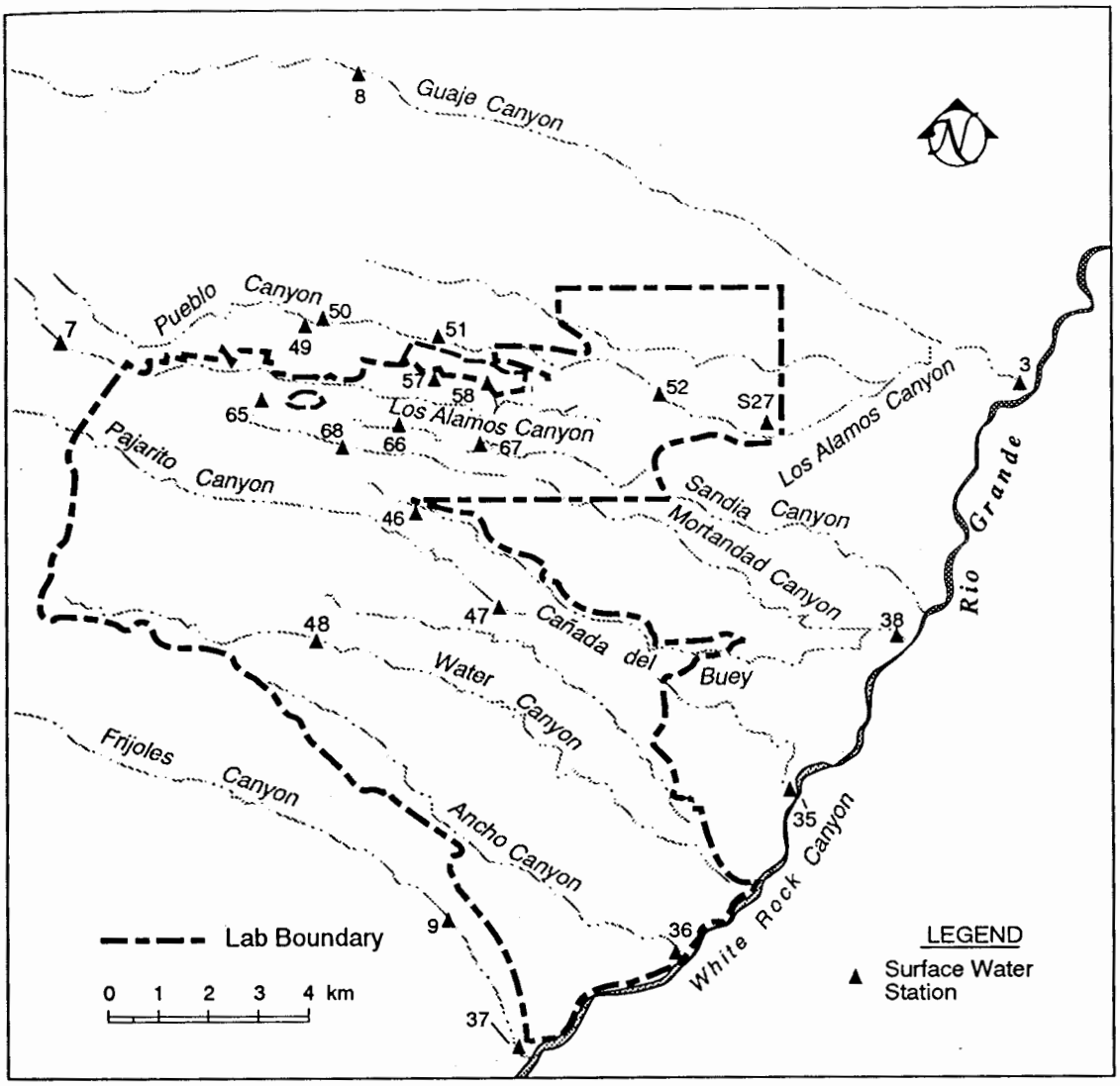


Figure IV-6. Surface water sampling locations for off-site perimeter and on-site Laboratory sites. (Map denotes general locations only. See Table D-10 for specific locations. The FIMAD system at the Community Reading Room also presents specific locations in a computer format.)

b. Off-Site Perimeter Stations.

Radioactive Effluent Areas. Effluent-associated radionuclides occur off site in Pueblo and Los Alamos canyons. The residual contaminants are from past discharges and are predominantly associated with sediments in the canyons (see Section IV.E for further information). Some resuspension and redissolution occurs when surface flows move across these sediments, resulting in measurable concentrations in the surface waters.

Acid Canyon, a small tributary of Pueblo Canyon, is a former on-site release area for industrial effluents. Acid Canyon and the upper portion of Pueblo Canyon are on what is now Los Alamos County land about 1,190 m (3,900 ft) west of the Los Alamos-Santa Fe County Line. Acid-Pueblo Canyon received untreated and treated industrial effluent containing residual radionuclides from 1944 to 1964 (ESG 1981). Most of the residual radioactivity from these historical releases is now associated with the sediments in Pueblo Canyon with an estimated total inventory of about 600 mCi of plutonium (ESG 1981). About two-thirds (400 mCi) of this total are in the DOE-owned portion of lower Pueblo Canyon. Pueblo Canyon presently receives treated sanitary effluent from the Los

DOE/EV-0005/30
LA-8890-ENV
UC-70

Formerly Utilized MED/AEC Sites Remedial Action Program

Radiological Survey of the Site of a Former Radioactive Liquid Waste Treatment Plant (TA-45) and the Effluent Receiving Areas of Acid, Pueblo, and Los Alamos Canyons, Los Alamos, New Mexico

May 1981

Final Report

Prepared for

U.S. Department of Energy

Assistant Secretary for Environmental Protection,
Safety, and Emergency Preparedness
Environmental and Safety Engineering Division
Washington, DC 20545

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

TABLE A-XXXIV

RADIOCHEMICAL QUALITY OF WATER IN ALLUVIUM FROM LOS ALAMOS CANYON 1967 THROUGH 1975

(average of a number of analyses in pCi/ℓ, except as noted)

Station	Year	No. of Analyses	Gross Alpha	Gross Beta	^{238}Pu	^{239}Pu	^{137}Cs	^{3}H	Total U*
LAO-C	1970	1	<1	4	<0.05	<0.05	---	<1000	0.4
	1971	2	<1	3	<0.05	<0.05	<350	<1000	1.0
	1972	4	<1	5	0.06	0.07	<350	<1000	1.0
	1973	4	<1	3	<0.05	<0.05	<40	1150	<0.4
	1974	4	1	8	<0.05	<0.05	<40	650	0.5
	1975	3	3	5	<0.05	<0.05	<40	1000	0.5
LAO-1	1967	1	<1	50	<0.05	<0.05	---	41 000	1.3
	1968	3	3	37	<0.05	0.08	<250	30 000	<0.4
	1969	3	<1	36	<0.05	0.06	---	22 000	0.4
	1970	4	<1	76	0.05	0.05	---	---	<0.4
	1971	4	1	94	0.05	0.27	<350	20 750	0.6
	1972	4	1	127	0.17	0.18	<350	19 600	<0.4
	1973	5	2	140	<0.05	0.06	<40	36 000	<0.4
	1974	4	2	147	<0.05	<0.05	40	27 000	<0.4
	1975	3	1	56	<0.05	<0.05	<20	7000	<0.4
LAO-2	1967	1	<1	91	<0.05	<0.05	---	475 000	2.0
	1968	3	3	59	<0.05	0.06	<250	273 000	1.5
	1969	2	1	77	0.10	0.60	---	337 000	1.6
	1970	3	<1	80	<0.05	0.14	<250	184 000	0.6
	1971	2	1	101	0.15	0.33	<350	52 000	0.9
	1972	3	2	188	0.09	0.19	<350	153 000	2.6
	1973	4	22	294	<0.05	0.11	<40	46 000	<0.4
	1974	3	2	247	<0.05	0.10	<40	18 000	<0.4
	1975	3	4	157	<0.05	0.05	<20	7200	0.7
LAO-3	1967	1	<1	45	<0.05	0.05	---	214 000	<0.4
	1968	3	2	61	0.07	0.08	<250	126 000	0.8
	1969	2	2	49	<0.05	0.06	---	350 000	1.3
	1970	4	2	56	<0.05	0.08	<250	73 000	0.8
	1971	3	3	95	0.07	0.08	<350	38 000	1.2
	1972	4	3	92	0.10	0.15	<350	187 000	3.0
	1973	5	3	47	0.06	0.05	50	35 000	<0.4
	1974	3	2	75	0.35	0.08	50	11 000	0.9
	1975	3	6	81	<0.05	<0.05	---	11 000	3.1
LAO-4	1967	1	<1	9	<0.05	0.06	---	222 000	0.8
	1968	3	5	16	0.05	0.05	250	61 000	1.2
	1969	2	<1	9	<0.05	<0.05	---	55 500	<0.4
	1970	1	<1	10	<0.05	<0.05	---	66 000	<0.4
LAO-4:5	1969	3	<1	5	<0.05	<0.05	---	43 000	0.7
	1970	5	1	26	0.06	0.07	---	78 000	<0.4
	1971	3	1	5	0.07	0.08	---	24 000	0.4
	1972	4	2	10	0.09	0.06	<350	28 000	1.1
	1973	4	1	8	<0.05	<0.05	<40	22 000	<0.4
	1974	3	1	107	<0.05	<0.05	<20	8000	<0.4
	1975	3	2	47	<0.05	0.06	---	18 000	0.8
LAO-5	1967	1	<1	4	<0.05	<0.05	---	126 000	<0.4
	1968	2	1	8	<0.05	0.09	<250	70 000	1.2
	1969	2	<1	5	<0.05	<0.05	---	56 000	0.7
LAO-6	1968	1	2	18	0.17	0.25	<250	75 000	0.4
	1969	1	<1	7	<0.05	<0.05	<250	51 000	<0.4

*μg/ℓ.

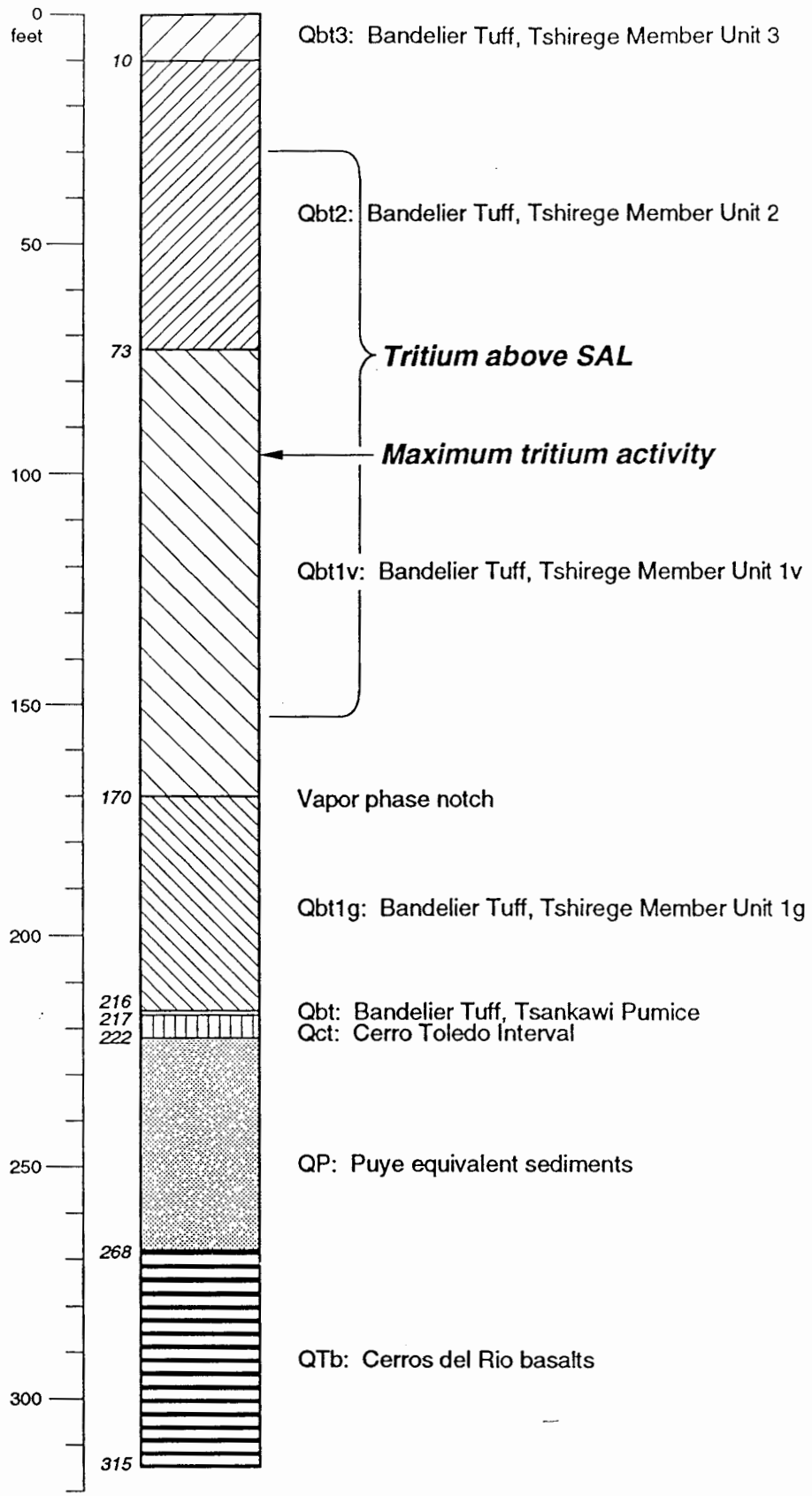


Fig. 4-7. Lithologic log.

35-2028

G.L. Elevation -7102.89 ft ; TD - 299ft.; ft Elev.
(drilled 1994;)

Log	Depth	Thickness	Top Elevation
Alluvium	0-25	25	
Tshirege Member, Bandelier Tuff (vapor-phase notch @148-150)	25-218	193	
Tsankawi Pumice Bed	218-220	2	6885
Cerro Toledo Rhyolite (boulder clasts from 259-271 ft; 20% moisture @ 220 ft and 270ft)	220-297?	77	6883
Otowi Member, Bandelier Tuff (the boring just began to enter the Otowi)	297-299	TD	6806?

source: Phone call w/Richard Koch, 7/95

MDA-V

G.L. Elevation -7160 ft ; TD - 707ft.; ft Elev.
(drilled 1994;)

Log	Depth	Thickness	Top Elevation	Differ w/ FIMAD
Tshirege Member, Bandelier Tuff	0-298	298		
Tsankawi Pumice Bed	298-300	2	6862	
Cerro Toledo Rhyolite	300-332	32		
Otowi Member, Bandelier Tuff	332-685	353	6828	
Guaje Member, Bandelier Tuff	685-701	16	6475	
Puye Fm	701-707		6459	

source: Phone call w/David Broxton, 6/29/95

TA-49 cold hole

G.L. Elevation -7130? ft ; TD - 700ft.; ft Elev.
(drilled 1994;)

Log	Depth	Thickness	Top Elevation	Differ w/ FIMAD
Tshirege Member, Bandelier Tuff	0-557	557		
Tsankawi Pumice Bed	557-561	4	6573	
Cerro Toledo Rhyolite	561-596	35	6569	
Otowi Member, Bandelier Tuff	596-700	TD	6534	

source: Phone call w/David Broxton, 6/29/95

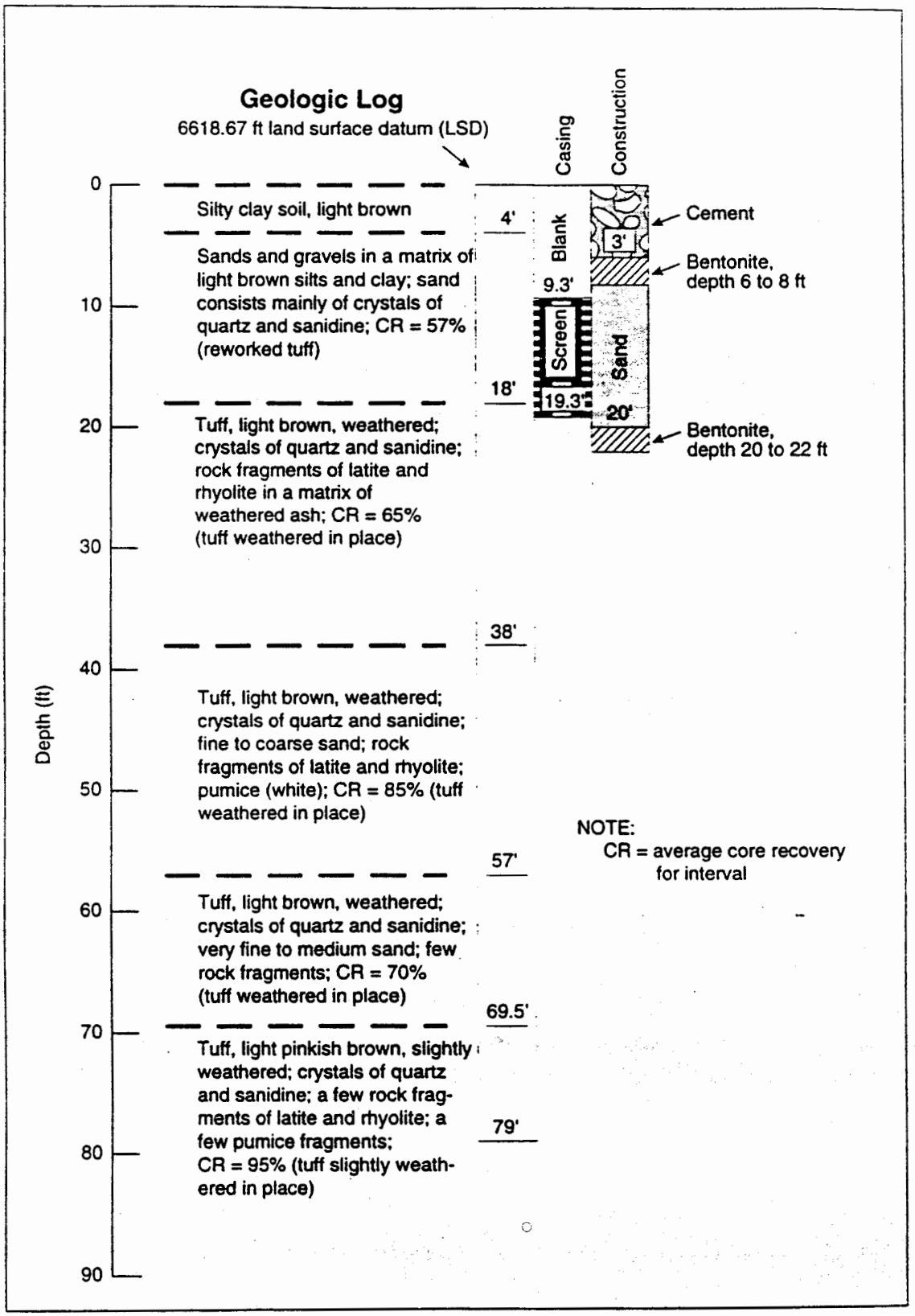


Fig. VIII-I. Sandia Canyon observation well SCO-1, completed August 1989, dry (Purtymun and Stoker 1990).

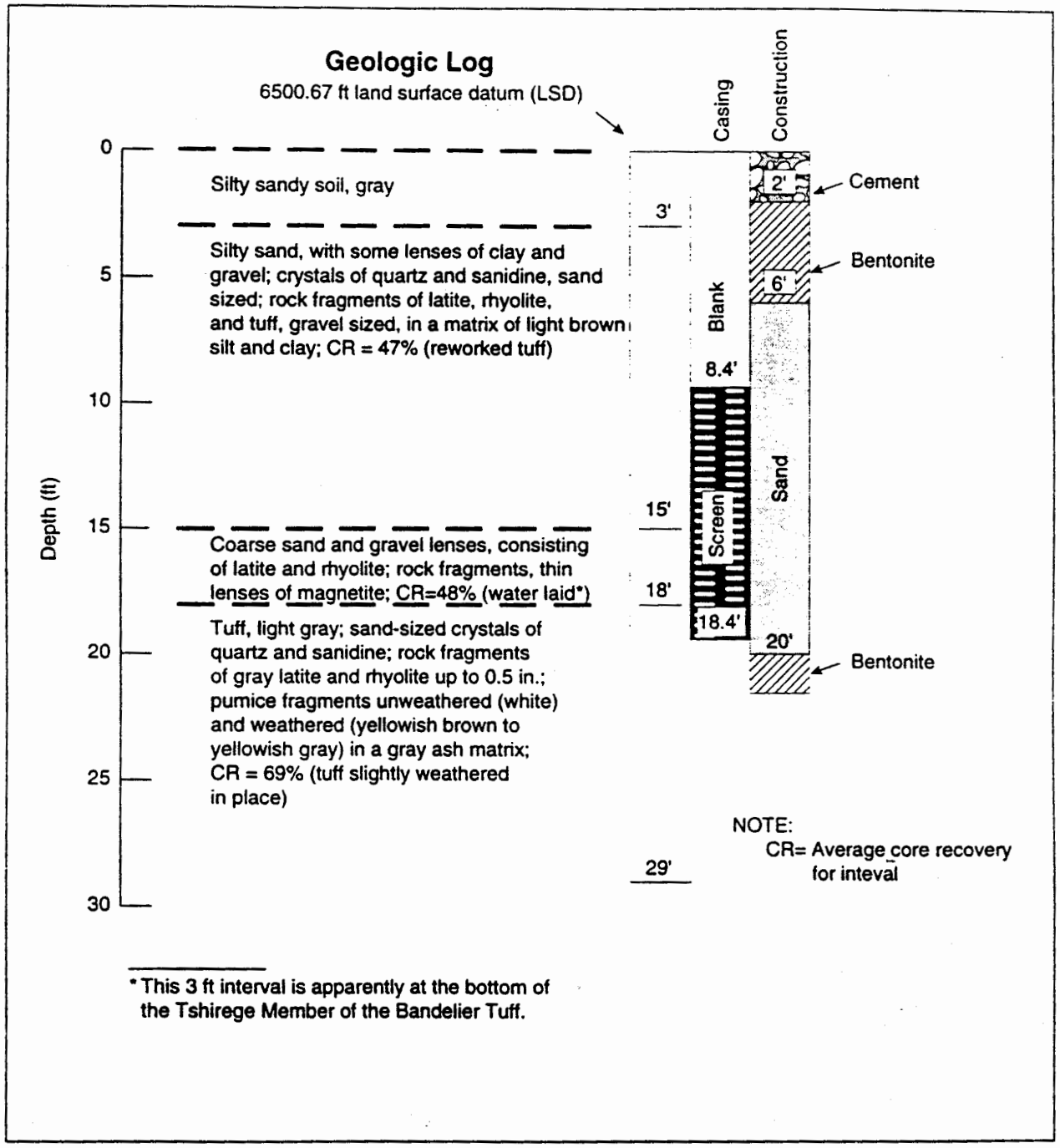


Fig. VIII-J. Sandia Canyon observation well SCO-2, completed August 1989, dry (Purtymun and Stoker 1990).

POTO-4ABC

G.L. Elevation - 6620 ft ; TD - 174 ft.; 6446 Elev.
drilled 1991-dry?

Log	Depth	Thickness	Top Elevation
Alluvium	0-9	9	
Tshirege Member, Bandelier Tuff	9-84	75	
Tsankawi Pumice Bed Cerro Toledo Rhyolite?	84-104	20	6536
Otowi Member, Bandelier Tuff	104-TD	70	6516

source: Purtyman Report pg.332, 1995

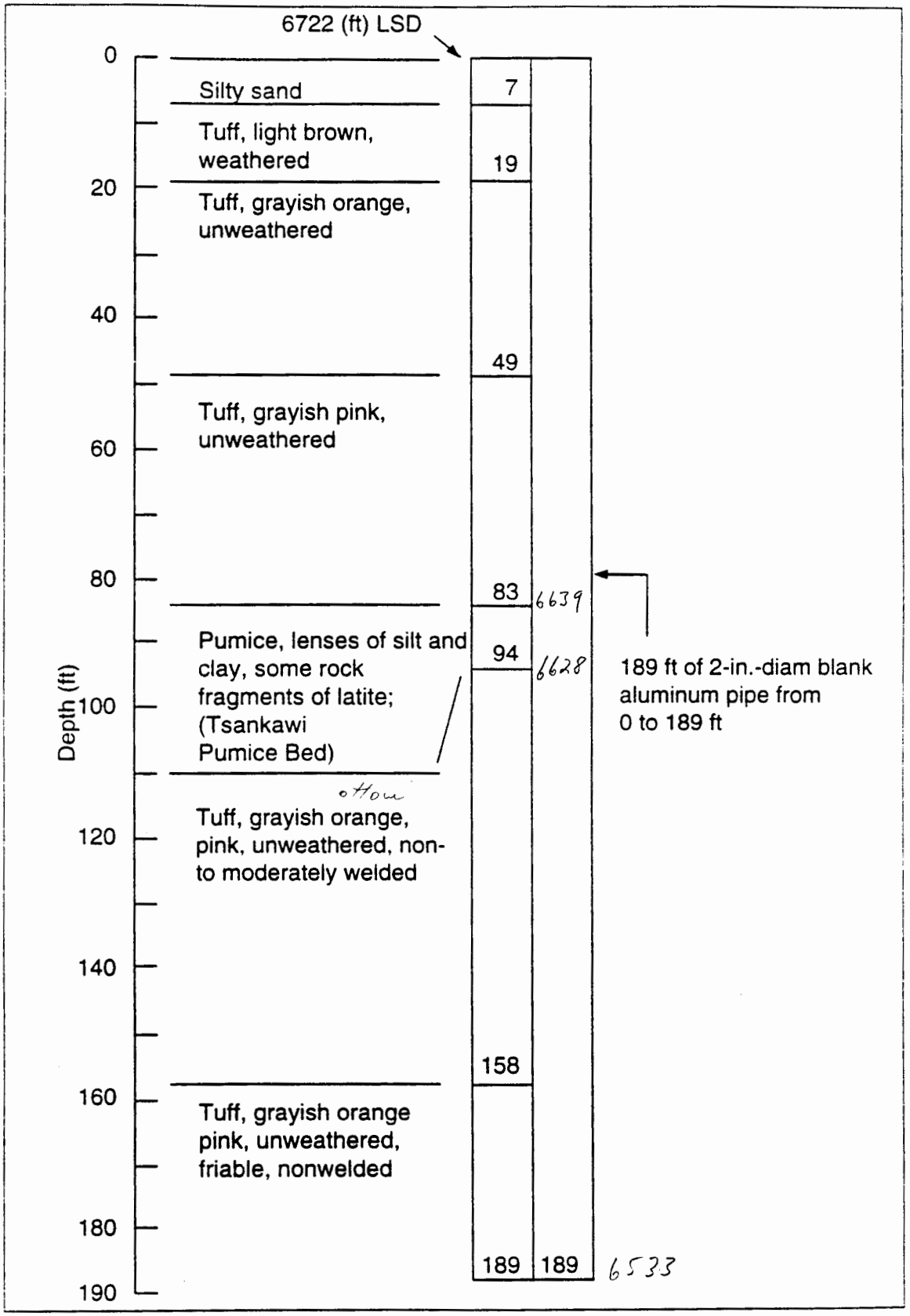


Fig. VII-T. Geologic log and casing schedule of moisture-access hole CDBM-1, dry (Purtymun 1992).

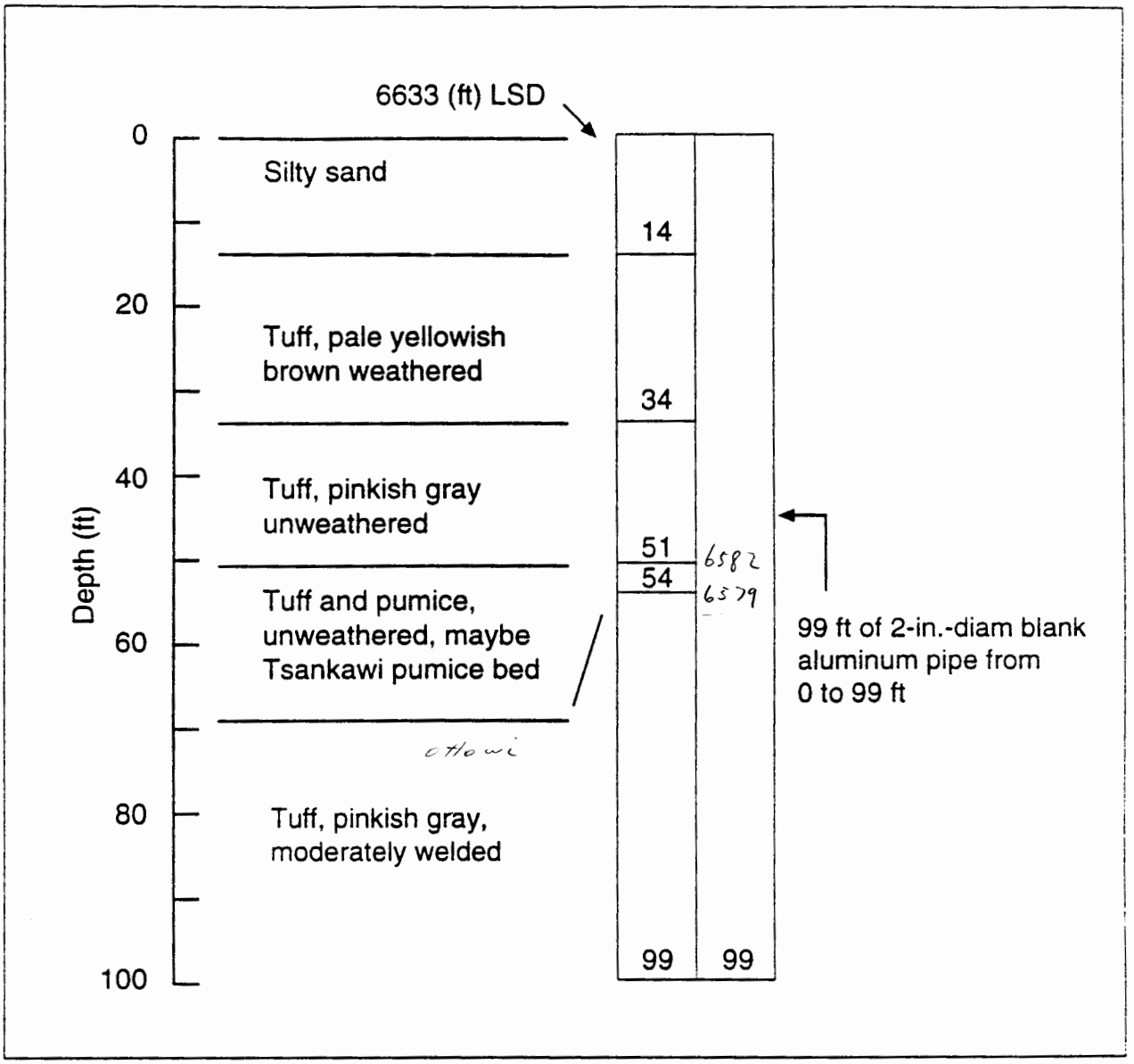


Fig. VII-U. Geologic log and casing schedule of moisture-access hole CDBM-2, dry (Purtymun 1992).

TA-46

G.L. Elevation - 7105 ft; TD - 747ft.; Elev
drilled (1971);

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-360	360	
Tsankawi Pumice Bed?	?		
Cerro Toledo Rhyolite	?		
Otowi Member, Bandelier Tuff	360-695	335	6745
Guaje Member, Bandelier Tuff	695-727	32	6410
Puye Fm	727-td		6378

source: Purtyman (FIMAD d-base)

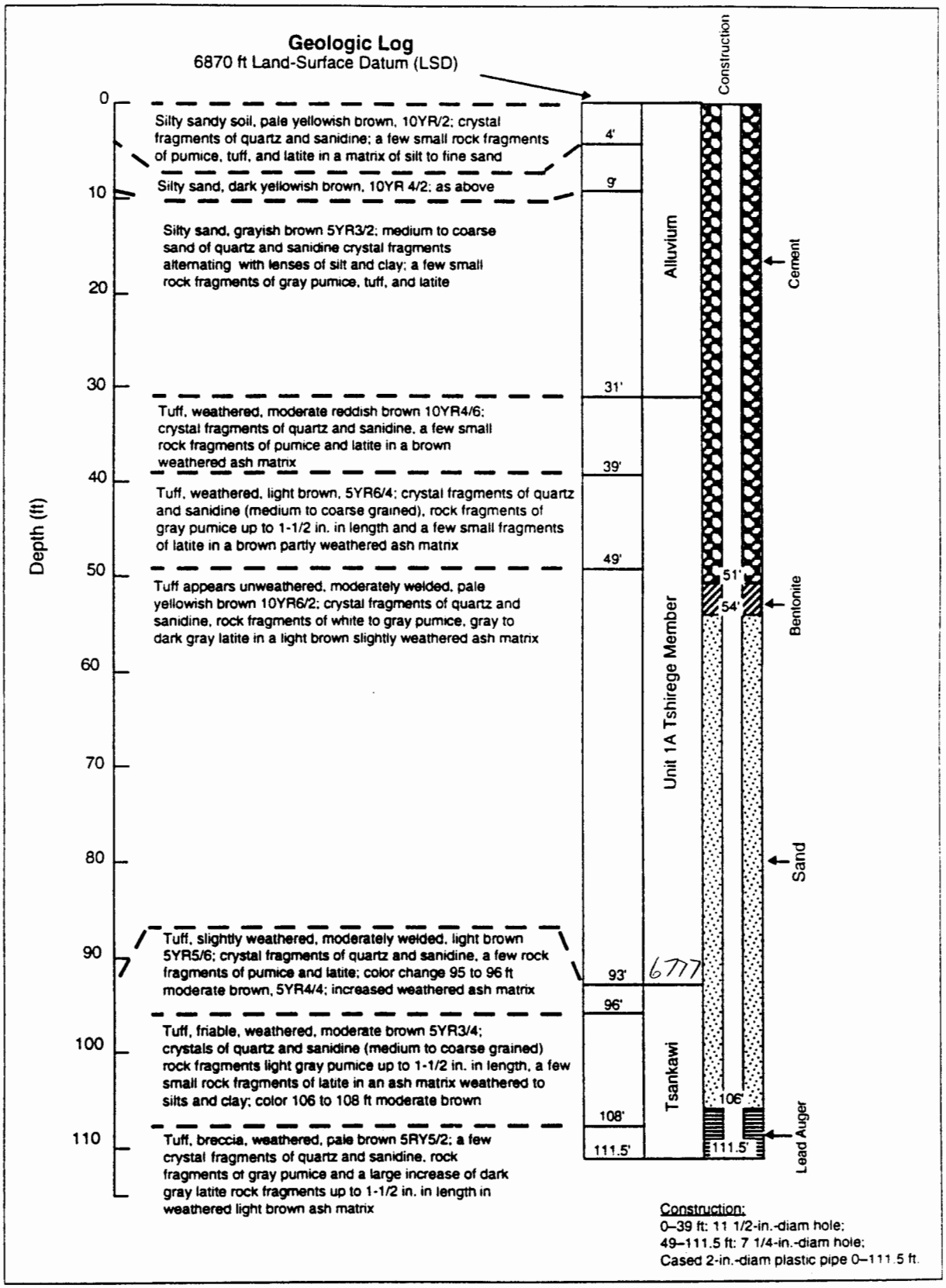


Fig. VI-AA. Mortandad test hole MCM-5.1, completed September 1990, water in alluvium cased out of hole (Stoker et al. 1991).

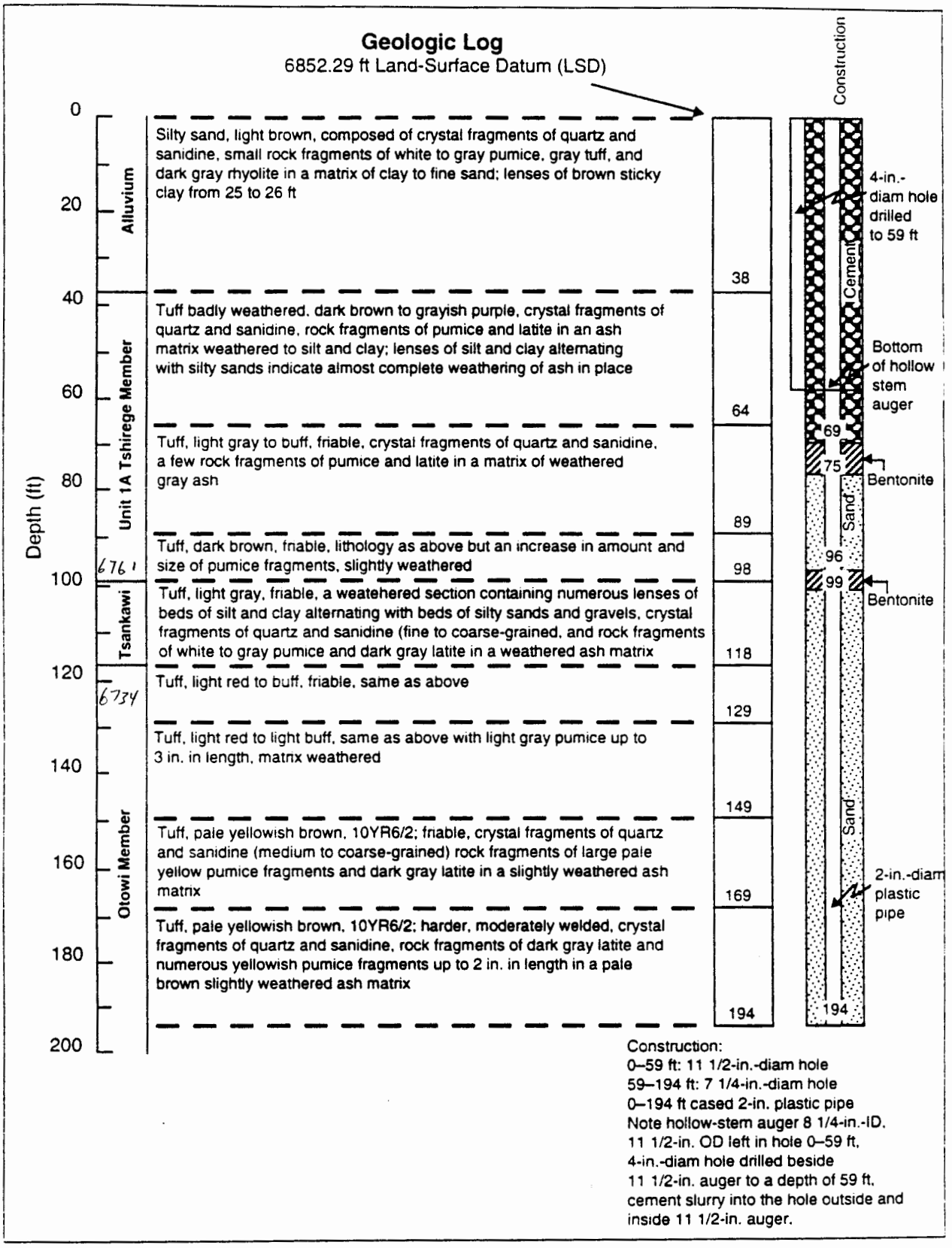


Fig. VI-AC. Mortandad test hole MCM-5.9A, completed July 1990, water in alluvium cased out of hole (Stoker et al. 1991).

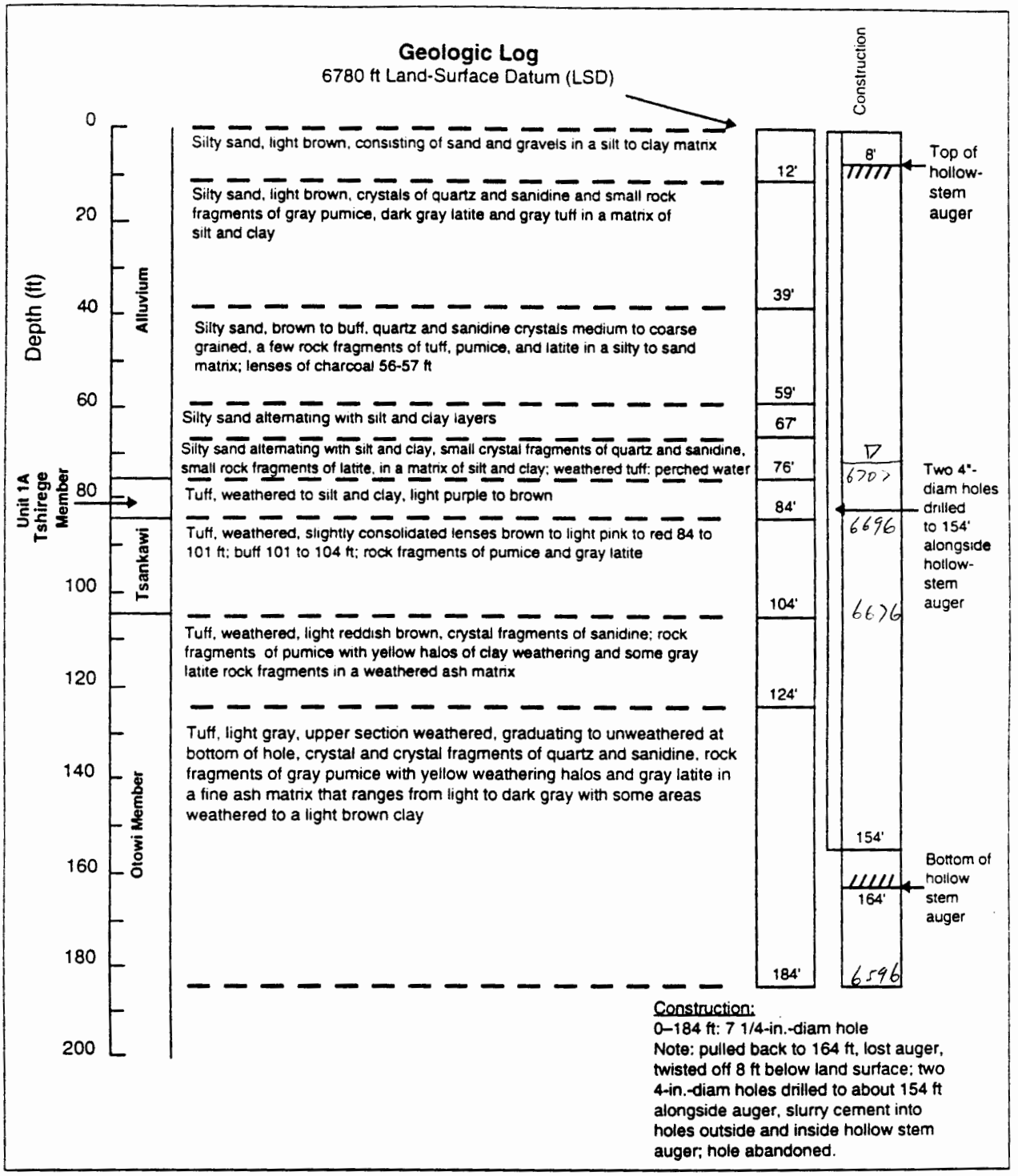


Fig. VI-AJ. Mortandad test hole MCC-8.2, core hole test April 1989, water level 73.0 ft (Stoker et al. 1991).

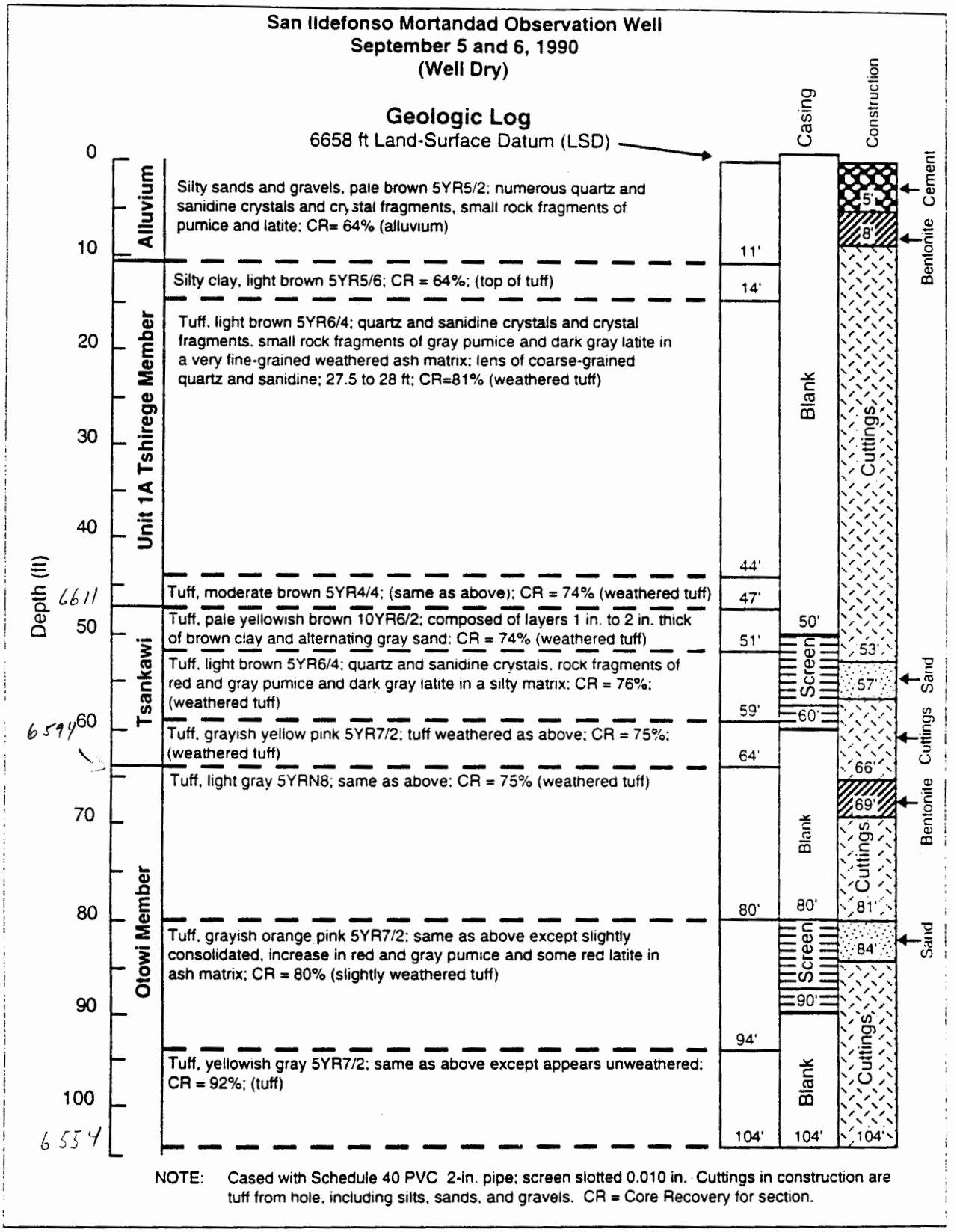


Fig. VI-AK. Mortandad test hole SIMO, drilled in cooperation with San Ildefonso Pueblo and BIA, September 1990, dry (Stoker et al. 1991).

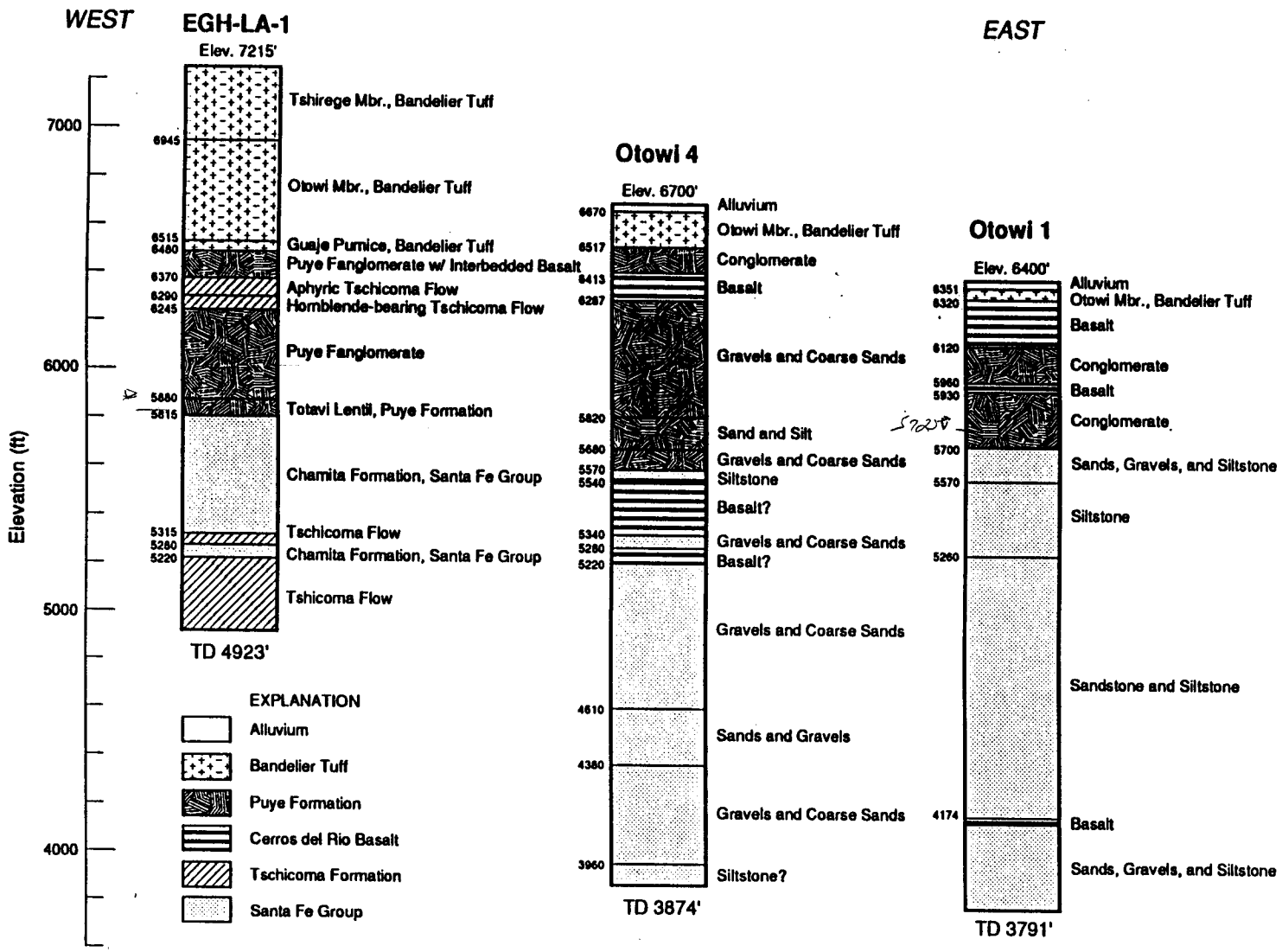


Fig. 4.1-8 Lithologic logs for deep wells near TA-21.

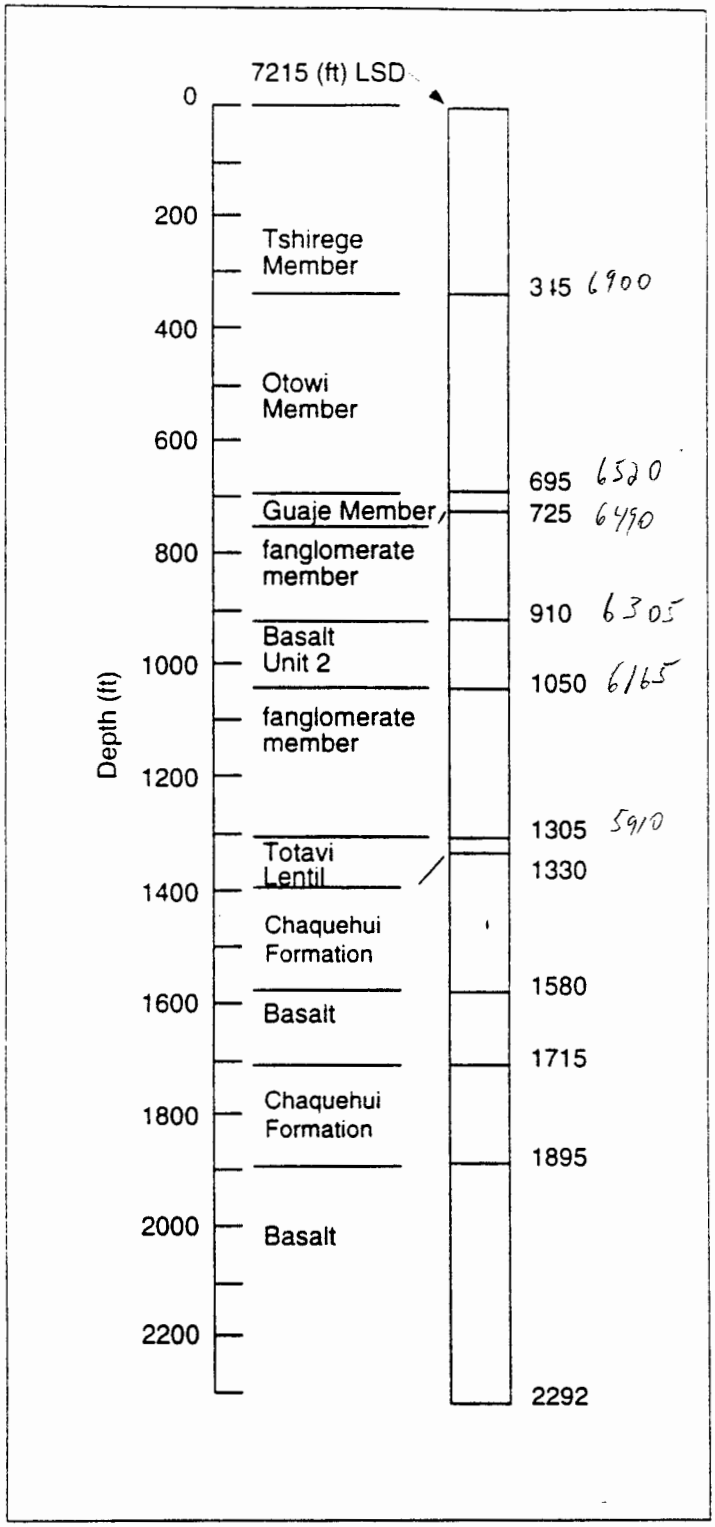


Fig. XVII-K. Geologic log of test hole Sigma Mesa, drilled July–November 1979, water level about 1330 - 5585 ft (data from unpublished log by Carolyn Potzich modified by Purtymun; see text and Table XVII-B).

Sigma Mesa

G.L. Elevation - 7215 ft; TD - 2292ft.; Elev drilled (1979);

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-345	345	
Tsankawi Pumice Bed?	?		
Cerro Toledo Rhyolite	?		
Otowi Member, Bandelier Tuff	345-700	355	6870
Guaje Member, Bandelier Tuff	700-735	735	6515
Puye Fm	735-845	110	6480
Tshicoma Fm? (From 6305-6290 basalt)	845-1080	235	6370
Puye Fm	1080-1305	225	6245
Totavi Lentil	1305-1400	95	5910
Santa Fe Gp, Chamita Fm	1400-1900	500	5815

source: Purtyman (FIMAD d-base)

SHB-4

G.L. Elevation - 6701 ft ; **TD - 200 ft.; 6501 Elev.**

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-117	117	
Tsankawi Pumice Bed	117?-120	3	6584
Otowi Member, Bandelier Tuff	120-TD		6581

source: Gardner, 1993

wet sample from 125 to 145
6576

SHB-1

G.L. Elevation - 7314 ft ; **TD - 700 ft.; 6614 Elev.**

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-302	302	
Tsankawi Pumice Bed	302?-*306	4	7012
Cerro Toledo Rhyolite	*306-*445	139	7008
Otowi Member, Bandelier Tuff	*445-*590	145	6869
Guaje Member, Bandelier Tuff	590-631	41	6724
Puye Fm	631-644	13	6683
Basalt	644-TD		6670

source: Gardner, 1993
*mod. using FIMAD data.

SHB-3

G.L. Elevation - 7607 ft ; **TD - 860 ft.; 6747 Elev.**

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-320?	335	
Tsankawi Pumice Bed	320?-335	15?	7287
Cerro Toledo Rhyolite	335-424	89	7272
Otowi Member, Bandelier Tuff	424-838	414	7183
Guaje Member, Bandelier Tuff	838-839	1	6769
Puye Fm	839-TD		6768

source: Gardner, 1993

346 - top of water ; 6807

LAOI(A)-1.1

Elevation - 6834.80 ft, 6835.2 **Total Depth - 325 ft (6511.8 ft elev.)**

Log	Depth	Thickness	Top Elevation
Alluvium	0-16.1	16.1	6834.8
Otowi Member, Bandelier Tuff (a 20 ft clay zone was encountered @ 52 ft, 6782.8 elev.)	16.1-294.2	278.1	6818.7 6819.2 - [illegible]
Guaye Member, Bandelier Tuff (water-level @ 293.8 ft, 6541 elev.)	294.2-316	21.8	6540.6 6541.2
Puye Fm Fanglomerate Member (water-level @ 296 ft, 6538.8 elev.)	316-323	7	6518.8

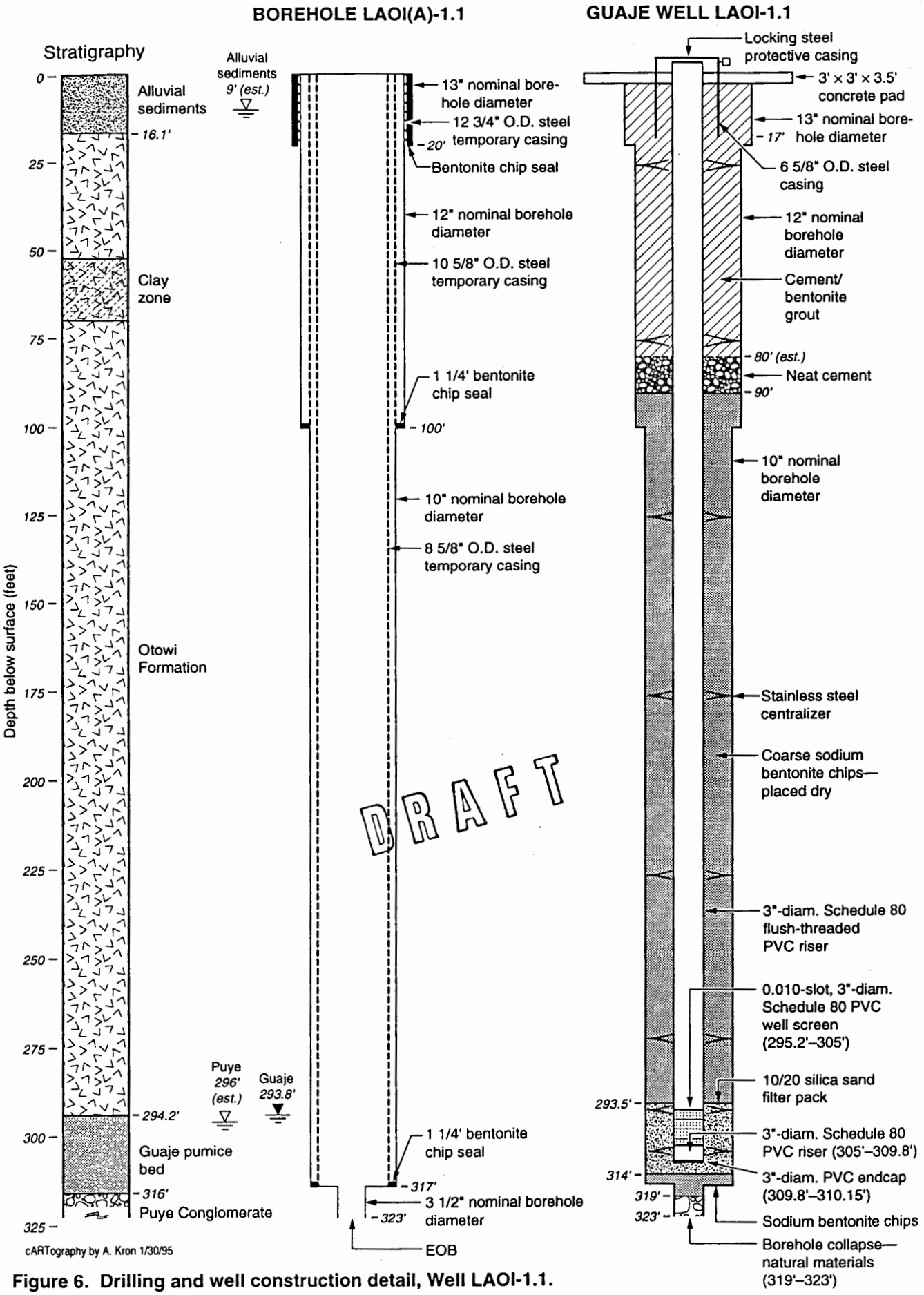


Figure 6. Drilling and well construction detail, Well LAOI-1.1.

LADP-3

Elevation - 6757 ft

Log	Depth	Thickness	Top Elevation
Tuffaceous colluvium	0 - 20	20	6757
Stream alluvium coarse, well-sorted sandy	20-27	7	6735
Cobble-rich stream alluvium	27-29	2	6728
Stream alluvium derived from El Cajete pumice falls	29-51.7	22.7	6726
Cobble-rich stream alluvium	51.7-57	5.3	6703.3
Otowi Member, Bandelier Tuff	57-318	261	6692
Guaje Member, Bandelier Tuff (water encountered @ 325 ft, 6430 elev.)	318-328	10	6449
Puye Fm (a 4 inch clay layer found @ top of Puye)	328-349	21	6429

source: Preliminary results for bore holes LADP-3, Broxton

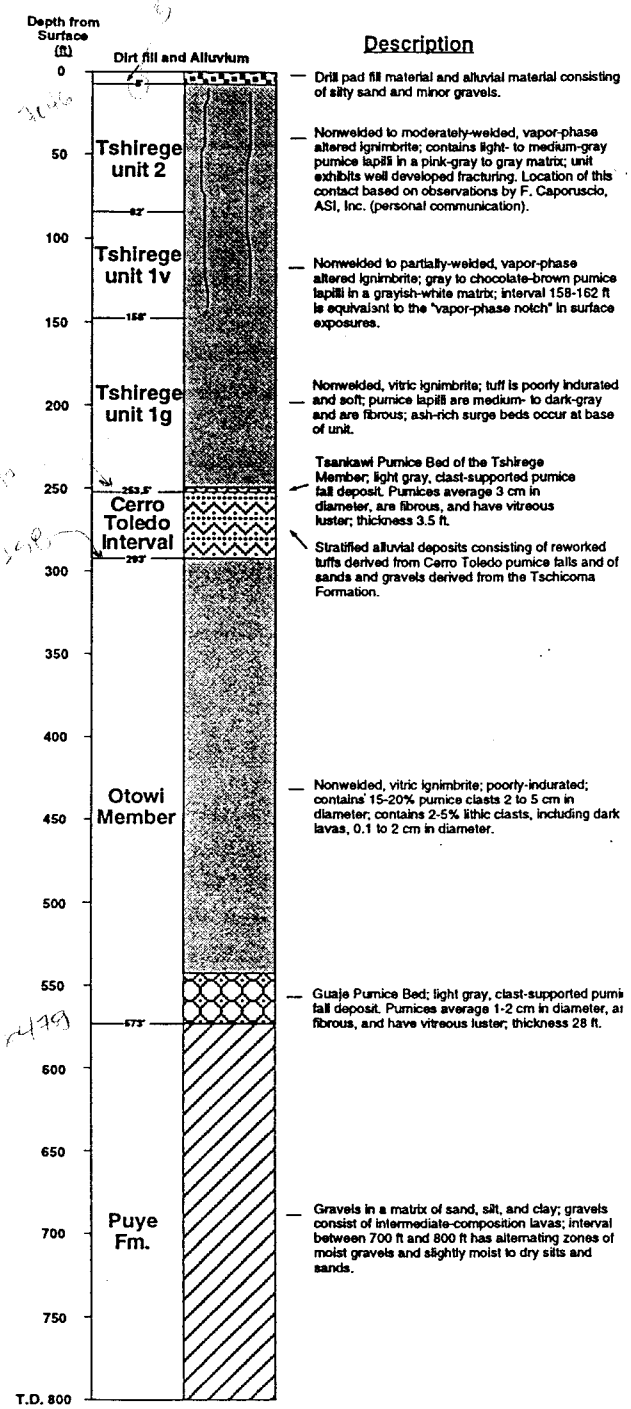


Fig. 6. Preliminary lithologic log for borehole LADP-4, DP Canyon.

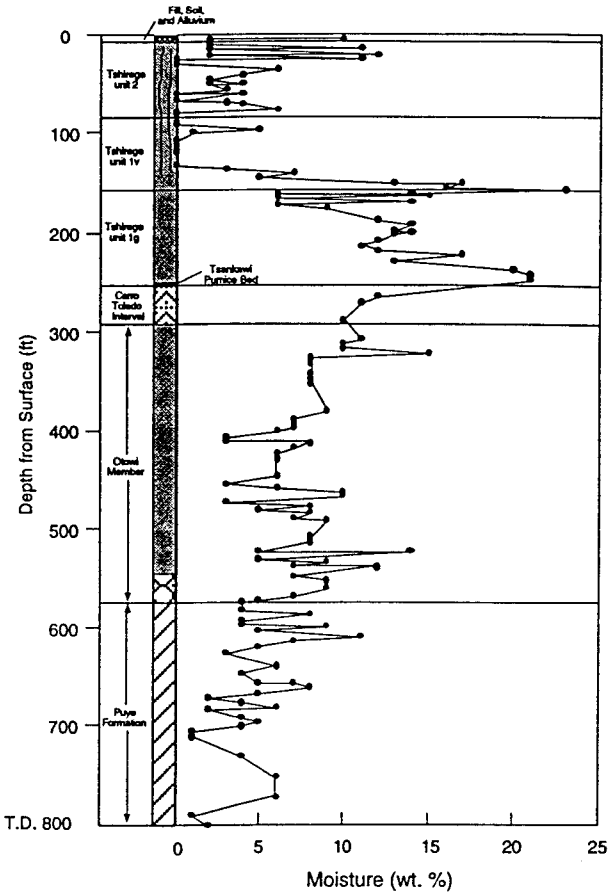


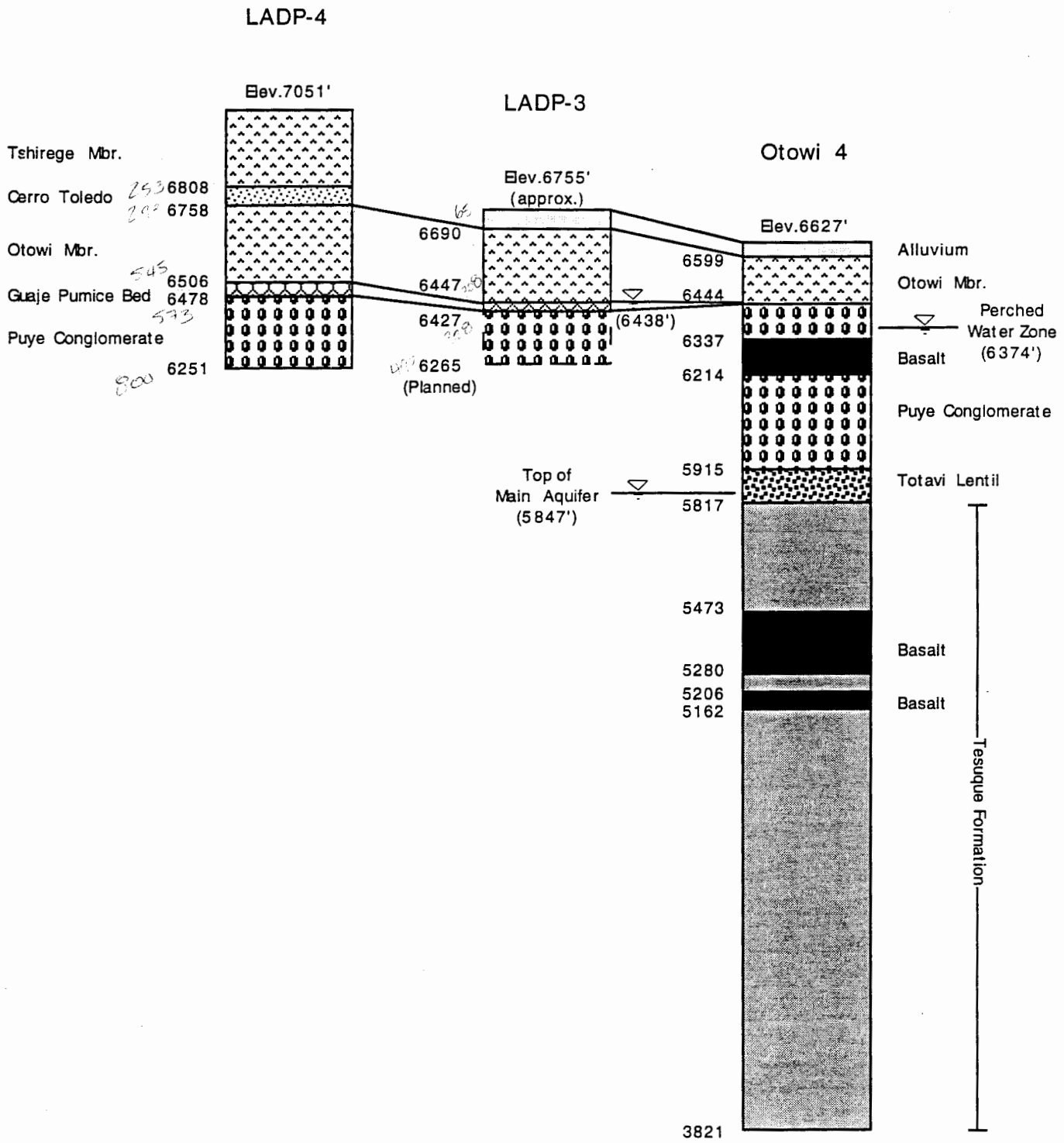
Fig. 7. Variation in moisture content as a function of depth in borehole LADP-4, DP Canyon.

tuff decreases to <5% to a depth of ~136 ft, where a noticeable increase in moisture occurs. The increase occurs at the abrupt transition between devitrified tuffs of Tshirege unit 1v and vitric tuffs of Tshirege unit 1g, with peak moisture contents reaching 23%. Moisture contents also are elevated (~20%) in the lowermost part of Tshirege unit 1g and in the underlying Tsankawi Pumice Bed. Although somewhat variable, moisture in LADP-4 generally decreases with depth below the Tsankawi Pumice Bed.

Laboratory tritium results are not yet available for most samples taken from LADP-4. However, initial screening of samples in the field laboratory indicates that low-level tritium is present in some samples. A high-priority laboratory analysis yielded 2.15 ± 0.18 pCi/g tritium in a tuff sample collected from the moist zone associated with the unit 1v/1g boundary at a depth of 158.6-160.1 ft. This value is significantly above background but

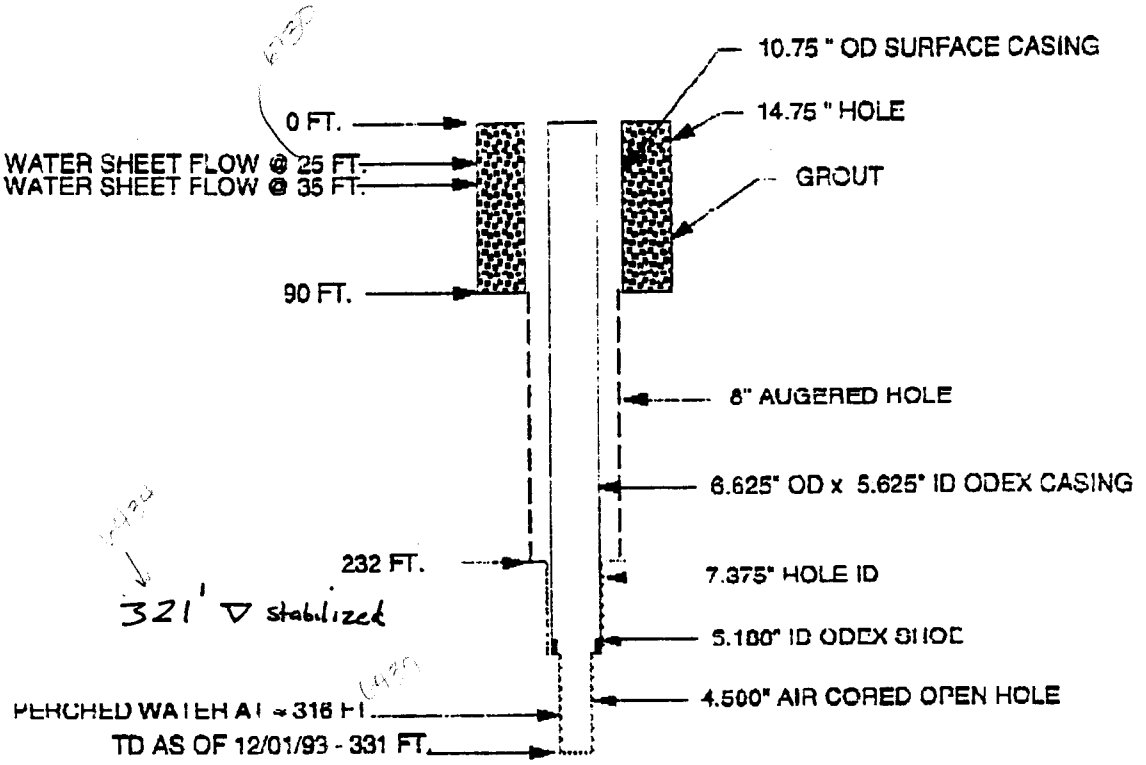
ER-17-0 v-1106

Drill Holes in the Vicinity of TA-21



All elevations shown in feet.

LADP-3
LA CANYON

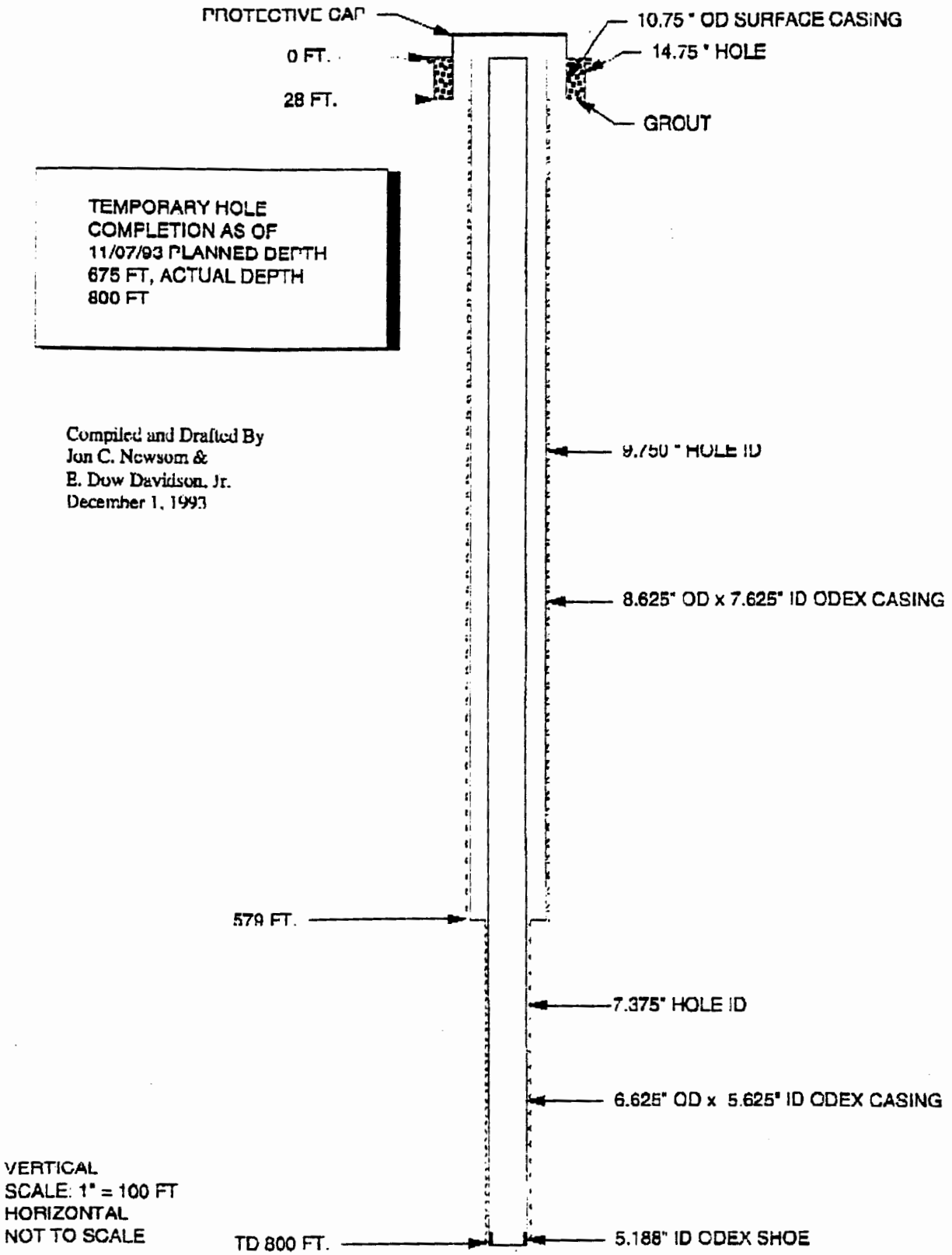


TEMPORARY HOLE CONFIGURATION AS OF 12/01/93. PLANNED TD 400 FT. ACTUAL TD MAY BE APPROXIMATELY 331 FT.

VERTICAL
SCALE: 1" = 100 FT
HORIZONTAL
NOT TO SCALE

Compiled and Drafted By
Jon C. Newsom &
E. Dow Davidson, Jr.
December 1, 1993

LADP-4
DP CANYON



Compiled and Drafted By
Jon C. Newsom &
E. Dow Davidson, Jr.
December 1, 1993

VERTICAL
SCALE: 1" = 100 FT
HORIZONTAL
NOT TO SCALE

LADP3 water ~-325'

Pat - Do you see anything notable here? PDG

PAJARITO PLATEAU SAMPLES

SAMPLE #	DESCRIPTION	DATE MM/DD/YY	Al ppm	Std.D. +/-	As ppm	B ppm	Std.D. +/-	Ba ppm	Std.D. +/-	Ca ppm	Std.D. +/-	Cl ppm	Std.D. +/-	CO3 ppm
PP93-36	LA DP-3	12/01/93	0.21	0.03	(0.05	0.04	0.01	0.02	0.01	11.7	0.1	39	titr	0

Log m = -2.96 for Cl

SAMPLE #	Cond. (L) umho/cm	F ppm	Fe ppm	Std.D. +/-	HCO3 ppm	K ppm	Std.D. +/-	Li ppm	Std.D. +/-	Mg ppm	Std.D. +/-	Mn ppm	Std.D. +/-	Na ppm	Std.D. +/-
PP93-36	302	0.38	0.13	0.01	65.00	8.7	0.3	0.02	0.01	4.08	0.01	0.44	0.01	33.8	0.9

SAMPLE #	NH4 ppm	pH Lab	Si ppm	Std.D. +/-	SiO2 ppm calc	Std.D. +/-	Sr ppm	Std.D. +/-	Zn ppm	Std.D. +/-
PP93-36	0.32	6.62	20.0	0.1	42.8	0.2	0.13	0.01	0.16	0.01

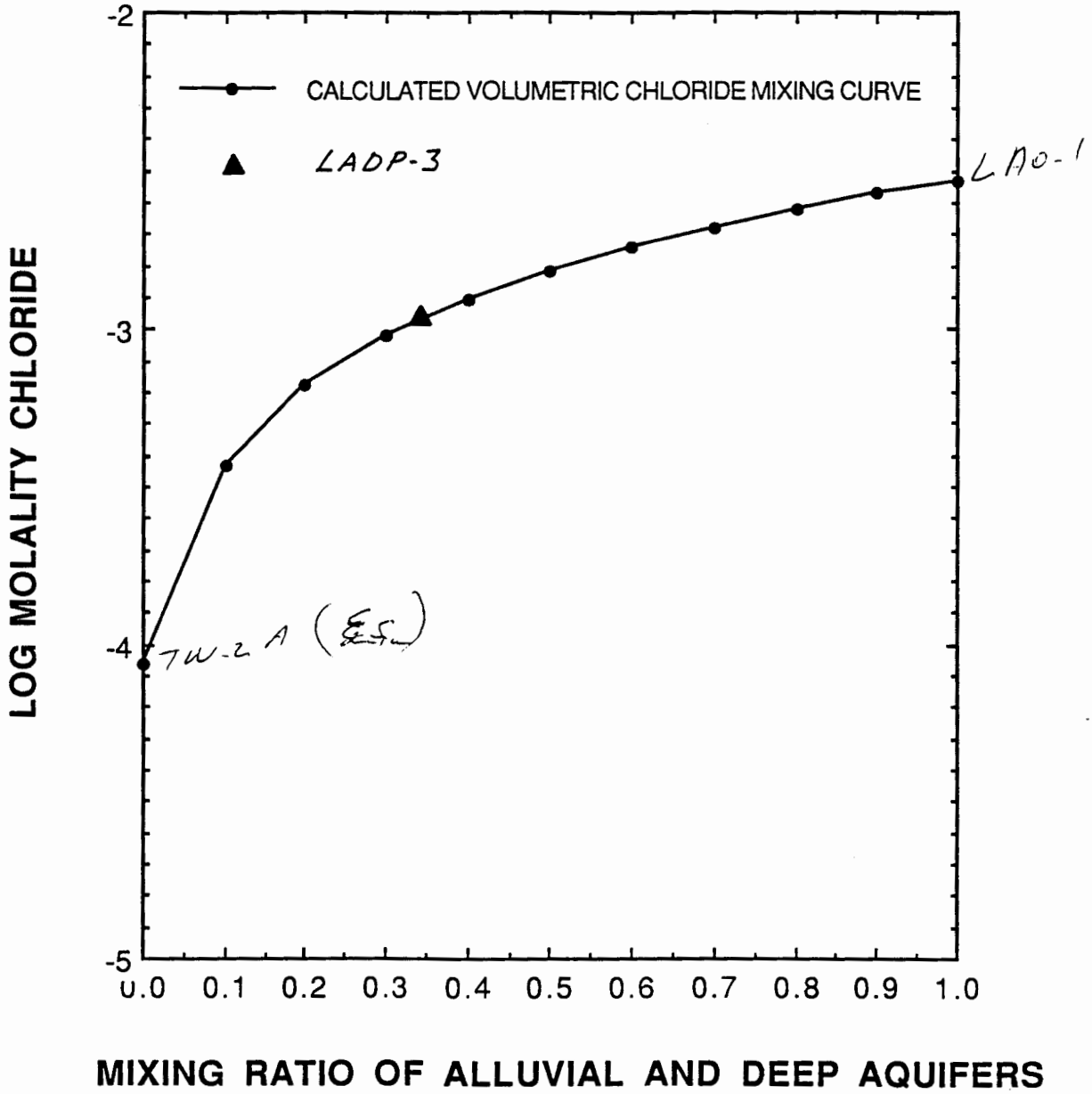
Gary,

Here is as much as I can get out to you this week on water sample PP93-36. The ion chromatograph used for anion determinations will hopefully be operating next week. Also trace elements done by graphite furnace AA will be done later. Some analyses such as Cl^- and As will be repeated later using more optimum methods but these #'s should be fairly close. Dave Broxton said you were interested in alkalinity values on raw and filtered samples. As $CaCO_3$, the Raw = 61.0 ppm and the Filtered = 53.3 ppm.

Please call if you've any questions about the data.

Dale Counce
EES-1
7-1224

LOS ALAMOS CANYON, LOS ALAMOS, NEW MEXICO



EA-18-OU-1106

WESTON
MANAGERS DESIGNERS/CONSULTANTS

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LOS ALAMOS, NM 87544-3023
PHONE: 505-662-6445
FAX: 505-662-6635

FACSIMILE TRANSMITTAL

FAX: 505-662-6635

TO: TERRY DAVIS

Recipient's Telecopy Telephone #: 672-0466

Recipient's Confirmation Telephone #:

FROM: DALE FLORES

Originator's Telephone Number

Total Pages: 6 (Incl. cover sheet)

Original Will:
- ____ Follow via mail
- ____ Follow via messenger
- ____ Follow via overnight service
- ____ Not be sent

(Sent By) DJ FLORES

(Sender's Telephone #) 662-6445

(Date) 12/9/93 (Time) 1705

COMMENTS: TERRY

LET ME KNOW IF THESE ARE NOT REMDABLE OR IF YOU HAVE ANY QUESTIONS.

DALE

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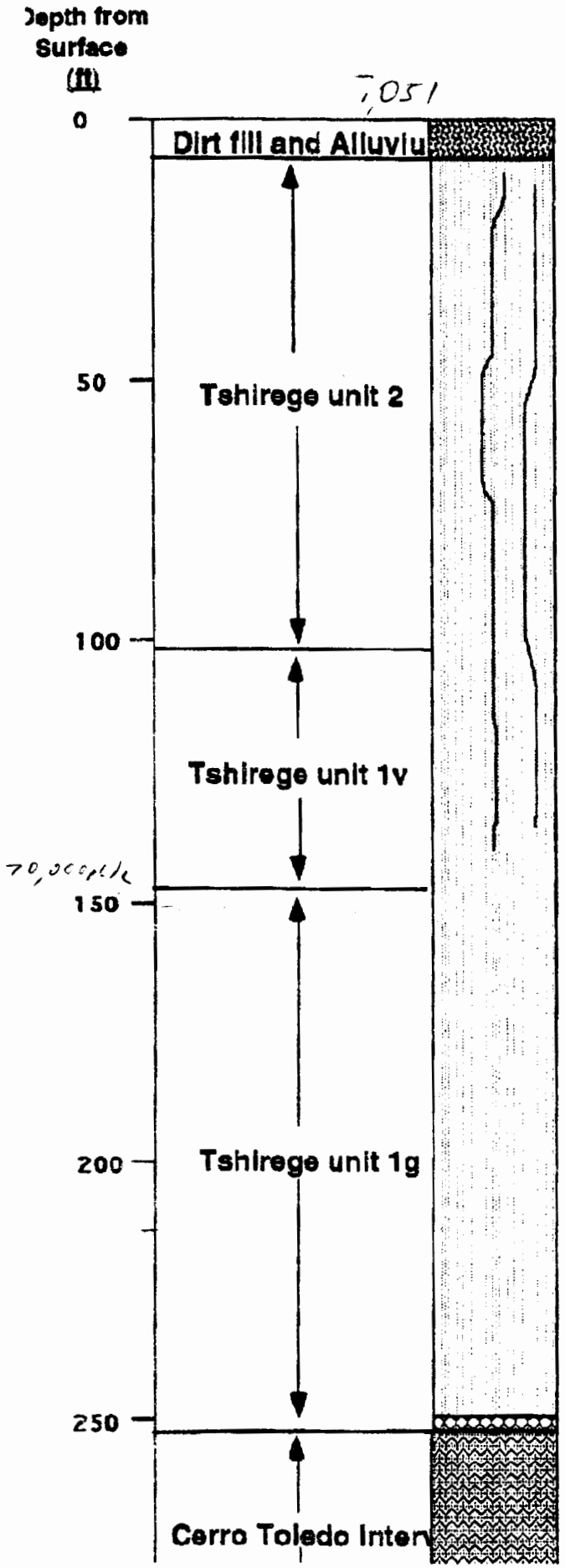
RFW 06-02-008/A-04/93

PRELIMINARY LITHOLOGIC LOG FOR DRILL HOLE LADP-4



Description

Drill pad fill material and alluvial material consisting of silty sand and minor gravels.

Massive, nonwelded to moderately-welded, vapor-phase altered ignimbrite; contains 20-25% light- to medium-gray pumice lapilli in a pinkish-gray to gray matrix; unit exhibits good fracturing.

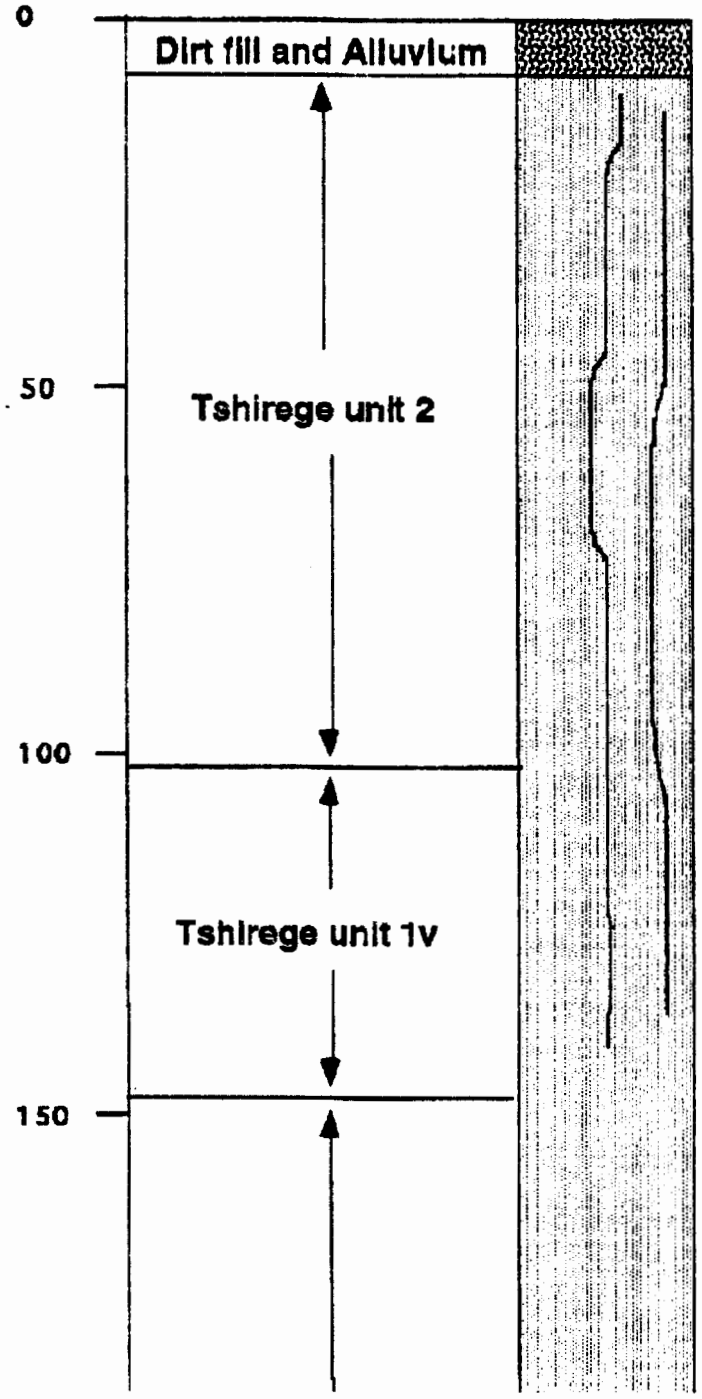
Massive, nonwelded to partially-welded, vapor-phase altered ignimbrite; gray to chocolate brown pumice lapilli in a grayish-white matrix; "vapor-phase notch" forms base of unit from 148 to 151 ft.

Massive, nonwelded, vitric ignimbrite; tuff is poorly indurated and soft; pumice lapilli are medium- to dark-gray and are fibrous; ash-rich surge beds occur at base of unit.

Tsankawi Pumice Bed of the Tshirege Member; light gray, clast-supported pumice fallout deposit. Pumices average 3 cm in diameter, are fibrous, and have vitreous luster.

Stratified alluvial deposits consisting of reworked tuffs derived from Cerro Toledo

PRELIMINARY LITHOLOGIC LOG FOR DRILL HOLE LADP-4

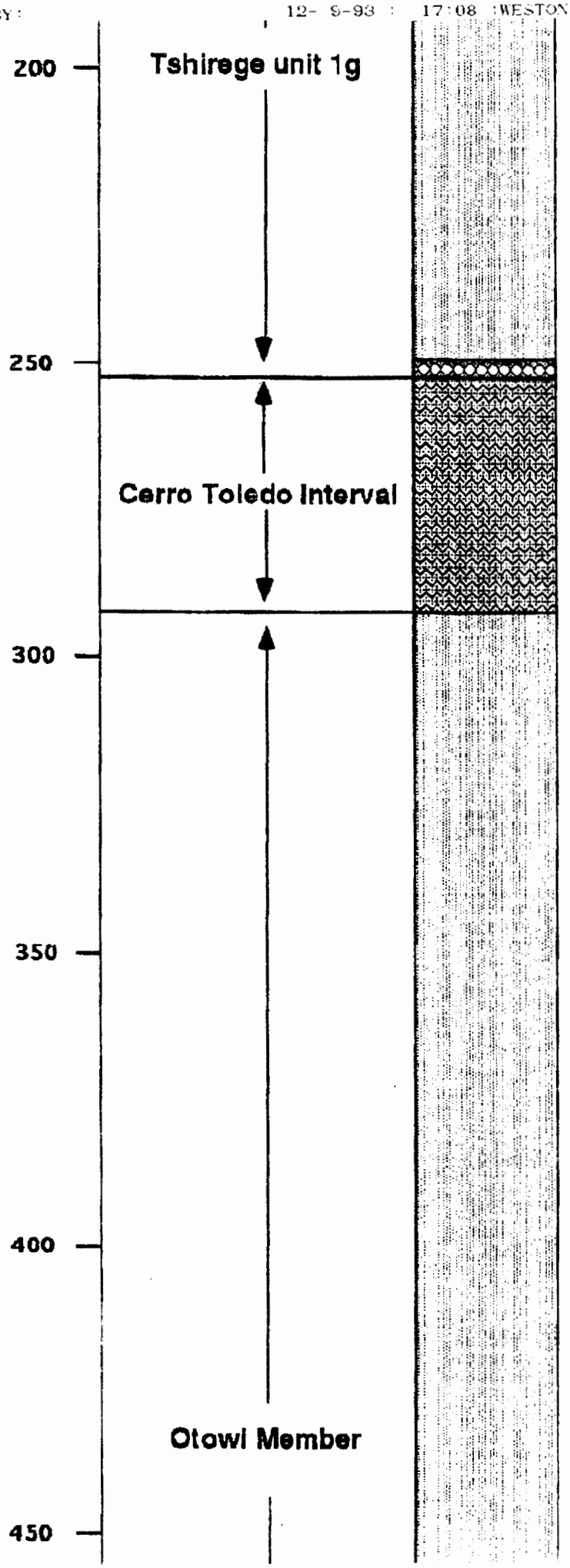


Description

Drill pad fill material and alluvial materi silty sand and minor gravels.

Massive, nonwelded to moderately-we phase altered ignimbrite; contains 20-2 medium-gray pumice lapilli in a pinkish matrix; unit exhibits good fracturing.

Massive, nonwelded to partially-welde altered ignimbrite; gray to chocolate br in a grayish-white matrix; "vapor-phase base of unit from 148 to 151 ft.

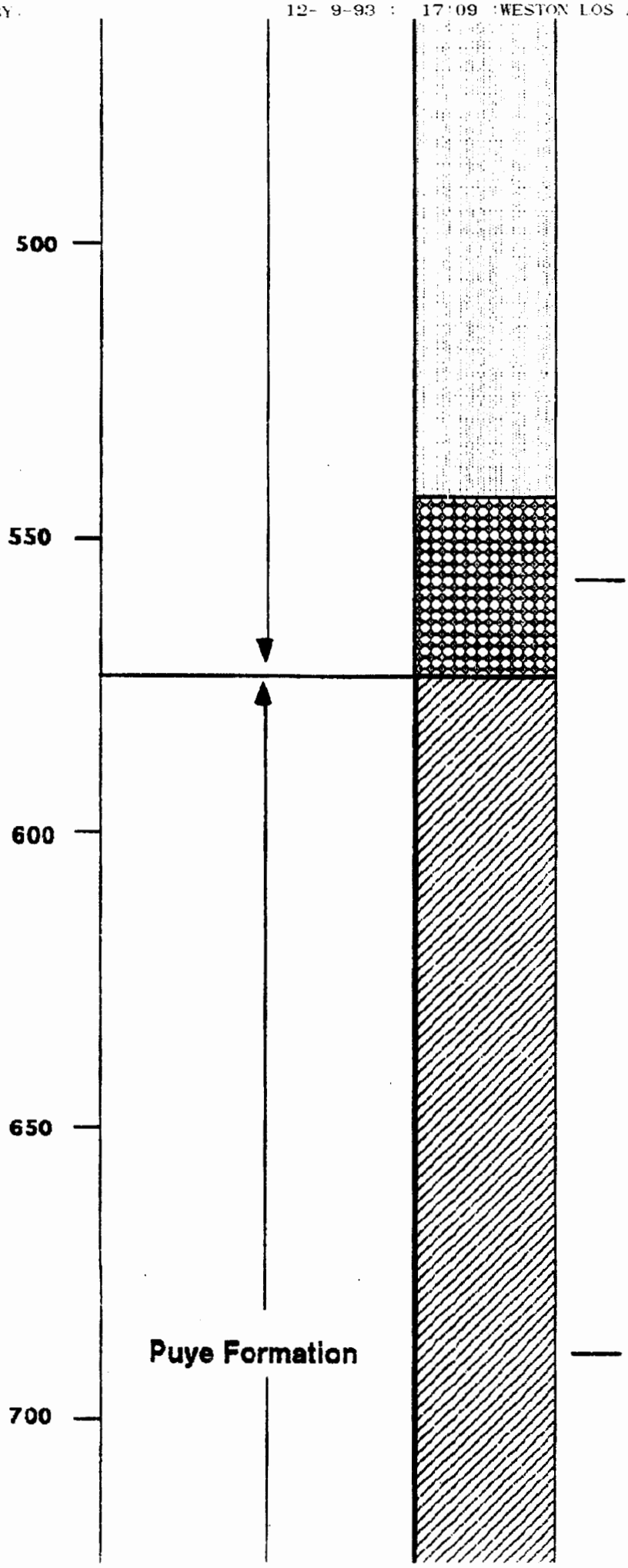


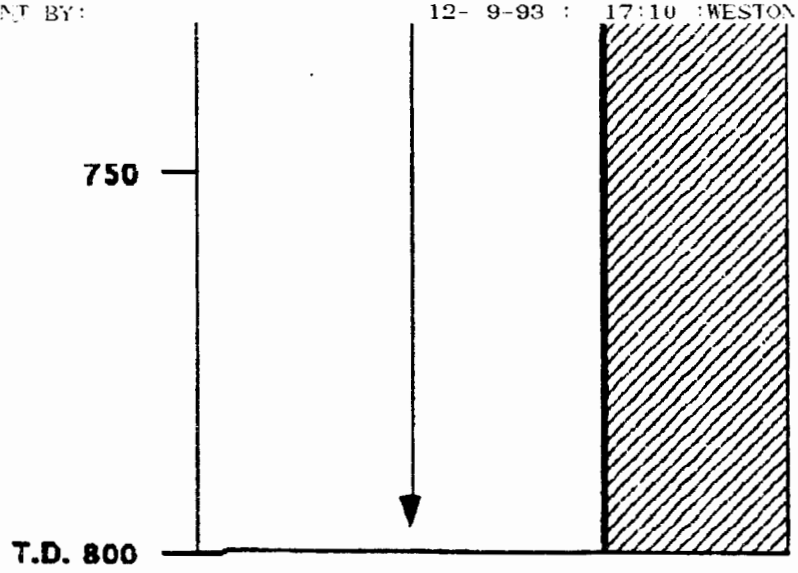
Massive, nonwelded, vitric ignimbrite; t
indurated and soft; pumice lapilli are m
gray and are fibrous; ash-rich surge be
of unit.

Tsankawi Pumice Bed of the Tshirege
gray, clast-supported pumice fallout de
average 3 cm in diameter, are fibrous,
vitreous luster.

Stratified alluvial deposits consisting o
tuffs derived from Cerro Toledo pumic
sands and gravels derived from the Ts
Formation.

Massive, poorly-indurated, nonwelded
contains 15-20% pumice clasts 2 to 5
contains 2-5% lithic clasts, including d
2 cm in diameter.


500
550
600
650
700
Puye Formation
Guaje Pumice Bed; light gray, clast-su
fallout deposit. Pumices average 1-2 c
are fibrous, and have vitreous luster
Gravels in a matrix of sand, silt, and cl
consist of intermediate-composition la
between 700 ft and 800 ft has alternati
moist gravels and slightly moist to dry


750
T.D. 800

OPEN INTERVAL (FT)	TIME AIRLIFTED (MIN)	VOLUME OF WATER RECOVERED (GAL)
321-323	5.5	5.5
321-323	10	5.5
322.5-324.4	10	7
326-328	5	4
328-330 DUYE	5	5.5
330-332	5	5.5
332-335	5	10

EXPLANATION:

OPEN INTERVAL-UNCASED SECTION OF BOREHOLE WHERE WATER WAS AIRLIFTED FROM. MEASURED FROM BOTTOM OF CASING TO BOTTOM OF 7.25IN BOREHOLE.

TIME AIRLIFTED-TIME REQUIRED FOR AIR COMPRESSOR TO BRING BOREHOLE WATER FROM OPEN INTERVAL TO THE SURFACE.

VOLUME RECOVERED-APPROXIMATE VOLUME OF WATER RECOVERED USING 5-GAL BUCKET TO MEASURE.

UPPER BENTONITE SEAL FROM 318.5-315
LOWER SEAL FROM 326-323

COMPILED ON 12-9-93 BY DJ FLORES

321-323

350
Shelby tube ~~from~~ first 2.5 ft. / Then Core

0 DEX to 350

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Records of wells, test holes, springs, and surface-water stations in the Los Alamos area, New Mexico

Compiled by

Edward C. John, Eugene Enyart

and William D. Purtymun

Introduction

The U.S. Atomic Energy Commission, the Los Alamos Scientific Laboratory and the U.S. Geological Survey have jointly conducted investigations of the geology and hydrology of the Los Alamos area related to water supply and to disposal of low-level radioactive effluents. These investigations covering the period 1950-65 required the drilling of many holes, some for special problems, others to obtain data concerning areal geologic and hydrologic characteristics.

Sampling points to obtain quality-of-water data for the ground and surface water of the area were established at several springs and at stations along the streams of the area.

Records of data collected from the holes and sampling points are scattered among several reports, thus they are not always readily available when needed by workers in the area. This report is a compilation and summarization of the geologic and hydrologic data on all wells, test holes, springs, and surface-water sampling points collected to date in the Los Alamos area.

Summary statements on the results obtained from various investigations are included where appropriate to answer questions posed by the stated purpose for which the work was done.

Most of the data presented here for the period since 1950 were collected by the Survey. Prior to 1950, military organizations and private firms conducted investigations of the water resources for public supply; data from these sources have been included in this report.

Location and designation numbers

USGS location number: USGS location numbers used in this report are based on the common system of subdivision of public lands. A number consists of four segments (fig. 1); the first segment denotes

Figure 1. (caption on next page) belongs near here.

the township north of the New Mexico base line; the second segment denotes the range east of the New Mexico principal meridian; the third segment denotes the section within the township; and the fourth segment denotes subdivisions of the section.

A section is considered as being divided into four quarters; 1, 2, 3, and 4 for the northwest, northeast, southwest, and southeast quarters respectively. The first digit of the fourth segment of the location numbers refers to the appropriate quarter of the section, or 160-acre tract. Similarly, each quarter section is divided into four quarters, or 40-acre tracts. The 40-acre tract is divided into 10-acre tracts which are numbered in the same manner as the 160- and 40-acre tracts. Thus location number 19.6.13.344 identifies the data collection point located in SE¼SE¼SW¼ sec. 13, T. 19 N., R. 6 E.

Figure 1.--System of numbering wells in New Mexico

USGS location number (continued)

If more than one data collection point is in a single 10-acre tract, lower case letters (a,b,c, and so forth) are added to the fourth segment to identify the additional points in that tract. Springs and surface-water collection points are identified by addition of the upper case letter S prior to the location number.

The system of subdivision of the public lands was extended arbitrarily into land grants in the Los Alamos area to facilitate well numbering within the boundaries of the grants. This extended land net is shown by dashed lines on Figure 2 of this report.

Figure 2 (caption on next page) belongs near here.

USGS designation: A combination of words, letters, and numbers used to designate the approximate location of a data collection point and the original purpose for which the hole was put down.

AEC and LASL coordinates: Surveyed location on the Los Alamos grid system.

Figure 2.--Map of the Los Alamos area showing location of wells, test holes, and springs.

Definition of terms

Hydrologic terms that have meanings not commonly known or self explanatory are defined below. The reader is referred to Meinzer (1923) and the American Geologic Institute Glossary (1960) for more detailed discussion and definitions not given here.

Aquifer - A formation, group of formations, or part of a formation that is water bearing.

Chief Aquifer - that formation which yields the greater portion of water to a well.

c.f.s. - cubic foot per second (one cfs=449 gallons per minute).

Moisture access tube - a hole 3 to 5 inches in diameter cased with 2-inch diameter plastic pipe through which the moisture content or density of material penetrated by the tube can be determined with a neutron-neutron moisture probe or gamma-ray density probe, and suitable metering equipment.

Perched water - ground water separated from an underlying body of ground water by unsaturated rock.

Potentiometric surface - a surface that everywhere coincides with the head of the water in the aquifer.

Specific capacity - yield of the well in gallons per minute divided by the drawdown in feet.

Test hole - Any exploratory hole drilled for the purpose of obtaining geologic or hydrologic information. A test hole may be utilized for fluid dynamics tests or may never be developed for any use.

Transmissibility - The coefficient of transmissibility is defined as the number of gallons of water per day that will pass through a vertical strip of the aquifer one foot wide and extending the height of the aquifer, under a unit hydraulic gradient, at the prevailing temperature of the water in the aquifer.

Water table - The upper surface or potentiometric surface of a zone of saturation except where that surface is formed by an impermeable body.

Well - An artifical excavation, other than ditches or tunnels, that derives some fluid from the interstices of the rock or soil which it penetrates. Divided by use in this report into public supply, observation, stock, and unused wells.

Use of tables

The tables of this report contain summaries of the data available for individual wells and test holes. The information is in abbreviated form and the following discussions of subject headings explain the abbreviated notations in greater detail for those headings which might not be clear and are not covered under "Definitions".

Method drilled: Method used in drilling well or test hole.

Hydraulic rotary - a method of drilling that is accomplished by rotating suitable tools that cut, chip, or abrade the rock formation. Water or drilling mud is pumped down the drill stem to cool the bit and carry the cuttings to the surface.

Air rotary - a drilling method similar to hydraulic rotary, in which compressed air is pumped down to the bit and carries the drill cuttings to the surface.

Cable-tool - the familiar "percussion" or "churn-drill" method in which a heavy drilling tool is raised and lowered with enough force to chip and abrade the rock. The rock debris suspended in water or mud is removed from the hole with a bailer.

Auger - a method of boring a hole in which the earth materials are raised from the hole along the spiral blades of an auger and thrown away from the hole at the surface by the spinning action.

Method drilled (continued)

Bucket-auger - a method of boring a hole by using a cylindrical bucket type auger that has a hinged blade on the bottom. The cuttings are lifted within the bucket.

Drive-point - a method of making a well (usually shallow and of small diameter) by driving a length of pipe equipped with a sand point and screen to the desired depth.

Dug - a well excavated by hand.

Diameter: Diameter of the smallest casing of a well at the surface.

Use: Current use of a well.

1. Observation - a well used for water-level measurements and/or for collection of water samples for quality of water data.
2. Public supply - a well supplying water for municipal or domestic use.
3. Stock - a well supplying stock water.
4. Unused

Chemical analysis: Analyses by the U.S. Geological Survey unless otherwise noted. Constituents are in parts per million (ppm) unless noted.

Radiochemical analysis: Analyses by the Los Alamos Scientific Laboratory unless noted. Plutonium and gross beta (gamma) reported as disintegrations per minute per liter (d/m/l). Uranium reported as micrograms per liter (μgm/l).

Report source of data: Published and unpublished reports were used to reference the source of data in the tables. Published reports are listed in selected references. The unpublished reports, shown below, are referenced in the tables only when they contain vital information; however, all are listed as they contain hydrologic data that is pertinent to this report.

Unpublished reports

Abrahams, John H., Jr., 1965, Hydrology and the chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, January 1956 through June 1957: U.S. Geol. Survey Admin Rept., 27 p., 6 figs.

Abrahams, John H., Jr., and Purtymun, W. D., 1965, The hydrology and the chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, July 1957 through June 1961: U.S. Geol. Survey Admin. Rept., 45 p., 6 figs.

Black and Veatch, 1946, Report on water supply Los Alamos Project, Los Alamos, New Mexico: Black and Veatch (Consulting Engineers), Admin. Rept. prepared for the U.S. Atomic Energy Commission, 45 p., 4 pls., 3 figs.

_____ 1948, Report on additional water-supply sources, Los Alamos, New Mexico: Black and Veatch (Consulting Engineers), Admin. Rept. prepared for the U.S. Atomic Energy Commission, 110 p., 6 pls., 6 figs.

_____ 1950, Ground-water observation wells, Los Alamos, New Mexico: Black and Veatch (Consulting Engineers), Admin. Rept. prepared for the U.S. Atomic Energy Commission, 28 p., 8 figs.

(18a follows)

Unpublished reports - Continued

Black and Veatch, 1951, Report on existing utility systems Los Alamos, New Mexico: Black and Veatch (Consulting Engineers), Admin. Rept. prepared for the U.S. Atomic Energy Commission: Volume 1, Water Utility, 80 p., 13 figs.

Cooper, J. B., Purtymun, W. D., and John, E. C., 1965, Records of water-supply wells Guaje Canyon 6, Pajarito Mesa 1, and Pajarito Mesa 2, Los Alamos, New Mexico, Basic Data Report: U.S. Geol. Survey Admin. Rept., 92 p., 12 figs.

Griggs, R. L., 1955, Geology and ground-water resources of the Los Alamos area, New Mexico: U.S. Geol. Survey Admin. Rept. to the U.S. Atomic Energy Commission only, 219 p., 17 pls., 17 figs.

Herkenhoff and Associates, 1965, Supplemental water-supply system for technical area FY 1965: Gordon Herkenhoff and Associates (Consulting Engineers), Admin. Rept. prepared for the U.S. Atomic Energy Commission, 4 p., 8 figs.

Purtymun, W. D., 1962, The districution of moisture in the soil and underlying tuff at Technical Area 49, Frijoles Mesa, Los Alamos County, New Mexico: U.S. Geol. Survey Admin. Rept., 37 p., 2 figs.

_____ 1965a, The chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, July 1961 through June 1962: U.S. Geol. Survey Admin. Rept., 18 p., 2 figs.

_____ 1965b, The chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, July 1962 through June 1963: U.S. Geol. Survey Admin. Rept., 6 p., 2 figs.

(18b follows)

Purtymun, W. D., 1965c, The chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, July 1965 through June 1964: U.S. Geol. Survey Admin. Rept., 18 p., 2 figs.

_____ 1965d, Geology and hydrology of White Rock Canyon from Otowi to the confluence of Frijoles Canyon, Los Alamos and Santa Fe Counties, New Mexico: U.S. Geol. Survey Admin. Rept., 27 p., 2 figs.

Turney and Associates, 1962, Long range engineering report for water utility system for Los Alamos, New Mexico, W. F. Turney and Associates (Consulting Engineers): Admin. Rept. prepared for the U.S. Atomic Energy Commission, 90 p., 28 figs.

Weir, J. E., Jr., Abrahams, John H., Jr., Waldron, J. R., and Purtymun, W. D., 1962, The hydrology and the chemical and radiochemical quality of surface and ground water at Los Alamos, New Mexico, 1949-55: U.S. Geol. Survey Admin. Rept., 40 p., 9 figs.

Weir, J. E., Jr., and Purtymun, W. D., 1962, Geology and hydrology of Technical Area 49, Frijoles Mesa, Los Alamos County, New Mexico: U.S. Geol. Survey Admin. Rept., 229 p., 74 figs.

Geology and hydrology

A brief description of the geology and hydrology of the area is included in this report as background material. The reader is referred to a report by Griggs (1964) for a more detailed discussion of the geology of Los Alamos County.

The rock units described in this report, from oldest to youngest, are: the Santa Fe Group of middle(?) Miocene to Pleistocene(?) age, the volcanic rocks of the Jemez Mountains of Pliocene and Pleistocene age, and the alluvium and soil of Recent age. Their generalized stratigraphic relations are shown on Figure 3.

Figure 3 (caption on next page) belongs near here.

Figure 3.--Diagrammatic cross section showing generalized stratigraphic relation of rocks in the Los Alamos area.

Santa Fe Group

The Santa Fe Group, in ascending order, consists of the Tesuque Formation, the Puye Conglomerate, and basaltic rocks of Chino Mesa.

The Tesuque Formation is a sequence of light-colored sediments laid down as coalescing alluvial-fan and flood-plain deposits in the Rio Grande depression. These sedimentary rocks were derived from highlands to the north, and possibly in part, from the Sangre de Cristo Mountains to the east. The separate beds are composed of friable to moderately well-cemented, light-pink-gray to light-brown siltstone and sandstone that contain lenses of conglomerate and clay. Bedding generally is poorly developed except locally in fine-grained material.

The Puye Conglomerate consists of two members. The lower member, the Totavi Lentil, is a poorly consolidated, channel-fill deposit. The fanglomerate member overlies the Totavi Lentil and is composed of volcanic debris.

The Totavi Lentil of the Puye Conglomerate overlies the Tesuque Formation disconformably along the Rio Grande and noncomformably in Los Alamos and Guaje Canyons. It is a gray, poorly consolidated conglomerate consisting of fragments of quartzite, schist, gneiss, and granite ranging in size from sand to boulders; well-sorted lenses of silt and sand are present sporadically. The materials making up the conglomerate were derived principally from igneous and metamorphic rocks to the north and northeast. They were deposited on a broad flood plain and in channels of the ancestral Rio Grande. A zone near the top of the Totavi Lentil is composed of a mixture of pegmatitic rocks and volcanic debris. This mixed zone represents a change in source of sediments from igneous and metamorphic terrane to the north to the igneous and volcanic terrane to the west.

The fanglomerate member of the Puye Conglomerate conformably overlies the Totavi Lentil; it is generally gray and composed of pebbles, cobbles, and boulders of rhyolite, latite, quartz latite, and pumice in a matrix of silt and sand. These rocks were derived from flows associated with the volcanic rocks of the Jemez Mountains. Sorting is poor, but tongues and lenses of fairly well-sorted pumiceous siltstone and water-lain pumice are present within the fanglomerate. The degree of cementation varies from friable to well-cemented. In upper Guaje and Los Alamos Canyons, the fanglomerate member consists of angular boulders; eastward it grades to silt, sand, gravels, and rounded boulders.

The basaltic rocks of Chino Mesa consist of five mappable units which originated from volcanic vents near Chino Mesa southeast of the Los Alamos area (Griggs, 1964, p. 37-41). The lower unit (unit 1) lies unconformably on the Tesuque Formation south of Ancho Canyon and interfingers unconformably with the Totavi Lentil north of Ancho Canyon, along the Rio Grande. The upper flows of unit 1 are conformable on the Totavi. To the west, beneath the Pajarito Plateau, unit 1 and unit 2 interfinger with the fanglomerate member. The middle unit (unit 3), which consists of a series of flows deposited in an old river channel, crops out in lower Los Alamos, Sandia, and Mortandad Canyons west of the Rio Grande.

Flows of unit 4 cap the mesas south of Los Alamos Canyon. They rest unconformably on the Puye Conglomerate and the Tesuque Formation and butt against unit 3 in lower Los Alamos Canyon. Unit 5 is composed of cinder cones and local basalt flows that crop out in secs. 13 and 24, T. 18 N., R. 6 E., and lie unconformably on the underlying rocks.

Volcanic rocks of the Jemez Mountains

Volcanic rocks of the Jemez Mountains along the eastern flanks of the Sierra de los Valles and on the Pajarito Plateau consist of the Tschicoma Formation and the younger Bandelier Tuff.

The Tschicoma Formation is composed of undifferentiated latite and quartz latite flows and pyroclastic rocks that are highly fractured and jointed; some intervals contain weathered zones and interflow breccia.

The Bandelier Tuff is composed chiefly of ashfall and ashflow tuff and some thin, water-lain sediments. The formation has been divided (Griggs, 1964, p.47-56) into three members: Guaje, Otowi, and Tshirege, from oldest to youngest

The Guaje Member of the Bandelier Tuff is an ashfall pumice and water-laid pumiceous tuff that rests unconformably on older rocks. The base of the unit contains gray lump-pumice fragments as much as 2-inches in length. Glass shards and crystals of quartz and sanidine are present in the cellular structure of partly devitrified pumice. Rounded, pebble-size fragments of light-red rhyolite are present near the top.

The Otowi Member of the Bandelier Tuff is a light-gray, nonweldei, pumiceous rhyolite tuff that weathers to a gentle slope; it is conformable with the underlying Guaje. Quartz crystals, glass shards, minor amounts of mafic minerals, and varying amounts of rhyolite, latite, and pumice fragments included in a fine-grained ash compose the tuff. Most of the rock fragments are rounded. The Otowi consists of ashflows primarily but it contains several beds of silt and water-laid pumice near the top.

The Tshirege Member of the Bandelier Tuff, is composed of a series of ashflows of rhyolite tuff that contains at least one thin, water-laid bed near the top. The Tshirege unconformably overlies the Otowi and forms the caprock of the fingerlike mesas of the Pajarito Plateau. The rhyolite tuffs range from nonwelded to welded. The thin, water-laid bed is composed of material derived from the underlying tuff.

Alluvium and soil

Alluvium from the Sierra de los Valles and the Pajarito Plateau has been deposited in the canyons of the plateau. Near the heads of the canyons bedrock commonly is exposed in the lower parts; but further down the canyons alluvium may be several hundred feet wide and as much as 80 feet thick.

Alluvial deposits in the canyons heading on the flanks of the Sierra de los Valles contain cobbles and boulders with accompanying clay, silt, sand, and gravel derived from the Tschicoma Formation and Bandelier Tuff. Deposits in the canyons heading on the Pajarito Plateau contain clay, silt, sand, and gravel derived from the Bandelier Tuff.

Clayey soil derived from weathering of the Bandelier Tuff covers most of the fingerlike mesas of the Pajarito Plateau.

Structure

The Rio Grande depression is a structurally low area that constitutes the valley through which the Rio Grande flows (Kelley, 1952, p.93-105). The Pajarito Plateau is part of the depression although it forms a topographic high area along the western margin of the valley.

A faulted part of the area called the Pajarito fault zone trends northward along the flanks of the Sierra de los Valles and the western edge of the Pajarito Plateau. Movement along the fault zone has caused the Bandelier Tuff to be downdropped against the Tschicoma Formation. The fault zone consists of several en echelon normal faults that are downthrown to the east. Northeast of the town of Los Alamos two normal faults are downthrown to the west and form a garben-like depression. The outcrop of Tschicoma Formation in Pueblo Canyon in the western part of sec. 3, T. 19 N., R. 6 E. is an indication of this northerly-trending fault zone.

A small depositional basin lies between the Pajarito fault zone and the basaltic rocks of Chino Mesa beneath the Pajarito Plateau (fig. 3). The basaltic rocks of Chino Mesa originated as flows from volcanic centers east of the Rio Grande; flowed northward, northwestward, and westward, and filled channels cut into the older sediments. The thick flows moved westward across the present position of the Rio Grande south of Sandia Canyon to Frijoles Canyon to form the edge of the small basin or trough. The eastern edge of the northerly-trending basin is 2 to 4 miles west of the river and the basin is filled with volcanic debris.

The Bandelier Tuff was extruded from volcanic centers to the northwest and west. It is thickest along the central and western edges of the plateau and thins eastward toward the Rio Grande. The upper ashflows of the Bandelier dip gently eastward toward the river at 1 to 2 degrees.

Surface water.

Rito de los Frijoles is the only perennial stream in the Los Alamos area that crosses the Pajarito Plateau and discharges into the Rio Grande. The upper reaches of Los Alamos and Guaje Canyons contain naturally perennial streams; but the perennial flow in the upper and mid-reach of Pueblo Canyon and Sandia Canyon results from the discharge of treated sewage. Only during periods of abnormally great precipitation do the intermittent streams which cross the Pajarito Plateau carry water to the Rio Grande.

The Rito de los Frijoles is fed by streams in canyons cut into the flanks of the Sierra de los Valles. The average discharge in Frijoles Canyon at the Pajarito fault zone averages about 1.5 cfs (cubic feet per second). Seepage runs in Frijoles Canyon indicate that the Rito de los Frijoles is a gaining stream on the upthrown (western) block of the fault which is underlain by the Tschicoma Formation at shallow depth, and is a losing stream on the downthrown block which is underlain by the Bandelier Tuff. The Tschicoma Formation at shallow depth west of the fault has a relatively low permeability allowing little infiltration from the stream.

The base flows in the upper reaches of the major canyons (Guaje, Los Alamos, Pajarito, Canonde Valle, and Water Canyons) discharge from perched water zones in the rocks of the Tschicoma Formation and the Bandelier Tuff. The average discharge at Guaje reservoir (about 4 miles northwest of Los Alamos) is generally less than 1 cfs, and the average discharge near Los Alamos Canyon reservoir (NE$\frac{1}{2}$ sec. 13, T. 19 N., R. 5 E projected) is generally less than 0.5 cfs.

The effluent from two full treatment sewage plants discharges to Pueblo Canyon and sustains the average flow of about 2 cfs from September through April and about 0.7 cfs from May through August near the eastern edge of sec. 9, T. 19 N., R. 6 E. The stream flows for a distance of about 5 miles below the discharge point but the water does not reach the Rio Grande as surface flow.

An average of about 100,000 gpd (gallons per day) of treated sewage and cooling water from the power plant is discharged into Sandia Canyon near the western edge of sec. 16, T. 19 N., R. 6 E. This discharge sustains flow in the stream channel for a distance of about 4 miles in the summer months.

Ground water

The main aquifer in the Los Alamos area is in the Santa Fe Group. The potentiometric surface (fig 3) rises from the Rio Grande westward through the Tesuque Formation into the lower part of the Puye Conglomerate which interfingers with the Tschicoma Formation. The position of the potentiometric surface in the Tschicoma Formation is not known beneath the western edge of the plateau. Brecciated zones within the Tschicoma Formation may contain water but where encountered in wells such zones have not yielded more than 5 to 10 gpm.

The gradient of the potentiometric surface beneath the Pajarito Plateau averages about 70 feet per mile. The depth to the main aquifer varies from about 1,200 feet along the western edge of the plateau to about 600 feet at the confluence of Pueblo and Los Alamos Canyons. Water in the aquifer moves eastward toward the Rio Grande where some water is discharged through springs in the channel and along the banks (fig. 2).

Ground water is perched in the alluvium at some places in Pueblo, Mortandad, and Los Alamos Canyons, and probably is perched seasonally in the upper parts and perenially in the lower parts of other canyons which receive seasonal runoff from the Pajarito Plateau and the Sierra de los Valles.

Supply wells

Growth of Los Alamos has been paralleled by increased water demand for residential and industrial uses. Originally surface-water sources were used for public water supply. A larger and more dependable source of water was developed by drilling wells in Los Alamos Canyon and in Guaje Canyon. New water-supply wells are currently being developed southeast of Los Alamos on the Pajarito Plateau. Approximately 16 wells now provide an average of 3 million gallons of water per day for domestic supply, and industrial use. Geologic, hydrologic, and construction data of these wells are presented in table 1 to 16. Locations are shown on figure 2.

Otowi-4

Elevation - 6627 ft, Total Depth - 2806 ft (3820 ft elev.)

Log	Depth	Thickness	Top Elevation
Alluvium (water encountered @ 23.5')	0-28	28	6627
Otowi Member,? Bandelier Tuff	28-183	155	6599
Guaje Member,? Bandelier Tuff			
Puye Fm Fanglomerate Member (water encountered @ 253 ft, 6374 elev.)	183-290	107	6444
Basalt Rx	290-413	123	6337
Puye Fm Fanglomerate Member	413-712	299	6214
Puye Fm Totavi Lentil (water encountered @ 780 ft, 5847 elev.)	712-810	98	5915
Tesuque Fm	810-1154	344	5817
Basalt	1154-1347	193	5413
Tesuque Fm	1347-1421	74	5280
Basalt	1421-1465	44	5206
Tesuque Fm	1465-1852	387	5162

FIMAD only note Bandelier Tuff from 6579 to 6499

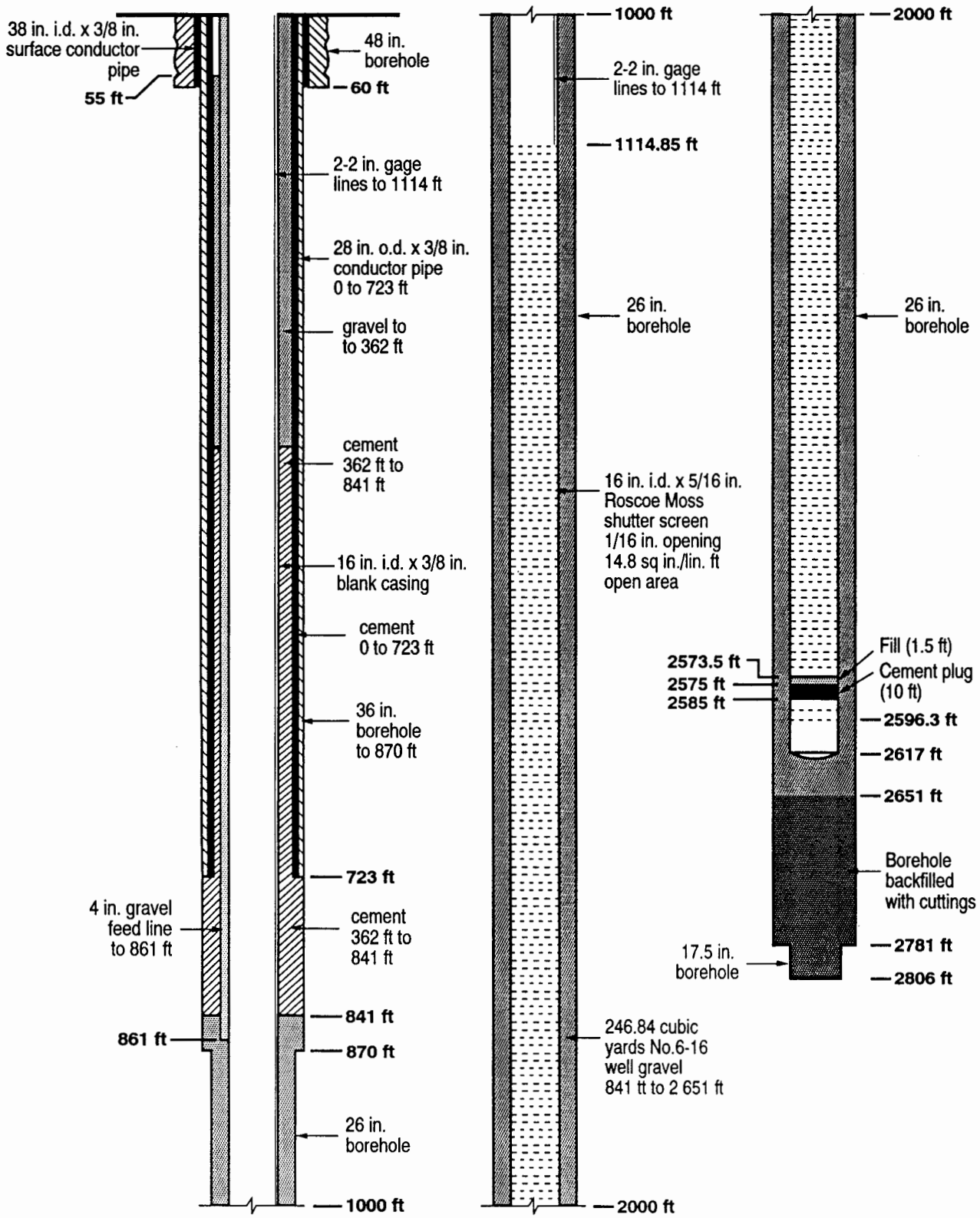

Fig. 7. Well Construction of Well Otowi-4.

PM-2

G.L. Elevation - 6715 ft; TD - 2600ft.; 4115 ft Elev
drilled (1965); depth to water 823 ft; 5892 ft elev.

Log	Depth	Thickness	Top Elevation
Alluvium	0-30	30	
Tshirege Member, [illegible] Bandelier Tuff (Gardner, 1993)	30-105	105	6685
Tsankawi Pumice Bed?	?		
Cerro Toledo Rhyolite	?		
Otowi Member, Bandelier Tuff (water @ 335 ft; 6380)	105-405	300	6610
Guaje Member, Bandelier Tuff	405-432	27	6310
basalt	432-700	268	6283
Puye Fm	700-738	38	6015
basalt	738-770	32	5977
Puye Fm	770-1000	230	5945
Puyemen Tetuvilcat.) missing log	1340-1410		5375 - 5305
basalt	2218-2312		4497
Santa Fe Gp Chanita Fm?	2312-2600		4403

source: descriptive log of well cuttings (Logs [illegible])

Table 1.—Supply well [illegible]

USGS Location No. 19.6.36.113 USGS Designation [illegible]-2 (Pajarito Mesa - 2)

ABC Coordinates _____ ABC Designation _____

Driller [illegible] Inc. Address [illegible]

Topography Floor of Pajarito Canyon Altitude 6,715 feet

Method drilled Hydraulic Rotary Diameter 14 inches Use Public Supply

Drilled depth 2,600 feet Completed depth 2,300 feet

Date drilled July 1965 Chief Aquifer(s) Puye Conglomerate and Tesuque Formation

Depth to water 825 feet Date July 6, 1965 Transmissibility 80,000 gpd/ft

Specific capacity 24 gpm/ft After 24 hours of pumping 1,200 gpm

Logs:

	Thickness	Depth
Alluvium	30	30
[illegible]		
[illegible]	375	405
[illegible]	27	432
[illegible]		
[illegible]	268	700
[illegible]		
[illegible]	640	1,340
[illegible]	70	1,410
[illegible]	1,190	2,600

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
[illegible]	0- [illegible]	
14	0-2,300	[illegible] from 0-[illegible] steel, closed [illegible] 5/32-inch [illegible] openings 1,[illegible] 2,300 feet

Chemical Analysis[1/]: Constituents in parts per million

Date [illegible], Temp. [illegible], SiO [illegible], Fe [illegible], Ca [illegible]

Mg [illegible], Na [illegible], HCO_3 [illegible], CO_3 [illegible], SO [illegible], Cl 3.5

F [illegible], NO [illegible], Hardness [illegible]; Dissolved solids [illegible]

Specific conductance 68[illegible] micromhos, pH 7.6

Radiochemical analysis: Date [illegible], Ra [illegible] c/m/l, U [illegible] µg/l

Gross β (Beta) [illegible] c/m/l

Report source of data: [illegible]

Remarks: [illegible]

1/ Analysis by Los Alamos Scientific Laboratory

Table 2.--Supply well G-5

USGS Location No. 19.7.1.133 USGS Designation G-3 (Guaje 3)

AEC Coordinates [illegible] AEC Designation

Driller Texas Water Wells Inc. Address Houston, Texas

Topography Floor of Guaje Canyon Altitude 6,139 feet

Method drilled Hydraulic Rotary Diameter 12 inches Use Public Supply

Drilled depth 1,996 feet Completed depth 1,792 feet

Date drilled July 1951 Chief Aquifer(s) Tesuque Formation

Depth to water 280 feet Date July 1951 Transmissibility 7,500 gpd/ft

Specific capacity 4.5 gpm/ft After 14 years of production (1965)

Log:	Thickness	Depth
Alluvium	17	17
Pure Conglomerate:		
Basaltic Rubble	41	58
Tuffaceous Rubble	52	110
Tesuque Formation	1,886	1,996

Basalts at 981 to 956 feet and 1,008 to 1,090 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12 in	0- 705	With 140 feet of torch cut slots.
10 in	705-1,800	With 260 feet of torch cut slots.

Chemical analysis: Constituents in parts per million.

Date April 1, 1964, Temp. 82 °F, SiO_2 56, Fe .02, Ca 13,

Mg 2.1, Na + K 25, HCO_3 105, CO_3 0, SO_4 4.8, Cl 5.0,

F .5, NO_3 .9, Hardness 41, Dissolved solids

Specific conductance 172 micromhos, pH

Radiochemical analysis: Date [illegible], Ra <0.4 d/m/l, U 1.2 µg/l,

Gross β (Gamma) 5.4 d/m/l

Report source of data: Griggs, R. L., 1959 and 1964

Remarks: Electric logs available.

Pajarito Mesa well 2

The last well drilled in 1964-1965 is in Pajarito Canyon a few hundred feet east of a technical area known as Pajarito site. The general location of this well was stipulated by the Atomic Energy Commission to be between the confluence of Twomile Canyon and Pajarito Canyon on the west and White Rock on the east. The site in Pajarito Canyon chosen for the well was suggested by the Geological Survey following a study of the area. (Purtymun and John, 1964.)

A descriptive log of drill cuttings from the pilot hole of Pajarito Mesa 2 supply well is given in table 7. Electric logs are shown on figures 9, 10, 11, and 12. Table 8 contains the construction record of

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Figure 9.--Temperature log of Pajarito Mesa well 2.

Figure 10.--Gamma Ray-Neutron log of Pajarito Mesa well 2.

Figure 11.--Induction-electrical log of Pajarito Mesa well 2.

Figure 12.--Microlog (with caliper) of Pajarito Mesa well 2.

Pajarito Mesa well 2; table 9 contains records of pumping tests made on the finished well.

Table 7 .--Descriptive log of drill cuttings from Los Alamos supply well, Pajarito Mesa 2, Pajarito Canyon.

Location: SW$\frac{1}{4}$NW$\frac{1}{4}$NW$\frac{1}{4}$ sec. 36, T. 19 N., R. 6 E., Los Alamos County, New Mexico.

Altitude: 6,715 feet above sea level datum.

Total depth: 2,600 feet (pilot hole).

Date drilled: 1965.

Tools: Cable-tool to 617 feet. Mud rotary 617-2,600 feet.

Driller: Layne-Texas Co., Inc., Houston, Texas.

Material	Thickness (feet)	Depth (feet)
Alluvium:		
Boulders and clay, boulders of latite as large as 12 inches and grayish-brown clay; some sand and gravel----------	7	7
Sand and gravel, sand is light-gray, fine-to-coarse and composed of crystals and fragments of sanidine and quartz; gravel is fine-to-coarse and composed of latite and tuff-------	23	30
Bandelier Tuff, Otowi Member:		
Tuff, buff, silty, consists mostly of sanidine and quartz crystals, many fragments of rhyolite and latite, trace of pumice near 105 feet----	95	125

Table 7 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Bandelier Tuff, Otowi Member - Continued		
Tuff, mostly crystals of sanidine and quartz with rhyolite and latite fragments; much white and tan pumice----------	40	165
Tuff, light-gray, consists of crystals and fragments of sanidine, quartz, and glass and many brown and gray rhyolite fragments to 1/8 inch----------	60	225
Pumice, buff----------	10	235
Tuff, crystals and fragments of sanidine, quartz, glass in sand-size grains and gravel of rhyolite, latite, and basalt, much white pumice--------	65	300
Pumice, light-gray to tan----------	15	315
Tuff, crystals and fragments of sanidine, quartz, glass and dark volcanic rocks with much white pumice (show of water at 335 feet)-----	30	345
Tuff, gray, composed of sand-size grains of sanidine, quartz, and glass crystals and many gravels of rhyolite and latite, trace pumice----------	45	390
Tuff, crystals and fragments of sand-size sanidine, quartz, and glass----------	15	405

Table 7 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Bandelier Tuff, Guaje Member:		
Pumice, light-tan to light-gray, lumps as large as 1/4 inch----------	27	432
Unit 3 of basaltic rocks of Chino Mesa:		
Basalt, black, dense, with some iron-staining, trace tan clayey silt, minor olivene, pyrite, and white crystalline material----------	73	505
Basalt, dark reddish-brown and dark-gray, dense----------	10	515
Basalt, dark-gray, dense with buff, clay and silt (caliper log indicates a zone of lost circulation 522-534 feet)----------	15	530
Basalt, dark-gray to black, vuggy, trace olivene----------	15	550
Basalt, scoria, dark-gray to reddish-brown, vuggy, trace buff clay (caliper log indicates a zone of lost circulation 546-564 feet)------	20	570
Basalt, gray to greenish-gray, granular to fine-grained glassy structure, much olivene and feldspar crystals----------	20	590
Basalt, black, brown, and red, vuggy, contains scoria----------	15	605
Basalt, dark grayish-red, dense, trace olivene and feldspar crystals----------	12	617

Table 7 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Unit 3 - Continued		
Basalt (no samples. Electric logs and driller's logs indicate this interval to be basalt. Hole was drilled without circulation.)----------	83	700
Puye Conglomerate, Fanglomerate Member:		
Conglomerate (no samples. Electric logs and driller's logs indicate this interval to be conglomerate. Hole was drilled without circulation.)----------	30	730
Conglomerate, sand is fine-to-coarse, quartz, frosted and rounded; gravel is mostly latite, much basalt----------	4	734
Basalt, dark-gray, dense----------	4	738
Conglomerate, as 730 to 734 feet----------	20	758
Basalt, as 734 to 738 feet----------	12	770
Conglomerate, greenish-gray, sand is fine-to-coarse, subrounded-to-rounded frosted quartz and subrounded-to-subangular basalt and latite; gravel sizes are subangular-to-subrounded basalt and latite; contains crystals and fragments of sanidine, quartz, and glass-----	230	1,000

Table 7 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Conglomerate, sand is grayish-pink, subangular-to-subrounded quartz; gravel is subrounded quartz and quartzite and a few gravels of vuggy basalt----------	292	1,840
Basalt, black to dark-gray, coarse crystalline with gray to green waxey clay filling some vugs and some vug lining of white crystals---	52	1,892
Sand and gravel, mostly sand-sized grains of fine-medium subrounded quartz, some subrounded gravels of basalt and latite, many chips of basalt. Interval may contain thin basalt flows----------	216	2,108
Conglomerate, sand, well-sorted, fine-to-coarse, and subrounded gravels of latite and quartzite----------	110	2,218
Basalt, brown, red, and black, weathered appearance, contains clay and white crystals in vugs----------	94	2,312

Table 7.--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Sand, grayish-pink, very fine-to-medium, subangular-to-subrounded, quartz, contains tan and cream clay and a few rounded basalt gravels--------	58	2,370
Sand, as 2,312 to 2,370 feet but coarser grained with white clay----------	40	2,410
Sand, grayish-pink, coarse-to-very coarse, rounded-to-subrounded, quartz, some white and tan clay----------	50	2,460
Clayey sand, fine-to-coarse sand with much white and tan clay----------	30	2,490
Clay, tan to white, sandy----------	20	2,510
Clayey sand, as 2,460 to 2,490, contains much basalt (possible basalt layer at 2,506 to 2,508 according to electric logs)----------	20	2,530
Sand, pinkish-gray to tan, fine-to-coarse, subangular-to-subrounded quartz and white to tan clay----------	70	2,600

Note: Sample obtained from bottom of drill bit after removal from hole at 2,600 feet is tan sandy clay and subangular fragments up to 1 inch of dark-gray, hard, structureless, very fine silty, non-calcareous shale. Exterior of shale fragments have lining of calcareous material on weathered surface.

Table 7 .--Descriptive log of drill cuttings - Continued

Note: Samples of the drill cuttings were collected by the contractor at 5-foot intervals from 0 to 617 feet and at 10-foot intervals from 617 to 2,600 feet. These samples were then washed by the Geological Survey and studied under the binocular microscope. The samples were described dry. Thickness and depth intervals of drill cutting samples have been correlated with data interpreted from electric logs and driller's logs.

Table 8 .--Construction record of Los Alamos supply well, Pajarito Mesa 2, Pajarito Canyon

Total depth: 2,300 feet

Date completed: July 1965

Casing and hole record: 30-inch hole from 0 to 504 feet. Cased with 26-inch ID pipe, cemented in hole.

24-inch hole from 504 to 2,300 feet. Cased with 14-inch ID blank pipe from 0 to 1,004 feet and with 14-inch ID pipe slotted with 3/32-inch louver openings from 1,004 to 2,300 feet.

Annulus between 14-inch pipe and 24-inch hole filled from 2,300 to 0 feet with washed and graded gravel ranging in size from about 1/32-inch to ¼-inch.

Gage lines: Two steel-pipe gage lines each of 2-inch diameter installed on outside of 14-inch pipe and enter pipe at a depth of 1,000 feet. An airline will be installed in one gage line; the other is used for entry of mechanical water-level measuring devices.

Well development: The well was swabbed for 102 hours and bailed for 44 hours. Further development consisted of pumping for 74 hours at rates of 600 to 1,470 gpm.

Yield: Data obtained during the pumping phase of well development indicated that the optimum yield of the well is about 1,200 gpm. Specific capacity was determined to be about 24 gpm per ft of drawdown.

Table 9 .--Record of pumping test., Los Alamos supply well Pajarito Mesa 2, Pajarito Canyon, July 6-7, 1965

Test made by J. B. Cooper, U.S. Geological Survey and B. G. Hammock, Gordon Herkenhoff and Associates. Depth to water measured with electric measuring line.

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Remarks
7-6-65				
0845	-	826.8	-	Static water level
0854	-	-	-	Pump on
	1	830.8	-	Depth to water meas-
	3	832.9	-	urements between
	6	831.1	1,162	1 and 32 minutes are
	11	830.95	-	erratic and probably
	20	851.6	1,218	inaccurate. Gage
				line appears to be
				dirty and oily.
	32	870.0	-	Washed out gage line.
	54	870.2	-	Temp. F 73°.
0945	-	-	1,218	-
0956	62	870.8	1,218	-
1019	85	871.2	1,218	-
1033	99	871.1	1,218	-
1058	124	872.6	1,218	-
1129	155	872.6	1,209	-
1200	186	872.4	1,218	-

Table 9.--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Remarks
7-6-65				
1230	216	872.5	1,218	-
1300	246	872.5	1,218	-
1305	251	875.4	1,218	-
1330	276	876.0	1,227	Temp. F 73°
1400	306	875.9	1,218	-
1430	336	876.1	1,218	-
1500	366	876.3	1,218	-
1600	426	876.4	1,209	-
1630	456	876.7	1,209	-
1705	491	872.4	1,200	-
1730	516	872.1	1,209	-
1745	531	872.1	1,209	Temp. F 73.5°
1800	546	872.1	1,209	-
1801	-	-	-	Decrease discharge
1815	-	-	990	-
1830	-	-	1,094	-
1845	-	870.0	1,043	-
1900	-	871.0	1,043	-
1930	-	871.1	1,043	-
2000	-	871.1	1,043	-
2030	-	871.1	1,043	-
2100	-	870.8	1,022	Decrease discharge

Table 9.--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Remarks
7-6-65				
2104	-	864.4	838	-
2130	-	863.7	851	-
2200	-	863.4	851	Decrease discharge
2205	-	856.4	617	-
2230	-	856.0	666	-
2300	-	856.2	650	Pump off
2310	-	-	-	Pump on
2317	-	881.9	1,461	-
2330	-	883.5	1,461	-
2345	-	886.5	1,476	-
2400	-	883.5	1,476	-
7-7-65				
0015	-	882.8	1,476	Pump off
0030	-	831.05	-	Recovery measurements
0045	-	831.00	-	-
0100	-	830.91	-	-
0115	-	830.90	-	-
0147	-	830.75	-	-
0246	-	830.75	-	-
0341	-	830.0	-	-
0448	-	829.6	-	-
0550	-	829.0	-	-

Table 9.--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Remarks
7-7-65				
0640	-	829.0	-	-
0723	-	828.8	-	-
0800	-	828.35	-	End of measurements

Note: Well had been idle for 74 hours prior to start of test. Specific capacity of well from above test is about 24 gpm per ft of drawdown. Transmissibility of aquifer calculated from drawdown measurements is about 40,000 gpd per ft. Depth-to-water measurements are referred to rig floor 4.0 feet above land surface.

References

Cooper, J. B., 1965, Pumping tests of February and March 1965, Guaje Well No. 6, Los Alamos, New Mexico: U.S. Geol. Survey Admin. Rept., April 1965, 28 p.

Purtymun, W. D., and Cushman, R. L., 1961, Site location for a Los Alamos supply well near the 10-inch water main that parallels State Highway 4 between Pueblo Canyon and White Rock: U.S. Geol. Survey Admin. Rept., December 1961, 17 p.

Purtymun, W. D., and Cushman, R. L., 1963, Site location for a municipal supply well in Guaje Canyon or Rendija Canyon near Los Alamos, New Mexico: U.S. Geol. Survey Admin. Rept., March 1963, 25 p.

Purtymun, W. D., and John, Edward, 1964, Site for a municipal supply well in Pajarito Canyon near Los Alamos, New Mexico: U.S. Geol. Survey Admin. Rept., April 1964, 15 p.

Table 3.--Supply well G-2

USGS Location No. 19.7.4.411 USGS Designation G-2 (Guaje 2)

AEC Coordinates _____ AEC Designation _____

Driller Texas Water Wells Inc. Address Houston, Texas

Topography Floor of Guaje Canyon Altitude 6,056 feet

Method drilled Hydraulic Rotary Diameter 12 inches Use Public Supply

Drilled depth 2,006 feet Completed depth 1,990 feet

Date drilled August 1951 Chief Aquifer(s) Tesuque Formation

Depth to water 259 feet Date Aug. 1951 Transmissibility 15,000 gpd/f

Specific capacity 11 gpm/ft After 14 years of production (1965)

Log:

	Thickness	Depth
Alluvium	13-	13
Puye Conglomerate:		
Fanglomerate Member	17-	30
Totavi Lentil	45-	75
Tesuque Formation	1,931-	2,006

No basalt logged

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-600	
10	600-1,990	With 425 feet of perforations

Chemical analysis: Constituents in parts per million

Date May 29, 1952, Temp. 85 °F, SiO_2 54, Fe .03, Ca 13,

Mg 1.4, Na + K 54, HCO_3 166, CO_3 _____, SO_4 8.2, Cl 4.8,

F 1.4, NO_3 1.0, Hardness 38, Dissolved solids _____,

Specific conductance 281 micromhos, pH _____

Radiochemical analysis: Date 12-10-64, Pu <0.4 d/m/l, U <0.5 μg/l,

Gross β (Gamma) 11.3 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.

Table 4.--Supply well G-1A

USGS Location No. 19.7.4.441 USGS Designation G-1A (Guaje 1A)

AEC Coordinates _____ AEC Designation _____

Driller B and W Drilling Co. Address Borger, Texas

Topography Floor of Guaje Canyon Altitude 6,014 feet

Method drilled Hydraulic Rotary Diameter 12 inches Use Public Supply

Drilled depth 2,071 feet Completed depth 1,519 feet

Date drilled December 1954 Chief Aquifer(s) Tesuque Formation

Depth to water 255 feet Date Dec. 1954 Transmissibility 11,000 gpd/ft

Specific capacity 11 gpm/ft After 11 years of production (1965)

Log:

	Thickness	Depth
Alluvium	12-	12
Puye Conglomerate:		
Fanglomerate Member	47-	59
Totavi Lentil	63-	122
Tesuque Formation	1,949-	2,071

Basalts or Basalt Breccias from 1,505 to 1,675 feet and 1,755 to 1,789 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12 ID	0- 663	
10 ID	660-1,519	With 563 feet of torch cut slots.

Chemical analysis: Constituents in parts per million

Date Dec. 29, 1954, Temp. 84 °F, SiO_2 80, Fe .11, Ca 12,
Mg .5, Na + K 27, HCO_3 97, CO_3 _____, SO_4 4.6, Cl 2.8,
F 0.4, NO_3 0.2, Hardness 32, Dissolved solids _____.
Specific conductance 167 micromhos, pH _____

Radiochemical analysis: Date May 24, 1964, Pu 1.5 d/m/l, U <0.5 μg/l,
Gross β (Gamma) 5 d/m/l

Report source of data: Cushman, R. L., 1963 and Griggs, R. L., 1955

Remarks: Electric logs available.
Tritium units <0.5, Mar. 1959.

Table 5.--Supply well G-1

USGS Location No. 19.7.4.444 USGS Designation G-1 (Guaje 1)

AEC Coordinates _____ AEC Designation _____

Driller Texas Water Wells Inc. Address Houston, Texas

Topography Floor of Guaje Canyon Altitude 5,973 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public Supply

Drilled depth 2,100 feet Completed depth 2,000 feet

Date drilled July 1950 Chief Aquifer(s) Tesuque Formation

Depth to water 192 feet Date July 20, 1950 Transmissibility 12,000 gpd/

Specific capacity 5 gpm/ft After 15 years of production (1965)

Log:	Thickness	Depth
Alluvium	12-	12
Puye Conglomerate:		
Fanglomerate Member	13-	25
Totavi Lentil	50-	75
Tesuque Formation	2,075-	2,100

Basalts logged between 1,540 and 1,838 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 490	
10	490-2,000	With 490 feet of perforations

Chemical analysis: Constituents in parts per million

Date April 4, 1954, Temp. 78 °F, SiO_2 66, Fe .01, Ca 13,

Mg 1.1, Na + K 25, HCO_3 97, CO_3 _____, SO_4 4.9, Cl 3.5,

F .3, NO_3 1.0, Hardness 37, Dissolved solids _____,

Specific conductance 169 micromhos, pH _____

Radiochemical analysis: Date Dec. 10, 1964, Pu <0.4 d/m/l, U 2.6 µg/l,

Gross β (Gamma) 8.7 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.

Table 6.--Supply well G-5

USGS Location No. 19.7.5.112 USGS Designation G-5 (Guaje 5)

AEC Coordinates _____ AEC Designation _____

Driller Texas Water Wells Inc. Address Houston, Texas

Topography Floor of Guaje Canyon Altitude 6,306 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public Supply

Drilled depth 1,997 feet Completed depth 1,840 feet

Date drilled May 1951 Chief Aquifer(s) Tesuque Formation

Depth to water 411 feet Date May 1951 Transmissibility 12,000 gpd/f

Specific capacity 8.0 gpm/ft After 14 years of production (1965)

Log:	Thickness	Depth
Alluvium	8-	8
Puye Conglomerate:		
Fanglomerate Member	119-	127
Totavi Lentil (not present)		
Tesuque Formation		1,870-1,997

Basalts or basalt breccias in the intervals: 586-613; 906-1,135; 1,211-1,238; 1,241-1,268; and 1,291-1,318 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 739	
10	739-1,840	400 feet of slots in the casing.

Chemical analysis: Constituents in parts per million

Date April 1, 1952, Temp. 78 °F, SiO_2 46, Fe .01, Ca 19,

Mg 4.4, Na + K 12, HCO_3 9.6, CO_3 _____, SO_4 4.4, Cl 4.5,

F .3, NO_3 1.5, Hardness 66, Dissolved solids _____,

Specific conductance 176 micromhos, pH _____

Radiochemical analysis: Date Dec. 10, 1964, Pu <0.4 d/m/l, U <0.5 μg/l,

Gross β (Gamma) 19.9 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.
Tritium units <0.5, Mar. 1959

Table 7.--Supply well G-4

USGS Location No. 19.7.5.231 USGS Designation G-4 (Guaje 4)

AEC Coordinates _____ AEC Designation _____

Driller Texas Water Wells Inc. Address Houston, Texas

Topography Floor of Guaje Canyon Altitude 6,229 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public Supply

Drilled depth 2,002 feet Completed depth 1,930 feet

Date drilled May 1951 Chief Aquifer(s) Tesuque Formation

Depth to water 347 feet Date May 1951 Transmissibility 17,500 gpd/f

Specific capacity 2 gpm/ft After 14 years of production (1965)

Log:	Thickness	Depth
Alluvium	15	15
Puye Conglomerate:		
Fanglomerate Member	45	60
Totavi Lentil	60	120
Tesuque Formation	1,882	2,002

Basalts or basalt breccias in the intervals: 499-526; 855-929; 956-976; and 1,103-1,141 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 720	
10	720-1,930	

Chemical analysis: Constituents in parts per million

Date June 7, 1951, Temp. 79 °F, SiO_2 50, Fe .02, Ca 16,

Mg 2.6, Na + K 19, HCO_3 9.6, CO_3 _____, SO_4 4.9, Cl 4.5,

F .3, NO_3 1.2, Hardness 50, Dissolved solids _____.

Specific conductance 177 micromhos, pH _____

Radiochemical analysis: Date Dec. 10, 1964, Pu <0.4 d/m/l, U <0.5 µg/l,

Gross β (Gamma) <0.1 d/m/l

Report source of data: Griggs, R. L., 1955, and 1964

Remarks: Electric logs available.

Table 8.--Supply well G-6

USGS Location No. 19.7.6.241 USGS Designation G-6 (Guaje 6)

AEC Coordinates _____ AEC Designation _____

Driller Burgett Drilling Co. Address Carlsbad, New Mexico

Topography Floor of Rendija Canyon Altitude 6,422 feet

Method drilled Cable tool and Hydraulic rotary Diameter 12 inches Use Public Supply

Drilled depth 2,005 feet Completed depth 1,530 feet

Date drilled March 1964 Chief Aquifer(s) Tesuque Formation

Depth to water 572 feet Date March 1964 Transmissibility of 6,300 gpd/f

Specific capacity 4.2 gpm/ft After 171 hours/pumping (Oct. 1964)

Log:	Thickness	Depth
Alluvium	40	40
Puye Conglomerate		
Fanglomerate Member	90	130
Totavi lentil	70	200
Tesuque Formation	1,805	2,005

Basalt or basalt breccias in the intervals: 1,070-1,170; 1,180-1,220; 1,270-1,425 1,445-1,470; 1,605-1,665; 1,720-1,730; 1,815-1,825; 1,905-1,915; and 1,955-1,970 feet.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-1,530	3/32-inch louver perforations from 700-1,530 feet.

Chemical analysis: Constituents in parts per million

Date June 8, 1965, Temp. 83 °F, SiO_2 50, Fe .00, Ca 13, Mg 1.7, Na + K 21.2, HCO_3 89, CO_3 0, SO_4 4.9, Cl 3.3, F .3, NO_3 1.8, Hardness 40, Dissolved solids _____.

Specific conductance 160 micromhos, pH 7.7

Radiochemical analysis: Date Dec. 10, 1964, Pu <0.4 d/m/l, U 1.2 µg/l, Gross β (Gamma) <1.0 d/m/l

Report source of data: Cooper, J. B., Purtymun, W. D., and John, E. C., 1965.

Remarks: Electric logs available.

Table 9.--Supply well L-1

USGS Location No. 19.7.13.114 USGS Designation L-1 (Los Alamos 1)

AEC Coordinates _____ AEC Designation _____

Driller _____ Address _____

Topography Floor of Los Alamos Canyon Altitude 5,624 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Observation

Drilled depth 1,001 feet Completed depth 870 feet

Date drilled November 1946 Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date December 1946 Transmissibility _____ gpd/ft

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	76	76
Tesuque Formation	925	1,001

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-870	12-inch slotted casing and screens alternating with 10-inch slotted casing and screen. 60 feet to 870 feet.

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 63 °F, SiO_2 29, Fe .03, Ca 7.4, Mg 1.0, Na + K 80, HCO_3 177, CO_3 _____, SO_4 20, Cl 18, F 1.3, NO_3 1.8, Hardness 22, Dissolved solids _____.

Specific conductance 383 micromhos, pH _____

Radiochemical analysis: Date Oct. 9, 1957, Pu 0 d/m/l, U 52 μg/l, Gross β (Gamma) 12 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Unused water-supply well equipped with water-level recorder.

Table 10.--Supply well L-1B

USGS Location No. 19 7.13.114b USGS Designation L-1B (Los Alamos 1B)

AEC Coordinates _____ AEC Designation _____

Driller H. P. Doty Drilling Co. Address Albuquerque, New Mexico

Topography Floor of Los Alamos Canyon Altitude 5,622 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 2,256 feet Completed depth 1,750 feet

Date drilled March 1960 Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date March 1960 Transmissibility 17,000 gpd

Specific capacity .5 gpm/ft After 5 years of production (1965)

Log:

	Thickness	Depth
Alluvium	78-	78
Tesuque Formation	2,178-	2,256

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 650	
10	650-1,750	591 feet of perforation between 326 and 1,750 feet.

Chemical analysis: Constituents in parts per million

Date March 18, 1965 Temp. 87 °F, SiO_2 40, Fe .03, Ca 8.0,

Mg .7, Na + K 171.3, HCO_3 387, CO_3 0, SO_4 40, Cl 16,

F 2.3, NO_3 1.8, Hardness 23, Dissolved solids _____.

Specific conductance 717 micromhos, pH 7.8

Radiochemical analysis: Date Feb. 5, 1965 Pu <0.4 d/m/l, U 2.7 µg/l,

Gross β (Gamma) 3.8 d/m/l

Report source of data: Cushman, R. L., 1963

Remarks: Electric logs available.

Table 11.--Supply well L-3

USGS Location No. 19.7.14.221 USGS Designation L-3 (Los Alamos 3)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,672 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 910 feet Completed depth 870 feet

Date drilled May 1947 Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date May 1947 Transmissibility _____ gpd/f

Specific capacity 2.6 gpm/ft After 19 years of production (1965)

Log:

	Thickness	Depth
Alluvium	51	51
Tesuque Formation	859	910

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-870	12-inch and 10-inch screens and casing alternate throughout depth of well. 140 feet of 10-inch screen and 620 feet of slotted 12-inch casing.

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 58 °F, SiO_2 32, Fe .01, Ca 16,

Mg .5, Na + K 32, HCO_3 117, CO_3 _____, SO_4 7.5, Cl 4.0

F .5, NO_3 1.3, Hardness 42, Dissolved solids _____.

Specific conductance 200 micromhos, pH _____

Radiochemical analysis: Date Feb. 5, 1965, Pu <0.4 d/m/l, U <0.5 μg/l.

Gross β (Gamma) 2.4 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks:

Table 12.--Supply well L-2.

USGS Location No. 19.7.14.222 USGS Designation L-2 (Los Alamos 2)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,651 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 882 feet Completed depth 870 feet

Date drilled December 1946 Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date Dec. 1946 Transmissibility 4,100 gpd/f

Specific capacity 1.6 gpm/ft After 19 years of production (1965)

Log:

	Thickness	Depth
Alluvium	60	60
Tesuque Formation	822	882

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-870	12-inch casing and 10-inch screen alternate to depth of well. 195 feet of 10-inch screen and 565 feet of 12-inch slotted casi

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 65 °F, SiO_2 30, Fe .01, Ca 5.8,

Mg 1.0, Na + K 84, HCO_3 185, CO_3 _____, SO_4 18, Cl 18,

F 2.0, NO_3 1.3, Hardness 18, Dissolved solids _____,

Specific conductance 378 micromhos, pH _____

Radiochemical analysis: Date Feb. 5, 1965, Pu <0.4 d/m/l, U<0.5 μg/l,

Gross β (Gamma) 3.5 d/m/l

Report source of data: Griggs, R. L., 1965 and 1964

Remarks:

Table 13.--Supply well L-6

USGS Location No. 19.7.14.312 USGS Designation L-6 (Los Alamos 6)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,770 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 2,030 feet Completed depth 1,790 feet

Date drilled December 1948 Chief Aquifer(s) Tesuque Formation

Depth to water 5 feet Date Dec. 1948 Transmissibility _____ gpd/f

Specific capacity 14 gpm/ft After 17 years of production (1965)

Log:

	Thickness	Depth
Alluvium	36-	36
Tesuque Formation	1,994-	2,030

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 597	Perforated 420 to 597 feet.
10	420-1,790	With 400 feet of 10-inch screen.

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 58 °F, SiO_2 30, Fe .02, Ca 2.9,
Mg .4, Na + K 63, HCO_3 158, CO_3 _____, SO_4 6.9, Cl 4.0,
F 1.3, NO_3 1.4, Hardness 8, Dissolved solids _____.
Specific conductance 273 micromhos, pH _____

Radiochemical analysis: Date Feb. 5, 1965, Pu <0.4 d/m/l, U 7.3 µg/l,
Gross β (Gamma) <1.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.
Tritium units <0.5, Mar. 1959.

Table 14.--Supply well L-5

USGS Location No. 19.7.15.434 USGS Designation L-5 (Los Alamos 5)

AEC Coordinates AEC Designation

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,840 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 2,024 feet Completed depth 1,750 feet

Date drilled Sept. 1948 Chief Aquifer(s) Tesuque Formation

Depth to water 71 feet Date Sept. 1948 Transmissibility gpd

Specific capacity 4 gpm/ft After 13 years of production (1961)

Log:	Thickness	Depth
Alluvium	42-	42
Tesuque Formation	1,982-	2,024

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 630	With 50 feet of 12-inch screen.
10	630-1,750	With 350 feet of 10-inch screen.

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 62 °F, SiO_2 36, Fe .01, Ca 10,

Mg .5, Na + K 54, HCO_3 140, CO_3 , SO_4 6.9, Cl 3.0,

F .7, NO_3 1.5, Hardness 27, Dissolved solids

Specific conductance 254 micromhos, pH

Radiochemical analysis: Date Oct. 13, 1964, Pu <0.4 d/m/l, U 0.9 µg/l,

Gross β (Gamma) 3.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.

PM-1

G.L. Elevation - 6520 ft; TD - 2501ft.; 4019 ft Elev drilled (1965); depth to water ft 722; 5798 ft elev.

Log	Depth	Thickness	Top Elevation
Otowi Member, Bandelier Tuff	0-120	120	
Guaje Member, Bandelier Tuff	120-159	39	~~6310~~ 6400
~~epiclastic~~ sedimentary zone	159-165	6	6361
basalt (water @ 450')	165-507	342	6355
Puye Fm (6070) (includes old Al)	507-775	268	6013 6072
Totavi Lentil	775-795	20	5745
Santa Fe Gp Chanita Fm?	795-2501	1706	5725

source: descriptive log of well cuttings

Table 15.--Supply well PM-1

USGS Location No. 19.7.20.341 USGS Designation PM-1 (Pajarito Mesa 1)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Texas Co. Inc. Address Houston, Texas

Topography Floor of Sandia Canyon Altitude 6,520 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 2,501 feet Completed depth 2,499 feet

Date drilled February 1965 Chief Aquifer(s) Puye Conglomerate (fanglomerate member and Totovi Lentil and Tesuque Formation

Depth to water 722.10 feet Date Mar. 8, 1965 Transmissibility 55,000 gpd/f

Specific capacity 15.7 gpm/ft After 2 months of production (July 1965)

Log:

	Thickness	Depth
Bandelier Tuff		
Otowi Member	120	120
Guaje Member	45	165
Basaltic Rocks of Chino Mesa		
Unit 3	342	507
Old Alluvium	43	550
Puye Conglomerate:		
Fanglomerate Member	225	775
Totavi Lentil	20	795
Tesuque Formation	1,706	2,501

725
785

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
24	0- 474	
12	0-2,499	Blank from 0-945 feet; slotted with 3/32-inch louver openings 945-2,499 feet.

Chemical analysis:1/ Constituents in parts per million

Date July 15, 1965, Temp. ____ °F, SiO_2 ____, Fe ____, Ca 17,

Mg 8.6, Na + K 18, HCO_3 115, CO_3 7, SO_4 ____, Cl 8.5,

F .16, NO_3 .44, Hardness 79, Dissolved solids 123,

Specific conductance 132 micromhos, pH 7.5

Radiochemical analysis: Date July 15, 1965, Pu < 0.4 d/m/l, U < 0.5 μg/l,

Gross β (Gamma) 2.4 d/m/l

Report source of data: Cooper, J. B., Purtymun, W. D., and John, E. C., 1965.

Remarks: Electric logs available.

1/ Analyses by the Los Alamos Scientific Laboratory

Table 16.--Supply well L-4

USGS Location No. 19.7.22.114 USGS Designation L-4 (Los Alamos 4)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Co. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,975 feet

Method drilled Hydraulic rotary Diameter 12 inches Use Public supply

Drilled depth 2,019 feet Completed depth 1,965 feet

Date drilled July 1948 Chief Aquifer(s) Tesuque Formation

5786 — Depth to water 189 feet Date July 1948 Transmissibility _____ gpd/f

Specific capacity 8.5 gpm/ft After 18 years of production (1965)

Log:	Thickness	Depth	
Alluvium	27	27	
Puye Conglomerate:			
Panglomerate Member	86	113	5748
Totavi Lentil	50	163	5862
Tesuque Formation	1,856	2,019	5812

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0- 754	
10	754-1,965	With 400 feet of 10-inch screen.

Chemical analysis: Constituents in parts per million

Date May 14, 1952, Temp. 73°F, SiO_2 36, Fe .01, Ca 9.2,

Mg .3, Na + K 27, HCO_3 91, CO_3 _____, SO_4 3.5, Cl 2.5,

F .3, NO_3 .8, Hardness 24, Dissolved solids _____,

Specific conductance 151 micromhos, pH _____

Radiochemical analysis: Date Feb. 5, 1965 Pu <0.4 d/m/l, U <0.5 μg/l,

Gross β (Gamma) 2.4 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Electric logs available.
Tritium Units <0.5, Mar. 1959

Table 4.--Descriptive log of drill cuttings from Los Alamos supply well, Pajarito Mesa 1, Sandia Canyon.

Location: NW¼SE¼SW¼ sec. 20, T. 19 N., R. 7 E., Santa Fe County, New Mexico.

Altitude: 6,520 feet above sea level datum.

Total depth: 2,501 feet (pilot hole).

Date drilled: 1964.

Tools: Cable-tool to 825 feet. Mud rotary 825-2,501 feet.

Driller: Layne-Texas Co., Inc., Houston, Texas.

Material	Thickness (feet)	Depth (feet)
Bandelier Tuff, Otowi Member:		
Pumice, pinkish-gray, rhyolitic(?), porphyritic, (rounded lumps as much as 1½-inches in diameter) that contain phenocrysts of subhedral crystals of sanidine, vesicles are elongate and parallel ----------	5	5
Tuff, moderate yellowish-brown, pumiceous, texture ranges from ash through euhedral sanidine and small (1/32 to 1/8-inch) rounded grains of reddish and dark-brown volcanic rock that are probably rhyolite to latite ---------	10	15

--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
, Otowi Member - Continued		
e-yellowish-brown, pumiceous, texture		
from ash and euhedral crystals to rounded		
contains about 60 percent sanidine and		
and about 40 percent grains of gray, red,		
k-brown igneous rock. At intervals		
h igneous rock (rhyolite to latite) as		
$\frac{1}{2}$-inch in diameter, and obsidian is		
----------	105	120
, Guaje Member:		
ump, pale-yellowish-brown to grayish-		
lumps are subrounded to subangular		
much as $1\frac{1}{2}$-inches in diameter,		
s are elongate and show parallel flow		
, contains sanidine, quartz, and		
of igneous rock ----------	30	150
ump, very light-gray to gray, lumps to		
es in diameter, sanidine and quartz-----	9	159
gravel, grayish-red, consists of silt		
el as much as $\frac{1}{4}$-inch in diameter, some		
particles are rounded. Grains of sanidine,		
and black igneous rock ----------	6	165

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Bandelier Tuff, Otowi Member - Continued		
Tuff, pale-yellowish-brown, pumiceous, texture ranges from ash and euhedral crystals to rounded grains, contains about 60 percent sanidine and quartz and about 40 percent grains of gray, red, and dark-brown igneous rock. At intervals purplish igneous rock (rhyolite to latite) as much as ½-inch in diameter, and obsidian is present	105	120
Bandelier Tuff, Guaje Member:		
Pumice, lump, pale-yellowish-brown to grayish-orange, lumps are subrounded to subangular and as much as 1½-inches in diameter, vesicles are elongate and show parallel flow texture, contains sanidine, quartz, and grains of igneous rock	30	150
Pumice, lump, very light-gray to gray, lumps to 1½-inches in diameter, sanidine and quartz	9	159
Sand and gravel, grayish-red, consists of silt to gravel as much as ¼-inch in diameter, some larger particles are rounded. Grains of sanidine, quartz, and black igneous rock	6	165

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Basaltic Rocks of Chino Mesa, Unit 3:		
Basalt, dark-gray to grayish-black, porhyritic, phenocrysts are small olivene crystals. Probably solid unbrecciated zone as drilling is very difficult and hard ----------	34	199
Basalt, similar to above, contains scoria. Probably a brecciated interflow zone as drilling is easier and drilling mud was lost from 199 to 216 feet and from 220 to 236 feet ----------	37	236
Basalt, dense, similar to interval from 165 to 199 feet. Lost mud at 254 feet ----------	18	254
No samples, lost mud and samples into formation -	11	265
Basalt, grayish-black, porphyritic, fractured ---	10	275
Basalt, scoria (cinders) ----------	5	280
Basalt, grayish-black, dense (Hole started crooked at 284 feet with harder drilling, cavity from 303 to 304 feet) ----------	30	310
Basalt, grayish-black, fractured, contains some reddish-brown mudstone (lost drilling mud from 310 to 314 feet) ----------	30	340
No sample ----------	5	345

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Basaltic Rocks of Chino Mesa - Continued		
Basalt, grayish-black, fractured, contains some mudstone and scoria	25	370
Basalt, grayish-black, dense	78	448
Basalt, grayish-black, brecciated, dense to slightly vesicular (contains water)	2	450
Basalt, grayish-black, brecciated, vesicular to scoriaceous, contains some mudstone	40	490
Basalt and sand, basalt, grayish-black, brecciated; sand, fine-to-coarse, quartz, clear to iron-stained, some tan clay	17	507
Old Alluvium:		
Sand and gravel, quartz and black latitic material, gravel-sized lumps of grayish-brown siltstone, heavy iron-staining	13	520
Sand and gravel, light-gray, quartz	5	525
Sand, quartz, frosted-to-clear, subangular-to-angular, well-sorted; 30 percent latitic sand	5	530
Sand and gravel, quartz, latite, and basalt, subangular-to-angular, pieces to ½-inch, fine-to-coarse sand	5	535
Siltstone, grayish-orange-pink, soft, contains mica and biotite	5	540

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Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Old Alluvium - Continued		
No sample	5	545
Clay, light-brownish-gray, plastic	5	550
Puye Conglomerate, Fanglomerate Member:		
Conglomerate, greenish-gray, silty, subangular fragments of latitic rocks, trace basalt	55	605
Conglomerate, similar to interval from 550 to 605 feet, with angular-to-subround fine quartz gravel	5	610
Conglomerate, fine-to-coarse quartz sand and sanidine, ranges to fine gravel, mostly clear, angular, 10-20 percent latite	20	630
Conglomerate, as above, 40 percent latite	50	680
Conglomerate, as above, 75 percent latite	20	700
Conglomerate, as above, 10-20 percent latite	25	725
Conglomerate, subrounded pieces of latitic rock and a few pieces of milky quartz	15	740
Conglomerate, fine gravel-sized pieces of latite and frosted, iron-stained quartz sand, some biotite and sanidine	5	745
Conglomerate, very fine-to-medium latite gravel, minor quartz and biotite	10	755
Conglomerate, latite pebbles and fragments, much light-colored volcanic material, minor quartz, sanidine, and biotite. Many crystals of pyroxene	15	770

Table 4.--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Puye Conglomerate, Fanglomerate Member - Continued		
Conglomerate, gray-to-pink, latite pebbles and fragments, quartz phenocrysts, minor biotite and pyroxene	5	775
Puye Conglomerate, Totavi Lentil:		
Sand and gravel, quartz and quartzite pebbles and fragments to ½-inch	10	785
Sand and gravel, as above, fragments to 1-inch	5	790
Sand, fine-to-coarse quartz, with quartzite gravel and fragments to ¼-inch	5	795
Tesuque Formation:		
Tuff, light-gray to tan with white blotches, devitrified, waxey, contains angular lapilli of latite and crystals of pyroxene (rounded pieces several inches in diameter cave into hole)	41	836
Basalt, dark gray, granular, contains much feldspar and analcite(?), some magnetite	58	894
Basalt, as above, with olivene	72	966
Siltstone, brick red-to-pink, clay, some fine quartz sand	18	984
Siltstone, tan and much fine sand	70	1,054
Basalt, dark-gray to black, dense, some feldspar and olivene	40	1,094

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Sand, fine-to-coarse, quartz, subrounded, clear-to-frosted, iron-staining. Some tan siltstone -	32	1,126
Silt, tan-to-cream, fine sandy ----------	24	1,150
Sand, fine, quartz, subangular ----------	16	1,166
Basalt and latite, dark-gray basalt, pink-to-brown latite with phenocrysts of feldspar -----	14	1,180
Sand, fine-to-coarse, quartz, subrounded-to-subangular, frosted, mostly brown-to-white. Some rounded fragments of volcanic rocks ------	21	1,201
Sand, fine-to-coarse, quartz, well-sorted, subrounded, clear-to-frosted, some iron-staining, a few grains of latite ----------	30	1,231
Silty sand, very fine, quartz, subangular, iron-stained, some fine latite gravel ----------	60	1,291
Sand, fine-to-coarse, quartz, subrounded, clear-to-iron-stained, latite gravels, some reddish-black basalt and tan micaceous silty clay -----	41	1,332
Sand, very fine-to-medium, trace coarse, quartz, subangular-to-subround, mostly gray, some clear-to-iron-stained, some latite gravel and tan and white silt ----------	116	1,448
Siltstone, gray, very fine-to-medium, trace quartz and latite sand ----------	26	1,474

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Sand, very fine-to-medium, trace coarse, grayish-brown, subrounded, well-sorted, quartz. Some dark grains	26	1,500
Siltstone, light-gray to cream, very fine sand	6	1,506
Basalt, dark-gray to black, trace latite	4	1,510
Siltstone, light-gray to cream, some sand, and rounded latite pebbles	22	1,532
Sand, fine-to-medium, brown, quartz, and siltstone, light-gray to cream	14	1,546
Basalt, dark-gray to black	2	1,548
Sand, very fine-to-medium, quartz, subrounded, clear-to-frosted, trace cream silt	20	1,568
Siltstone, light-gray to cream	6	1,574
Silty sand, very fine-to-medium, subrounded, clear-to-frosted, much grayish-gray to cream silt	122	1,696
Sand, very fine-to-medium, quartz, subangular, clear with much iron-staining, a few dark grains, trace cream silt	20	1,716
Silty sand, very fine-to-medium, quartz, subangular-to-round, some iron-staining, much gray, cream, and tan silt	44	1,760

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Sand, fine-to-coarse, quartz, subangular-to-round, mostly clear-to-frosted, much iron-staining, trace white clay and rounded latite grains	38	1,798
Siltstone, white-to-gray, very fine	8	1,806
Siltstone, very fine-to-medium, subangular-to-round, brownish-gray, trace white silt and rounded latite grains	68	1,874
Silty sand, as above with larger percentage of silt	52	1,926
Silty sand, very fine-to-medium, trace coarse, subrounded, brownish-gray with some iron-staining, much tan clayey silt, trace white silt	35	1,961
Silty sand, as above with less clayey silt	20	1,981
Silty sand, as above with no clayey silt	80	2,061
Silt, light-gray, very fine, sandy	10	2,071
Silty sand, very fine quartz sand and light-gray to cream silt	20	2,091
Silty sand, very fine-to-fine, grayish-brown	30	2,121
Sand, very fine-to-medium, quartz, subrounded, light-brown, and white-to-tan silt	10	2,131

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Silty sand, very fine-to-fine, quartz, subrounded, light-gray, and white silt -------	50	2,181
Sand, very fine-to-fine, quartz, subrounded, light-brown to light-gray, some tan silt -----	29	2,210
Clay, gray, very fine-to-fine sandy ----------	62	2,272
Siltstone, very fine-to-fine, tan-to-gray -------	12	2,284
Sand, very fine-to-fine, occasional coarse grains, quartz, subangular, tan-to-gray ------	7	2,291
Silty sand, very fine-to-fine, quartz, subrounded, gray-to-tan, and white-to-gray silt ----------	37	2,328
Siltstone, light-gray to tan, very fine --------	6	2,334
Sand, very fine-to-medium, quartz, tan, some silt ----------	40	2,374
Silty sand, very fine-to-fine, gray-to-tan sand, and white-to-gray silt ----------	27	2,401
Sand, very fine-to-fine, some medium-to-coarse, tan, subrounded, loose ----------	41	2,442
Conglomerate, fine-to-coarse, some fine gravel, quartz, and much gray to reddish-gray rounded latitic rock ----------	16	2,458

Table 4 .--Descriptive log of drill cuttings - Continued

Material	Thickness (feet)	Depth (feet)
Tesuque Formation - Continued		
Sand, very fine-to-fine, some medium-to-coarse, tan, subrounded, some silt ----------	43	2,501

Note: Interval from 165 to 507 feet (Unit 3 of Basaltic rocks of Chino Mesa) is exposed, in part, near top of the hill west of Totavi.

Samples of the drill cuttings were collected by the contractor/ at 5-foot intervals from 0 to 825 feet and at 10-foot intervals from 825 to 2,501 feet. These samples were then washed, by the Geological Survey, and studied under the binocular microscope. The samples were described dry. Thickness and depth intervals of drill cutting samples have been correlated with data interpreted from electric logs and driller's logs.

Table 5.--Construction record of Los Alamos supply well, Pajarito Mesa 1, Sandia Canyon

Total depth: 2,499 feet

Date Completed: February 1965

Casing and hole record: 28-inch hole from 0 to 474 feet. Cased with 24-inch ID pipe, cemented in hole.

22-inch hole from 474 to 2,499 feet. Cased with 12-inch ID blank pipe from 0 to 945 feet and with 12-inch ID pipe slotted with 3/32-inch louver openings from 945 to 2,499 feet.

Annulus between 12-inch pipe and 22-inch hole filled from 2,499 to 0 feet with washed and graded gravel ranging in size from about 1/32-inch to ¼-inch.

Gage lines: Two steel-pipe gage lines each of 2-inch diameter installed on outside of 12-inch pipe and enter pipe at a depth of 950 feet. An airline will be installed in one gage line; the other is used for entry of mechanical water-level measuring devices.

Well development: The well was swabbed for 68 hours and bailed for 65 hours. Further development consisted of pumping for 189 hours at rates of 400 to 850 gpm.

Yield: Data obtained during the pumping phase of well development indicated that the optimum yield of the well is about 700 gpm. Specific capacity was determined to be about 15 gpm per ft of drawdown.

Table 6 .--Records of pumping tests, Los Alamos supply well,

Pajarito Mesa 1, Sandia Canyon

Test of February 11-13, 1965

Tests made by J. B. Cooper, U.S. Geological Survey, near end of pumping for well development. Depth to water measured with electric measuring line.

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Sand content of water (ppm)	Remarks
2-11-65					
1527	-	-	-	-	Pump off
1555	-	746.12	-	-	-
1600	-	-	-	-	Pump on
	2.5	769.5	-	-	-
	4	775.3	-	-	-
1605	5	-	717	176	-
	6	774.1	-	-	-
	8	774.5	-	-	-
	10	774.8	717	550	-
	12	775.2	-	-	-
1615	15	-	717	242	-
	14	775.4	-	-	-
	16	775.8	-	-	-
	18	775.9	-	-	-
	20	776.2	-	-	-
	22	776.3	-	-	-
	24	776.4	-	-	-
	26	776.5	-	-	-
	28	776.6	-	-	-

Table 6.--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Sand content of water (ppm)	Remarks
2-11-65					
1630	30	776.7	726	176	-
	35	776.9	-	-	-
	40	777.0	-	-	-
1645	45	777.2	-	121	-
	50	777.4	-	-	-
	55	777.3	-	-	-
1700	60	777.6	735	129	-
	70	777.8	-	-	-
	80	778.0	-	-	-
1730	90	778.2	735	77	-
	100	778.3	-	-	-
	115	778.5	-	-	-
1800	120	-	735	30.8	-
	125	778.4	-	-	-
1810	-	-	-	-	Pump off
2-12-65					
1155	-	-	-	-	Pump off
1210	-	749.3	-	-	-
1225	-	748.4	-	-	-
1245	-	746.05	-	-	-
1259	-	745.75	-	-	-

Table 6 .--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Sand content of water (ppm)	Remarks
2-12-65					
1300	-	-	-	-	Pump on
	1.5	780.0	-	-	-
	2.25	778.0	-	-	-
	3	778.1	-	-	-
	4	778.3	-	-	-
	5	778.6	-	779	-
	6	778.8	-	-	-
	7	779.1	-	-	-
	8	779.2	-	-	-
	9	779.4	-	-	-
1310	10	779.6	831	836	-
	12	780.0	-	-	-
	14	780.5	-	-	-
1315	15	-	838	429	-
	16	780.9	-	-	-
	18	781.2	-	-	-
	20	781.5	-	-	-
	22	781.7	-	-	-
	24	781.9	-	-	-
	26	782.0	-	-	-
	28	782.2	-	-	-

Table 6 .--Records of pumping tests, Los Alamos supply well - Continued

Time	Time since pump started (minutes)	Depth to water (feet)	Discharge (gpm)	Sand content of water (ppm)	Remarks
2-12-65					
1330	30	782.3	844	180.3	-
	35	782.6	-	-	-
	40	782.8	-	-	-
	45	783.1	-	-	-
	50	783.2	-	-	-
	55	783.3	-	-	-
1400	60	783.4	844	-	-
	70	783.7	-	-	-
	80	783.9	-	-	-
1430	90	784.1	844	-	-
	100	784.3	-	-	-
	110	784.4	-	-	Last measuremen

Test of February 12-13, 1965

Following well development, measurements of water-level recovery were made by personnel of Layne-Texas Co., Inc. with electric measuring line.

Time	Depth to water (feet)	Remarks
2-12-65		
2100	762.7	Pump off
2115	747.3	-
2130	746.4	-
2145	746.0	-
2200	745.7	-
2230	745.2	-
2300	744.8	-
2330	744.3	-
2-13-65		
0730	743.5	-
1130	742.5	-
1730	741.5	-
2-15-65		
0800	736.7	-

Note: Specific capacity of well from above tests is about 17 gpm per ft of drawdown. Transmissibility of aquifer calculated from drawdown measurements is about 55,000 gpd per ft. Both of these values are thought to be high because an absolute static water level was not established and because water levels in the aquifer were in a state of drawdown at time of tests, due to prior pumping. Depth-to-water measurements are referred to rig floor 4.3 feet above land surface.

PM-4

G.L. Elevation - 6921 ft
TD - 6921ft.; 4001 Elev.
drilled (1981); depth to water 1060 SWL?ft ; 5861ft elev.

Log	Depth	Thickness	Top Elevation	Differ w/ FIMAD
Tshirege Member	0-190	190		
Otowi Member, Bandelier Tuff	190-525	335	6731	6700
Guaje Member, Bandelier Tuff	525-600	75	6396	6380
basalt	600-1090	490	6321	
Puye Fm	1090-1380	290	5831	
Totavi Lentil	1380-1420	40 ok	5541	5620
Santa Fe Gp Chamita Fm?	1420-TD	1500	5501	

source: Geologic log LANL H-8 Group, Purtyman. Purtyman Report, 1995 agrees with FIMAD except with the elevation of the top of the Totavi Lentil. The Purtyman report agrees with the above elevation of 5541 ft.

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: W. D. Purtymun, H-8, MS K490

DATE: June 30, 1982

THRU:

MAIL STOP/TELEPHONE: F659/7-1049

FROM: Allen H. Cogbill AHC

SYMBOL: ESS-3

SUBJECT: DENSITY DATA FROM WELLS PM-4 AND PM-5

I have used the Schlumberger-run compensated density logs from water wells Pajarito Mesa #4 (PM-4) and Pajarito Mesa #5 (PM-5) to estimate mean densities for the rocks within the logged portions of the wells. The logs were sampled every 2 feet and mean densities were calculated for specified intervals. The intervals for which I calculated mean values were chosen largely on the basis of homogeneity of the density log within the given interval (that is, the mean value within the interval appeared approximately constant). On the back of this memo are two tables listing the results of my calculations. The presence of several basalt flows in the upper portion of the Tesuque Formation seems to raise the mean density of the formation measurably but not substantially.

AHC/mk

xc: F. E. Goff, ESS-2, MS J978
E. F. Homuth, ESS-3, MS C335
M. E. Ander, ESS-3, MS C335
A. H. Cogbill, ESS-3, MS F659
ES/CPO File

Pajarito Mesa No. 4 [PM-4]

Coordinates: N.1,764,250 ft E.495,600 ft (NM state plane, Central Zone)
Latitude: 35 50.9′ N. Longitude: 106 15.9′ W.

Elevation: 6921 feet (2109.5 m)

TD at time of logging: 2920 feet (890.0 m)
Top of the logged interval: 976 feet (297.5 m)
Base of the logged interval: 2916 feet (888.8 m)
Intervals missing: 2134-2200 feet (650.4-670.6 m)
2250-2316 feet (685.8-675.4 m)

(feet) Depth Interval	Lithology or other Information	(gm/cc) Mean Density	(gm/cc) Est. Error
976-1091	Basaltic Rocks of Chino Mesa	2.08	0.02
1091-1190	Puye Conglomerate, fanglomerate member	2.13	0.01
1190-1328	Puye Conglomerate, conglomerate	1.90	0.02
1328-1384	Puye Conglomerate, conglomerate member	2.17	0.02
1384-1444	Totavi Lentil (conglomerate)	2.22	0.02
1444-1590	Tesuque Fm. (sandstone)	2.13	0.01
1590-1884	Tesuque Fm. (sandstone)	2.16	0.01
1884-1934	Tesuque Fm. (sandstone)	2.04	0.04
1934-1952	Tesuque Fm. (claystone & sandstone)	1.90	0.16
1952-1982	Tesuque Fm. (basaltic rocks)	2.53	0.07
1982-2034	Tesuque Fm. (sandstone)	2.06	0.02
2034-2041	Tesuque Fm. (siltstone & claystone)	1.88	0.14
2041-2087	Tesuque Fm. (siltstone & sandstone)	2.01	0.06
2087-2282	Tesuque Fm. (basaltic rocks)	2.70	0.04
2316-2332	Tesuque Fm. (basaltic rocks)	2.74	0.08
2332-2426	Tesuque Fm. (basaltic rocks)	2.51	0.04
2426-2584	Tesuque Fm. (silt-, sand-, & claystone)	2.13	0.02
2584-2916	Tesuque Fm. (silt-, sand-, & claystone)	2.09	0.01
1444-2916	Tesuque Fm. (basalts & clastic rocks)	2.19	0.02
1091-1444	Puye Fm. (fanglomerate & conglomerate)	2.12	0.02
976-2916	entire logged interval	2.17	0.01

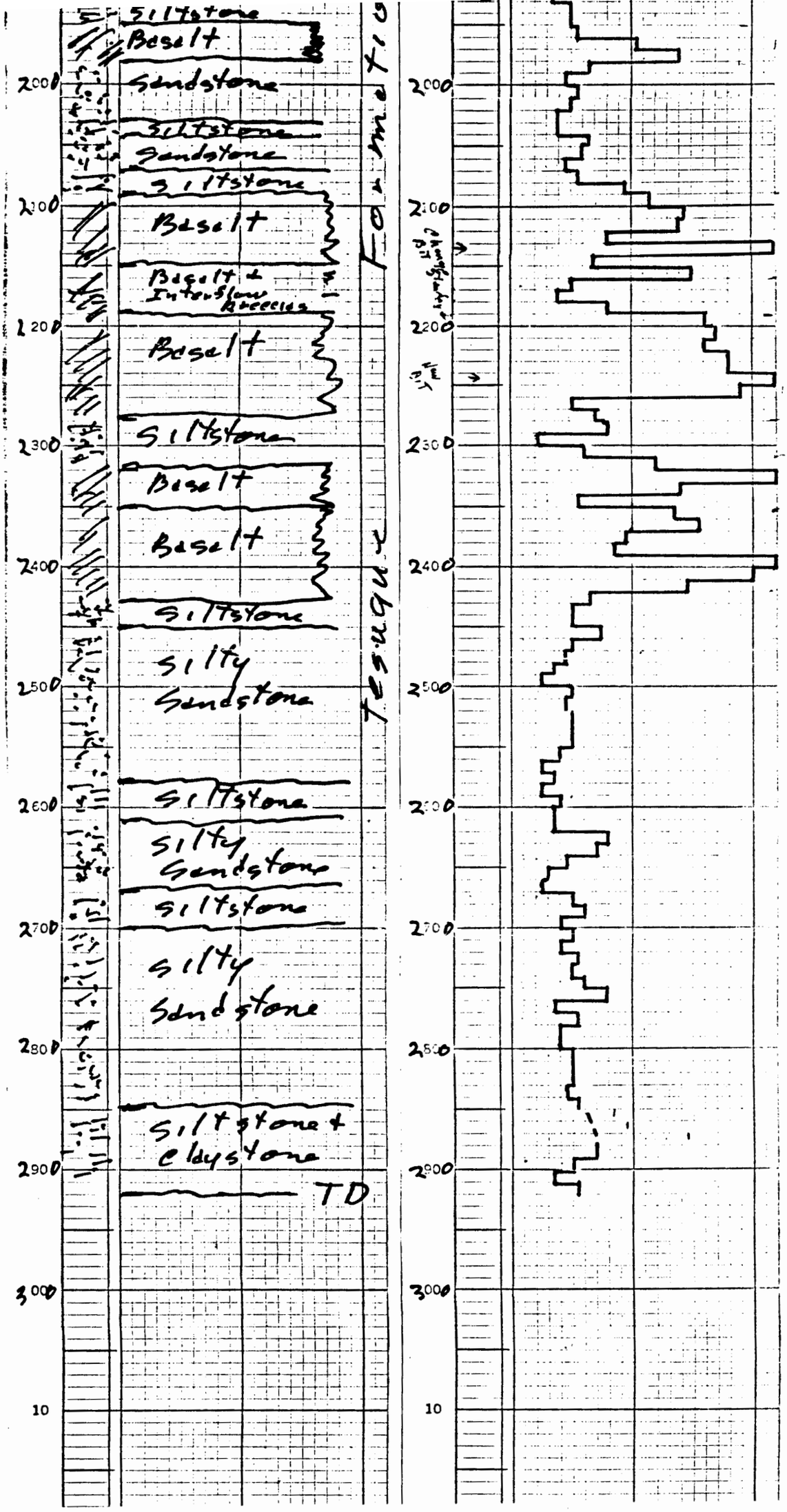
Pajarito Mesa No. 5 [PM-5]

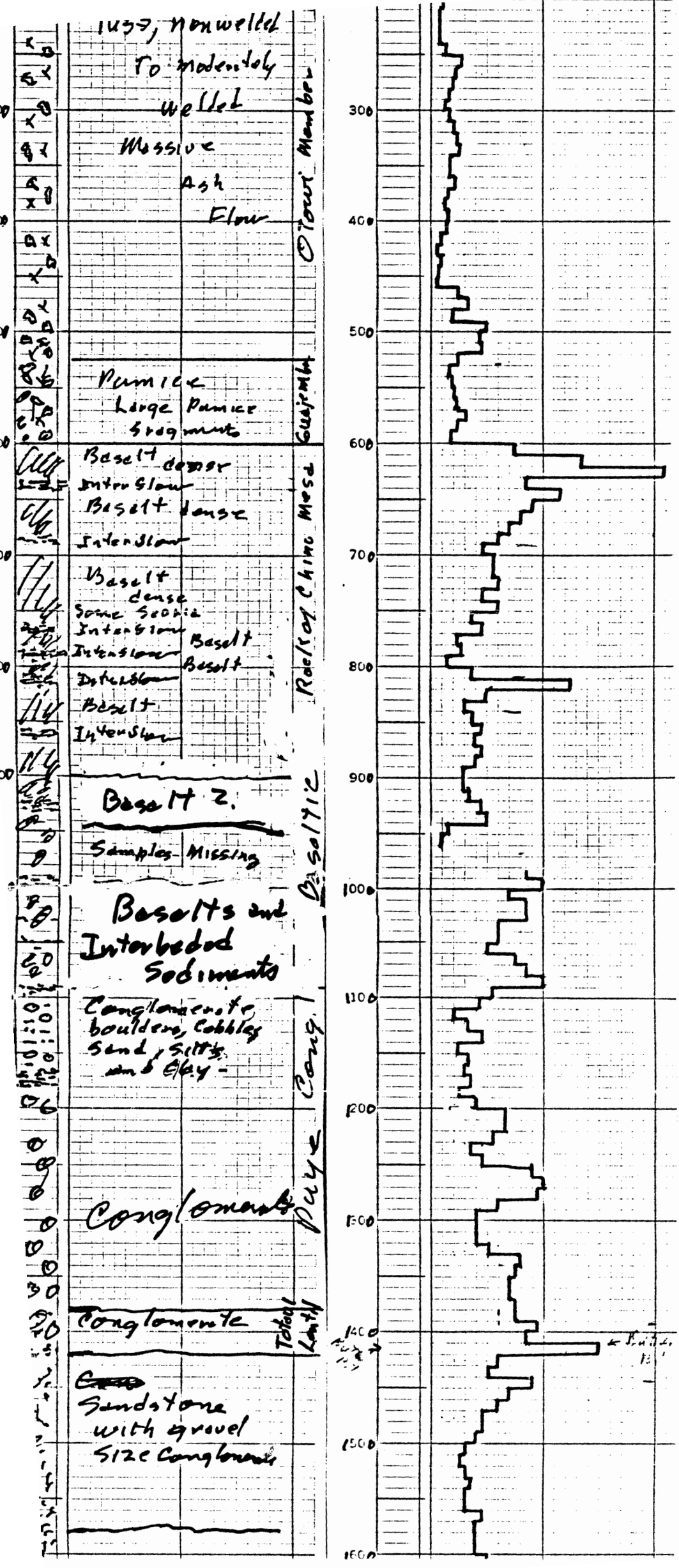
Coordinates: N.1,767,600 ft E.492,700 ft (NM state plane, Central Zone)
Latitude: 35 51.5′ N. Longitude: 106 16.5′ W.

Elevation: 7095 feet (2162.6 m)

TD at time of logging: 2427 feet (739.7 m)
Top of the logged interval: 1190 feet (362.7 m)
Base of the logged interval: 2412 feet (735.2 m)
Interval missing: 1870-1880 feet (570.0-573.0 m)

(feet) Depth Interval	Lithology or other Information	(gm/cc) Mean Density	(gm/cc) Est. Error
1190-1255	Puye Conglomerate, conglomerate member	2.13	0.02
1255-1464	Puye Conglomerate, conglomerate member	1.93	0.02
1464-1551	Totavi Lentil (conglomerate)	2.13	0.02
1551-1572	Totavi Lentil (conglomerate)	2.26	0.03
1572-1761	Totavi Lentil (conglomerate)	2.15	0.01
1761-1818	Tesuque Fm. (mostly silty sandstone)	2.17	0.02
1818-1888	Tesuque Fm. (basalts & sandstones)	2.00	0.02
1888-1945	Tesuque Fm. (basalts & sandstones)	2.19	0.02
1945-2001	Tesuque Fm. (basalt & sandstone)	2.27	0.02
2001-2090	Tesuque Fm. (basalt & sandstone)	2.28	0.02
2090-2148	Tesuque Fm. (mostly sandstone)	2.17	0.04
2148-2204	Tesuque Fm. (basalt)	2.51	0.05
2204-2325	Tesuque Fm. (basalt)	2.45	0.04
2325-2380	Tesuque Fm. (siltstone & claystone)	2.18	0.03
2380-2416	Tesuque Fm. (basalt)	2.56	0.03
1190-1464	Puye Conglomerate (incomplete section)	1.98	0.02
1464-1761	Totavi Lentil (complete section)	2.15	0.01
1761-2416	Tesuque Formation (incomplete section)	2.28	0.02
1190-2416	entire logged interval	2.18	0.02


Formation
Tesuque
Siltstone
Basalt
Sandstone
Siltstone
Sandstone
Siltstone
Basalt
Basalt + Interflow breccias
Basalt
Siltstone
Basalt
Basalt
Siltstone
Silty Sandstone
Siltstone
Silty Sandstone
Siltstone
Silty Sandstone
Siltstone + claystone
TD
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
10


Tuff, nonwelded
To moderately
welded
Massive
Ash
Flow
Otowi Member
Pumice
Large Pumice
fragments
Guaje Mbr
Basalt dense
Interslow
Basalt dense
Interslow
Basalt
dense
Some Scoria
Interslow
Basalt
Interslow
Basalt
Interslow
Basalt
Interslow
Rocky Chino Mesa
Basalt 2.
Samples Missing
Basaltic
Basalts and
Interbedded
Sediments
Conglomerate
boulders, Cobbles
Sand, Silts
and Clay -
Cong.
Conglomerate
Puye
Conglomerate
Total Length
Sandstone
with gravel
size Conglomerate
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600

PM-5

G.L. Elevation - 7095 ft
TD - 2427ft.; 4668 Elev.
drilled (1982); depth to water 1208 SWL?ft ; 5887 ft elev.(Purtyman)

Log	Depth	Thickness	Top Elevation	Differ w/ FIMAD
Tshirege Member	0-285	285		
Otowi Member, Bandelier Tuff	285-690	405	6810	6760
Guaje Member, Bandelier Tuff	690-740	50	6405	6385
basalt (interbedded zones of conglomerate)	740-1150	410	6355	6355 (Chaquehui)
Puye Fm	1150-1470	320	5945	5950
Totavi Lentil	1470-1550	80	5625	5625
Santa Fe Gp Chamita Fm?	1550-TD	877	5545	5545 (Chaquehui)

source: Geologic log Gordon Herkenhoff & Associates, Sept. 17, 1982. FIMAD disagrres with the topof the Otowi by 50 feet, the topof the Gauje by 20 feet, but then agrres with the pick for the Totavi Lentil and Santa Fe Gp. Purtyman Report, 1995 agrees with FIMAD.

By temp log top [illegible] e 676'

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: W. D. Purtymun, H-8, MS K490

DATE: June 30, 1982

THRU:

MAIL STOP/TELEPHONE: F659/7-1049

FROM: Allen H. Cogbill AHC

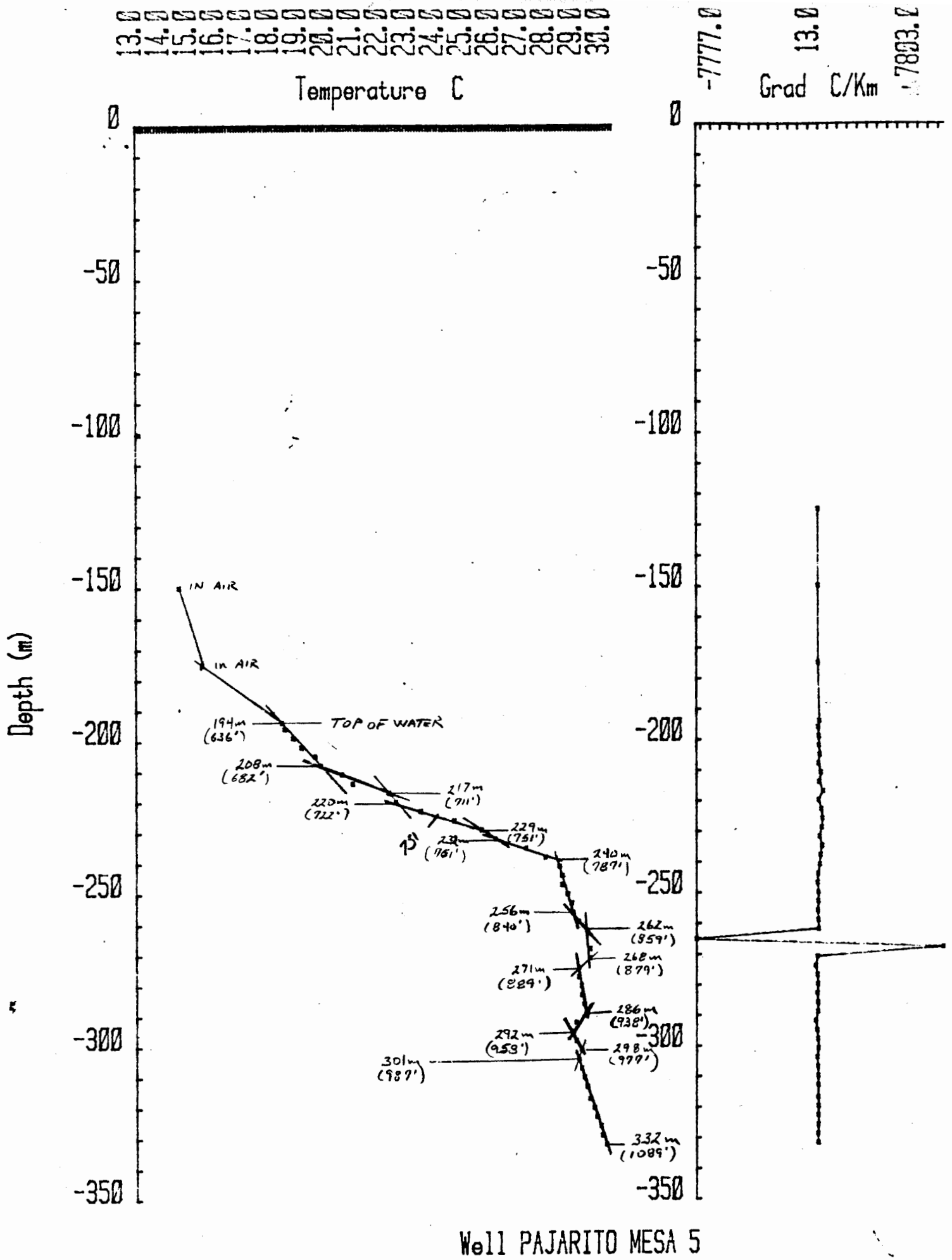
SYMBOL: ESS-3

SUBJECT: DENSITY DATA FROM WELLS PM-4 AND PM-5

I have used the Schlumberger-run compensated density logs from water wells Pajarito Mesa #4 (PM-4) and Pajarito Mesa #5 (PM-5) to estimate mean densities for the rocks within the logged portions of the wells. The logs were sampled every 2 feet and mean densities were calculated for specified intervals. The intervals for which I calculated mean values were chosen largely on the basis of homogeneity of the density log within the given interval (that is, the mean value within the interval appeared approximately constant). On the back of this memo are two tables listing the results of my calculations. The presence of several basalt flows in the upper portion of the Tesuque Formation seems to raise the mean density of the formation measurably but not substantially.

AHC/mk

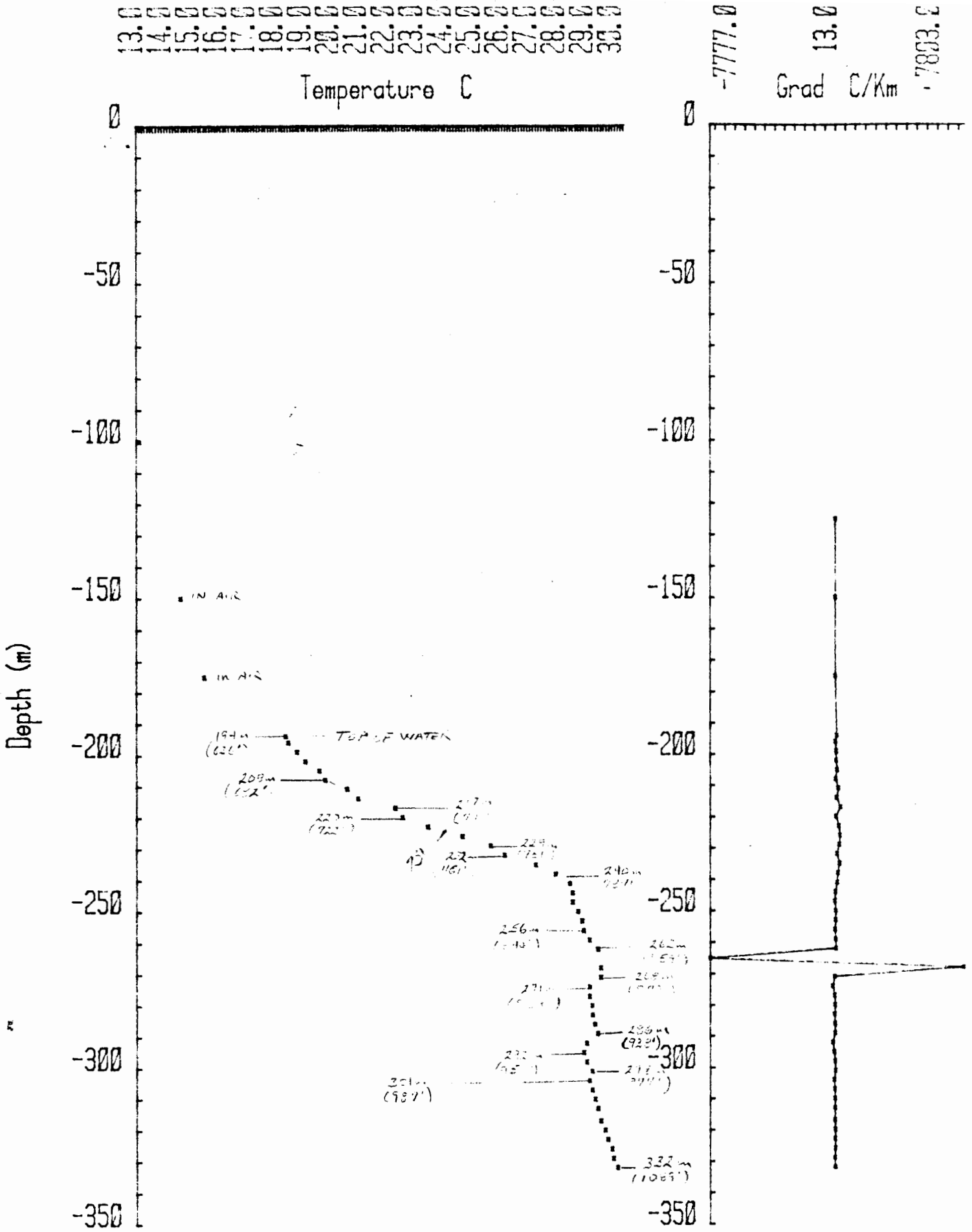
xc: F. E. Goff, ESS-2, MS J978
E. F. Homuth, ESS-3, MS C335
M. E. Ander, ESS-3, MS C335
A. H. Cogbill, ESS-3, MS F659
ES/CPO File



Well PAJARITO MESA 5

SAMPLE LOG OF PAJARITO MESA WELL NO. 5

FORMATION NAME	THICKNESS	DEPTH
Bandelier Tuff		
Tshirege Member	285	285
Otowi Member	405	690
Guaje Member	50	740
Puye Conglomerate		
Basalt	20	760
Conglomerate	45	805
Basalt	70	870
Conglomerate	35	905
Basalt	20	925
Conglomerate	40	965
Basalt	125	1,090
Basalt (Interflow Breccias)	60	1,150
Conglomerate (clay & silt stones)	320	1,470
Totavi Lentil		
Conglomerate	80	1,550
Tesuque Formation		
Conglomerate	160	1,710
Silty Sandstone	65	1,775
Basalt	30	1,805
Silty Sandstone	45	1,850
Sandstone	45	1,895
Basalt	10	1,905
Sandstone	30	1,935
Basalt & Interflow Breccia	25	1,960
Silty Sandstone	10	1,970
Dense Basalt	40	2,010
Silty Sandstone	15	2,025
Basalt	5	2,030
Silt and Sandstone	10	2,040
Basalt	5	2,045
Sandstone	15	2,060
Basalt	10	2,070
Sandstone	70	2,140
Interflow Breccias	20	2,160
Dense Basalt	80	2,240
Interflow Breccias	40	2,280
Dense Basalt	45	2,325
Silt and Claystone	55	2,380
Dense Basalt	30	2,410
Interflow Breccia	20	2,430
Dense Basalt	40	2,470
Interflow Breccia	30	2,500
Dense Basalt	60	2,560
Interflow Breccia	40	2,600
Dense Basalt	20	2,620
Interflow Breccia	80	2,700
Dense Basalt	50	2,750
Clay and Siltstone	20	2,770
Conglomerate	30	2,800



Well PAJARITO MESA 5

SAMPLE LOG OF PAJARITO MESA WELL NO. 5

FORMATION	THICKNESS	DEPTH
Coarse to fine sand, fine gravel	80	2,880
Coarse Sand	20	2,900
Silt to Claystone	50	2,950
Conglomerate	10	2,960
Claystone	10	2,970
Coarse Sand	30	3,000
Siltstone	10	3,010
Coarse Sand	10	3,020
Siltstone and Claystone	45	3,065
Coarse Sand	20	3,085
Fine Gravel	15	3,100
Claystone	17	3,117

Total Depth of the 15 3/4" Pilot Hole = 3,117' Below Ground Level

GORDON PERKENHOFF & ASSOCIATES, INC. 302 Eighth Street, N.W. Albuquerque New Mexico 87102 (505) 247-0294 ENGINEERING COMPUTATIONS	NAME OF PROJECT FAJARITO MESA WELL No. 5 SAMPLE LOG			SHEET NUMBER 1 OF 2
	COMPUTED BY SORELL	CHECKED BY	JOB NUMBER 1812.11	DATE SEPT 17, 1982

-0 TOP SOIL

BANDELIER TUFF

-3 ASH FLOW TUFF. MODERATELY CONSOLIDATED BUFF TO LIGHT GREY RHYOLITIC, QUARTZ AND SANIDINE CRYSTALS, PUMICE AND IGNEOUS CLASTS IN A MATRIX OF FINE ASH.

-285 TSHIREGE MEMBER

ASH FALL TUFF POORLY CONSOLIDATED LIGHT GREY, RHYOLITIC QUARTZ AND SANIDINE CRYSTALS, FAIR AMOUNT

OTOWI MEMBER

-690

ASH FALL TUFF COMPOSITION SAME AS ABOVE FORMATION VERY PUMACEOUS

-740 GUAJE MEMBER

PUYE FORMATION

BASALT

-760 CONGLOMERATE (VERY POORLY SORTED CLAY SIZES TO LARGE BOULDERS)

-805 BASALT

-870 CONGLOMERATE

-905 BASALT

-925 CONGLOMERATE

-965 BASALT

-1090 BASALT AND LAHARIC BRECCIA

-1150 CONGLOMERITIC CLAYSTONES AND SILTSTONES

-1470 TOTAVI LENTIL (POORLY CONSOLIDATED CONGLOMERATE)

-1550 SANTA FE FORMATION

CONGLOMERATE

-1710 SILTY SANDSTONE

-1775 BASALT

-1805 SILTY SANDSTONE

-1850 SANDSTONE

-1895 BASALT

-1905 SANDSTONE

-1935 BASALT AND LAHARIC BRECCIA

-1960 SILTY SANDSTONE

-1970 DENSE BASALT

-2010 SILTY SANDSTONE

-2025 BASALT

-2030 SILTY SANDSTONE

-2040 BASALT

GORDON HERKENHOFF & ASSOCIATES, INC. 302 Eighth Street N.W. Albuquerque, New Mexico 87102 (505) 247-0294 ENGINEERING COMPUTATIONS	NAME OF PROJECT WATER SYSTEMS IMPROVEMENTS PACARIC MESA WELL No. 5 SAMPLE LOG			SHEET NUMBER 2 OF 2
	COMPUTED BY SORRELL	CHECKED BY	JOB NUMBER 1812.11	DATE SEPT. 17, 1982

-2045 SANDSTONE

-2060 BASALT

-2070 SANDSTONE

-2140 INTERFLOW LAHARIC BRECCIA

-2160 DENSE BASALT

-2240 INTERFLOW LAHARIC BRECCIA

-2280 DENSE BASALT

-2325 SILT AND CLAYSTONE

-2380 DENSE BASALT

-2410 INTERFLOW LAHARIC BRECCIA

-2430 DENSE BASALT

-2470 INTERFLOW LAHARIC BRECCIA

-2500 DENSE BASALT

-2560 INTERFLOW LAHARIC BRECCIA

-2600 DENSE BASALT

-2620 INTERFLOW LAHARIC BRECCIA

-2700 DENSE BASALT

-2750 CLAY TO SILTSTONE

-2770 CONGLOMERATE

-2800 COARSE TO FINE SAND, FINE GRAVEL

-2830 COARSE SAND

-2900 SILT TO CLAYSTONE

-2950 CONGLOMERATE

-2960 CLAYSTONE

-2970 COARSE SAND

-3000 SILTSTONE

-3010 COARSE SAND

-3020 SILT TO CLAYSTONE

-3065 COARSE SAND

-3085 FINE GRAVEL

-3100 CLAYSTONE

-3117 TOTAL DEPTH OF PILOT HOLE

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Fraser E. Goff ESS-2, MS J978

DATE: June 17, 1982

THRU:

MAIL STOP/TELEPHONE: F659/7-1049

FROM: Allen H. Cogbill AHC

SYMBOL: ESS-3

SUBJECT: MEASURED DENSITIES OF SAMPLES OF TSCHICOMA FORMATION

In the interest of estimating the (dry) bulk density of the Tschicoma Formation, I measured the density of seven cylindrical samples (cores) of Tschicoma Formation. The samples were collected by Ian MacGregor and are not obviously very porous. I don't know how representative these samples are of the entire rock unit, but I presume that they are more dense than the formation as a whole. My results are below:

Sample ID	Volume, cc	Mass, gm	Density, gm/cc
IM-125A	177.4 ± 1.4	428.30	2.41 ± 0.02
IM-207	143.2 ± 1.2	326.47	2.28 ± 0.02
IM-158	124.8 ± 1.2	311.41	2.50 ± 0.02
IM-146	148.0 ± 2.9	372.22	2.52 ± 0.05
IM-206A	169.5 ± 1.3	416.06	2.45 ± 0.02
IM-149	140.7 ± 1.2	326.87	2.32 ± 0.02
IM-168	181.2 ± 1.4	455.74	2.52 ± 0.02

The weighted mean density of the seven samples is 2.42 gm/cc; the median is 2.45 gm/cc.

AHC/mk
xc: W. D. Purtymun, H-8, MS K490
E. F. Homuth, ESS-3, MS C335
A. H. Cogbill, ESS-3, MS F659
ES/CPO File

SAMPLE LOG OF PAJARITO MESA WELL NO. 5

FORMATION NAME	THICKNESS	DEPTH
Bandelier Tuff		
Tshirege Member	285	285
Otowi Member	405	690
Guaje Member	50	740
Puye Conglomerate		
Basalt	20	760
Conglomerate	45	805
Basalt	70	870
Conglomerate	35	905
Basalt	20	925
Conglomerate	40	965
Basalt	125	1,090
Basalt (Interflow Breccias)	60	1,150
Conglomerate (clay & silt stones)	320	1,470
Totavi Lentil		
Conglomerate	80	1,550
Tesuque Formation		
Conglomerate	160	1,710
Silty Sandstone	65	1,775
Basalt	30	1,805
Silty Sandstone	45	1,850
Sandstone	45	1,895
Basalt	10	1,905
Sandstone	30	1,935
Basalt & Interflow Breccia	25	1,960
Silty Sandstone	10	1,970
Dense Basalt	40	2,010
Silty Sandstone	15	2,025
Basalt	5	2,030
Silt and Sandstone	10	2,040
Basalt	5	2,045
Sandstone	15	2,060
Basalt	10	2,070
Sandstone	70	2,140
Interflow Breccias	20	2,160
Dense Basalt	80	2,240
Interflow Breccias	40	2,280
Dense Basalt	45	2,325
Silt and Claystone	55	2,380
Dense Basalt	30	2,410
Interflow Breccia	20	2,430
Dense Basalt	40	2,470
Interflow Breccia	30	2,500
Dense Basalt	60	2,560
Interflow Breccia	40	2,600
Dense Basalt	20	2,620
Interflow Breccia	80	2,700
Dense Basalt	50	2,750
Clay and Siltstone	20	2,770
Conglomerate	30	2,800

SAMPLE LOG OF PAJARITO MESA WELL NO. 5

FORMATION	THICKNESS	DEPTH
Coarse to fine sand, fine gravel	80	2,880
Coarse Sand	20	2,900
Silt to Claystone	50	2,950
Conglomerate	10	2,960
Claystone	10	2,970
Coarse Sand	30	3,000
Siltstone	10	3,010
Coarse Sand	10	3,020
Siltstone and Claystone	45	3,065
Coarse Sand	20	3,085
Fine Gravel	15	3,100
Claystone	17	3,117

Total Depth of the 15 3/4" Pilot Hole = 3,117' Below Ground Level

PM-3

G.L. Elevation - 6640 ft; TD - 2552ft.; 4088 ft Elev
drilled (1966); depth to water ft 740 SWL?; 5900 ft elev.

Log	Depth	Thickness	Top Elevation
Alluvium	0-30	30	
Otowi Member, Bandelier Tuff	30-170	140	6610
Guaje Member, Bandelier Tuff	170-190	20	6470
Puye Fm (grey pumice zone 190-200ft; 6450-6440)	190-215	25	6450
basalt	215-540	325	6425
Puye Fm	540-745	205	6100
Totavi Lentil	745-805	60	5895
Santa Fe Gp Chamita Fm?	805-2552	1747	5835

source: ~~descriptive log of well cuttings~~ Purtymun, 1967

SCHLUMBERGER WELL SURVEYING CORPORATION
Houston, Texas

LOCATION WILDCAT
WELL PAJARITO MESA
COMPANY ATOMIC ENERGY COMMISSION

COMPANY ATOMIC ENERGY COMMISSION *pm-3*

WELL PAJARITO MESA

FIELD WILDCAT

COUNTY SANTA FE STATE NEW MEXICO

Location: S 1/2 SW NW

Sec. 19 Twp. 19N Rge. 7E

Other Services:
DWT
IES
ML

HL

ıanent Datum: GL ; Elev.: 6640
Measured From GL , 0 Ft. Above Perm. Datum
ing Measured From GL

Elev.: K.B. --
D.F. --
G.L. 6640

;	6/30/66		
No.	ONE		
e Log	NGR		
th—Driller	2555		
th—Logger	2554		
om logged interval	2552		
logged interval	50		
e fluid in hole	FRESH GEL	W/CAUSTIC	
alinity, PPM Cl.	1100		
ensity	9.8		
evel	FULL		
x rec. temp., deg F.	109		
erating rig time	2 HR.		
orded by	KIMBALL & BROOKS		
nessed by	MR. CROSS		

BORE-HOLE RECORD			CASING RECORD			
Bit	From	To	Size	Wgt.	From	To
8 3/4	SURFACE	2555	NONE			

THIS HEADING AND LOG CONFORMS TO API RP 33

FOLD HERE

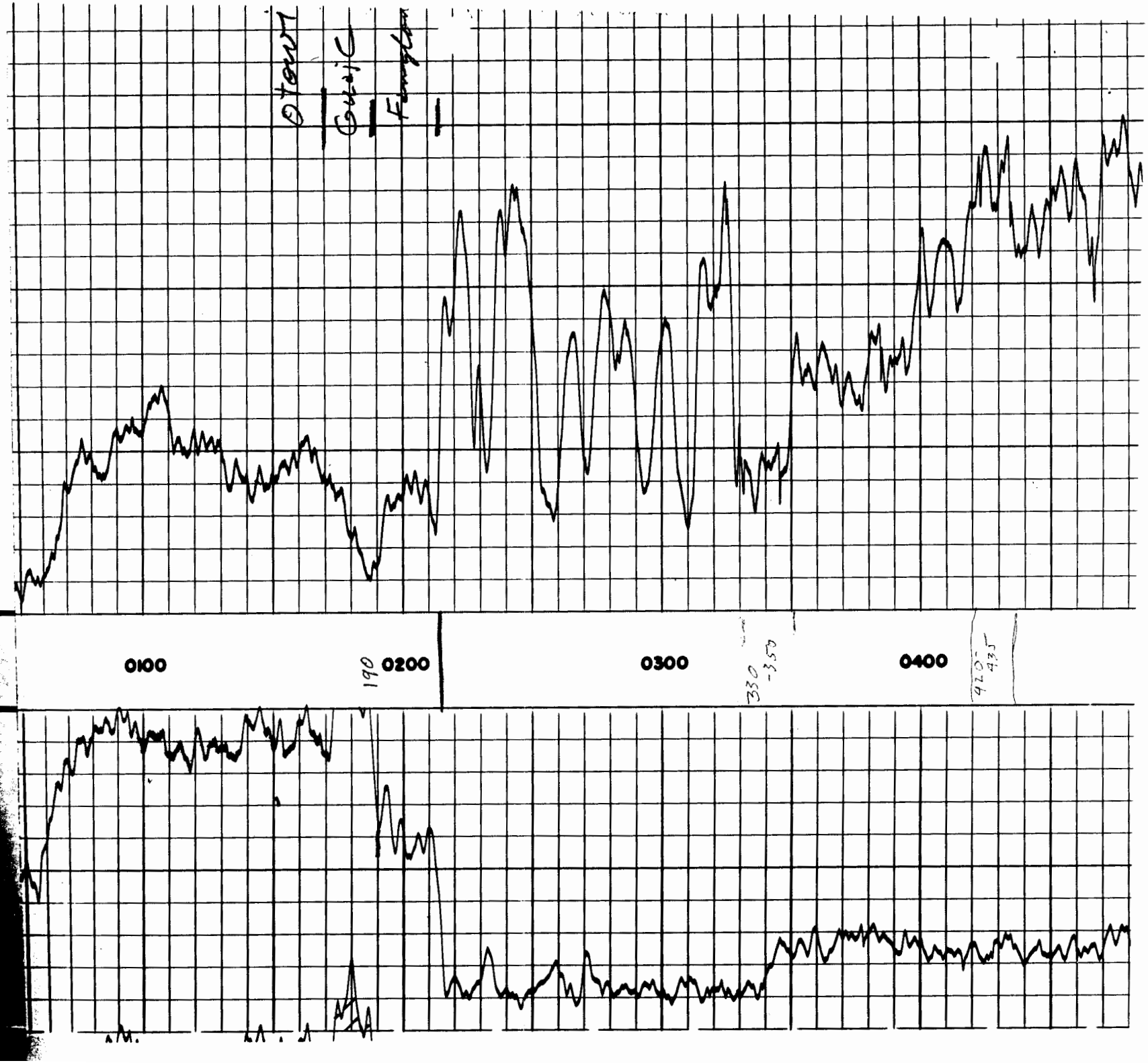
EQUIPMENT DATA

	Gamma Ray		Neutron	
Run No.	ONE		ONE	
Tool Model No.	GNT-F		NGR	
Diameter	3 5/8		GNT-F	
Det'r Model No.	SGD-F		3 5/8	
Type	SCINT		NLD-D	
Length	8"		G-M	
Dist. to N. Source	84"		6"	
			NLS-B	
			--	
General			19.5	
Hoist Truck No.	4542		PU BE	
Inst. Truck No.	--		5 CURIES	
Tool Serial No.	GNC 52			
Location	FARM			

LOGGING DATA

General Depths				Gamma Ray				Neutron			
Run No.	From	To	Speed Ft/Min.	T.C. Sec.	Sens. Settings	Zero Div. L or R	API G.R. Units per Log Div.	T.C. Sec.	Sens. Settings	Zero Div. L or R	API N per L
1	100	TD	30	2	300	2L	12	2	200	3L	1(

Reference Literature:


Ottawa
Guelph
Fergus
0100
0200
0300
0400
190
330
-350
420
435

0900
1000
1100
1200
1300
1400

0300
0400
0500
0600
0700
Total Landed

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Santa Fe, New Mexico

Record of water-supply well PM-3

Los Alamos, New Mexico

By

William D. Purtymun

Open-file report

Prepared in cooperation with the U.S. Atomic Energy Commission

June 1967

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Specific capacity and coefficient of transmissibility	13
Chemical and radiochemical quality of water	16
Conclusions	21
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Illustrations

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3.--Gamma Ray-Neutron log of well PM-3	Reference page 7 (in pocket)
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Record of water-supply well PM-3, Los Alamos, New Mexico

By

William D. Purtymun

Introduction

This report contains data on the geology and hydrology at the site of construction of supply well PM-3 which was drilled in 1966 to supplement the water supply at Los Alamos, New Mexico. The well is in Sandia Canyon about 7,000 feet west of the junction of the Laboratory Truck Route and State Highway 4 (fig. 1).

The location was chosen by the U.S. Atomic Energy Commission as the first of five well locations suggested by the Geological Survey (Purtymun and Cooper, 1965). The well has a capability of supplying either of the communities of Los Alamos or White Rock through the 16-inch water line that parallels State Highway 4.

The drilling and construction of the well was divided into 2 main phases: 1) drilling a 9-inch pilot hole to a depth of 2,552 feet, logging by geophysical methods the formations penetrated, and preparation of a geologic log of the formations; and 2) reaming the pilot hole to 2,552 feet, casing, gravel-packing, and developing by swabbing, bailing, and pumping.

Well construction and development was supervised by Gordon Herkenhoff and Associates, Consulting Engineers, Albuquerque, New Mexico.

Geology and construction

Well PM-3 is completed at a depth of 2,552 feet, and penetrates the Bandelier Tuff, basaltic rocks of Chino Mesa, Puye Conglomerate and the Tesuque Formation. The static water level stands at 740 feet below land surface. Units of the Puye Conglomerate and Tesuque Formation are in the zone of saturation.

The descriptive log of the formations penetrated by the pilot hole is given in table 1. Figures 2, 3, 4, and 5 are geophysical logs of the well. Examination and interpretation of the geologic and geophysical logs indicate that the greater part of the formations in the zone of saturation (740 to 2,552 feet) are permeable and would yield water to the well. A high yield well (1,000 to 1,500 gallons per minute) could be developed by completing the well to the total depth of the pilot hole (2,552 feet).

The well, gravel packed, is cased with 2,552 feet of 14-inch casing. The lower 1,596 feet is perforated.

Table 2 contains the construction record.

Table 1.--Geologic log of well PM-3

Location:	NW½,NW¼,SW¼,sec.19,T.19N., R.7 E
Altitude:	6,640 feet above sea-level datum
Total Depth:	2,552 feet
Date Drilled:	1966
Tools	Mud rotary
Driller:	Perry and Faast Drilling Co.; Grand Junction, Colo.

Material	Thickness (feet)	Depth (feet)
Alluvium:		
Sand, silty, composed of quartz and sanidine crystals and crystal fragments and occasional rock fragments of latite and pumice; latite as much as one-inch in length.	30	30
Bandelier Tuff, Otowi Member:		
Tuff, light pinkish gray, composed of quartz and sanidine crystals and crystal fragments; small rock fragments of pumice, latite and rhyolite.	140	170

Table 1.--Geologic log of well PM-3 - Continued

Material	Thickness (feet)	Depth (feet)
Bandelier Tuff, Guaje Member:		
Pumice, light gray, composed of quartz and sanidine crystals and crystal fragments; some latite rock fragments in a cellular glassy matrix.	20	190
Puye Conglomerate, fanglomerate member:		
Siltstone, light pink, composed of silt and clay; rock fragments of latite, rhyolite, and basalt; gray pumice fragments from 190 to 200 feet; increasing basalt fragments from 200 to 215 feet.	25	215
Unit 3 of the basaltic rocks of Chino Mesa:		
Basalt, dark gray, dense, some iron staining with olive crystals; basalt light red, composed of basalt fragments in clay, silt, and gravel from 330 to 350 feet and from 410 to 420 feet.	325	540

Table 1.--Geologic log of well PM-3 - Continued

Material	Thickness (feet)	Depth (feet)
Puye Conglomerate, fanglomerate member:		
Conglomerate, light gray, composed of gravel and boulders; fine fraction is composed of quartz, sanidine orthoclase, and some mafic minerals; gravel and boulders are composed of latite, rhyolite, and occasional fragments of basalt and pumice; boulders increase from 625 to 745 feet.	205	745
Puye Conglomerate, Totavi Lentil:		
Conglomerate, gray, composed of gravel and boulders of latite, rhyolite and quartzsite; and some mafic minerals.	60	805
Tesuque Formation:		
Sandstone, silty, light gray, composed of medium to coarse sand consisting chiefly of quartz and feldspar and some mafic minerals.	300	1,105
Basalt, dark gray, dense, containing some pyroxine and olivine; clay, light orange 1,210-1,215 feet; some red vesicular basalt from 1,250 to 1,280 feet.	175	1,280

Table 1.--Geologic log of well PM-3 - Continued

Material	Thickness (feet)	Depth (feet)
Basalt, dark gray, dense, angular, some clay, sand and gravel, subrounded; probably alternating thin basalts and interbedded sediments.	35	1,315
Conglomerate, dark gray, composed mostly of sand with occasional cobbles or boulders of rhyolite; some thin flows of gray basalt, some light pinkish clay and silt.	125	1,440
Siltstone, light brown, contains a small amount of subrounded sand; sand size fraction increases from 1,460 to 1,470 feet.	55	1,495
Basalt, dark gray dense, with some phenocrysts of pryoxine and olivine.	45	1,540
Sandstone, dark gray, composed of medium to coarse sand, subrounded, with some rock fragments of basalt and a few subrounded pebble fragments of quartzsite.	220	1,760

Table 1.--Geologic log of well PM-3 - Continued

Material	Thickness (feet)	Depth (feet)
Sandstone, silty, light pinkish gray, fine to medium sand, subrounded to well rounded, a few subrounded pebbles.	130	1,890
Siltstone, light brown, with an occasional lense of pebbly conglomerate; some basalt fragments 2,030 to 2,060.	170	2,060
Sandstone, silty, light pinkish brown, predominately fine to medium sand, subrounded to well rounded; coarse sand increases from 2,320 to 2,410 feet; clay and silt, light pink, from 2,470 to 2,490 feet and 2,530 to 2,540 ft.	492	2,552

Table 2.--Construction record of well PM-3

Total depth: 2,552 feet.

Date completed: November 1966.

Casing and hole record: 30-inch hole from 0 to 552 feet, cased with 26-inch pipe, cemented in hole.

24-inch hole from 552 to 2,552 feet. Cased with 14-inch ID blank pipe from 0 to 956 feet and with 14-inch ID pipe slotted with 3/32-inch louver openings from 956 to 2,552 feet.

Annulus between 14-inch and 24-inch hole was filled from 2,552 to 0 feet with washed and graded gravel ranging in size from about 1/32-inch to ¼-inch.

Gage lines: Two steel-pipe gage lines each of 2-inch diameter installed on outside of 14-inch pipe and enter the casing at a depth of 960 feet. An airline will be installed in one gage line; the other is used for entry of mechanical water-level measuring devices.

Well development: The well was swabbed and bailed for 418 hours. Further development consisted of pumping for about 99 hours at rates of 780 to 1,500 gpm.

Yield: Data obtained during the step test indicated that specific capacity of the well is about 37 gpm per foot of drawdown after 12 hours of pumping at 1,400 gpm.

Specific capacity

and

coefficient of transmissibility

A step test to determine the size and capacity of the permanent pump was made near the end of the test pumping and development period. The well had been pumped 22 ~~hours~~ out of the ~~past~~ 24 hours prior to the step test. The results indicate specific capacities (ratio of pumping rate to water level drawdown) ranging from about 45 gpm per foot of drawdown after 4 hours of pumping at about 900 gpm (gallons per minute) to about 37 gpm per ft. of drawdown after 12 hours of pumping at about 1,400 gpm (table 3). The specific capacities are the highest obtained during the testing of any well in the Los Alamos area.

Table 3.--Step test of well PM-3, November 4 and 5, 1966.

Date	Time (hours)	Water level (feet)	Discharge (gpm)	Specific Capacity (gpm per ft. of drawdown)
11-4-66	11:00	740.0	-	-
	12:00	774.9	1,401	40.1
	13:00	775.5	1,401	39.5
	14:00	775.8	1,401	39.1
	15:00	776.2	1,409	38.9
	16:00	776.6	1,409	38.4
	17:00	776.6	1,401	38.3
	18:00	776.7	1,401	38.2
	19:00	777.1	1,401	37.8
	20:00	777.3	1,401	37.6
	21:00	777.8	1,401	37.1
	22:00	777.8	1,401	37.1
	23:00 a/	777.9	1,401	37.0
	24:00	770.0	1,311	43.7
11-5-66	01:00	769.7	1,295	43.6
	02:00	771.0	1,295	41.8
	03:00 a/	771.1	1,295	41.6
	04:00	767.5	1,134	41.2
	05:00	767.7	1,143	41.3
	06:00	767.8	1,143	41.1
	07:00 a/	767.8	1,153	41.5
	08:00	760.0	899	45.0
	09:00	759.0	887	46.7
	10:00	759.5	899	46.1
	11:00	759.8	899	45.4

a/ Reduce gpm

Note: The amount of sand in discharge was too small to measure, less than 0.1 ppm.

The projected drawdowns and specific capacities at a pumping rate of 1,400 gpm are shown below for periods at the end of one, ten, and thirty days.

	Drawdown (feet)	Specific Capacity (gpm per ft. of drawdown)
1 day	39	36
10 days	42	33
30 days	45	31

The above drawdowns and specific capacities were obtained by projecting drawdown trends during the segment of step test of 12 hours at a pumping rate of 1,400 gpm. The projected values are valid if there were no geologic features that would affect the rate of flow of ground water into the well after prolonged pumping. These data indicate that the well can be equipped with a pump capable of producing as much as 1,400 gpm.

Chemical and radiochemical quality of water

Three water samples were collected at intervals during the test pumping and development of the well. The analyses indicated no significant changes in chemical or radiochemical quality of water with increased pumpage (table 4). The quality of the water is similar to that of well PM-1, which is in Sandia Canyon about 7,000 feet to the east (figure 1). The concentrations of calcium and magnesium in water from both wells is high and results in a water that is moderately hard (98 to 104 ppm) as compared to the other supply wells (range 8 to 54 ppm in 1966),

The water samples were not analyzed for silica, however, four water samples bailed from selected depths in February 1967 had the following silica concentrations:

Depth (feet)	Silica (ppm)
1,000	50
1,500	67
2,000	74
2,400	58

Pumping of the well will probably result in silica concentrations similar to that in water from well PM-1 which range from 65 ppm to 89 ppm.

Table 4.--Chemical and radiochemical analyses of water from well PM-3

(Analyses by the Los Alamos Scientific Laboratory)

Chemical		Date		
		10-31-66	11-3-66	11-4-66
Parts per million	Calcium	26	30	26
	Magnesium	9	7	8
	Sodium	23	24	24
	Carbonate	0	0	0
	Bicarbonate	128	132	126
	Chloride	16	18	16
	Fluoride	0.2	0.	0
	Nitrate	0.2	0.3	0.3
	Dissolved solids	242	166	268
	Total hardness as C_aCO_3	102	104	98
Conductivity in micromhos at 25°C		240	260	240
pH		7.7	7.7	7.7
Radio-chemical				
	Plutonium d/m/l 1/	< 0.4	< 0.4	< 0.4
	Uranium $\mu g/l$ 2/	5.1	0.8	1.2
	Beta-gamma emitters d/m/l 1/	~~Bq.~~ BKG	~~Bq.~~ BKG	~~Bq.~~ BKG
Prepumped (hours)		30	54	67
Estimated Pumpage (millions of gallons)		3	4.5	5.1

1/ Disintegration per minute per liter.

2/ Microgram per liter.

The coefficient of transmissibility "T" was determined by analyzing the rate of water level recovery after 12 hours of pumping at a rate of 1,235 gpm by using the method described by Wenzel (p.96, 1942). The indicated "T" is about 320,000 gallons per day per foot (figure 6).

The amount of sand produced with pumpage during the step and aquifer tests was collected and measured at 30 minute intervals. The amount of sand produced during the step test and during the aquifer test was too small to measure--it was less than 0.1 ppm (part per million).

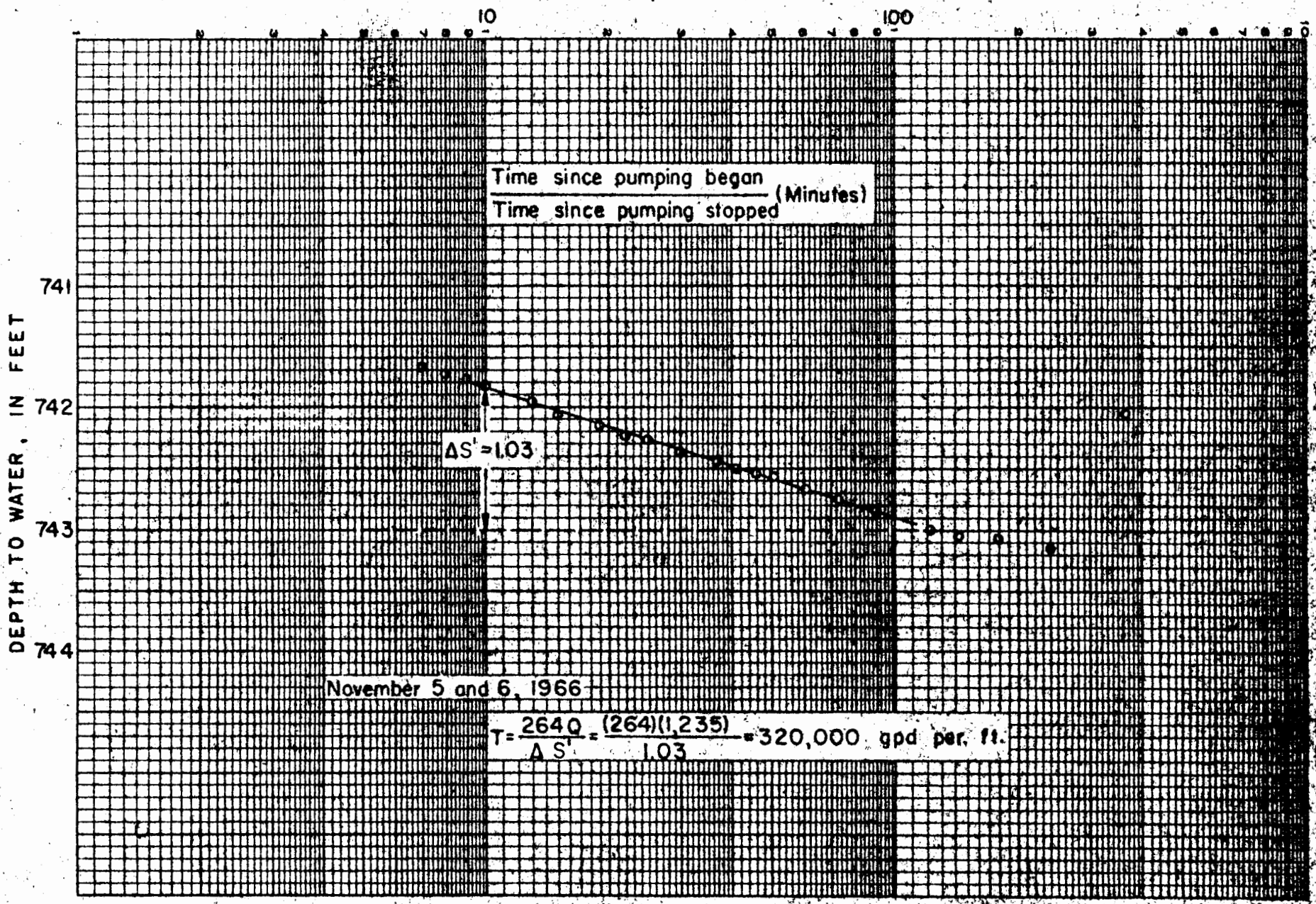

Figure 6.--Water level recovery plot of well [illegible]

Radiochemical analyses of water from the well shows ~~no~~ LESS THAN THE LOWER DETECTABLE LIMIT OF plutonium and only background levels of beta-gamma ~~emitters~~ activity. Uranium ACTIVITY reported is low, ~~occurring~~ AND OCCURS naturally in the aquifer, ~~and~~ It is not the result of contamination.

Conclusions

The well was completed at a depth of 2,552 feet and based on interpretations of geologic and geophysical logs a high yield well (1,000 to 1,500 gpm) could be developed. The data collected during the step test indicate that the well can supply a pump capable of producing 1,400 gpm. The methods used in construction (size of gravel, size of louver openings in casing, and development by swabbing, bailing, and pumping), were satisfactory. Little or no sand was produced with the water pumped during the squifer and step test, thus sand should cause no difficulties when water from the well is added to the supply system.

The water is of good quality for domestic and most industrial use; however, the relatively high concentrations of silica, calcium, and magnesium will contribute scale formation when the water is heated and may be objectionable for some industrial use.

References

Purtymun, Willian D., and Cooper, James B., 1965, Locations for five water-supply wells at Los Alamos, New Mexico: U.S. Geol. Survey Unpublished Admin. Rept., 47 p. 2 figs.

Wenzel, L. K., 1952, Methods for determining permeability of water-bearing materials with special reference to discharging-well methods: U.S. Geol. Survey Water-Supply Paper 887, 192 p. 17 figs.

Table 30.--Test well T-1

USGS Location No. 19.7.20.221 USGS Designation T-1 (Test well 1)

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography Pueblo Canyon Altitude 6,371 feet

Method drilled Cable tool Diameter 8 inches Use observation

Drilled depth 642 feet Completed depth 642 feet

Date drilled January 1950 Chief Aquifer(s) Totavi lentil

Depth to water 593.1 feet Date Jan. 4, 1951 Transmissibility 200 gpd/

Specific capacity 2 gpm/ft After 246 hours pumping

Log:

	Thickness	Depth
Puye Conglomerate		
Fanglomerate member	50-[illegible]50	[illegible]
Basaltic Rocks Unit 3	115-165	62[illegible]
Puye Conglomerate		
Fanglomerate member	11[illegible]-176	[illegible]
Basaltic Rocks Unit 2	79-255	6[illegible]6
Puye Conglomerate		
Fanglomerate member	155-[illegible]10	[illegible]
Basaltic Rocks Unit 2	100-510	[illegible]
Puye Conglomerate		
Fanglomerate member	[illegible]95-605	[illegible]
Totavi Lentil	[illegible]37-642	[illegible]

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
16 OD	0-52	
12 ID	0-241	
8 ID	0-627	
6	622-642	10 feet of screen from 622-632 feet.

Chemical analysis: Constituents in parts per million

Date Jan. 7, 1953, Temp. 70 °F, SiO_2 56, Fe .04, Ca 20,

Mg 1.2, Na + K 19, HCO_3 92, CO_3 _____, SO_4 5.1, Cl 4.2,

F 1.1, NO_3 7.2, Hardness 55, Dissolved solids _____,

Specific conductance 183 micromhos, pH _____

Radiochemical analysis: Date June 19, 1962, Pu <0.4 d/m/l, U 3.0 µg/l,

Gross β (Gamma) <20 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Table 31.—Test well T-1A

USGS Location No. 19.7.20.221a USGS Designation T-1A (Test well 1A)

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography Pueblo Canyon Altitude 6,370 feet

Method drilled Cable tool Diameter 6 inches Use Observation

Drilled depth 225 feet Completed depth 225 feet

Date drilled Jan. 1950 Chief Aquifer(s) Basaltic Rocks of Chimo Mesa Unit 2

Depth to water 183.8 feet Date Dec. 22, 1950 Transmissibility 8,300 gpd/ft

Specific capacity .75 gpm/ft After 1,128 hours pumping

Log:

	Thickness	Depth
Puye Conglomerate		
Fanglomerate member	50	50
Basaltic Rocks Unit 3	115	165
Puye Conglomerate		
Fanglomerate member	11	176
Basaltic Rocks Unit 2	49	225

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
16 OD	0- 39	
12 ID	0-100	
6 ID	0-223	10 feet of 6-inch diameter screen welded on the bottom.

Chemical analysis: Constituents in parts per million

Date Jan. 7, 1953, Temp. 53 °F, SiO_2 49, Fe .09, Ca 17, Mg 7.8, Na + K 38, HCO_3 125, CO_3 _____, SO_4 19, Cl 14, F .5, NO_3 17, Hardness 74, Dissolved solids _____, Specific conductance 321 micromhos, pH 7.2

Radiochemical analysis: Date Oct. 19, 1964, Pu <0.4 d/m/l, U 0.7 µg/l, Gross β (Gamma) 10 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled to locate perched water at 205 feet.

TW-1(TH 1-C)

Elevation - 6371 ft, Total Depth - 642ft (5729 ft elev.) ψ_p = 38 ft
(water @ 623 ft; 5748 elev. when drilled (1950);
water rose to 585 ft; 5786 elev.)

Log	Depth	Thickness	Top Elevation
Alluvium	0-50	50	
Basalt Rx	50-173	123	6321
Interflow Zone (Maar?)	173-176	3	6198
Basalt Rx	176-210	34	6195
Interflow Zone (water @212; 6159 elev.; water rose @185ft; 6186 elev.)	210-215	5	6161
basalt rx	215-255	40	6156
Puye Fm Fanglomerate Member?	255-410	155	6116
basalt rx	410-510	100	5961
Puye Fm? fanglomerate member	510-605	95	5861
Totavi Lentil	605-642	37	5766

source: Geologist's Log

Geologists Log

TEST HOLE NO. 1

Pueblo Canyon

SW¼SE¼ Sec. 17, T. 19 N., R. 7 E.
Altitude: 6,371 feet
Top Concrete Base-Elev.-6371.74

	Depth (feet) From	To
Alluvial cover		
Soil zone	0	1.5
Sand, fine to medium, and silt.		
The grains are angular to sub-angular. Materials are quartz, sanidine, and Bandelier tuff. A few small fragments of sub-angular to sub-rounded pumice are present.		
Valley fill	1.5	50
Sand and gravel, with silty clay.		
Sand and gravel composed of varying amounts of medium to coarse sand and medium gravel. In general sand is more abundant than gravel. The sand is composed of angular to sub-angular fragments of quartz, sanidine, and andesite and dacite derived from Chicoma volcanic rocks. Some of the sub-angular grains of quartz and sanidine show worn surfaces. The gravel consists of angular to almost sub-rounded fragments of welded Bandelier tuff, light gray, dense rhyolite, and Chicoma volcanic rocks, with the Chicoma rocks predominant. Pumice is present in very small amounts. Silty clay is present throughout the zone.		

Test Hole No. 1 -- Continued

	Depth (feet) From	To
White Rock Canyon basalt		
Upper flow or flows	50	173

Very dark gray to black fine-grained basalt containing a few small phenocrysts of olivine. The basalt consists of alternate vesicular and non-vesicular zones as follows:

50- 58	Vesicular basalt with oxidized fragments, and silty clay at top.
58- 77	Non-vesicular, jointed basalt.
77- 98	Vesicular basalt with red, silty clay-filled vesicles. Some oxidized fragments.
98-117	Non-vesicular, jointed basalt.
117-126	Vesicular basalt with red, silty clay-filling vesicles.
126-138	Non-vesicular, jointed basalt.
138-173	Vesicular basalt with red, silty clay-filling vesicles; large fragments of oxidized basalt also are present.

It is possible that this sequence represents a series of three thin flows.

Interflow zone	173	176±

This zone consists of angular fragments of vesicular and oxidized basalt; pinkish buff, silty clay; and a few small sub-angular to sub-rounded fragments of andesite and dacite derived from Chicoma volcanic rocks.

Middle flow	176±	210

Medium gray to dark gray, fine-grained basalt which appears to contain a larger proportion of feldspar and olivine than the upper flow zone. The upper 4 feet of the flow is vesicular, the central part non-vesicular, and the lower 5 feet vesicular.

	Depth (feet) From	To
Interflow zone	210	215

This zone consists of angular fragments of basalt, and a little silty clay.

A perched water zone was encountered at 212 feet and the water rose to 184.90 feet below ground surface. The hole was bailed at the rate of 45 gallons per minute for 15 minutes and a drawdown of 15 feet resulted. Thirty minutes were required for a recovery of 14 feet and in 33 minutes the water stood at the same level as before bailing.

Lower flow	215	255

This basalt appears to be identical with the middle flow rock but possibly contains more olivine. The top 7 feet is vesicular, the central part non-vesicular, and the lower 13 feet is vesicular and slightly reddened by oxidation.

Puye gravel

Gravel zone	255	410

Sand and gravel; and clay, laminated.

Sand and gravel ranging from medium to coarse sand and fine to medium gravel. The zone is predominately angular to sub-rounded sand which is composed of quartz, quartzite, basalt, Chicoma rock, gray, dense rhyolite, gray, glassy rhyolite, and a trace of yellowish chalcedonic silica. Chicoma rocks predominate. The angular to sub-rounded gravel is composed chiefly of Chicoma rocks, basalt, and quartzite, but small amounts of gray, dense rhyolite, and pink rhyolite (?) are gravel size. Large amounts of clay are present at the following depths: 320 to 355 feet, 388 to 400 feet, and 405 to 415 feet. From 340 to 348, and 390 to 395 feet all clay is finely laminated and free of silt and sand.

Test Hole No. 1 Continued

	Depth (feet) From	To
White Rock Canyon basalt (?)		
Indefinite zone	410	510

Black, very finely vesicular basalt, moderately rich in olivine, and containing a few tiny phenocrysts of plagioclase. Also present in small amounts are small sub-rounded to rounded pebbles of andesite and dacite derived from Chicoma volcanic rocks; and gray, dense rhyolite. It is believed that this zone represents a basalt flow or flows that incorporated some alluvial materials from the underlying Puye gravel. One fragment of basalt was observed which contained a pebble of Chicoma andesite. The zone contains abundant thinly laminated, plastic clay between the following depths: 440 to 445 feet and 458 to 477 feet. This clay is buff colored and is free from sand and silt. It is not known if this clay represents interflow deposition or material incorporated in advancing basalt.

Puye gravel		
Gravel with some sand	510	605

The gravel is sub-angular to sub-rounded and is composed chiefly of Chicoma volcanic rocks that range up to 3/4-inch in diameter. Also present in small amounts are quartz; gray, dense rhyolite; gray, glassy rhyolite; and white, pumiceous glass (?). The zone apparently contains a little finely vesicular basalt at the top but this may be caving. The sand grains are angular to almost sub-round and range from medium to coarse and are composed of quartz, Chicoma rocks, gray dense rhyolite, gray glassy rhyolite, and white pumiceous glass (?).

Test Hole No. 1 - Continued

	Depth (feet) From	To
Gravel and clay; some sand	605	642 (Bottom)

The gravel is sub-angular to sub-rounded and ranges up to 2 inches in diameter and is composed largely of Chicoma volcanic rocks. There is some quartzite; granite; gray dense rhyolite; and volcanic rocks foreign to the area. Clay is abundant and is grayish pink, in part silty, and contains soft, white material and flakes of biotite. It resembles the clay in the Santa Fe formation. The sub-angular to sub-rounded sand grains range from medium to coarse and are composed chiefly of quartz. Ground water was encountered at 623 feet and the water rose to 584.90 feet below ground surface. The hole was bailed at the rate of 15 gallons per minute for 30 minutes and a drawdown of 20 feet resulted, according to the driller. The time required for recovery was not observed.

Casing record:

16-inch ID casing set at 51 feet 8 inches.
12-inch ID casing with 13 7/8-inch drive shoe set at 241 feet.
8-inch ID casing was run to 627 feet.
10 feet of 6-inch Layne scree, with 10 feet of 6-inch ID casing, on top end, was set at 642 feet. Screen assembly extends up into 8-inch ID casing (to 622 feet below LSD - lower end of screen at 642 feet).

Total depth of hole 642 feet.

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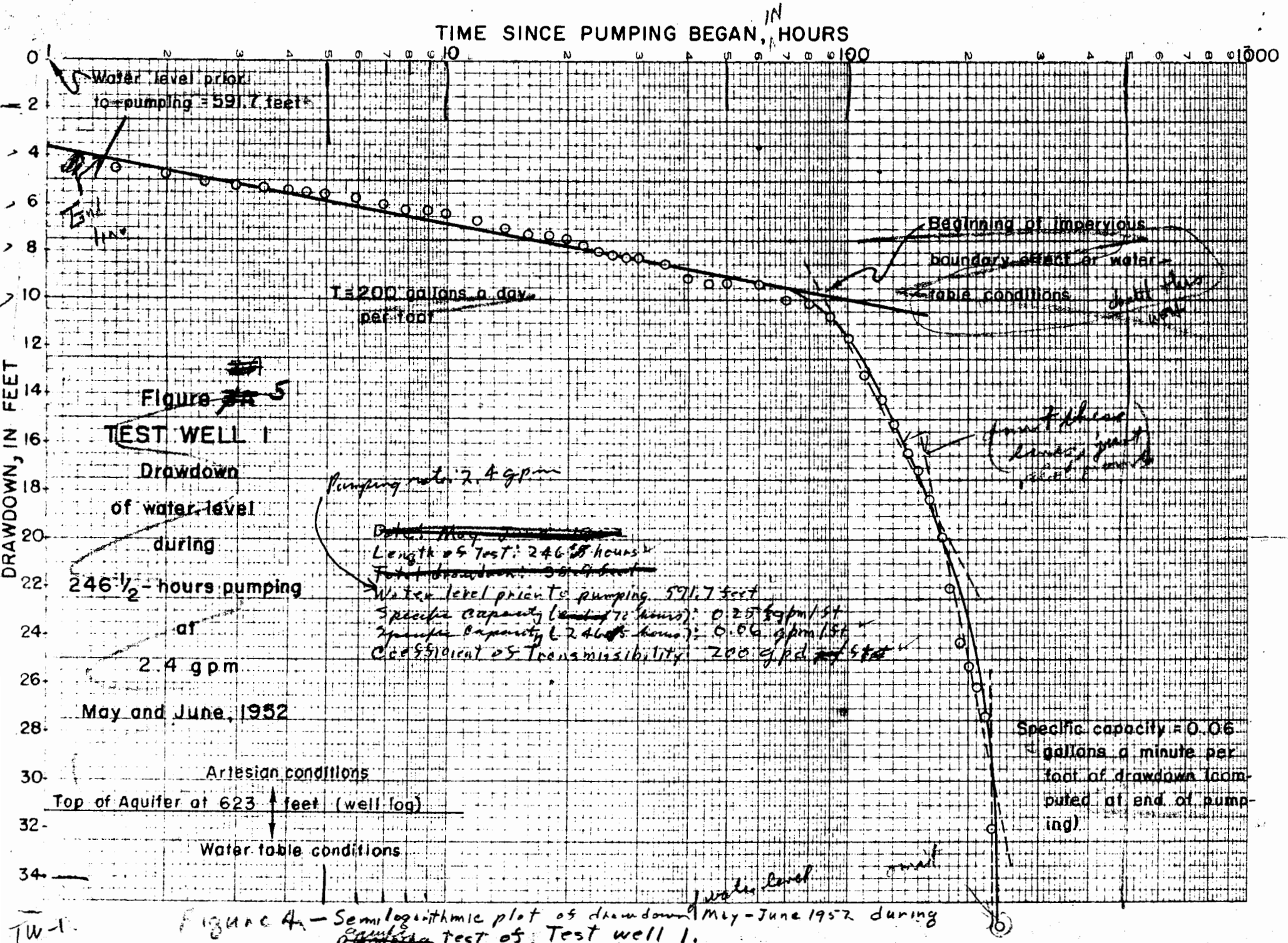


Figure 4 — Semilogarithmic plot of drawdown of water level during May-June 1952 pumping test of Test well 1.

TW-1

TW-2

6649- Purtyman

Elevation - 6646 ft, Total Depth -834ft (5812 ft elev.)
(water @ 765 ft; 5881 elev. when drilled (1949);
water rose to 759 ft; 5887 elev.)

Log	Depth	Thickness	Top Elevation
Alluvium	0-11	11	
Otowi Member, Bandelier Tuff	11-35	24	6635
Guaje Member, Bandelier Tuff	35-63	28	6611 - 6618 Purtyman
Puye Fm Fanglomerate Member (water @112-115;6534-6531; water rose - 93ft, 6553)	63-700	637	6583
Totavi Lentil	700-834	134	5946

source: Geologist's Log

USGS Location No. 19.6.14.221 USGS Designation T-2

AEC Coordinates _____ AEC Designation _____

Driller: Pioneer Drilling Larry Parnell Address Abiquiu, N.M.

Topography: Floor of Pueblo Canyon Altitude 6,646 feet

Method drilled Cable tool Diameter ____ inches Use Observation

Drilled depth 780 feet Completed depth 834 feet

Date drilled Nov. 1990 Chief Aquifer(s) Totovi Lentil

Depth to water ____ feet Date _____ Transmissibility 7,000 gpd/

Specific capacity 1.0 gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	11	11
Bandelier Tuff		
Otowi Member	20	31
Guaje Member	32	63
Puye Conglomerate		
Fanglomerate Member	637	700
Totovi Lentil	89	789

(*) Pump Intake Set @ 828' 1-15-91

(*) Work Done 9-90 - 12-90.

(*) Water level @ 789'.

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
6 OD	0 - 767.8	
6 OD Well Screen	767.8 - 824	(56 1/3' well screen)
Blank	824 - 834	- Bottom (10' Blank

Note: No plug needed due to 6" sitting on Solid Surface. Bailed ~ 20 bailer fulls and little to No sediment

Chemical analysis: Constituents in parts per million

Date [redacted] 6, 1953, Temp. 71 °F, SiO_2 75, Fe .01, Ca 15,

Mg 4.[redacted], Na + K 10, HCO_3 83, CO_3 0, SO_4 2.9, Cl 3.0,

F .3 [redacted], NO_3 .5, Hardness 54, Dissolved solids _____.

Specific conductance 141 micromhos, pH 7.4

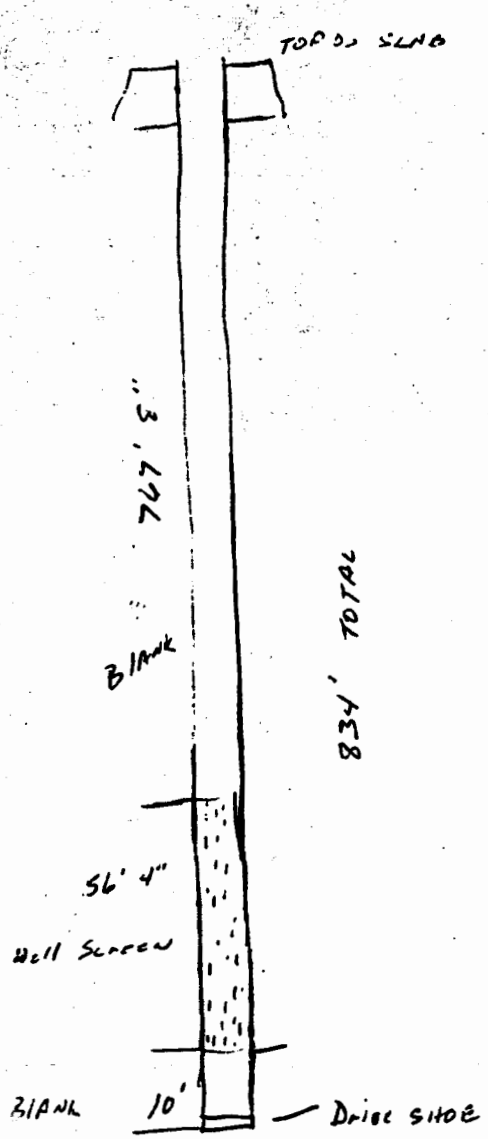
Radiochemical analysis: Date 10-19-64, Pu <0.4 d/m/l, U 0.5 µg/l,

Gross β (Gamma) 8.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Several abandoned holes nearby. Drilled for geologic and hydrologic information.

No plug Needed due to 6" setting on solid Sry
+ Bailed ~20 bailer fulls and no sediment.



APROX WATER LEVEL 789' 12-20-1990

834'
48'
789'

Table 20.--Test well T-2

USGS Location No. 19.6.14.221 USGS Designation T -2

AEC Coordinates _____ AEC Designation _____

Driller Layne - Western Inc. Address Kansas City, Mo.

Topography Floor of Pueblo Canyon Altitude 6,646 feet

Method drilled Cable tool Diameter 8 inches Use Observation

Drilled depth 789 feet Completed depth 789 feet

Date drilled November 1949 Chief Aquifer(s) Totovi Lentil

Depth to water 760.1 feet Date Jan. 4, 1951 Transmissibility 7,000 gpd/ft

Specific capacity 1.0 gpm/ft After 760 hours pumping

Log:	Thickness	Depth
Alluvium	11	11
Bandelier Tuff		
Otowi Member	20	31
Guaje Member	32	63
Puye Conglomerate		
Fanglomerate Member	637	700
Totovi Lentil	89	789

Pump set 8/5/77 782.5'

Casing Schedule:

Diameter (inches)	Depth (feet)
16 - OD	0- 57
12 - ID	0-197
10 - ID	0-519
8 - ID	0-778
6-in. well screen	778-788

Remarks

Hole cleaned to 787'

Chemical analysis: Constituents in parts per million

Date Jan. 6, 1953, Temp. 71 °F, SiO_2 75, Fe .01, Ca 15,

Mg 4.1, Na + K 10, HCO_3 83, CO_3 0, SO_4 2.9, Cl 3.0,

F .3, NO_3 .5, Hardness 54. Dissolved solids _____.

Specific conductance 141 micromhos, pH 7.4

Radiochemical analysis: Date 10-19-64, Pu <0.4 d/m/l. U 0.5 µg/l,

Gross β (Gamma) 8.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Several abandoned holes nearby. Drilled for geologic and hydrologic information.

Table 21.--Test well T-2A

USGS Location No. 19.6.14.221a USGS Designation T-2A

AEC Coordinates _____ AEC Designation _____

Driller Layne - Western Inc. Address Kansas City, Mo.

Topography Floor of Pueblo Canyon Altitude 6,646 feet

Method drilled Cable tool Diameter 8 inches Use Observation

Drilled depth 133 feet Completed depth 133 feet

Date drilled November 1949 Chief Aquifer(s) Fanglomerate Member

Depth to water 117.1 feet Date Dec. 22, 1950 Transmissibility 50 gpd/f

Specific capacity .03 gpm/ft After 4.5 hrs. pumping

Log:

	Thickness	Depth
Alluvium	11	11
Bandelier Tuff		
Otowi Member	21	31
Guaje Member	32	63
Puye Conglomerate		
Fanglomerate Member	70	133

▷ 6534

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12 - ID	0- 12	
8 - ID	0-118	
6 - ID	118-128	
6 - Screen	128-133	

Chemical analysis: Constituents in parts per million

Date Jan. 6, 1953, Temp. 53 °F, SiO_2 60, Fe 2.6, Ca 7.8,

Mg 3.7, Na + K 9.2, HCO_3 53, CO_3 0, SO_4 4.5, Cl 3.2,

F 0.2, NO_3 1.6, Hardness 34, Dissolved solids _____,

Specific conductance 102 micromhos, pH 7.3

Radiochemical analysis: Date March 11, 1965, Pu <0.4 d/m/l, U <0.5 μg/l,

Gross β (Gamma) 4.8 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled to locate perched water at 130 feet.

Geologists Log

TEST HOLE NO. 2

Pueblo Canyon

NW¼NE¼ Sec. 14, T. 19 N., R. 6 E.

Altitude: 6,646.4 feet

Top Concrete Base - Elev. 6647.63

Drilled by Layne-Western Co., Aug. 29-Nov.4, 1949

	Depth (feet) From	To
Alluvial cover		
Soil zone	0	1.5
Sand, fine to medium, and silt. Grains are angular to sub-angular. Materials are quartz, sanidine, and Bandelier tuff. A few rounded pieces of pale pinkish-white pumice are present.		
Valley fill.	1.5	11
Sand and gravel. Sizes range from coarse sand to medium gravel. The sand is composed of angular to sub-angular grains of quartz and sanidine. Quartzoids are rare. The gravel is composed of angular fragments of welded Bandelier tuff, rhyolite, and Chicoma volcanic rocks.		
Bandelier tuff		
Tent Rock member (?)	11	35
Pumiceous tuff. Angular to sub-angular fragments of pumice ranging up to 3/4 inch in diameter embedded in light gray ashy tuff. The pumice is light gray to pale pinkish gray, silky, and carries phenocrysts of quartz and sanidine (?). From 30 to 35 feet are found a few fragments of light gray, dense rhyolite.		
Santa Clara pumice member (?)	35	63
Angular fragments of light gray to white pumice ranging up to 1/2 inch across, compose 80% of the zone. This pumice contains numerous phenocrysts of quartz (some of which are quartzoids). Other materials present are angular fragments of rhyolite and similar fragments of Chicoma volcanic rocks that range up to 1/4 inch across.		

	Depth (feet) From	To
Puye gravel zone		
Upper gravel zone		
Gravel with some sand	63	103

The gravel, ranging to about 2 inches in diameter, is sub-angular to sub-rounded. It is composed chiefly of andesite and dacite derived from Chicoma volcanic rocks. Other materials present are light gray to pinkish gray, dense rhyolite and a little pumice which may be caving from other levels. The sand grains are angular to sub-angular and are composed of the same materials as the gravel. Also present, possibly in thin streaks, is a little clay.

Silty clay with some sand and gravel	103	110

The zone is largely pinkish buff, silty clay which contains tiny areas of white powdery material, small flakes of biotite, and pieces of fine gravel. This clay is very plastic when wet. The gravel is sub-angular to sub-rounded and ranges up to 1/2 inch in diameter. It is composed chiefly of andesite and dacite derived from Chicoma rocks. Light gray, dense rhyolite is also present in small amounts. The sand present is composed of quartz and derivatives of Chicoma rocks. It is angular to sub-angular and ranges from medium to very coarse.

Gravel with some sand	110	125

The gravel, ranging up to about 2-1/2 inches in diameter, is sub-angular to sub-rounded. It is composed chiefly of andesite and dacite derived from Chicoma volcanic rocks. Light gray, dense rhyolite and finely cellular, white pumice are present in small amounts. Silty clay is also present in very small amounts.

Perched water zone encountered between 112 and 115 feet. Water rose to 92.70 feet below ground surface. This zone apparently yielded approximately 4 gallons per minute per foot of drawdown (by bailing).

Test Hole No. 2 - Continued

	Depth (feet From	To
Sandy, silty clay with gravel	125	146

The clay in this zone is pinkish buff, sandy to silty and contains some fine gravel is sub-angular to sub-rounded and ranges up to 1/4 inch in diameter. It is composed chiefly of andesite and dacite derived from Chicoma volcanic rocks. Traces of light gray, dense rhyolite and white, finely cellular pumice are present. A thin zone of gravel and sand, with gravel predominating, occurs between 135 and 141 feet. This material is also composed of Chicoma volcanic rocks.

Gravel with a little sand; with clayey zones	146	335

The sub-angular to sub-rounded gravel is essentially all derived from Chicoma volcanic rocks. There are only traces of light gray to pinkish-gray, dense rhyolite and gray, glassy rhyolite. Gravel sizes range up to 1/2 inch in diameter. The sand is composed of angular to sub-angular grains of quartz and Chicoma rocks. It ranges from medium to coarse. The zone is noticeably clayey between the following depths: 155 to 165, 175 to 180, and 195 to 200 feet, and the entire zone is apparently clayey. A zone of large, sub-rounded pebbles is present between 215 and 220 feet.

Encountered perched water zone between 165 and 170 feet. Water rose to 108.10 feet below ground surface.

Sand with a little gravel	335	340

The sand ranges from fine to medium with the grains predominately angular but ranging to sub-angular. It is composed of quartz, Chicoma materials, and some gray, glassy rhyolite. The gravel is composed of sub-angular to sub-rounded pieces of Chicoma rocks that range to 1/2 inch in diameter.

Test Hole No. 2 - Continued

	Depth (feet) From	To
Gravel with some sand; clayey zones	340	380

Same as 146 to 335 feet. Possibly a slight increase in amount of gray, glassy rhyolite.

Pumice zone

Gravel with some sand	380	700

Most of the gravel is less than 1/2 inch in diameter and ranges from angular to sub-angular. The gravel aggregate is composed chiefly of pumice and Chicoma volcanic rocks with the ratio of pumice to Chicoma materials varying through the zone. In general, the pumice is more abundant than the Chicoma rocks; however, Chicoma rocks equal or exceed the pumice at the following depths: 380 to 390, 475 to 500, 540 to 555, 585 to 598, 630 to 658, and 690 to 700 feet. The pumice in this zone ranges from white through light gray to pale pinkish-buff. It varies from a very finely cellular pumice to a dense, pumiceous glass. Phenocrysts of biotite, quartz, and glassy feldspar (at least some of which is plagioclase) are present but rare. Also present in small amounts are gray, dense rhyolite; gray, glassy rhyolite; and traces of pale gray, perlitic glass. The angular to sub-angular sand grains range from fine to coarse and consist of quartz and pumice.

Lower gravel zone (Lowdermilk type gravel)

Sand with gravel	700	789(bottom)

The sand, pinkish gray to grayish pink, ranges from fine to coarse and the grains are sub-angular to sub-rounded. The materials composing the sand are quartz, colorless to pinkish feldspar, and chalcedonic silica. The gravel ranges up to 2-1/2 inches in diameter and consists of sub-rounded to rounded pieces of quartz, quartzite, granite pegmatite, feldspar, and volcanic rocks. The volcanic rocks are rhyolitic to basaltic. Some clay is present through the zone and is most abundant

Depth (feet) From	To	
		between 700 and 712 feet. Chicoma volcanic fragments are very rare. Ground water was encountered between 765 and 770 feet, and the water rose to 758.90 feet below ground surface. When the hole was bailed at the rate of 12 gallons per minute any drawdown that resulted could not be measured, according to the driller.

Casing record:

16" ID casing set at 57 feet.
12" ID casing first set at 141 feet but followed down hole and finally set at 197 feet.
10" ID casing set at 519 feet.
8" set at 778 feet.
10' of 6" screen set at 789 feet.
Hole blew air at 270, 280, and 435 feet.

TW-3

6595-pumping

Elevation - 6625ft, Total Depth - 815ft (5818 ft elev.)
(water @ 790ft; 5835 elev. when drilled (1950);
water rose to 743ft; 5882 elev.)

Log	Depth	Thickness	Top Elevation
Alluvium	0-37	37	
Otowi Member/Guaje? Bandelier Tuff	37-175	138	6588
Guaje - Pa[illegible]	140-175	35	6485
Puye Fm Fanglomerate Member?	175-266	91	6450
Basalt rx	266-388	122	6359
Puye Fm Fanglomerate Member? (pumice rich between 530-620 ft; 6095-6005)	388-620 753	232	6237
Totavi Lentil Fm	620-815	195	6005

source: Geologist's Log

Table 18.--Test well T-3

USGS Location No. 19.6.13.344 USGS Designation T-3

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 6,625 feet

Method drilled Cable tool Diameter 10 inches Use Observation

Drilled depth 815 feet Completed depth 815 feet

Date drilled November 1949 Chief Aquifer(s) Totovi Lentil

Depth to water 749.9 feet Date Jan. 17, 1951 Transmissibility 7,800 gpd/f

Specific capacity 0.5 gpm/ft After 720 hrs. pumping

Log:	Thickness	Depth	
Bandelier Tuff			
Otowi Member ----------	140	140	
Guaje Member ----------	35	175	6485
Puye Conglomerate			
Fanglomerate Member-------	91	266	6450
Basalt Unit 2 ----------	72	338	6359
Puye Conglomerate			
Fanglomerate Member ------	415	753	6287
Totovi Lentil ----------	62	815	5872

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
16 - OD	0- 33	
10 - ID	0-811	
6 - ID	804-815	Screen from 805-815 feet

Chemical analysis: Constituents in parts per million

Date Jan. 7, 1953, Temp. 74 °F, SiO_2 76, Fe .01, Ca 19,

Mg 6.2, Na + K 14, HCO_3 112, CO_3 0, SO_4 3.8, Cl 4.8,

F .3, NO_3 .2, Hardness 73, Dissolved solids _____,

Specific conductance 194 micromhos, pH 7.3

Radiochemical analysis: Date March 11, 1965 Pu <0.4 d/m/l U<0.5 µg/l,

Gross β (Gamma) <1.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Geologist's Log

TEST HOLE NO. 3

Los Alamos Canyon

SE¼SW¼ Sec.13, T. 19N., R. 6 E.
Altitude: 6,625 feet
Top Concrete Base - Elev. 6625.31

	Depth (feet) From	To
Alluvial cover		
Soil zone	0	1.5
Sand, fine to medium and silt		
Grains are angular to sub-angular. Materials are quartz, sanidine, and Bandelier tuff. A few small fragments of sub-rounded to rounded, pale pinkish-white pumice are present.		
Valley fill	1.5	37± /6588
Sand and gravel		
Sand and gravel composed of equal amounts of medium to coarse sand and medium gravel. The sand is composed of angular to sub-angular fragments of quartz and sanidine. Gravel consists of angular to sub-angular fragments of welded Bandelier tuff, light gray, dense rhyolite, and Chicoma volcanic rocks. A little silt is present through the zone.		
Bandelier tuff (?)		
Tent Rock member (?)	37±	175 /6450
Pumiceous tuff with fragments of volcanic rock		
Poorly consolidated, pinkish buff and gray tuffaceous material composed of quartz, sanidine, pumice, and ash. The materials present are chiefly angular fragments. The pumice varies from white to pale pinkish buff, and consists of fragments ranging up to 1/4 inch across. It varies from cellular, silky pumice to a pumiceous glass and carries phenocrysts of quartz (some of which are quartzoids),	35	140 - 6ωje

	Depth (feet) From	To	
and sanidine (?). The fragments of volcanic rock are chiefly andesite and dacite derived from Chicoma rocks, but small fragments of rhyolite also are present. This zone contains some fragments showing worn surfaces and it is possible that the material was at least in part deposited in water.			
Gravel zone			
Gravel and some sand; with subordinate amounts of clay	175	266	6359
The sub-angular to sub-rounded gravel is essentially all derived from Chicoma volcanic rocks and ranges in size up to 1 inch in diameter. There are only traces of pumiceous glass; gray, dense rhyolite; and gray, glassy rhyolite. The sand, ranging from fine to coarse, is angular to sub-angular and is composed of the same materials as the gravel. The zone is noticeably clayey between the following depths: 190 to 197, 210 to 215, and 225 to 239 feet. The clay is brick red, very plastic when wet, and apparently occurs in thin beds.			
White Rock Canyon basalt			
Basalt (upper flow)	266	327	6298
Very dark gray to black, fine-grained basalt containing a few tiny phenocrysts of olivine (?). The upper 6 feet of the flow is vesicular, the central part is non-vesicular and the lower 25 feet is highly vesicular and slightly reddened by oxidation.			
Interflow zone	327	332	6293
This zone consists of angular fragments of vesicular and oxidized basalt, sub-rounded pebbles of andesite, and some clay.			

	Depth (feet) From	To	
Andesitic (?) basalt (lower flow)	332	388	6237

Medium gray to medium dark gray, fine grained andesitic (?) basalt which appears to contain a high proportion of feldspar. This basalt is slightly coarser grained than the upper flow. The upper 11 feet of the flow is vesicular and reddened by oxidation, the central part is non-vesicular, and the lower 4 feet is vesicular and slightly reddened by oxidation.

Puyo gravel

Upper Gravel zone

Gravel and sand; with some clay	388	530	6095

The angular to sub-angular gravel ranges up to 1 inch in diameter and is composed chiefly of andesite and dacite derived from Chicoma volcanic rocks. Other materials present are light gray, dense rhyolite; gray glassy rhyolite; and a trace of pumiceous glass (?). The sand, medium to coarse, is composed of angular to sub-angular fragments of quartz, and the same materials as compose the gravel. The gravel and sand immediately underlying the andesitic (?) basalt flow is brick red. The entire zone is slightly clayey.

Pumice zone

Gravel with some sand	530	620	6005

The gravel ranges from angular to sub-angular and most fragments are less than 1 inch in diameter. The materials composing the gravel are chiefly pumice and fragments of Chicoma volcanic rocks with the ratio of pumice to Chicoma fragments varying through the zone. In general, the pumice is more abundant than Chicoma fragments, but from 525 to 555 feet the Chicoma fragments equal or exceed the pumice. The pumice in this zone ranges from white through light gray to pale pinkish buff. It varies from a very finely cellular

	Depth (feet) From	To
pumice to a pumiceous glass. Phenocrysts of quartz, and glassy feldspar (at least some of which is plagioclase) are rare. Also present in small amounts are gray dense rhyolite; gray glassy rhyolite; and traces of pale gray perlitic glass. The sand grains are angular to sub-angular, range from fine to coarse and consist of quartz, pumice, and Chicoma materials. The zone is very clayey between 595 and 612 feet.		
Lower gravel zone (Lowdermilk type gravel)		
Sand and gravel; clay, pink.	620	815(bottom)

The sand is pinkish gray to grayish pink and ranges from fine to coarse and the grains are sub-angular to sub-rounded. The materials composing the sand are chiefly quartz, and colorless to pinkish feldspar. Some pink chalcedonic silica and volcanic rock fragments are also present. The gravel ranges up to 3 inches in diameter and consists chiefly of sub-rounded to rounded pieces of quartz, quartzite, granite pegmatite, feldspar, and volcanic rocks. The volcanic rocks are rhyolitic to basaltic with dark colors predominating. Chicoma rocks are rare. Some clay is present through the zone. At the top of the zone a few fragments of finely cellular, dense pumice are present. This material may be caving.

Encountered ground water at 790 feet and the water rose to 743.30 feet below the ground surface. The hole was bailed at the rate of 22 gallons per minute for 25 minutes with an apparent drawdown of 7 feet. Ten minutes were required for recover, according to the driller.

Casing record:

16-inch OD surface casing was set at 32 feet 10 inches.
10-inch ID casing was run to 811 feet.
10 feet of 6-inch Layne screen with 10 feet of 6-inch ID casing on top end was set at 815 feet. Screen assembly extends up into 10-inch ID casing to 795 feet below LSD. (Lower end of screen set at 815 feet)
Total depth of hole 815 feet.

General investigations

Test holes were drilled to determine the thickness of geologic units and of water-bearing formations. Some of the holes are now used as observation wells to monitor the chemical and radiochemical quality of water in perched water zones and in the main aquifer. Geologic, hydrologic and construction data of these test holes and observation wells are presented in table 17 to table 38. Locations are shown on Figure 2. Included in the tables are records of two wells drilled for stock water and now used also as observation wells.

Table 17.--Test well T-4

USGS Location No. 19.6.9.443 USGS Designation T-4

AEC Coordinates AEC Designation

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Rim of Pueblo Canyon Altitude 7,243 feet

Method drilled Cable Tool Diameter 6 inches Use Observation

Drilled depth 1,205 feet Completed depth 1,205 feet

Date drilled March 1950 Chief Aquifer(s) Tschicoma Formation

6077 Depth to water 1,166.0 feet Date Jan. 5, 1951 Transmissibility 1,000 gpd/f

DTW 6059 Specific capacity 0.6 gpm/ft After 720 hrs.

Log:	Thickness	Depth
Bandelier Tuff		
Tshirege Member ----------	280	280 6963
Otowi Member ----------	88	368 6875
Guaje Member ----------	27	395 6848
Puye Conglomerate		
Fanglomerate Member -------	240	635 6608
Tschicoma Formation ---------	570	1,205

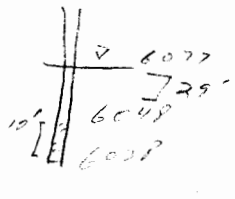
6077 - [illegible]

6070 - [illegible]

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
16 - OD	0- 109	
12 - ID	0- 288	
10 - ID	0- 734	
6 - ID	0-1,195	
4 - screen	1,195-1,205	

6048 - 6078



Chemical analysis: Constituents in parts per million

Date July 17, 1952, Temp. 70 °F, SiO_2 73, Fe .02, Ca 11,

Mg 7.1, Na + K 9.4, HCO_3 87, CO_3 0, SO_4 1.8, Cl 2.2,

F .1, NO_3 2, Hardness 56, Dissolved solids ____,

Specific conductance 149 micromhos, pH 7.2

Radiochemical analysis: Date Feb. 1, 1965, Pu <0.4 d/m/l, U 1.9 μg/l,

Gross β (Gamma) <1.0 d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information

TW-4

7244.6 - Puye Fm

Elevation - 7243 ft, Total Depth - 1205ft (6038 ft elev.)
(water @ 1184 ft; 6059 elev. when drilled (1950);
water rose to 1170.8 ft; 6072.2 elev.)

Log	Depth	Thickness	Top Elevation	
Tshirege Member, Bandelier Tuff	0-258	258		
Tsankawi Pumice Bed?	258-330	72	6985	?
Cerro Toledo Rhyolite?	330-340	10	6913	
Otowi Member, Bandelier Tuff	340-368	28	6903	6964.6 ?
Guaje Member, Bandelier Tuff	368-395	27	6875	6876.6
Tschicoma Fm Puye Fm - Puye Fm	395-1184	789	6848	6849.6
Puye Fm Fanglomerate Member? Tschicoma - Puye Fm	1184-1195	11	6059	6609.6
Tschicoma Fm	1195-1205	10	6048	
				6079.6 ??

Geologist's Log

TEST HOLE NO. 4

Canyon Road

SE¼SE¼ Sec. 9, T. 19 N., R. 6 E.
Altitude: 7,243 feet
Top Concrete Base - Elev. 7244.56
Drilled by Layne-Western Co.,

	Depth (feet) From	To
Bandelier tuff		
Pinkish orange and gray tuff.	0	258
Poorly consolidated tuff containing phenocrysts of quartz, sanidine, and hornblende (?). This tuff contains some gray and brown, very cellular pumice. Other materials present in traces are gray rhyolite containing phenocrysts of quartz, biotite, and hornblende; and minute fragments of dark gray, fine-grained rock which is possibly derived from the Chicoma.		
Slightly pumiceous tuff.	258	285
Slightly pumiceous, buff colored tuff containing numerous fragments of Chicoma rocks and some fragments of light gray rhyolite. The light gray to pale pinkish white pumice is finely cellular, and contains phenocrysts of quartz, sanidine, and biotite (?).		
Pumiceous tuff.	285	368
Pinkish buff pumiceous tuff containing some angular fragments of Chicoma rocks and rhyolite ranging up to 1/2 inch across. Between 330 and 340 feet, Chicoma fragments are abundant. The light gray to pale pinkish pumice is finely cellular and contains phenocrysts of quartz, sanidine, and biotite. The fragments of pumice range up to 1/4 inch across. Other materials present in traces are obsidian, perlitic glass, and pumiceous glass.		

6914.56

Test Hole No. 4 - Continued

	Depth (feet) From	To
Pumice Zone	368	395

The zone is composed of light gray to almost white, finely cellular, silky pumice which contains numerous phenocrysts of quartz and sanidine.

Chicoma volcanic formation

Dacite flows and flow breccia	395	805

Dull lavender-gray dacite porphyry containing phenocrysts of plagioclase, quartz, biotite, and hornblende. The plagioclase occurs both as dull, porcelaineous and glassy phenocrysts. Some of these phenocrysts are 1/2 inch long. The quartz occurs as small subrounded phenocrysts which range to almost 1/4 inch long. The biotite and hornblende phenocrysts are oxidized to a brownish bronze color. The ground mass of this rock is extremely fine grained. Individual flows cannot be differentiated.

Dacite flows and flow breccia	805	1184

Reddish brown dacite porphyry containing phenocrysts of plagioclase, quartz, biotite, and hornblende which compose about 25 percent of the total mass. Most of the plagioclase phenocrysts are glassy but some have a dull, porcelaineous luster. The phenocrysts range up to 1/2 inch and are more numerous than in the preceding series of flows. The quartz occurs as small, sub-rounded phenocrysts which range to almost 1/4 inch across. The horn-blende and biotite are somewhat oxidized and have a brownish tint. The ground mass of this rock has a slight granular appearance. Individual flows cannot be differentiated.

	Depth (feet) From	To
Dacitic sand and gravel or tuff breccia	1184	1195±

The zone is composed of angular fragments of reddish brown dacite ranging in size from very fine sand to fine gravel. This zone is unconsolidated and the water present caused the material to heave 5 to 10 feet up into the hole.

Ground water was encountered at 1184 feet and the water rose to 1170.8 feet below ground surface. The hole was bailed at the rate of 8 gallons per minute for 35 minutes. A drawdown of 2 feet resulted and 5 minutes were required for recovery, according to the driller.

Dacite flows and flow breccia	1195±	1205(bottom)

Same as 805 to 1184 feet.

Casing record:

16-inch OD surface casing set at 109 feet.
12-inch ID casing with a 13 7/8-inch drive shoe on bottom end was run to 288 feet.
10-inch ID casing with a 11 1/2-inch drive shoe on bottom end was run to 1,195 feet.
6-inch ID casing was run to 1,195 feet.
10 feet of 4-inch Layne screen, with 11 feet of 4-inch ID casing on top end, was set at 1,205 feet. Screen assembly extends up into 6-inch ID casing to 1,184 feet below LSD. (Lower end of screen set at 1,205 feet).

Total depth of hole 1,205 feet.

T-5

G.L. Elevation - 6592 ft ; TD - 263ft.; 6329ft Elev.
(drilled 1950;)

Log	Depth	Thickness	Top Elevation	Differ w/ FIMAD	USGS
Alluvium (water @ 15-25ft)	0-23	23		not in d-base	N[illegible]
Tshirege Member, Bandelier Tuff	23-120?	97			23-40
Tsankawi Pumice Bed? Cerro Toledo Rhyolite? (angular Chicoma frag. from 50-120 ft)	50-120?	70	6542		-
Otowi Member, Bandelier Tuff	120-160?	30	6472	6552	40-160
Guaje Member, Bandelier Tuff	160-171	11	6432		160-171
basalt	171-TD	92	6421		171-TD

source: Black & Veatch, 1950

note: The original geologist's logs do not provide enough data to determine the Tshirege - Otowi contact. Do not understand how the U.S.G.S. determined Tshirege-Otowi contact from the original geologist's logs(Black & Veatch). Reviewed Griggs, 1964, U.S.G.S source- did not find reference to this well other than a location marker on geologic map.

Table 32.--Test well T-5

USGS Location No. 19.7.31.433 USGS Designation T-5 (Test well 5)

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography floor of Pajarito Canyon Altitude 6,592 feet

Method drilled Cable tool Diameter 24 inches Use Unused

Drilled depth 263 feet Completed depth 263 feet

Date drilled March 1950 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	23- 23	
Bandelier Tuff	[illegible]	
Tshirege Member	17- 40	
Otowi Member	120-160	
Guaje Member	11-171	
Basaltic rock		
Unit 2	92-263	

6592
171
6421
11

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
24 OD	0-22	Open hole below 22 feet

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Table 33.--Buckman No. 1

USGS Location No. 19.7.36.314 USGS Designation Buckman No. 1

AEC Coordinates _____ AEC Designation _____

Driller _____ Address _____

Topography Flood plain of Canada Ancha Altitude 5,550 feet

Method drilled _____ Diameter _____ inches Use stock

Drilled depth _____ feet Completed depth _____ feet

Date drilled _____ Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log: feet feet

Not available

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: 1/ Constituents in parts per million

Date Oct. 1964, Temp. 63 °F, SiO_2 _____, Fe _____, Ca 4,

Mg 0.5, Na + K 48, HCO_3 63, CO_3 14, SO_4 _____, Cl 4,

F 0.4, NO_3 1.2, Hardness 12, Dissolved solids 247 ppm,

Specific conductance 120 micromhos, pH 8.9

Radiochemical analysis: Date Nov. 2, 1964, Pu $<$ 0.4 d/m/l, U 2.0 µg/l,

Gross β (Gamma) 18.0 d/m/l

Report source of data: Spiegel, Zane, and others, 1963

Remarks: Sounded depth was 43 feet in October, 1964. Well flows 4 gpm.
1/ Analyses by the Los Alamos Scientific Laboratory
Well used as part of LASL and AEC monitoring net.

Log of Test Hole Pajarito No. 1 or (T-5)

Pajarito Canyon, Los Alamos County, New Mexico

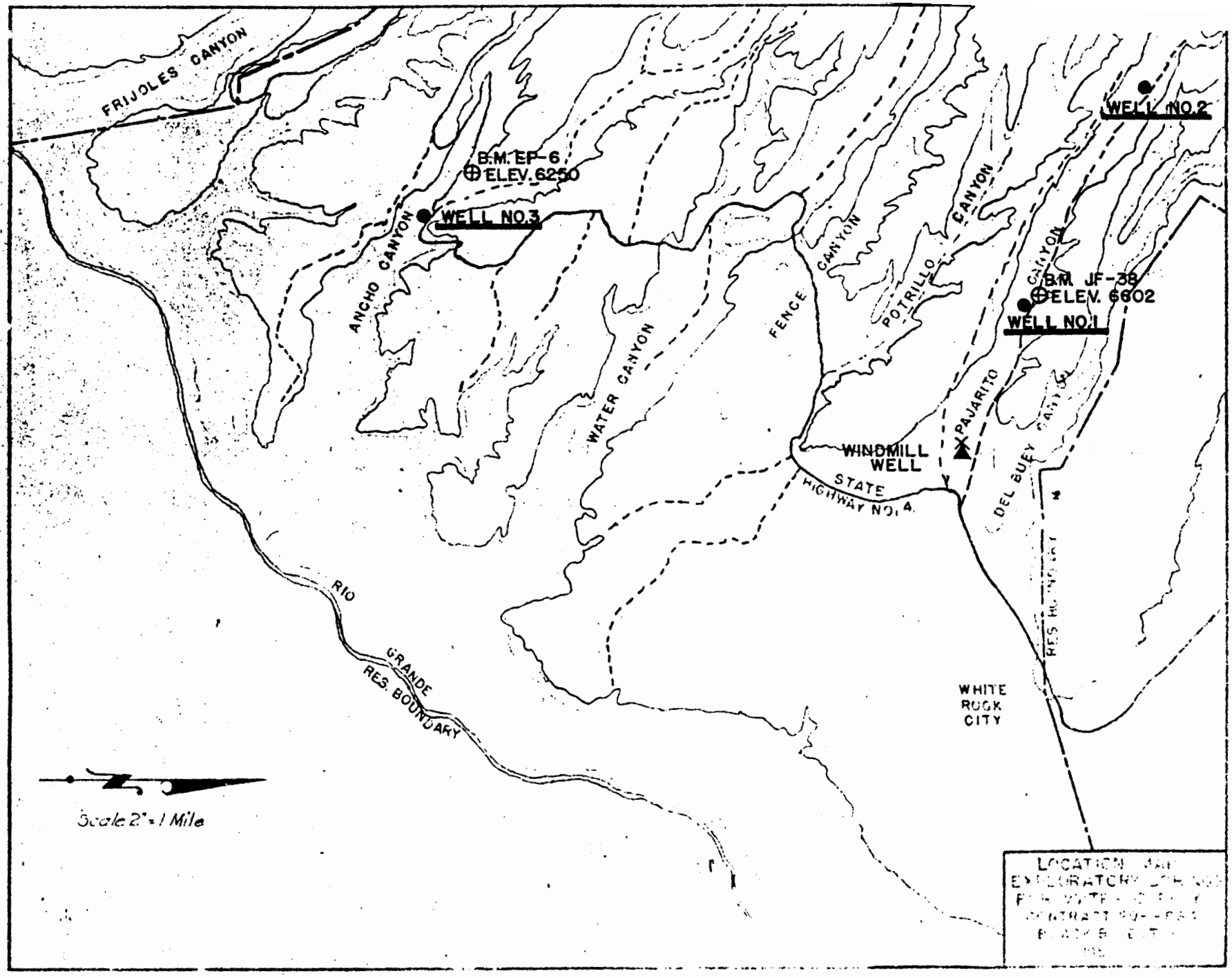
Elevation: 6,592 feet

	Depth (feet) From	To
Quaternary alluvium:		
Soil zone		
Sand, fine to medium, and silt. The sand consists of quartz, sanidine, and debris derived from the Bandelier tuff. The silt is chiefly tuffaceous debris from the Bandelier tuff.....	0	1.5
Valley fill		
Sand and gravel with some silt. The sand is medium to coarse and composed mainly of angular grains of quartz and sanidine (quartz crystals are rare). The gravel, with pieces ranging to 1/2 inch across, is composed of angular to subangular fragments of Chicoma volcanic rocks; welded Bandelier tuff; and gray, dense rhyolite. Some silt, composed chiefly of debris from the Bandelier tuff, is present throughout the zone..	1.5	23
Bandelier tuff (Pleistocene):		
Tuff, pinkish orange to buff, to light gray. The material apparently ranges from slightly welded to ashy(?) tuff and contains crystals and crystal fragments of quartz and sanidine, and traces of obsidian. Also present from 50 to 120 feet are some angular fragments of Chicoma volcanic rocks and gray, dense rhyolite. Some of these fragments may have caved from the valley fill.....	23	120±
Tuff, buff to light gray, and essentially as from 23 to 120± feet but containing some white to pale pinkish buff pumice and probably largely ashy.....	120±	160

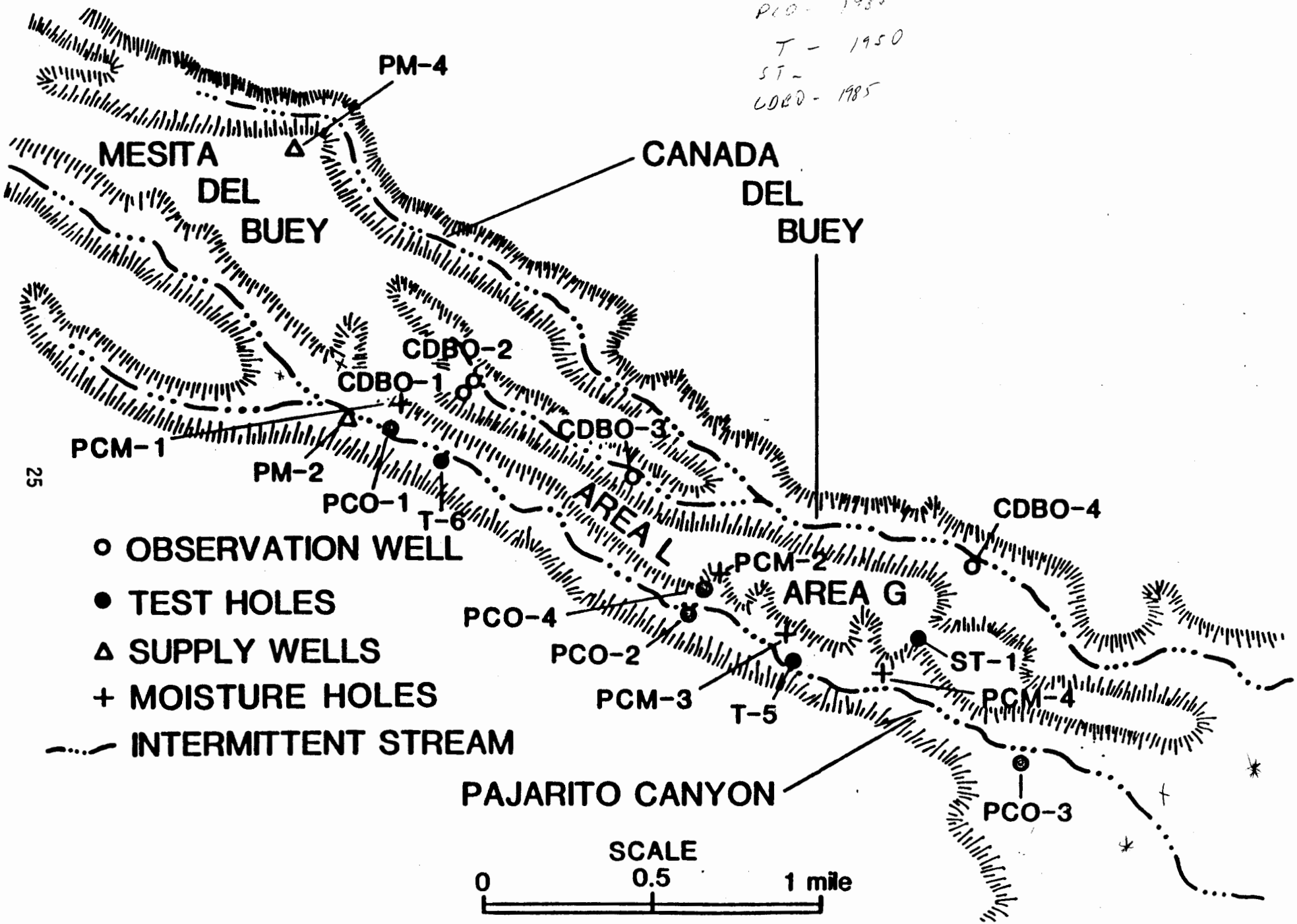
Log of Test Hole Pajarito No. 1 (continued)

	Depth (feet) From	To
Pumice zone. White to very light gray, silky, lump pumice containing phenocrysts of quartz and sanidine. Also present are some minute fragments of dark gray, fine-grained, volcanic rock; and some ashy, tuffaceous material. This zone probably represents the Santa Clara pumice.	160	171
White Rock Canyon basalt (Pleistocene):		
Basalt, very dark gray to black, moderately rich in olivine and containing a few small phenocrysts of plagioclase. From 171 to 220 and from 250 to 263 the basalt is vesicular.	171	263 T.D.

Note: No water was encountered and the hole was abandoned. Twenty-two feet of 24-inch conductor pipe was left in the hole.


FRIJOLES CANYON
B.M. EP-6
ELEV. 6250
WELL NO.3
ANCHO CANYON
WATER CANYON
FENCE CANYON
POTRILLO CANYON
PAJARITO CANYON
B.M. JF-38
ELEV. 6602
WELL NO.1
WELL NO.2
WINDMILL WELL
STATE HIGHWAY NO. 4
DEL BUEY CANYON
RIO GRANDE RES. BOUNDARY
WHITE ROCK CITY
Scale 2" = 1 Mile

PM-2 1965
PCM - 1985
PCO - 1950
T - 1950
ST -
CDBO - 1985



T-6

				Differ w/ FIMAD	USGS
G.L. Elevation - 6698 ft TD - 300ft.; 6398 Elev. (drilled 1950;)				not in d-base	6705 N
Log	**Depth**	**Thickness**	**Top Elevation**		
Alluvium (water @ 15-25ft)	0-25	25			N
Tshirege Member, Bandelier Tuff	25-?				25-65
Tsankawi Pumice Bed?					-
Cerro Toledo Rhyolite?					-
Otowi Member, Bandelier Tuff	25?-275	250	6673? * USC USGS		6613 85-265
Guaje Member, Bandelier Tuff	275-TD	25	6423		265-285
Puye Fm					285-300

source: Black & Veatch, 1950

note: The original geologist's logs do not provide enough data to determine the Tshirege - Otowi contact. Do not understand how the U.S.G.S. determined Tshirege-Otowi contact from the original geologist's logs(Black & Veatch). Reviewed Griggs, 1964, U.S.G.S source- did not find reference to this well other than a location marker on geologic map. Also, the Puye Fm is noted in U.S.G.S. logs and not in original geologist's logs. Purtyman Report agrees w/U.S.G.S except for GL elev.; 6642.1 ft.

6705

Table 23.--Test well T-6

USGS Location No. 19.6.36.141 USGS Designation T-6

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography Floor of Pajarito Canyon Altitude 6,705 feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 300 feet Completed depth 300 feet

Date drilled March 1950 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:	Thickness	Depth
Alluvium	25	25
Bandelier Tuff		
Tshirege Member	60-	85
Otowi Member	180-	265
Guaje Member	20-	285
Puye Conglomerate		
Fanglomerate Member	15-	300

6705
285
6420

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Log of test hole Pajarito No. 2 (T-6)

Pajarito Canyon, Los Alamos County, New Mexico

Elevation: 6,698 feet

	Depth (feet) From	To
Quaternary alluvium		
Soil zone		
Sand, fine to coarse, and silt. The fine to medium sand consists of quartz, sanidine, and debris derived from the Bandelier tuff. The silt is chiefly debris derived from the Bandelier.	0	1.5
Valley fill		
Sand and gravel, with some silt. The medium to coarse sand is composed chiefly of angular to sub-angular grains of quartz and sanidine (some quartz crystals are present). The gravel, with pieces ranging to 1 inch across, is angular to rounded and composed of fragments of Chicoma volcanic rocks, welded Bandelier tuff, and pinkish gray to gray rhyolite (Chicoma materials are predominant). Some silt, composed of debris from the Bandelier tuff, is present throughout the zone. . . .	1.5	25±5
Bandelier tuff (Pleistocene):		
Tuff, pinkish orange to buff to light gray, containing crystals and crystal fragments of quartz and sanidine, and traces of small fragments of obsidian. From 25±5, to about 200 feet, the tuff is slightly welded. From 70 to 275±, it is slightly pumiceous. Also present in the samples are some angular to subrounded pieces of Chicoma volcanic rocks, and gray to pinkish gray, dense rhyolite. Most of this material probably caved from the valley fill.	25±5	275±5

Log of test hole Pajariot No. 2 (continued	Depth (feet) From	To
Tuff, light gray, ashy; and containing some light gray to pale pinkish gray, finely collular pumice and a trace of small fragments of obsidian. Also present are some angular to sub-angular fragments of Chicoma volcanic rocks, and gray, dense rhyolite.....	275±5	300 T.D.

Note: A small (unmeasured) amount of water was present from about 15 to 25±5 feet. The hole was abandoned.

T-7

				Differ w/ FIMAD	USGS
G.L. Elevation - 6224 ft				not in	N
TD - 55ft.; 6169 Elev.				d-base	N
(drilled 1950;)					
Log	**Depth**	**Thickness**	**Top Elevation**		
Alluvium	0-10	10			N
Otowi Member??, Bandelier Tuff	10-45	35			N
basalt (clay 45-51 ft)	45-TD	10	6179		N

source: Black & Veatch, 1950

note: Purtyman Report cites Griggs (1955) and agrees w/U.S.G.S data.

Table 19.—Test well T-7

USGS Location No. 18.6.13.444 USGS Designation T-7

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography Ancho Canyon Altitude 6,224 feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 55 feet Completed depth 55 feet

Date drilled April 1950 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	10	10
Bandelier Tuff		
Otowi Member	35	45
Basaltic Rocks of Chino		
Mesa Unit 2	10	55
(clay 45-51)		

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____.

Mg _____, Na + K _____ HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____.

F _____, NO_3 _____, Hardness _____, Dissolved solids _____.

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____ Pu _____ µg/l.

Gross β (Gamma) _____ d/m/l

Report source of data: Griggs, R. L. 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Log of test hole Ancho No. 1 (T-7)
OCH Inap

Ancho Canyon, Los Alamos County, New Mexico

Elevation: 6,224 feet

	Depth (feet) From	To
Quaternary alluvium:		
Soil zone		
Sand, fine to medium, and silt. The sand consists of angular to sub-angular grains of quartz and sanidine derived from the Bandelier tuff. The silt is chiefly tuffaceous material derived from the Bandelier.	0	1.5
Valley fill		
Sand with some gravel. Medium to coarse sand composed of angular to sub-angular grains of quartz and sanidine (quartz crystals are rare). The fine to medium gravel is composed mainly of angular to sub-angular fragments of Chicoma volcanic rocks, and gray, dense rhyolite. A trace of gray, glassy rhyolite, pinkish-buff pumice, and pumiceous glass are also present.	1.5	10
Bandelier tuff (Pleistocene):		
Tuff, pinkish orange to buff, ashy, and containing phenocrysts of quartz and sanidine. Also present in small amounts are angular fragments of Chicoma volcanic rock, gray, dense rhyolite (?), and pumiceous glass. Some of these latter materials may be caving.	10	45
Undifferentiated lake clay (Pleistocene):		
Clay, buff colored, plastic, and without sand and silt but containing small angular to sub-angular fragments of vesicular basalt, and Chicoma volcanic rocks. . . .	45	51
White Rock Canyon basalt (Pleistocene):		
Basalt, very dark gray to black, fine grained, vesicular and moderately rich in olivine. Buff colored, plastic clay fills some of the pore spaces.	51	55 T.D.

Note: No water was obtained and the hole was abandoned.

H-19

Elevation - 7178 ft, Total Depth - 2000 ft (5178 ft elev.)

Log	Depth	Thickness	Top Elevation
Alluvium (water between 14ft & 27ft)	0-27	27	
Tshirege Member, Bandelier Tuff	27-200	173	7151
Tsankawi Pumice Bed? Cerro Toledo Rhyolite?	124-130	6	7054
Otowi Member, Bandelier Tuff	200-415	215	6978
Guaje Member, Bandelier Tuff (water @ 450-472ft 6728 ft -6706 ft)	415-472	57	6763
Tschicoma Fm	472-819	347	6706
Puye Fm Fanglomerate Member (water @ 970 ft, 6208 elev.)	819-1210	391	6359
Tschicoma Fm	1210-1480	270	5968 ~~1210~~
Puye Fm Totavi Lentil	1480-1490	10	5698
Tschicoma Fm	1490-2000	510	5688

Table 22.--Test hole H-19

USGS Location No. 19.6.17.234 USGS Designation H-19

AEC Coordinates AEC Designation

Driller Jenkins Drilling Co. Address

Topography Floor of Los Alamos Canyon Altitude 7,178 feet

Method drilled Cable tool Diameter 8 inches Use Unused

Drilled depth 2,000 feet Completed depth - feet

Date drilled September 1949 Chief Aquifer(s) Tschicoma Formation

Depth to water 970 ±5 feet Date Oct. 1949 Transmissibility - gpd/f

Specific capacity -- gpm/ft After -

Log:	Thickness	Depth	Top of
Alluvium	27	27	7178
Bandelier Tuff			
Tshirege Member	173	200	7151
Otowi Member	215	415	6978
Guaje Member	57	472	6763
Tschicoma Formation	347	819	6706
Puye Conglomerate			
Fanglomerate Member	391	1,210	6359 6208
Tschicoma Formation	270	1,480	5968
Puye Conglomerate			
Totovi Lentil	10	1,490	5698
Tschicoma Formation	510	2,000	5688

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
8 - ID	0-10	Open hole

Chemical analysis: Constituents in parts per million

Date_____, Temp._____°F, SiO_2_____, Fe_____, Ca_____,

Mg_____, Na + K_____, HCO_3_____, CO_3_____, SO_4_____, Cl_____,

F_____, NO_3_____, Hardness_____, Dissolved solids _____,

Specific conductance_____ micromhos, pH_____

Radiochemical analysis: Date_____, Pu_____d/m/l, U_____µg/l,

Gross β (Gamma)_____d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Table 23.--Test well T-6

USGS Location No. 19.6.36.141 USGS Designation T -6

AEC Coordinates _____ AEC Designation _____

Driller Jenkins Drilling Co. Address _____

Topography Floor of Pajarito Canyon Altitude 6,705 feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 300 feet Completed depth 300 feet

Date drilled March 1950 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:	Thickness	Depth
Alluvium	25	25
Bandelier Tuff		
Tshirege Member	60-	85
Otowi Member	180-	265
Guaje Member	20-	285
Puye Conglomerate		
Fanglomerate Member	15-	300

6705
285
6420

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Griggs, R. L., 1955 and 1964

Remarks: Drilled for geologic and hydrologic information.

Table 24.--Layne-Western well

USGS Location No. 19.7.4.444a USGS Designation: Layne-Western Well

AEC Coordinates AEC Designation

Driller Layne-Western Co. Address Kansas City, Mo.

Topography Floor of Guaje Canyon Altitude 5,971 feet

Method drilled Cable tool Diameter 8 inches Use Observation

Drilled depth 157 feet Completed depth 147 feet

Date drilled March 1950 Chief Aquifer(s) Tesuque Formation

Depth to water 100.6 feet Date Dec. 6, 1952 Transmissibility - gpd

Specific capacity - gpm/ft After -

Log:

	Thickness	Depth
Alluvium	12	12
Puye Conglomerate		
Fanglomerate Member	13	25
Totovi Lentil	50	75
Tesuque Formation	82	157

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
8	0-147	20 feet of screen 127 feet to 147 feet

Chemical analysis: Constituents in parts per million

Date Apr. 21, 1959, Temp. 63 °F, SiO_2 ____, Fe ____, Ca ____,

Mg ____, Na + K 8.9, HCO_3 98, CO_3 0, SO_4 ____, Cl 2.2,

F 0.4, NO_3 0.3, Hardness 60, Dissolved solids ____,

Specific conductance 162 micromhos, pH 7.4

Radiochemical analysis: Date Apr. 21, 1959, Pu 0 d/m/l, U 0 µg/l,

Gross β (Gamma) 0 d/m/l

Report source of data: USGS well schedules.

Remarks: Used to supply contractor with water during drilling of supply wells in Guaje Canyon.

Table 25.--Test GT-1

USGS Location No. 19.7.13.114a USGS Designation GT-1 (L-1A, Guaje Test)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Co. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,624 feet

Method drilled Hydraulic rotary Diameter 4 inches Use Observation

Drilled depth 400 feet Completed depth 400 feet

Date drilled March 1946 Chief Aquifer(s) Tesuque Formation

Depth to water flowed feet Date March 1946 Transmissibility - gpd/f

Specific capacity - gpm/ft After -

Log:

	Thickness	Depth
Alluvium	78-	78
Tesuque Formation	322-	400

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
6	0-76.5	
4	0-400	

Chemical analysis: Constituents in parts per million

Date May 1960, Temp. 64 °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K 70, HCO_3 188, CO_3 0, SO_4 25, Cl 7.0,

F 0.4, NO_3 1.0, Hardness 37, Dissolved solids 239,

Specific conductance 363 micromhos, pH 8.1

Radiochemical analysis: Date May 1960, Pu 0.0 d/m/l, U 17.5 μg/l,

Gross β (Gamma) 10 d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Sounded depth 305 feet. Exploratory test hole for water supply.

Table 26.--Test GT-5

USGS Location No. 19.7.13.124 USGS Designation GT-5 (Stop Sign, Guaje Te

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,609 fee

Method drilled Cable tool Diameter 2 inches Use Observation

Drilled depth 475 feet Completed depth 275 feet

Date drilled March 1946 Chief Aquifer(s) Tesuque Formation

Depth to water flowing feet Date March 1946 Transmissibility - gpd

Specific capacity - gpm/ft After -

Log:	Thickness	Depth
Alluvium	38	38
Tesuque Formation	437	475

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2-inch to an undetermined depth. Well sounded and found to be open to a depth of 275 feet, Oct. 1965.		

Chemical analysis: Constituents in parts per million

Date_____, Temp._____°F, SiO_2_____, Fe_____, Ca_____,

Mg_____, Na + K_____, HCO_3_____, CO_3_____, SO_4_____, Cl_____,

F_____, NO_3_____, Hardness_____, Dissolved solids _____,

Specific conductance_____ micromhos, pH_____

Radiochemical analysis: Date_____, Pu_____d/m/l, U_____µg/l,

Gross β (Gamma)_____d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Exploratory test hole for water supply.

Table 27.--Test GT-3

USGS Location No. 19.7.13.211 USGS Designation GT-3 (Guaje Test)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Houston, Texas

Topography Floor of Los Alamos Canyon Altitude app. 5,620 feet

Method drilled Hydraulic rotary Diameter - inches Use Unused

Drilled depth 475 feet Completed depth 0 feet

Date drilled March 1946 Chief Aquifer(s) Tesuque Formation

Depth to water flowing feet Date March 1946 Transmissibility - gpd/ft

Specific capacity - gpm/ft After -

Log:

	Thickness	Depth
Alluvium	31	31
Tesuque Formation	444	475

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date_____, Temp._____°F, SiO_2_____, Fe_____, Ca_____,

Mg_____, Na + K_____, HCO_3_____, CO_3_____, SO_4_____, Cl_____,

F_____, NO_3_____, Hardness_____, Dissolved solids _____,

Specific conductance_____ micromhos, pH_____

Radiochemical analysis: Date_____, Pu_____d/m/l, U_____µg/l,

Gross β (Gamma)_____d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Exploratory test hole for water supply.

Table 28.--Test GT-2

USGS Location No. 19.7.13.424 USGS Designation GT-2 (Guaje Test)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude - feet

Method drilled Cable tool Diameter - inches Use Unused

Drilled depth 50 feet Completed depth 0 feet

Date drilled March 1946 Chief Aquifer(s) Alluvium

Depth to water - feet Date _____ Transmissibility _____ gpd/f

Specific capacity - gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	40	40
Tesuque Formation	10	50

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Exploritory test hole for water supply.

Table 29.--Test GT-4

USGS Location No. 19.7.14.221a USGS Designation GT-4 (L-3A, Guaje Test)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Floor of Los Alamos Canyon Altitude 5,675 feet

Method drilled Hydraulic rotary Diameter 2 inches Use Observation

Drilled depth 315 feet Completed depth 315 feet

Date drilled March 1946 Chief Aquifer(s) Tesuque Formation

Depth to water flowing feet Date March 1946 Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:	Thickness	Depth
Alluvium	54	54
Tesuque Formation	261	315

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2	0-315	Perforated 60 to 315 feet Bottom sounded 164 feet, Oct. 1965.

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch Inc., 1946

Remarks: Exploratory test hole for water supply.

Table 34.--Buckman well

USGS Location No. 19.7.36.443 USGS Designation Buckman well

AEC Coordinates [illegible] AEC Designation _____

Driller _____ Address _____

Topography Flood plain of Canada Ancha Altitude 5,680 feet

Method drilled _____ Diameter 6 inches Use Stock

Drilled depth _____ feet Completed depth _____ feet

Date drilled _____ Chief Aquifer(s) Tesuque Formation

Depth to water Flowing feet Date Oct. 6, 1950 Transmissibility _____ gpd/ft

Specific capacity _____ gpm/ft After _____

Log: feet feet

Not available

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: Constituents in parts per million

Date _____, Temp. 60 °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: USGS well schedules, Santa Fe County

Remarks: Well used as part of LASL and AEC monitoring net.

Table 35.--Test RGT-3

USGS Location No. 19.8.7.143 USGS Designation RGT-3 (Rio Grande Test-3)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Valley of Rio Grande Altitude _____ feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 495 feet Completed depth 0 feet

Date drilled February 1946 Chief Aquifer(s) Alluvium and Tesuque Formation

Depth to water _____ feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	68	68
Tesuque Formation	427	495

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Water reported from 50 to 80 feet
Exploratory test hole for water supply.

Table 36.--Test RGT-1

USGS Location No. 19.8.7.144 USGS Designation RGT-1 (Rio Grande Test 1)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Rio Grande Valley Altitude _____ feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 53 feet Completed depth 0 feet

Date drilled Feb. 1946 Chief Aquifer(s) Alluvium

Depth to water _____ feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	48	48
Tesuque Formation	5-	53

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch, 1946.

Remarks: Exploratory test hole for water supply.

Table 37.--Test RGT-2

USGS Location No. 19.8.7.144a USGS Designation RGT-2 (Rio Grande Test)2)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Valley of Rio Grande Altitude _____ feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 497 feet Completed depth 0 feet

Date drilled Feb. 1946 Chief Aquifer(s) Alluvium and Tesuque Formation

Depth to water _____ feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	41	41
Tesuque Formation	456	497

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Water reported from 50 feet to 80 feet.
Exploratory test hole for water supply.

Table 38.--Test RGT-4

USGS Location No. 19.8.7.213 USGS Designation RGT-4 (Rio Grande Test 4)

AEC Coordinates _____ AEC Designation _____

Driller Layne-Western Inc. Address Kansas City, Mo.

Topography Valley of Rio Grande Altitude _____ feet

Method drilled Cable tool Diameter _____ inches Use Unused

Drilled depth 495 feet Completed depth 0 feet

Date drilled Feb. 1946 Chief Aquifer(s) Alluvium and Tesuque Formation

Depth to water _____ feet Date _____ Transmissibility _____ gpd/ft

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	47	47
Tesuque Formation	448	495

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Black and Veatch, 1946

Remarks: Water reported from 50 to 80 feet.
Exploratory test hole for water supply.

Special investigations

Special investigations related to test-site evaluations and to the disposal of low-level radioactive wastes were made at Technical Area TA-49, Mortandad Canyon, Acid and Pueblo Canyons, Bayo Canyon, Los Alamos and DP Canyons, and the contaminated waste pits near TA-21. Fluid dynamics studies were made near TA-50 and TA-52.

Technical Area TA-49

A study was made of the geology and hydrology of area TA-49 (Weir and Purtymun, 1962). Four test holes were drilled to determine the hydrologic and geologic characteristics of the main aquifer, and to detect possible radioactive contamination. Three test holes were drilled to determine the presence or absence of perched water beneath Ancho and Water Canyons and four test holes were cored to determine the physical properties of the tuff. Applicable geologic, hydrologic, and construction data obtained from these holes are presented on tables 39-50. Locations are shown on Figures 2 and 4. Construction

Figure 4 (caption on next page) belongs near here.

records of twenty-five moisture access tubes used to determine the distribution of moisture in soil and underlying tuff are shown in table 51 and locations are shown on Figures 2 and 5.

Figure 5 (caption on next page) belongs near here.

No radioactive contamination was found in the main aquifer, and no perched water was found under Ancho and Water Canyons. Air permeability, porosity, density, and water content of the cores was studied.

Figure 4.--Location of test holes in TA-49, Los Alamos County, N. Mex.

5.--Location of moisture access tubes in TA-49, Los Alamos County, New Mexico.

Table 39.--Deep Test DT-5

USGS Location No. 18.6.3.113 USGS Designation DT-5

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,143 feet

Method drilled Air rotary Diameter 8 inches Use Unused

Drilled depth 978 feet Completed depth 927 feet

Date drilled 1959 Chief Aquifer(s) None

Depth to water dry feet Date - Transmissibility - gpd/f

Specific capacity - gpm/ft After _____

Log: Thickness Depth

Bandelier Tuff

Tshirege Member	641	641
Otowi Member	198	839
Guaje Member	101	940
Puye Conglomerate	38	978

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
8	0-180	Open hole below 180 feet

Chemical analysis: Constituents in parts per million

Date _____, Temp. ____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: Abandoned due to drilling difficulties. Electric logs available.

Table 40.--Core hole CH-2

USGS Location No. 18.6.3.114 USGS Designation CH-2 (core hole 2)

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,137 feet

Method drilled Air Rotary Diameter 3 inches Use Observation

Drilled depth 501 feet Completed depth 500 feet

Date drilled November 1959 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Bandelier Tuff		
Tshirege Member	501	501

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2	0-500	Galvanized pipe with lower 20 feet perforated

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Drilled to obtain core samples of Bandelier Tuff.

Table 41.--Deep test DT-5P

USGS Location No. 18.6.3.171 USGS Designation DT-5P

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech., Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,144 feet

Method drilled Air Rotary Diameter 4 3/4 inches Use unused

Drilled depth 692 feet Completed depth 692 feet

Date drilled 1959 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log: Thickness Depth

Bandelier Tuff

	Thickness	Depth
Tshirege Member -------	641-[illegible]	641
Otowi Member ----------	651-692	692

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
		Open hole

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Drilled to locate possible perched water zones in the Bandelier Tuff.

Table 42.--Deep test DT-5A

USGS Location No. 18.6.3.131a USGS Designation DT-5A

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,144 feet

Method drilled Hydraulic Rotary Diameter 8 inches Use Observation

Drilled depth 1,821 feet Completed depth 1,821 feet

Date drilled January 1960 Chief Aquifer(s) Santa Fe Group and Tschicoma Fm.

Depth to water 1,173 feet Date April 1960 Transmissibility 11,000 gpd/ft

Specific capacity 5.7 gpm/ft After pumping 25 hours at 81 gpm

Log:	Thickness	Depth
Bandelier Tuff		
Tshirege Member	641	641
Otowi Member	198	839
Guaje Member	91	930
Puye Conglomerate		
Fanglomerate Member	237	1,167
Tschicoma Formation	126	1,293
Puye Conglomerate		
Fanglomerate Member	138	1,431
Tschicoma Formation	26	1,457
Puye Conglomerate		
Fanglomerate Member	18	1,475
Totovi Lentil	52	1,527
Tesuque Formation	294	1,821

1520
1175
355

Casing schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-525	
8	0-1,821	220 feet of torch cut slots below depth of 1,172 feet.

Chemical analysis: Constituents in parts per million

Date Apr. 30, 1960, Temp. 70 °F, SiO_2 76, Fe .21, Ca 8.8,

Mg 2.9, Na + K 15.8, HCO_3 68, CO_3 0, SO_4 8.7, Cl .5,

F 0.2, NO_3 2.0, Hardness 34, Dissolved solids _____,

Specific conductance 132 micromhos, pH 7.6

Radiochemical analysis: Date 11-13-63, Pu < 0.1 d/m/l, U 0.5 μg/l,

Gross β (Gamma) 8 d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Electric logs available. Drilled for geologic and hydrologic information.
(Tritium Units 2,6, May 1960).

DT-5A

G.L. Elevation - 7144 ft ; **TD - 1821 ft.; TD- 5323 Elev.;**

water-level (1960) @ 1173 ft or 5971 Elev.

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-641	641	
Otowi Member, Bandelier Tuff	641-839	198	6503
Guaje Member, Bandelier Tuff	839-930	91	6305 — [illegible]
Puye Fm	930-1167	237	6214
Tschicoma Fm Basalt - Polymer	1167- 1293	126	5977
Puye Fm	1293-1431	138	5851
Tschicoma Fm Basalt	1431-1457	26	5713
Puye Fm	1457-1475	18	5687
Totavi Lentil Puye-chAgulti - Polymer	1475-1527	52	5669 5617

source: Weir, 1962

Table 5.--Sample log of well DT-5A

Drilled by rotary with mud for carrier

Total depth 1,821 feet

Completed pilot hole January 25, 1960

Altitude of land surface 7,143.78 feet

	Thickness (feet)	Depth (feet)
Bandelier Tuff		
Tshirege Member:		
Sidewall cores from hole DT-5:		
Unit 1B		
Tuff, ~~light gray to~~ light-pinkish-gray, highly friable; greenish glass shards; rhyolite rock fragments ----------		370
Unit 1A		
Tuff, light gray to light tan, pumiceous ----------		490
Tuff, light gray to pinkish gray, pumiceous, apparently friable --		500

Table 5.--Log of well DT-5A - Continued

	Thickness (feet)	Depth (feet)
No samples recovered due to lack of circulation ---	520	520
Unit 1A		
Tuff, light-gray to light-pinkish-gray; quartz and sanidine crystals and fragments; mafic minerals in fine-grained ash matrix; light-yellowish-gray pumice with cellular structure; light-red rhyolite rock fragments occur from 560 to 641 feet; light-gray rhyolite rock fragments occur from 580 to 641 feet; fragments of light-gray siltstone occur from 610 to 615 feet ----------	121±	641

Table 5.--Log of well DT-5A -Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Otowi Member:		
Tuff, light-gray, pumiceous; quartz and sanidine crystals and fragments with minor amounts of mafic minerals in a fine-grained ash matrix. Light- or dark-gray and light-red rhyolite; light-red and gray latite; white to light-gray pumice fragments throughout member	198	839
Guaje Member:		
Pumice, light-gray, contains some rhyolite and latite rock fragments	91	930
Santa Fe Group		
Puye Conglomerate		
Fanglomerate member:		
Conglomerate composed of rhyolite, latites, andesite(?), and light-colored igneous debris. Other rock fragments include light-red sandstone, pumice, and light-tan clays. Some gravels appear well rounded	237	1,167

Table 5.--Log of well DT-5A - Continued

	Thickness (feet)	Depth (feet)
Tschicoma Formation		
Undifferentiated latite and quartz latite:		
Latite flow rock, light-gray to dark-gray; interflows of greenish-gray siltstone, rhyolite, and tuff fragments and clays occur from 1,221 to 1,225 feet and from 1,259 to 1,264 feet -----	126	1,293
Santa Fe Group		
Puye Conglomerate		
Fanglomerate member:		
Conglomerate composed of rhyolite, latites, andesites(?) and light-colored igneous debris. Other rock fragments include light-gray and white siltstone; light-gray and greenish-gray sandstone. Some fragments appear well rounded. Light-gray ash containing some of the above rock fragments occurs from 1,415 to 1,431 feet ---------	138	1,431

Table 5.--Log of well DT-5A - Continued

	Thickness (feet)	Depth (feet)
Tschicoma Formation		
Undifferentiated latite and quartz latite:		
Latite flow rock, dark-gray, some of appears glassy ----------	26	1,457
Santa Fe Group		
Puye Conglomerate		
Fanglomerate member:		
Conglomerate consisting of rhyolite, latite, and other igneous debris; light-gray sandstone and brown clay ----------	18	1,475
Totavi Lentil:		
Conglomerate composed of bull quartz, quartzite, and much granitic debris. Also abundant volcanic rock debris; gray and brown sandstone fragments -------	52	1,527

Table 5.--Log of well DT-5A - Continued

	Thickness (feet)	Depth (feet)
Undifferentiated unit:		
Siltstone and sandstone, light-pinkish-gray, yellow and brown with lenses of conglomerate; arkosic is some zones but containing much volcanic debris. Light-gray and brown siltstones occur from 1,555 to 1,580 feet; pumiceous zones from 1,585 to 1,595 feet and 1,760 to 1,780 feet. Cuttings are finer from 1,775 to 1,820 feet ----------	294	1,821

Table 43.--Test hole Alpha

USGS Location No. 18.6.3.132 USGS Designation Alpha

AEC Coordinates _____ AEC Designation _____

Driller Casey Drilling Co. Address Los Angeles, Calif.

Topography Surface of Frijoles Mesa Altitude 7,125 feet

Method drilled Rotary bucket Diameter 24 inches Use Unused

Drilled depth 189 feet Completed depth 189 feet

Date drilled February 1960 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:	Thickness	Depth
Bandelier Tuff	189	189

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
24	0-10	Corrugated metal pipe cemented at surface

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Drilled for geologic information.

Table 44.— Core hole CH-4

USGS Location No. 18.6.3.134 USGS Designation CH-4 (core hole 4)

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,116 feet

Method drilled Air Rotary Diameter 3 inches Use Observation

Drilled depth 303 feet Completed depth 300 feet

Date drilled February 1960 Chief Aquifer(s) none

Depth to water dry feet Date _____ Transmissibility _____ gpd/ft

Specific capacity _____ gpm/ft After _____

Log: Thickness Depth

Bandelier Tuff
Tshirege Member ---------- 303 303

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2	0-300	Galvanized pipe with the lower 20 feet slotted

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Drilled to obtain core samples of Bandelier Tuff

DT-10

G.L. Elevation - 7020 ft ; TD - 1409 ft.; 5611 Elev.
water-level (1960) @ 1085 ft or 5935 Elev.

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-672	672	
Cerro Toledo Rhyolite?	754?-765?	11	6266
Otowi Member, Bandelier Tuff	672-829	157	6348
Guaje Member, Bandelier Tuff	829-864	35	6191
Puye Fm	864-972	108	6156
Tschicoma Fm	972-1012	40	6048
Basalt	1012-1281	269	6008
Puye Fm	1281-1356	75	5738
Totavi Lentil	1356-1402	46	5663
Puye Fm?	1402-1409	7	5617

Basalt unit L-Pajarito

5727

source: Weir, 1962

Table 7.--Sample log of well DT-10

Drilled by cable tool

Total depth, 1,409 feet

Completed March 13, 1960

Altitude of land surface 7,019.4 feet

	Thickness (feet)	Depth (feet)
Bandelier Tuff		
Tshirege Member		
Unit 6:		
Tuff, light-gray; medium to very coarse; prominent sanidine phenocrysts with larger phenocrysts containing white globular inclusions; black mafic minerals; large assortment of volcanic rock fragments ----------	29	29
Unit 5:		
Not noted in samples.		
Unit 4:		
Tuff, light-gray to light-red, welded; composed of sanidine, quartz, and mafic minerals with some rock fragments of white and gray glassy rhyolite and brown latite ----------	52	81

Table 7.--Log of well DT-10 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Tshirege Member - Continued		
Unit 3:		
Tuff, light-reddish-brown; containing sanidine, quartz, and black and green mafic minerals with some rock fragments of gray glassy and reddish rhyolite and latite. Light-yellow devitrified pumice occurs from 128 to 138 feet ----------	57	138
Unit 2:		
Tuff, reddish-brown to light-gray; contains sanidine, quartz, pink orthoclase, and a few fragments of chalcedony and sand-size rock fragments of gray glassy rhyolite and latite ----------	90	228

Table 7.--Log of well DT-10 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Tshirege Member - Continued		
Unit 1B:		
Tuff, light-gray to very light-orange; pumiceous, contains sanidine, quartz, dark mafic minerals, and feldspar with prominent alteration rings; rock fragments of rhyolite and latite. Large pumice fragments occur from 348 to 370 feet. White to light-gray pumice with reddish-orange rhyolite occur from 408 to 476 feet -	248	476
Unit 1A:		
Tuff, white to light-gray, pumiceous; brown stains on sanidine fragments; orange pumice fragments with streaks of dark-brown glass along cellular structure; dark-green mafic minerals; an abundance of latite and rhyolite rock fragments ----------	196	672

Table 7.--Log of well DT-10 - Continued

	Thickness (feet)	Depth (feet)
Bandelier tuff - Continued		
Otowi member:		
Tuff, light-reddish-tan; white, very light-gray, and bright-orange pumice fragments; dark-green mafic minerals; latite, and light-gray rhyolite ~~rock~~ fragments. Various volcanic rocks with layered structure occur from 754 to 765 feet (754 → 765) -----	157	829
Guaje member:		
Pumice, light-gray ----------	35	864
Santa Fe group:		
Puye conglomerate:		
Fanglomerate member:		
Conglomerate; samples from 864 to 972 feet contain medium-gray, gray, and brown latite and rhyolite fragments and pebbles; subangular to subrounded; large vesicular fragments of black basalt. Sand-size fraction contains sanidine and white pumice fragments -	108	972

Table 7.--Log of well DT-10 - Continued

	Thickness (feet)	Depth (feet)
Tschicoma Formation		
Undifferentiated latite and quartz latite:		
Latite flow, ~~rock~~, dark-gray, vesicular, very fine crystalline; mafic minerals appear to be altered; unweathered basalt fragments are included in latite ----------	40	1,012
Santa Fe Group		
Basaltic rocks of Chino Mesa		
Unit 2:		
Basalt, ~~Tcb~~ $_2$, dark-red, vesicular ----	96	1,108
Unit 1:		
Basalt, reddish-brown to black, dense, containing olivine, and drusy green minerals on some basalt fragments --	173	1,281
Puye Conglomerate		
Fanglomerate member:		
Conglomerate, consisting of dark-gray latite, red glassy rhyolite; and brown clays and silts ----------	75	1,356

Table 7.--Log of well DT-10 - Continued

	Thickness (feet)	Depth (feet)
Santa Fe group - Continued		
Puye conglomerate - Continued		
Totavi lentil:		
Conglomerate, consisting of feldspathic quartzsite, gray and brown latite, and red and light-gray rhyolite ------	46	1,402
Undifferentiated unit:		
Siltstone, sandstone and occasional conglomerate; no samples recovered, interpretation from gamma log ---------	7	1,409

Water-bearing characteristics

At TA-49 the undifferentiated unit is saturated, but inasmuch as it is overlain by much more permeable saturated rocks, little could be learned about the water-bearing characteristics of the undifferentiated unit from the pumping tests on wells DT-5A, DT-9, and DT-10. Several inferences can be made, however, about its water-bearing properties on the basis of its lithologic characteristics, and by extrapolation of conditions in the Los Alamos Canyon well field. Pumping tests on city supply well L3 indicated a transmissibility of about 2,500 gpd (gallons per day) per foot for approximately the upper 1,000 feet for the unit (Theis and Conover, 19~~50~~61). Therefore, a moderate to low permeability for the undifferentiated unit is indicated. Variations in lithologic character both laterally and vertically in the undifferentiated unit probably result in differences in permeability and differences in velocity within the aquifer. Movement through beds having relatively higher permeability would be more rapid than through less permeable beds.

Table 45.--Deep test DT-10

USGS Location No. 18.6.3.241 USGS Designation DT-10

AEC Coordinates _____ AEC Designation _____

Driller Branch Drilling Co. Address Farmington, New Mexico

Topography Surface of Frijoles Mesa Altitude 7,019 feet

Method drilled Cable tool Diameter 12 inches Use Observation

Drilled depth 1,409 feet Completed depth 1,408 feet ?

Date drilled March 1960 Chief Aquifer(s) Santa Fe Group and Tschicoma Formation

Depth to water 1,085 feet Date April 1960 Transmissibility 36,100 gpd/f

Specific capacity 16 gpm/ft After 16 hours pumping at 78 gpm

Log:	Thickness Depth		Thickness Depth
Bandelier Tuff		Puye Conglomerate	
Tshirege Member	672-672	Fanglomerate Member	75-1,356
Otowi Member	157-829	Totovi Lentil	46-1,402
Guaje Member	35-864	Tesuque Formation	7-1,409
Puye Conglomerate			
Fanglomerate Member	108-972		
Tschicoma Formation	40-1,012		
Basaltic Rocks of Chino Mesa			
Unit 2	96-1,108		
Unit 1	173-1,281		

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-1,128	
8	1,096-1,408	8-inch casing rests on the bottom and is swedged into the 12-inch casing at 1,096 feet. 12-inch casing contains 50 feet of slots below 1,078 feet and the 8-inch casing contains 141 feet of slots.

Chemical analysis: Constituents in parts per million

Date April 1960, Temp. 67 °F, SiO_2 65, Fe .00, Ca 12,

Mg 2.9, Na + K 12.2, HCO_3 80, CO_3 0, SO_4 3.7, Cl 2.2,

F .2, NO_3 1.0, Hardness 42, Dissolved solids _____,

Specific conductance 135 micromhos, pH 7.3

Radiochemical analysis: Date Nov. 13, 1968, Pu < 0.4 d/m/l, U 0.7 µg/l,

Gross β (Gamma) 4 d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: Electric logs available. Drilled for geologic and hydrologic information.

Table 46.--Test hole Gamma

USGS Location No. 18.6.3.314 USGS Designation Gamma

AEC Coordinates _____ AEC Designation _____

Driller Los Alamos Contractors Inc. Address Los Alamos, New Mexico

Topography Floor of Ancho Canyon Altitude 6,870 feet

Method drilled Air rotary Diameter 4 inches Use Observation

Drilled depth 54 feet Completed depth 54 feet

Date drilled March 1960 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/ft

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Alluvium	3	3
Bandelier Tuff		
Tshirege Member	51	54

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
4	0-6	

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ μg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: A nearby 24-inch diameter hole was drilled with a bucket auger to 7 feet and abandoned because of the hardness of the tuff.
Drilled to locate ~~possible~~ perched water beneath Ancho Canyon.

DT-9

6935 - [illegible]

G.L. Elevation - 6937 ft ; TD - 1501 ft.; 5436 Elev.
water-level (1960) @ 1003 ft or 5934 Elev.

Log	Depth	Thickness	Top Elevation
Tshirege Member, Bandelier Tuff	0-676	676	
Tsankawi Pumice Bed?	609-618	9	6328
Otowi Member, Bandelier Tuff	676-802	126	6261 6259
Guaje Member, Bandelier Tuff	802-850	48	6135 6133
Puye Fm (brown clay, 60 % occurs 918-924 ft)	850-924	74	6087 6085
Tschicoma Fm (water @ 1005 ft or 5932 ft elev.)	924-1162	238	6013 6011
Puye Fm	1162-1319	157	5775 5773
Totavi Lentil	1319-1357	38	5618 5616
Puye Fm? Chaquehui [illegible]	1357-1501	144	5580 5578

source: Weir, 1962

Table 6.--Sample log of well DT-9

Drilled by cable tool

Total depth 1,501 feet

Completed February 19, 1960

Altitude of land surface 6,937.3 feet

	Thickness (feet)	Depth (feet)
Bandelier Tuff		
Tshirege Member		
Unit 4:		
Tuff, light-brownish-tan, welded; composed of quartz and sanidine crystals and fragments; light-gray glassy and gray rhyolite in an ash matrix; dark-green mafic minerals; light-yellowish-gray pumice fragments with dark mafic minerals parallel to the cellular structure of the pumice; minor amounts of clay weathered from pumice fragments occur from 48 to 58 feet ----------	58	58

Table 6.--Log of well DT-9 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Tshirege Member - Continued		
Unit 3:		
Tuff, light gray, containing quartz and sanidine crystals and fragments; fragments of light-tan and white pumice and dark-gray rhyolite in an ash matrix. Sanidine crystals increase in quantity from 74 to 116 feet ----------	58	116
Unit 2:		
Tuff, light-purplish-gray, welded, dense; composed of sanidine crystals and fragments up to granule size; a few quartz crystals and fragments; light-gray to gray rhyolite fragments; matrix is gray glassy ash; green mafic minerals coated with an iron stain ----------	98	214

Table 6.--Log of well DT-9 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Tshirege Member - Continued		
Unit 1B:		
Tuff, light-gray to reddish-orange, pumiceous, containing some rhyolite rock fragments. Light-gray tuff from 280 to 308 feet contains sanidine; iron-stained quartz crystals and fragments; gray glassy rhyolite fragments; light-gray pumice fragments. Light reddish-orange tuff occurs from 308 to 390 feet and is composed of sanidine and quartz crystals, with some dark-colored inclusions in the quartz crystals; light-gray and light-orange pumice with streaks of dark-gray glass along the cell structure; and a few fragments of dark-gray rhyolite. Light-gray pumice fragments occur from 390 to 462 feet ----------	248	462

Table 6.--Log of well DT-9 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Tshirege Member - Continued		
Unit 1A:		
Tuff, gray, friable, pumiceous; sanidine and quartz crystals in equal amounts; light-gray and gray glassy rhyolite fragments; some yellowish-orange pumice fragments included. Large light-gray pumice fragments occur from 609 to 618 feet ----------	214	676
Otowi Member:		
Tuff, light-gray, friable; containing light-gray and light-pink pumice fragments; quartz and sanidine crystals and fragments in a glassy ash matrix; light-red, gray, and glassy gray rhyolite; green mafic minerals. Light-red volcanic rock fragments with black and gray glassy bands occur from 756 to 766 feet ----------	126	802

Table 6.--Log of well DT-9 - Continued

	Thickness (feet)	Depth (feet)
Bandelier Tuff - Continued		
Guaje Member:		
Pumice, light-gray ----------	48	850
Santa Fe Group		
Puye Conglomerate		
Fanglomerate member:		
Conglomerate, gray; composed of rhyolite, latite, and light-colored igneous debris; some particles are fine to very coarse and appear to be subrounded. Brown clay up to 60 percent occurs from 918 to 924 feet ----------	74	924
Tschicoma Formation		
Undifferentiated latite and quartz latite:		
Latite and quartz latite ~~flow rocks~~, dark-gray. Inter-flow zones from 1,058 to 1,078 feet and from 1,114 to 1,143 feet contain latite and quartz-latite rock fragments; brown clay; yellow and milky quartz fragments. Water encountered at approximately 1,005 feet ----------	238	1,162

Table 6.--Log of well DT-9 - Continued

	Thickness (feet)	Depth (feet)
Santa Fe group:		
Puye conglomerate:		
Fanglomerate member:		
Conglomerate, gray; composed of rhyolite latite, and quartz-latite fragments with some of the fine to coarse fragments shwoing well-rounded grains. Also fragments of light-gray siltstone and light-yellowish-brown clay ----------	157	1,319
Totavi lentil:		
Conglomerate, gray; rhyolite, latite, and quartzite rock fragments; minerals noted were quartz, white orthoclase, pink microcline, biotite, magnetite, tourmaline, and chalcedony; sand-size particles appear subrounded to well rounded ----------	38	1,357
Undifferentiated unit:		
Siltstone, silty sandstone, and sandstone with occasional conglomerate, light-brown; composed of rhyolite, latite, quartzite, and some pumice.----------	144	1,501

Table 47.--Deep test DT-9

USGS Location No. 18.6.3.443 USGS Designation DT-9

AEC Coordinates AEC Designation

Driller Branch Drilling Co. Address Farmington, New Mexico

Topography Surface of Frijoles Mesa Altitude 6,937 feet

Method drilled Cable tool Diameter 12 inches Use Observation

Drilled depth 1,501 feet Completed depth 1,501 feet

Date drilled February 1960 Chief Aquifer(s) Santa Fe Group and Tschicoma Formation

Depth to water 1,003 feet Date April 1960 Transmissibility 61,000 gpd/f

Specific capacity 22 gpm/ft After pumping for 24 hours at a rate of 88 gpm.

Log:

	Thickness	Depth
Bandelier Tuff		
Tshirege Member	676	676
Otowi Member	126	802
Guaje Member	48	850
Puye Conglomerate		
Fanglomerate Member	74	1,924
Tschicoma Formation	238	1,162
Puye Conglomerate		
Fanglomerate Member	157	1,319
Totovi Lentil	38	1,357
Tesuque Formation	144	1,501

1357
1006
351

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
12	0-1,335	115 feet of slots above 1,003 feet and 180 feet below 1,003 feet.
8	1,314-1,500	183 feet of slots.

Chemical analysis: Constituents in parts per million

Date May 7, 1960, Temp. 70 °F, SiO_2 69, Fe 4, Ca 12,

Mg 1.2, Na + K 13.2, HCO_3 68, CO_3 0, SO_4 3.7, Cl 2.0,

F .3, NO_3 .0, Hardness 34, Dissolved solids _____.

Specific conductance 132 micromhos, pH 7.6

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: Electric logs available. Drilled for geologic and hydrologic information
Tritium units 3,8, Feb. 1960, depth 1,325 feet.
Tritium units 3,5, Feb. 1960, depth 1,501 feet.

Table 48.--Core hole CH-1

USGS Location No. 18.6.4.224 USGS Designation CH-1 (corehole 1)

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,170 feet

Method drilled Air Rotary Diameter 3 inches Use Observation

Drilled depth 501 feet Completed depth 500 feet

Date drilled December 1959 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Bandelier Tuff		
Tshirege Member ----------	501	501

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2	0-500	Galvanized pipe with the lower 20 feet slotted.

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: Drilled to obtain core samples of Bandelier Tuff.

Table 49.--Core hole CH-3

USGS Location No. 18.6.4.242 USGS Designation CH-3 (core hole 3)

AEC Coordinates _____ AEC Designation _____

Driller Soil Mech. Inc. Address Bryan, Texas

Topography Surface of Frijoles Mesa Altitude 7,170 feet

Method drilled Air Rotary Diameter 3 inches Use Observation

Drilled depth 300 feet Completed depth 300 feet

Date drilled February 1960 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Bandelier Tuff		
Tshirege Member	300	300

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
2	0-300	Galvanized pipe with the lower 20 feet slotted.

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E. Jr., and Purtymun, W. D., 1962

Remarks: Drilled to obtain core samples of Bandelier Tuff.

Table 50.--Test hole Beta

USGS Location No. 19.6.34.331 USGS Designation Beta

AEC Coordinates _____ AEC Designation _____

Driller Casey Drilling Co. Address Los Angeles, Calif.

Topography Floor of Water Canyon Altitude 6,801 feet

Method drilled Bucket Auger Diameter 24 inches Use Observation

Drilled depth 180 feet Completed depth 180 feet

Date drilled 1960 Chief Aquifer(s) None

Depth to water dry feet Date _____ Transmissibility _____ gpd/f

Specific capacity _____ gpm/ft After _____

Log:

	Thickness	Depth
Bandelier Tuff		
Tshirege Member	180	180

Casing Schedule:

Diameter (inches)	Depth (feet)	Remarks
24	0-15	Corrugated iron pipe

Chemical analysis: Constituents in parts per million

Date _____, Temp. _____ °F, SiO_2 _____, Fe _____, Ca _____,

Mg _____, Na + K _____, HCO_3 _____, CO_3 _____, SO_4 _____, Cl _____,

F _____, NO_3 _____, Hardness _____, Dissolved solids _____,

Specific conductance _____ micromhos, pH _____

Radiochemical analysis: Date _____, Pu _____ d/m/l, U _____ µg/l,

Gross β (Gamma) _____ d/m/l

Report source of data: Weir, J. E., Jr., and Purtymun, W. D., 1962

Remarks: Drilled to determine possible perched water beneath Water Canyon.

Table 51.--Moisture access tubes in TA-49

USGS designation	USGS location number	AEC-LASL designation (hole number)	AEC-LASL cordinates	Construction date	Altitude of land surface (feet above mean sea level)	Diameter of casing (inches)	Length of plastic casing below land surface (feet)	Log	
								Alluvium (feet)	Bandelier Tuff (feet)
1M-1	18. 6. 4.224a	13	104 + 40S 85 + 48E	Feb. 1960	7,162	2	49	4.5	44.5
1M-2	18. 6. 4.224b	14	104 + 63S 83 + 39E	Feb. 1960	7,170	2	19	1	18
1M-3	18. 6. 4.224c	12	105 + 92S 84 + 95E	Feb. 1960	7,171	2	19	4	15
1M-3A	18. 6. 4.224d	11	105 + 92S 85 + 02E	Apr. 1960	7,171	2	49	3	46
2M-1	18. 6. 3.114a	17	104 + 73E 99 + 28E	Feb. 1960	7,129	2	49	1	48
2M-2	18. 6. 3.114b	16	107 + 12S 100 + 05E	Feb. 1960	7,131	2	10	5	5
2M-3	18. 6. 3.114c	15	106 + 66S 96 + 01E	Feb. 1960	7,141	2	19	5	14
3M-1	18. 6. 4.243	19	115 + 97E 82 + 03E	Feb. 1960	7,163	2	50	1	49
3M-2	18. 6. 4.242a	18	114 + 82S 82 + 67E	Feb. 1960	7,169	2	19	2.5	16.5
3M-3	18. 6. 4.241	20	114 + 56S 79 + 96E	Feb. 1960	7,174	2	20	7	13
4M-1	18. 6. 3.134a	7	121 + 29S 96 + 44E	Feb. 1960	7,112	2	49	2	47

Table 51.--Moisture access tubes - Continued

USGS designation	USGS location number	AEC-LASL designation (hole number)	AEC-LASL coordinates	Construction date	Altitude of land surface (feet above mean sea level)	Diameter of casing (inches)	Length of plastic casing below land surface (feet)	Log	
								Alluvium (feet)	Bandelier Tuff (feet)
4M-2	18. 6. 3.133	5	120 + 57S 94 + 70E	Feb. 1960	7,116	2	20	1.5	18.5
4M-3	18. 6. 3.312	8	122 + 76E 96 + 94E	Feb. 1960	7,107	2	19	3	16
4M-4	18. 6. 3.133a	6	118 + 72S 94 + 94E	Feb. 1960	7,122	2	19	3	16
5M-1	18. 6. 3.132a	23	111 + 32S 94 + 36E	Feb. 1960	7,136	2	39	2.5	36.5
5M-2	18. 6. 3.131	1	111 + 05S 92 + 38E	Feb. 1960	7,146	2	19	3	16
6M-1	18. 6. 4.212	10	102 + 15S 68 + 83E	Feb. 1960	7,210	2	19	9	10
9M-1	18. 6. 4.244	9	116 + 67S 88 + 44E	Feb. 1960	7,115	2	19	6	13
9M-2	18. 6. 3.132b	3	113 + 40S 98 + 15E	Mar. 1960	7,104	2	19	6.5	12.5
9M-3	18. 6. 3.143	4	117 + 02S 104 + 57E	Feb. 1960	7,049	2	19	4	15
9M-4	18. 6. 3.132c	2	113 + 93S 100 + 40E	Feb. 1960	7,097	2	19	12.5	6.5
10M-1	18. 6. 3.124	21	104 + 96S 110 + 31E	Feb. 1960	7,090	2	29	2	27

Table 54--Moisture access tubes - Concluded

USGS designation	USGS location number	AEC-LASL designation (hole number	AEC-LASL coordinates	Construction date	Altitude of land surface (feet above mean sea level)	Diameter of casing (inches)	Length of plastic casing below land surface (feet)	Log	
								Alluvium (feet)	Bandelier Tuff (feet)
10M-2	18. 6. 3.124a	22	104 + 54S 108 + 69E	Feb. 1960	7,093	2	20	4	16
WCM-1	19. 6.34.344	-	92 + 20S 1/ 111 + 20E	Feb. 1960	6,745	2	10	10	-
WCM-2	18. 6. 2.113	-	102 + 20S 1/ 145 + 00E	Feb. 1960	6,650	2	10	10	-

1/ Location approximate, taken from map.

Mortandad Canyon

An investigation of Mortandad Canyon as a site for disposal of treated low-level radioactive wastes was conducted prior to its use as a disposal area (Baltz, Abrahams, and Purtymun, 1963). A well to monitor possible radioactive contamination of the main aquifer, a system of observation wells to monitor the movement of perched water within the alluvium, and lines of moisture access tubes adjacent to many of the observation wells to monitor movement of moisture into the underlying tuff were constructed. Eight surface-water sampling points were established. No contamination has been found in the main aquifer. The perched water was found to infiltrate the tuff underlying the canyon and not to flow beyond the area of study. Geologic, hydrologic, and construction data are presented on table 52 to table 55. Locations of observation and test wells are shown on Figure 6 and location of

Figure 6 (caption on next page) belongs near here.

moisture access tubes are shown on Figure 7.

Figure 7 (caption on next page) belongs near here.

Figure 6.--Mortandad Canyon disposal area.

Figure 7.--Location of moisture access tubes in the Mortandad Canyon disposal area.

TW-8

6870 - [illegible]

G.L. Elevation - 6872 ft; TD - 1065 ft.; 5807 Elev.
(water @ 985ft; 5887 elev. when drilled (1960);
water rose to 963 ft; 5909 elev.)

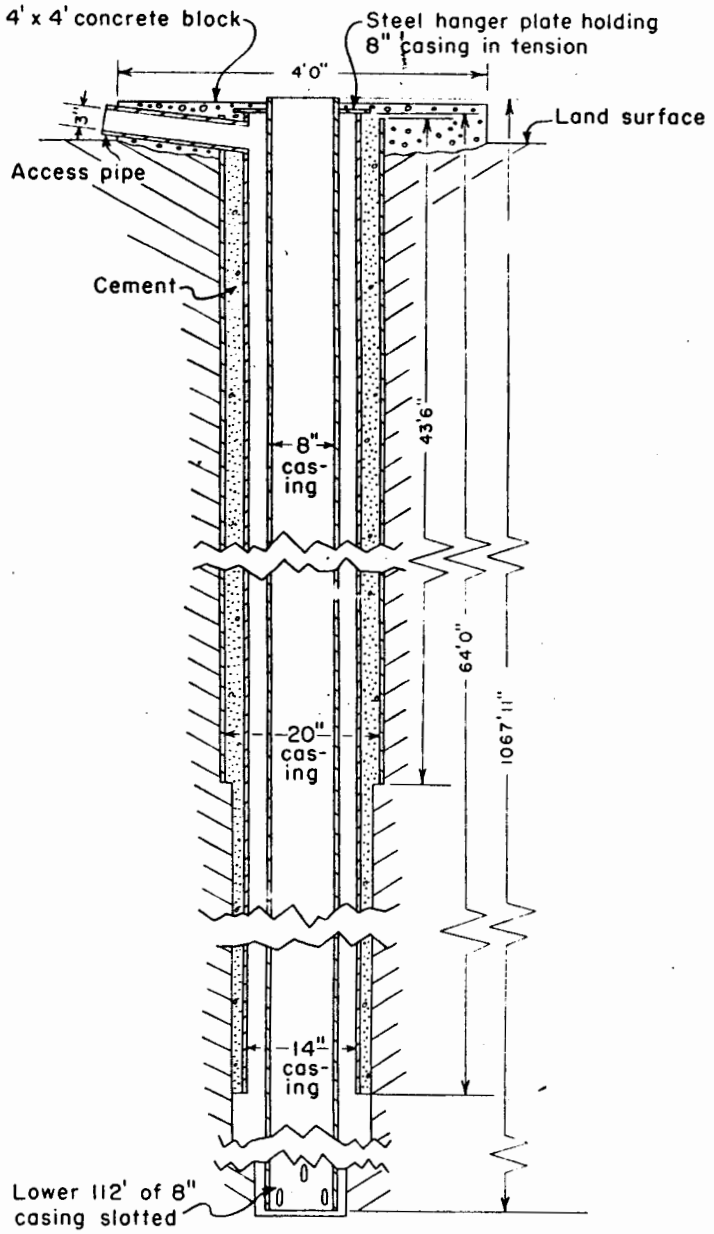
Log	Depth	Thickness	Top Elevation
Alluvium	0-45	45	
Tshirege Member, Bandelier Tuff	45-110?	65	6827 - 6838 - [illegible]
Tsankawi Pumice Bed?	110-150	40	6762 -
Cerro Toledo Rhyolite	150-165	~~89~~ 15	6722 -
Otowi Member, Bandelier Tuff	200- ~~165~~-445	~~280~~	~~6707~~ 6727 - 6818
Guaje Member, Bandelier Tuff	445-490	45	6427 - 6433
Puye Fm	490-575	85	6382 - 6388
basalt	575-725	150	6297 - 6298
Puye Fm	725-1065	340	6147 - 6153

note * in [illegible] TW-8: [illegible] 6877, [illegible]

source: well logs from Baltz ?

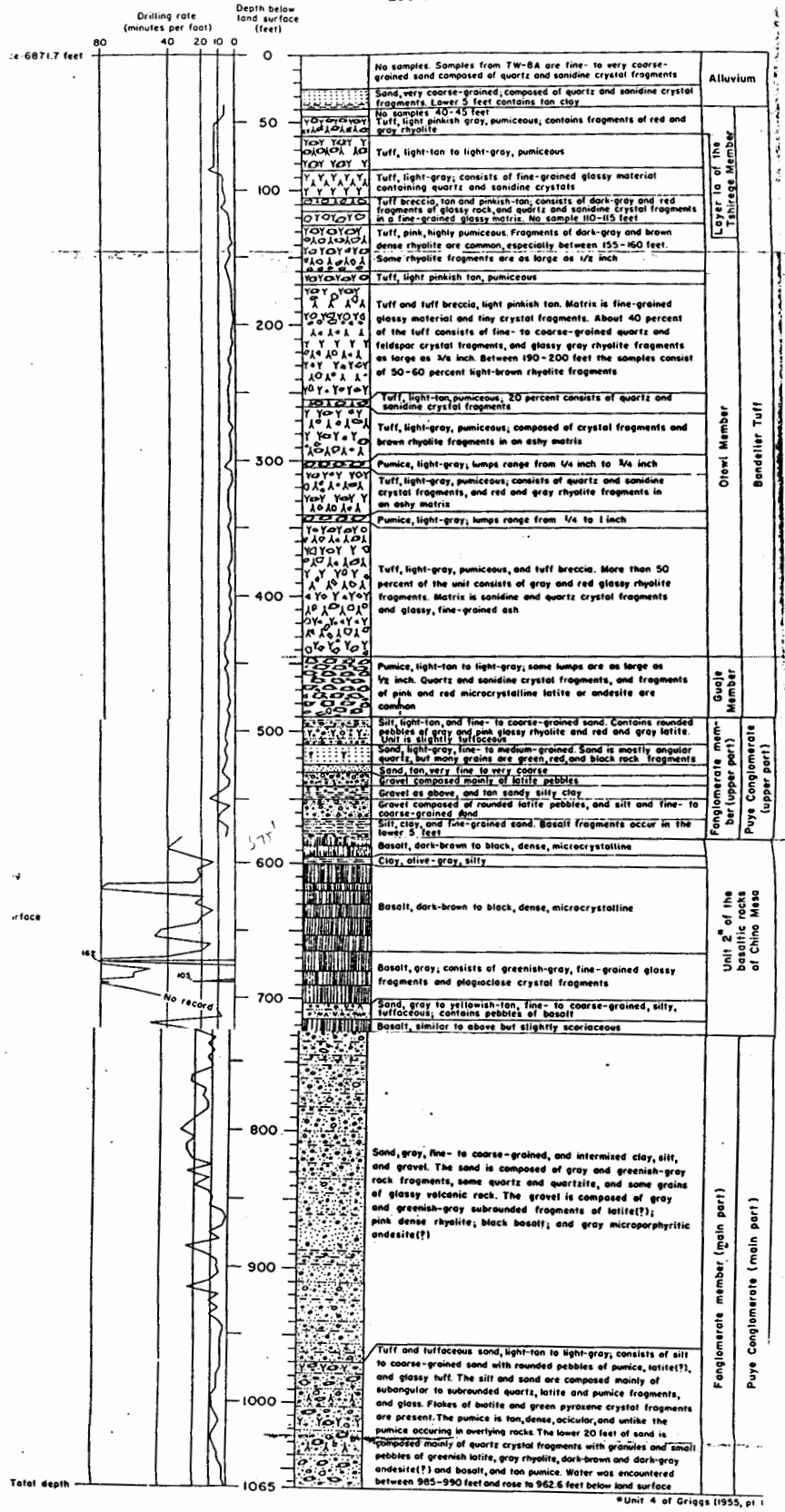
TW-8

CROSS SECTION SHOWING WELL CONSTRUCTION



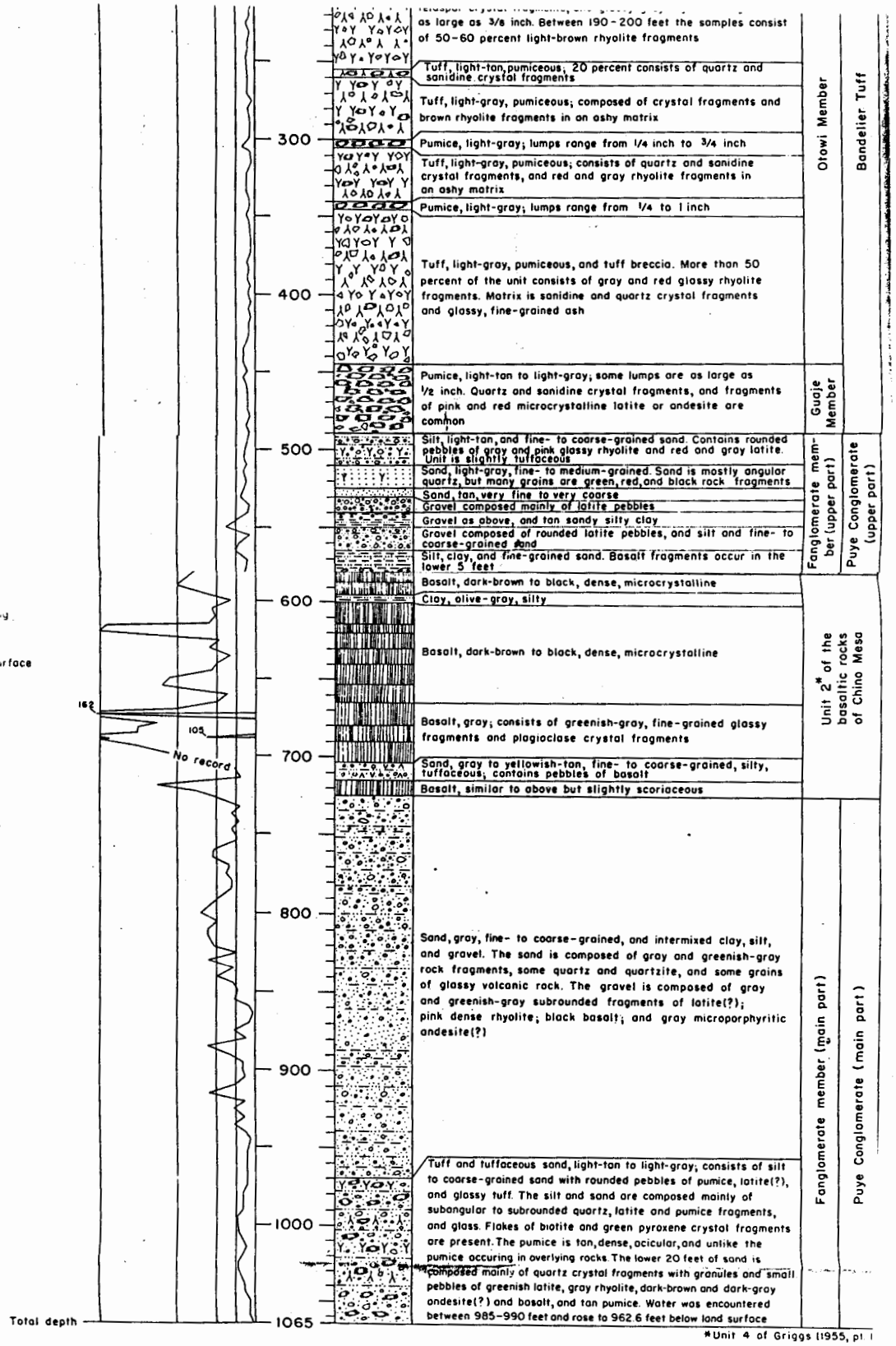
TW-8

LOG OF SAMPLES OF ROCKS PENETRATED



*Unit 4 of Griggs (1955, pl. 1

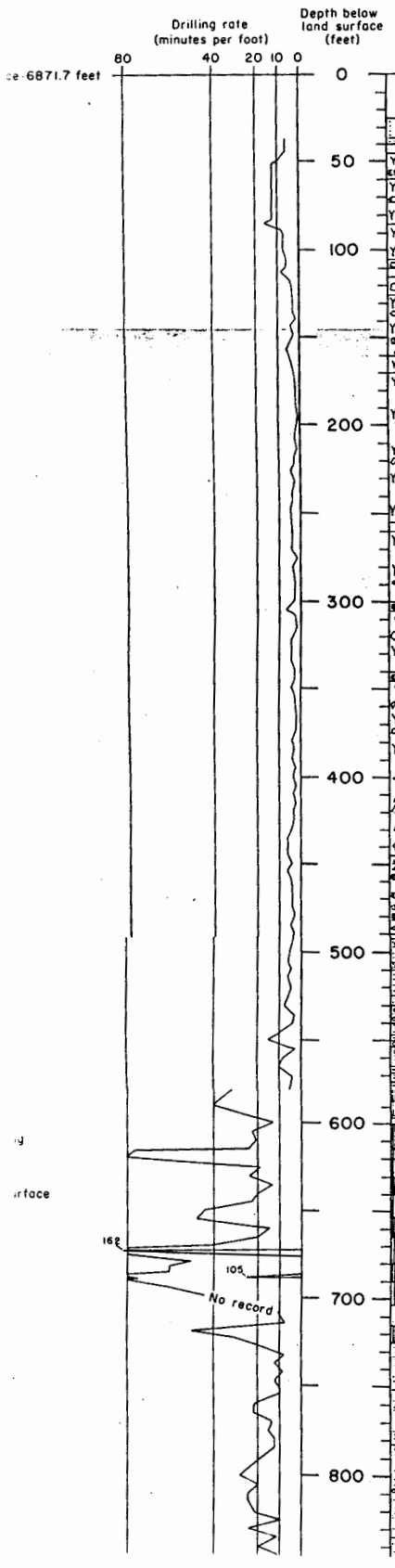
TW-8



*Unit 4 of Griggs (1955, pl. 1

TW-8

LOG OF SAMPLES OF ROCKS PENETRATED



Depth (feet)	Description	Unit	Member	Formation
0	No samples. Samples from TW-8A are fine- to very coarse-grained sand composed of quartz and sanidine crystal fragments	Alluvium		
	Sand, very coarse-grained; composed of quartz and sanidine crystal fragments. Lower 5 feet contains tan clay			
50	No samples 40-45 feet Tuff, light pinkish gray, pumiceous; contains fragments of red and gray rhyolite	Layer 1a of the Tshirege Member		Bandelier Tuff
	Tuff, light-tan to light-gray, pumiceous			
100	Tuff, light-gray; consists of fine-grained glassy material containing quartz and sanidine crystals			
	Tuff breccia, tan and pinkish-tan; consists of dark-gray and red fragments of glassy rock, and quartz and sanidine crystal fragments in a fine-grained glassy matrix. No sample 110-115 feet			
	Tuff, pink, highly pumiceous. Fragments of dark-gray and brown dense rhyolite are common, especially between 155-160 feet.			
	Some rhyolite fragments are as large as 1/2 inch	Otowi Member		
	Tuff, light pinkish tan, pumiceous			
200	Tuff and tuff breccia, light pinkish tan. Matrix is fine-grained glassy material and tiny crystal fragments. About 40 percent of the tuff consists of fine- to coarse-grained quartz and feldspar crystal fragments, and glassy gray rhyolite fragments as large as 3/8 inch. Between 190-200 feet the samples consist of 50-60 percent light-brown rhyolite fragments			
	Tuff, light-tan, pumiceous; 20 percent consists of quartz and sanidine crystal fragments			
	Tuff, light-gray, pumiceous; composed of crystal fragments and brown rhyolite fragments in an ashy matrix			
300	Pumice, light-gray; lumps range from 1/4 inch to 3/4 inch			
	Tuff, light-gray, pumiceous; consists of quartz and sanidine crystal fragments, and red and gray rhyolite fragments in an ashy matrix			
	Pumice, light-gray; lumps range from 1/4 to 1 inch			
400	Tuff, light-gray, pumiceous, and tuff breccia. More than 50 percent of the unit consists of gray and red glassy rhyolite fragments. Matrix is sanidine and quartz crystal fragments and glassy, fine-grained ash			
	Pumice, light-tan to light-gray; some lumps are as large as 1/2 inch. Quartz and sanidine crystal fragments, and fragments of pink and red microcrystalline latite or andesite are common		Guaje Member	
500	Silt, light-tan, and fine- to coarse-grained sand. Contains rounded pebbles of gray and pink glassy rhyolite and red and gray latite. Unit is slightly tuffaceous		Fanglomerate member (upper part)	Puye Conglomerate (upper part)
	Sand, light-gray, fine- to medium-grained. Sand is mostly angular quartz, but many grains are green, red, and black rock fragments			
	Sand, tan, very fine to very coarse			
	Gravel composed mainly of latite pebbles			
	Gravel as above, and tan sandy silty clay			
	Gravel composed of rounded latite pebbles, and silt and fine- to coarse-grained sand			
	Silt, clay, and fine-grained sand. Basalt fragments occur in the lower 5 feet			
	Basalt, dark-brown to black, dense, microcrystalline	Unit 2* of the basaltic rocks of Chino Mesa		
600	Clay, olive-gray, silty			
	Basalt, dark-brown to black, dense, microcrystalline			
	Basalt, gray; consists of greenish-gray, fine-grained glassy fragments and plagioclase crystal fragments			
700	Sand, gray to yellowish-tan, fine- to coarse-grained, silty, tuffaceous; contains pebbles of basalt			
	Basalt, similar to above but slightly scoriaceous			
800	Sand, gray, fine- to coarse-grained, and intermixed clay, silt, and gravel. The sand is composed of gray and greenish-gray rock fragments, some quartz and quartzite, and some grains of glassy volcanic rock. The gravel is composed of gray			

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Albuquerque, New Mexico

Preliminary report on the geology and hydrology of Mortandad Canyon near Los Alamos, N. Mex., with reference to disposal of liquid, low-level radioactive waste

By

Elmer H. Baltz, John H. Abrahams, Jr.,
and William D. Purtymun

Prepared in cooperation with the
U.S. Atomic Energy Commission and the
Los Alamos Scientific Laboratory

Deep test well

A deep test ~~hole~~ well was drilled in Mortandad Canyon near the middle of sec. 23, T. 19 N., R. 6 E. The ~~hole~~ well was bottomed at a depth of 1,065 feet in the main aquifer of the Los Alamos area. This ~~hole~~ well is designated as test well 8 (TW-8 on fig. 2). The ~~hole~~ well was drilled by the cable-tool method. Drilling began on November 8, and the well was completed December 15, 1960. Drilling time was recorded and rock cuttings were collected at depth intervals of 5 feet. The drilling-rate log, a description of the cuttings, and details of well construction are shown on figure 4. A hole 18 to 20 inches in diameter was drilled to a depth of 85 feet. From 85 feet to the total depth of 1,065 feet, a hole 13 5/8 inches in diameter was drilled.

An unperforated steel casing, 20 inches in diameter, and 43.5 feet long, was driven to a depth of 42 feet below land surface to seal out water in the alluvium. A 14-inch diameter steel casing, 63 feet long, was suspended inside the 20-inch casing. Cement was poured around the 14-inch casing to fill the annular space from a depth of 62 feet to the land surface (fig. 4). An 8-inch casing, 1,067 feet 11 inches long, was suspended inside the 14-inch casing in such a manner that the 8-inch casing does not rest on the bottom of the hole. Slots were cut with an acetylene torch in the lower 112 feet of the 8-inch casing. The slots are 6 inches long, 1/8 inch wide, and are spaced 90° degrees apart horizontally. The vertical spacing is 6 inches between the horizontal rows of slots, and the slots of each row are staggered 45° degrees horizontally, with respect to the slots in the next row above and below. The well was partly developed by bailing for 1 hour on December 15; it was developed additionally ~~development occurred~~ during a 2-hour bailing test on December 16, 1/a.

If surface water or shallow ground water should begin to leak down around the 20-inch and 14-inch surface casings, it may be possible to seal the upper 465 feet of the well by pouring grout into the annular space between the 8-inch casing and the borehole. A packer made of machinery belting is attached to the outside of the 8-inch casing at a depth of 465 feet to provide a bridge for the grout. Access to the annular space above this bridge is provided by a 3-inch-diameter pipe at the well head (fig. 4).

The first attempt to drill a deep test ~~hole~~ well was abandoned at a depth of 40 feet, because a drill bit and holding wrench were lost in the hole. This ~~hole~~ well, designated test well 8A (TW-8A), is about 50 feet east of TW-8 and is used as a shallow observation well.

Transmissibility and permeability

A bailing test was made at test well 8 on December 16, 1961, to determine the coefficient of transmissibility and the permeability of the part of the main aquifer tapped by the well. The average rate of bailing was 16 gpm during the 2-hour test. The residual drawdown 5 minutes after bailing ended was 0.35 foot. Recovery to the original water level was complete 8 minutes after bailing ended. The water level recovered so rapidly that it was impossible to determine the total amount of drawdown and the rate of recovery during the first 5 minutes after bailing ended. Thus, the coefficient of transmissibility and the permeability computed from the data obtained in the bailing test are considered to be only approximations of the actual values.

The coefficient of transmissibility is defined as the rate of flow, in gallons per day, of water under unit hydraulic gradient at the prevailing temperature through a 1-foot wide vertical strip of the aquifer. The vertical strip has a height equal to the thickness of the aquifer. The ~~determination of the~~ coefficient of transmissibility is determined from ~~is based on~~ the rate of drawdown or recovery of the water level during or after a period of pumping or bailing and the rate of withdrawal, which is the method devised by Theis (1935) and later described by Wenzel (1942). The coefficient of transmissibility is calculated to be 2,400 gpd/ft (gallons per day per foot) for the part of the main aquifer penetrated by test well 8. This figure may be slightly higher or lower than the actual transmissibility, because the rapid recovery of the water level resulted in fewer measurements than are usually considered necessary to determine the rate of recovery.

To determine the field coefficient of permeability, the coefficient of transmissibility (2,400 gpd/ft) is divided by the thickness of the aquifer penetrated (80 feet). This gives a field coefficient of permeability of 30 gpd per square foot for the lower part of the fanglomerate member of the Puye Conglomerate at test well 8.

North of test well 8 in the vicinity of test wells 2 and 3, the top of the main aquifer lies below the fanglomerate member, and the water-bearing beds occur in the Totavi Lentil of the Puye Conglomerate. Data from pumping tests show that the field coefficient of permeability of the Totavi Lentil at test well 2 (290 gpd per square foot) and test well 3 (320 gpd per square foot) is about 10 times greater than that of the fanglomerate member at test well 8 (30 gpd per square foot). This change in permeability in the main aquifer is reflected in the change in direction of the contours on figure 11 between test wells 2 and 8.

Using the data collected during the bailing test at TW-8, the estimated velocity of the water in the part of the main aquifer penetrated by the well is 0.2 foot per day, or about 73 feet per year.

$\frac{x}{30} : \frac{73}{5280}$ .748

73
32
3650

Because of the time elapsed between the end of the bailing test and the drawdown measurement, the total amount of drawdown is not known. However, by using the coefficient of transmissibility, the specific capacity (gallons per minute per foot of drawdown), is estimated to be about 2 gpm per foot of drawdown (Theis and others, 1954). Thus test well 8 could supply small quantities of water for domestic or industrial use. The well can be used as a monitoring well, as have the other test wells in the Los Alamos area.

Test well 8
Coefficient of transmissibility 2,400 gpd per foot

8"

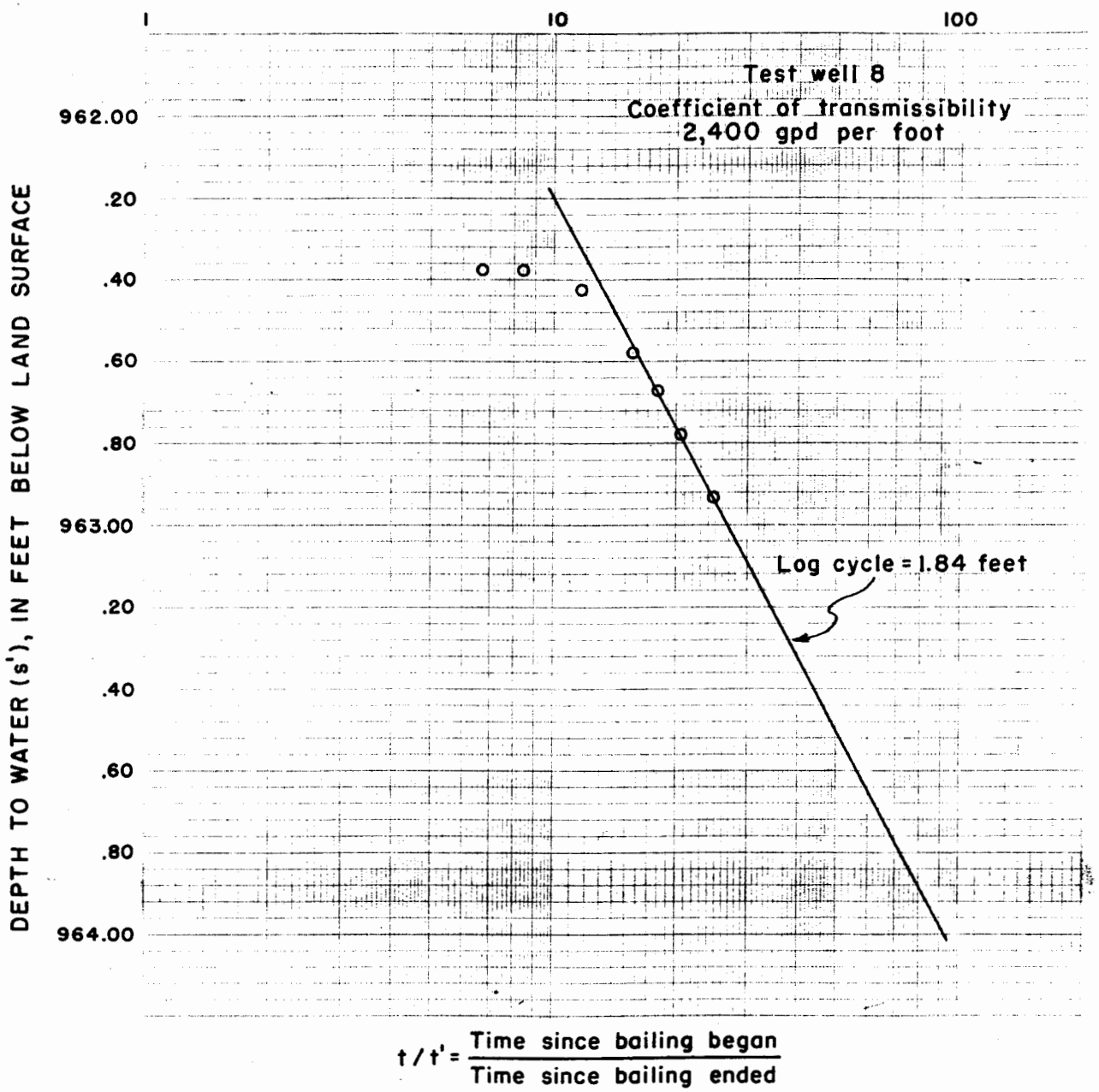


Figure 14.--Semi-logarithmic plot of data obtained from bailing test of test well 8 by plotting s' against t/t'

Table 53.--Observation wells in Mortandad and Ten-Site Canyons - Los Alamos Area, New Mexico.

USGS designation	USGS location number	AEC-LASL coordinates	Construction date	Altitude of land surface (feet above mean sea level)	Diameter of casing (inches)	Length of plastic casing below land surface (feet)	Log: Alluvium (feet)	Log: Bandelier Tuff (feet)	Remarks
MCO-1	19.6.22.133		Nov. 1960	7,153.3	3	1.2	1	0.2	-
-2	19.6.22.134		Nov. 1960	7,133.5	2	9.9	1	8.9	-
-3	19.6.22.144		Nov. 1960	7,046.2	2	12.7	7	5.7	-
-4	19.6.23.312		Oct. 1960	6,909.4	2	23.5	22	1.5	Destroyed, new well 5 ft. west.
-4A[a]	19.6.23.312a		Oct. 1963	6,909.5	3	19	18	1.0	Now known as MCO-4
-5	19.6.23.322b		Oct. 1960	6,876.7	3	38.5	35	3.5	-
-6	19.6.23.414		Oct. 1960	6,848.9	3	70.7	36	34.7	-
-6.5A	19.6.23.414a		Dec. 1961	-	2	45	45	-	-
-6.5B	19.6.23.414b		Nov. 1961	6,839.3	4	42[b]	42	-	-
-7	19.6.23.441		Oct. 1960	6,827.6	3	68.5	55	13.5	-
-7.5	19.6.23.442		Nov. 1961	6,808.6	3	60	60	-	-
-8	19.6.24.313		Oct. 1960	6,797.3	3	83.4	61	22.4	-
-8A	19.6.24.313a		Nov. 1961	-	2	50	50	-	-
-8.2	19.6.24.314		Nov. 1961	6,781.8	2	70	70	-	-
-9	19.6.24.342		Nov. 1961	6,749.8	3	55.5	55.5	-	-
-9.5	19.6.24.431		Nov. 1961	-	2	46	46	-	-

Table 55.--Surface water sampling points in Mortandad Canyon

USGS designation	USGS location number
Effluent Canyon (TA-48)	S19.6.22.134
New Sigma effluent near outfall	S19.6.21.121
(Confluence of Mortandad and Effluent canyons	S19.6.22.145a
Gaging Station (GS-1)	S19.6.22.143
MCS 3.2	S19.6.22.234
MCS 3.8	S19.6.22.422
MCS 3.9	S19.6.23.311
Gaging Station 2 (GS-2)	S19.6.23.312
MCS 5	S19.6.23.322

Acid and Pueblo Canyons

A study of the disposal of treated low-level radioactive wastes was conducted in Acid and Pueblo Canyons (Abrahams and others, 1961). An observation well system consisting of drive points and dug wells in the alluvium and shallow wells drilled into the underlying conglomerate was constructed. Weirs and surface-water sampling points to measure discharge and monitor water-borne radioactivity were established.

Sparse information is available on construction of wells in Acid and Pueblo Canyons. Several wells have been destroyed by high water flow; others have been partially filled by sand. Many of the sites are used only as reference points in surface water and alluvium sampling. In general, the system is in poor repair. Locations and available construction data are presented in tables 56 to 58. Locations are shown on Figure 8. Radioactive nuclides were found to collect

Figure 8 (caption on next page) belongs near here.

mostly in the clay and alluvial particles and dispersed downstream by flood flow and intermittent waste discharge such that there was no high concentration buildup. Contamination was generally below off site tolerances.

Figure 8.--Location of well, spring, stream, and alluvium sampling points in Acid, Pueblo and Bayo Canyons.

Table 56.--Wells in Acid and Pueblo Canyons disposal area, AC and PC series well

USGS location number	USGS designation	AEC-LASL cordinates	Remarks
19.6.16.214	AC-1		Destroyed.
19.6.16.212	AC-2		Do.
19.6.16.212a	AC-3		Corrugated metal pipe.
19.6. 9.434	AC-4		Destroyed.
19.6. 9.441	AC-5		Corrugated metal pipe.
19.6. 9.423	PC-1		Drive point.
19.6. 9.442	PC-2		Destroyed.
19.6.10.331	PC-3		Do.
19.6.10.431	PC-4		Drive point.
19.6.11.333	PC-5		Destroyed.
19.6.14.222	PC-6		Corrugated metal pipe.
19.6.14.221	PC-6A		Drive point.
19.6.13.131	PC-7		Do.
19.7.18.132	PC-8		Destroyed.
19.7.18.241a	PC-9		Corrugated metal pipe.
19.7.17.321	PC-10		Drive point.
19.7.17.322	PC-11		Do.

Table 57.--Observation wells drilled April 10 to 18, 1956, in Pueblo Canyon, PO series wells

USGS designation	USGS location number	AEC-LASL coordinates	Altitude of land surface (feet above mean sea level)	Well depth (feet)	Depth to water below measuring point (feet)	Remarks
PO-1	19.7.18.1422		-	16	dry	Abandoned
PO-1A	19.7.18.244		6,442.0	36	do.	18 feet of 3-inch pipe.
PO-1B	19.7.18.244a		6,411.2	18	do.	Abandoned
PO-1C	19.7.18.242		6,446.5	22	do.	Abandoned
PO-1D	19.7.18.242a		6,450(?)	23	do.	Abandoned
PO-2	19.7.18.234		6,478.4	30	do.	Abandoned
PO-2A	19.7.18.241a		6,452.0	14½	2 feet	8 feet of 1½-inch pipe and sandpoint.
PO-2B	19.7.18.241b		6,455.5	11	dry	Abandoned
PO-3	19.7.18.141		6,498.9	27	1½ feet	12 feet of 1½-inch pipe and sandpoint. Abandoned
PO-3A	19.7.18.141a		6,512.7	33	10 feet	22 feet of 1½-inch pipe and sandpoint.
PO-3B	19.7.18.132a		6,520.4	73	50½ feet	59 feet of 2-inch plastic pipe.
PO-4	19.6.13.242		6,524.2	43	25.8	27 feet of 1½-inch pipe and sandpoint.
PO-4A	19.6.13.242a		6,524.3	43	18	21 feet of 3-inch pipe.
PO-4B	19.6.13.242b		6,541.6	57	24	27 feet of 1½-inch pipe and sandpoint.
PO-5	-		6,475(?)	22	dry	Abandoned
PO-6	-		6,520(?)	18	do.	Abandoned

Table 58.--Surface water sampling points, Acid and Pueblo Canyons

AEC-LASL designation	USGS location number	Remarks
Acid Weir	S19.6. 9.442	-
Pueblo 1	S19.6. 9.44[illegible]a	-
Pueblo 2	S19.6.14.223	-
Pueblo 3	S19.6.18 and 19	Water collected at end of flow in Pueblo Canyon (generally between Hamilton Bend Spring and well PC-11.
Otowi Seep	S19.7.18.241	-
Hamilton Bend Spring	S19.7.18.124	-

Bayo Canyon

Four test holes ranging in depth from 25 to 89 feet were augered at Bayo Site in Bayo Canyon to determine if perched water was present. No perched water was found. Geologic and hydrologic data for these test holes are shown in table 59 and the locations of the holes are shown on Figure 8.

Table 59.--Test holes augered at Bayo Site, December 7 and 8, 1961

USGS designation	USGS location number	AEC-LASL Coordinates	Altitude of land surface (feet above mean sea level)	Depth of hole (feet)	Log			Remarks
					Alluvium	Bandelier Tuff	Puye Conglomerate	
B-1	19. 6.13.212		6,660	89 a/	-	0-85	85-89	Destroyed
B-2	19. 6.13.212a		6,660	25 a/	0- 5	5-24	24-25	Do.
B-3	19. 7. 7.313		6,610	70 a/	0-12	12-65	65-70	Do.
B-4	19. 6.12.434		6,670	79 a/	0-10	10-77	77-79	Do.

a/ dry hole

Technical Areas TA-50 and TA-52 (fluid dynamics studies)

Five test holes were drilled or augered at Site 1 near Technical Area TA-52 and 8 holes at Site 1 near Technical Area TA-50 to implement study of behavior of gas injected into the rock. At Site 2 near Technical Area TA-50 12 holes were augered or drilled to study the behavior of liquid injected into rock. The studies which are still in progress are expected to yield information relative to the problems of disposing of liquid and gaseous wastes by injection into the Bandlier Tuff. Results are not yet available. Descriptions of the holes are shown in tables 60 through 62. Locations are shown on Figure 9.

Figure 9 (caption on next page) belongs near here.

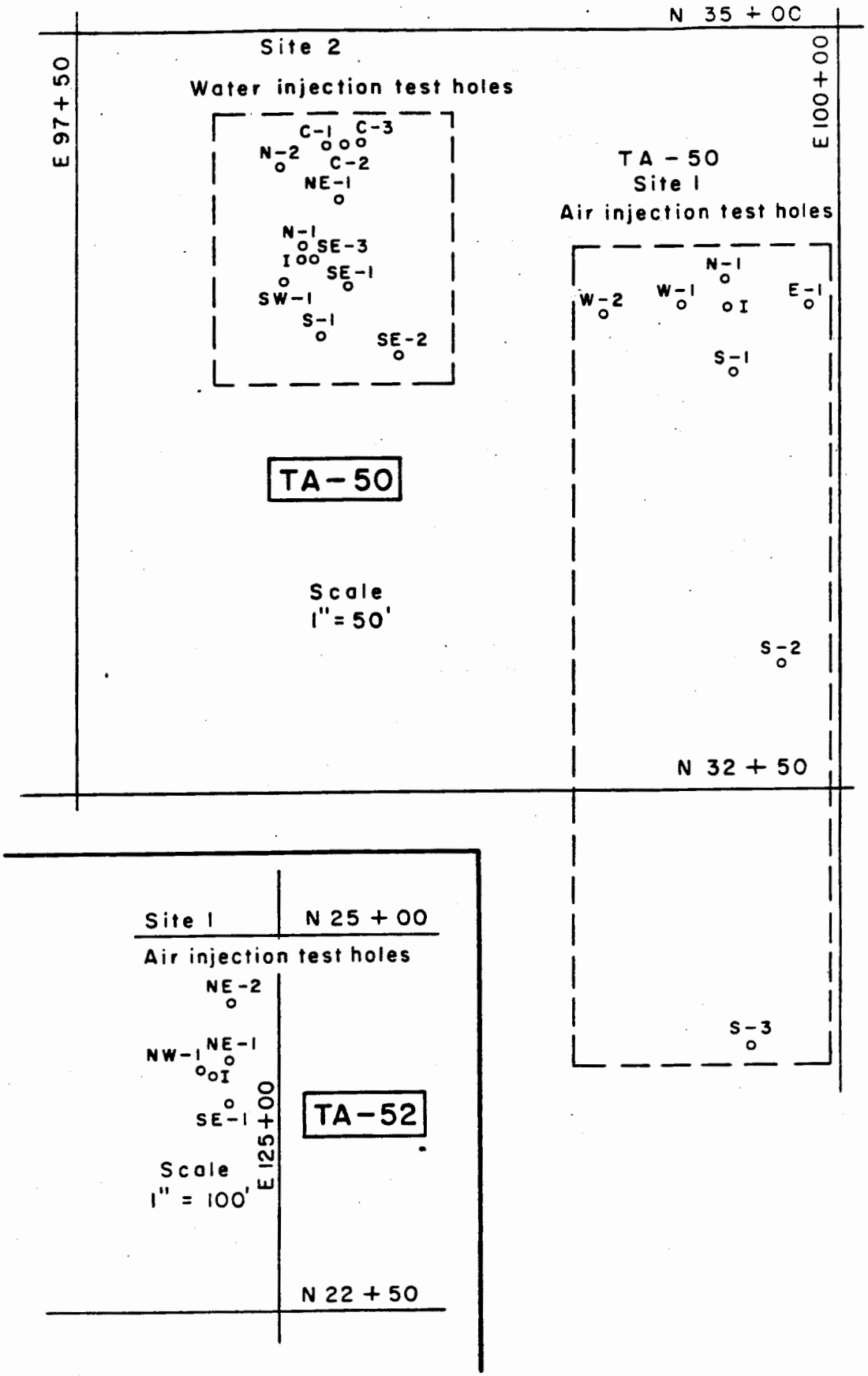


Figure 9.--Location of test holes at site 1 and 2, TA-50 and site 1, TA-52.

Figure 9.--Location of test holes at Sites 1 and 2, TA-50 and Site 1, TA-52.

Table 66.--Site 1, TA-52, air-injection test holes

USGS Hole Designation	USGS Location	AEC-LASL Designation (structure number)	AEC-LASL Coordinates	Drilling date	Altitude of land surface (feet above mean sea level)	Diameter (in inches)	Depth (in feet)	Type of drilling
I	19.6.22.441a	TA-52-25	N. 24 + 08 E. 124 + 57	Dec 1964	7168.8	5	97	Auger
NW-1	19.6.22.441b	TA-52-24	N. 24 + 10 E. 124 + 53	Dec 1964	7169.1	5	97	Do.
SE-1	19.6.22.441c	TA-52-26	N. 23 + 90 E. 124 + 66	Dec 1964	7167.4	5	97	Do.
NE-1	19.6.22.441d	TA-52-23	N. 24 + 15 E. 124 + 67	Dec 1964	7169.2	5	97	Do.
NE-2	19.6.22.441e	TA-52-22	N. 24 + 53 E. 124 + 69	Oct 1965	7171.5	4	295	Rotary-air

Note: Holes I, NE-1, SE-1 and NW-1 have steel casing 6-inches in diameter cemented into top of tuff, near surface.

Table 61.--Site 1, TA-50 air injection test holes

Location

USGS Hole designation	USGS Location number	AEC-LASL Designation (structure number)	AEC-LASL Coordinates	Drilling date	Altitude of land surface (feet above mean sea-level)
E-1	19.6.22.321a	TA-50-29	N. 34 + 08 E. 99 + 89	Nov 1964	7240.4
N-1	19.6.22.321b	TA-50-25	N. 34 + 16 E. 99 + 62	Nov 1964	7241.8
W-1	19.6.22.321c	TA-50-27	N. 34 + 08 E. 99 + 48	Nov 1964	7241.7
W-2	19.6.22.321d	TA-50-26	N. 34 + 05 E. 99 + 22	Nov 1964	7241.7
I	19.6.22.321e	TA-50-28	N. 34 + 07 E. 99 + 64	Nov 1964	7241.6
S-1	19.6.22.321f	TA-50-30	N. 33 + 86 E. 99 + 65	Nov 1964	7239.7
S-2	19.6.22.321g	TA-50-31	N. 32 + 89 E. 99 + 81	Nov 1964	7231.6
S-3	19.6.22.321h	TA-50-32	N. 31 + 63 E. 99 + 77	Nov 1964	7218.3

Table 61.--Site 1, TA-50, air injection test holes - Continued

Construction

USGS Hole Designation	Diameter (in inches)	Depth (in feet)	Depth Injection Zone No. 1	Depth Injection Zone No. 2	Depth Injection Zone No. 3	Depth Injection Zone No. 4	Type of drilling	Remarks
E-1	3	86	3- 8	37- 43	69-74	81-86	Rotary-air	Monitoring tubes
N-1	5	94	3- 6	25- 30	54-60	86-94	Auger	Injection and monitoring tubes
W-1	3	91	3- 8	39- 44	69-74	86-91	Rotary-air	Monitoring tubes
W-2	3	114	3- 8	109-114	-	-	do.	Do.
I	5	60	3- 8	25- 30	55-60	-	Auger	Injection and monitoring tubes
S-1	5	90	3- 8	24- 29	50-55	83-90	do.	Do.
S-2	5	56	49-56	-	-	-	do.	Water injection test
S-3	5	43	-	-	-	-	do.	Open hole

Note: Injection zone consists of 3/8" diameter gravel. Monitoring tube is ½ inch plastic tubing perforated about 1 foot from bottom. Injection tube is 3/4" plastic tubing perforated about 3 feet from bottom. Perforations in each tube are separated from those in the other tube by lead plate. Tubes are cemented into the gravel-pack intervals.

Table 62.--Site 2, TA-50, liquid injection test holes

U.G.S. Hole Designation	U.G.S. Location number	AEC-LASL Designation (structure number)	AEC-LASL Coordinates	Drilling date	Altitude of Land Surface (feet above mean sea-level)	Diameter of hole (inches)	Depth (feet)	Type of drilling
N-2	19.6.22.312a	TA-50-16	N 34+55 E 98+18	Sept 1965	7,247.7	5	112	Auger
NE-1	19.6.22.312b	TA-50-17	N 34+34 E 98+36	Sept 1965	7,246.6	5	118	Do.
N-1	19.6.22.312c	TA-50-18	N 34+29 E 98+26	Nov 1964	7,245.2	5	97	Do.
I	19.6.22.312d	TA-50-19	N 34+24 E 98+26	Nov 1964	7,244.7	5	67	Do.
SE-3	19.6.22.312e	TA-50-20	N 34+23 E 98+28	Oct 1965	7,244.6	4	295	Rotary, air
SW-1	19.6.22.312f	TA-50-21	N 34+17 E 98+19	Nov 1964	7,244.4	5	97	Auger
SE-1	19.6.22.312g	TA-50-22	N 34+15 E 98+39	Nov 1964	7,243.9	5	97	Do.
S-1	19.6.22.312h	TA-50-23	N 33+99 E 98+30	Oct 1965	7,242.9	4	295	Rotary, air
SE-2	19.6.22.312j	TA-50-24	N 33+92 E 98+56	Sept 1965	7,241.6	5	112	Auger

Table 62.--Site 2, TA-50, liquid injection test holes - Continued

USGS Hole Designation	USGS Location number	AEC-LASL Designation (structure number)	AEC-LASL Coordinates	Drilling date	Altitude of Land Surface (feet above mean sea-level)	Diameter of hole (inches)	Depth (feet)	Type of drilling
C-1	19.6.22.312k	TA-50-13	N 34+62 E 98+33	Dec 1964	Approx. 7,248	5	18	Auger
C-2	19.6.22.312l	TA-50-14	N 34+62 E 98+38	Dec 1964	Approx. 7,248	5	18	Do.
C-3	19.6.22.312m	TA-50-15	N 34+63 E 98+43	Dec 1964	Approx. 7,248	5	18	Do.

Note: All holes are drilled in tuff. Hole I, the injection well, has an injection tube and an observation tube set in gravel from 55 ft to 65 ft. The bottom 2 ft from 65 ft to 67 ft are filled with crushed tuff. The hole is cemented from the surface to the top of the gravel pack at 55 ft. Hole C-1, a calibration hole, cased with 1.5 in. steel tubing. Hole C-2, a calibration hole, open hole. Hole C-3, a calibration hole, is cased with 2 in. plastic tubing.

Los Alamos and DP Canyons

Six observation wells were constructed in Los Alamos Canyon during February 1966 to monitor the chemical and radiochemical quality of water in the alluvium of the canyon downgradient from TA-2 and TA-21. No results have yet been interpreted from this study. The logs and construction data are shown on table 63 and the location of the wells on Figure 2.

Table 63.--Observation wells in Los Alamos and DP Canyons

USGS designation	USGS location number	Altitude 1/ of land surface (feet above mean sea level)	Depth of well (feet)	Log		Casing schedule (4-inch diameter plastic hung in hole) (depth in feet)
				Alluvium (feet)	Bandelier Tuff (feet)	
LAO-1	19.6.15.423	6,940	32	12	20	20
LAO-2	19.6.13.343	6,625	32	19	13	32
LAO-3	19.6.13.343a	6,610	32	16	16	24
LAO-4	19.6.24.222	6,560	31	17	14	24
LAO-5	19.7.20.113	6,425	27	12	a/ 15	19
LAO-6	19.7.20.113a	6,430	26	11	a/ 15	14
DPO-1 b/						
DPO-2 b/						
DPO-3 b/						

1/ Estimated from U.S. Geological Survey topographic sheets.

a/ Bottomed in the basaltic rocks of Chino Mesa.

b/ To be constructed in the early summer, 1966.

Contaminated waste pit near TA-21

Thirteen test holes were drilled around the perimeter of a contaminated waste pit west of TA-21 to determine if there had been any movement of radioactive contaminants from the pit into the adjacent tuff. Logs of the holes are shown on table 64 and the locations of the test holes are shown on Figure 10.

Figure 10 (caption on next page) belongs near here.

The distribution of moisture in the soil and tuff adjacent to the bore holes was determined and samples of tuff collected during drilling of the holes were analyzed for alpha and beta emission as well as plutonium and uranium. The results of the investigation indicated no lateral migration of contaminants from the pit into the adjacent soil and tuff.

Figure 10.--Location of test holes drilled near the contaminated waste pit west of TA-21.

Table 64.--Test holes drilled during February 1966 near the contaminated waste pit west of TA-21

USGS designation	AEC and LASL Coordinates	Depth (feet)	Altitude (feet above mean sea level)	Log	
				Soil (feet)	Bandelier Tuff (feet)
DPS-1	N 95 + 13 E132 + 97	50	7,190	3	47
DPS-2	N 94 + 78 E130 + 56	25	7,191	3	22
DPS-3	N 94 + 43 E127 + 87	50	7,194	3	47
DPS-4	N 94 + 16 E125 + 89	25	7,202	3	22
DPS-5	N 93 + 80 E122 + 85	50	7,214	3	47
DPS-6	N 92 + 58 E122 + 10	50	7,216	6	44
DPS-7	N 94 + 41 E135 + 69	25	7,185	3	22
DPS-8	N 93 + 66 E138 + 06	50	7,181	6	44
DPS-9	N 93 + 66 E135 + 19	25	7,180	4	21
DPS-10	N 93 + 66 E131 + 55	35	7,182	4	31
DPS-11	N 93 + 21 E128 + 50	50	7,192	4	46

Table 64.--Test holes drilled during February 1966 - Concluded

USGS designation	AEC and LASL coordinates	Depth (feet)	Altitude (feet above mean sea level)	Log	
				Soil (feet)	Bandelier Tuff (feet)
DP9-12	N 92 + 79 E125 + 21	36	7,192	3	33
DP9-13	N 91 + 39 E122 + 72	35	7,210	2	33

Note: Holes augered 4-inches in diameter, destroyed after study.

Springs

Natural discharge from the aquifers in the Los Alamos area issues from springs. Samples of water from some springs are taken periodically and analyzed for possible radioactive contamination. Other springs are sampled less frequently for a check on chemical and radiochemical changes. One spring is currently equipped with a weir and recorder for continuous discharge measurement to assess the effect of pumpage from the Los Alamos area on the discharge from the springs. No contamination of water from the main aquifer has been found and no effects from pumping on the discharge has been observed.

Geologic and hydrologic data of the springs are presented on table 65. Chemical quality of the water is shown on table 66. Locations are shown on Figure 2.

Table 65.--Springs of the Los Alamos area, New Mexico

USGS location number	USGS designation	AEC and LASL corrdinates	Topographic situation	Altitude (feet)	Geologic formation	Structure	Opening	Yield (gpm) 1/	Use 2/	Temperature (°F)	Remarks
S18.5. 2.131	Sawyer Spring	[illegible]	Steep slope [illegible]	6,520	Tshirege Member	Contact between welded ashflows	Crack	1 E	U	48°	Piped in to stock watering trough
S18.7. 3.421	Spring 3		Slope on west side of Rio Grande Canyon	5,560	Totavi lentil	Gravels underlying basalt	Seeps and boils	19M	U	67°	-
S18.7. 3.421a	Spring 3A		do.	5,560	do.	do.	do.	47M	U	67°	-
S18.7. 3.443	Spring 3AA		do.	5,460	Tesuque Formation	Sandy layer	Seep	< ½E	U		-
S18.7. 9.422	Spring 4A		West side of Pajarito Canyon	5,600	Totavi lentil	Gravels underlying basalt	Gravel beds	122M	U	69°	Equipped with a water-stage recorder. Other springs in this area.
S18.7.10.113	Spring 4		Slope on west side of Rio Grande Canyon	5,502	do.	Gravel	Seep area	81M	U	63°	Seep area about 500 ft. long.
S18.7.10.224	Spring 3B		Flat area on east side of Rio Grande	5,500	Tesuque Formation	Sandy layer	[illegible]	31M	U,S	67°	-
S18.7.12.244	Canoncito Spring		Floor of Canada Ancha	5,700	do.	Contact with Basalt dike	Crack	10E	S	-	-
S18.7.16.234	Spring 5		Slope on west side of Rio Grande	5,570	Contact of Basaltic Rocks Unit 1 and Totavi lentil	Contact	Crack in basalt	9M	U	69°	-

Table 65.--Springs of the Los Alamos area, New Mexico - Continued

USGS location number	USGS designation	AEC and LASL corrdinates	Topographic situation	Altitude (feet)	Geologic formation	Structure	Opening	Yield (gpm) 1/	Use 2/	Temperature (°F)	Remarks
S18.7.16.423	Spring 5A		West bank of Rio Grande	5,430	Tesuque Formation	Basalt flow in siltstone	Boils	27M	U	69°	-
S18.7.20.312	Ancho Spring		Floor of Ancho Canyon	5,700	Totavi lentil	Gravels	Seeps	65M	U	67° to 69°	-
S18.7.20.431	Spring 6		West bank of Rio Grande	5,380	Tesuque formation	Basalt flow	Fractures	57M	U	68° to 74°	Spring area 200 ft. in length
S18.7.21.131	Spring 5B		West do.	5,400	do.	do.	do.	10E	U	59°	-
S18.7.29.112	Spring 6A		do.	5,375	do.	do.	Boil	150M	U	71°	-
S18.7.30.123	Doe Spring		Slope on north side of Chaquehui Canyon	5,600	do.	Sandy bed	Seep	5E	U	-	-
S18.7.30.124	Spring 9		Slope on west side of Rio Grande Canyon	5,510	do.	do.	do.	8E	U	68°	-
S18.7.30.213	Spring 8A		do.	5,365	do.	Basalt flow	Fractures	26M	U	70°	-
S18.7.30.214	Spring 8		East bank of Rio Grande	5,370	do.	do.	do.	70M	U	69° to 70°	-
S18.7.30.223	Spring 7		do.	5,370	do.	do.	do.	173 M	U	70° to 72°	-
S19.5.12.143	-		Floor of Los Alamos Canyon	8,000	Alluvium and Talus	Contact	Seeps	20E	U	-	-
S19.5.14.431	Pajarito Spring		Floor of Pajarito Can.	8,660	do.	do.	do.	25E	U	-	-
S19.5.25.111	-		Wall of Valle Canyon		Tshirege Member	Contact between welded ash	Crack	4E	U	-	-

Table 65.--Springs of the Los Alamos area, New Mexico - Continued

USGS location number	USGS designation	AEC and LASL corrdinates	Topographic situation	Altitude (feet)	Geologic formation	Structure	Opening	Yield (gpm) 1/	Use 2/	Temperature (°F)	Remarks
19.5.25.333	-		Floor of Water Canyon	8,000	Tshirege Member	Contact between welded ash flows	Crack	90E	-	-	- -
19.5.26.221	-		Floor of Valle Canyon	8,240	Talus and Alluvium	Contact	Seep	4E	U	-	-
19.5.26.332	Armstead Spring		Floor of Water Canyon	8,216	Tschicoma Formation	Fractured latite	Fracture	2E	U	-	-
19.5.33.431	-		Wall of west Fork of Frijoles Canyon	8,430	Tshirege Member	Contact between welled ashflows	Cracks and Seeps	108M	U	-	-
19.5.33.234	-		Wall of North Fork of Frijoles Canyon	8,430	do.	do.	do.	99M	U	-	-
19.5.35.114	American Spring		Slope of Canyon	8,280	do.	do.	do.	5M	U	-	-
19.7.12.233	Sacred Spring		Hillside	5,640	Tesuque Formation	Fault zone	Seep	1E	S	55° to 62°	-
19.7.13.112	Indian Spring		do.	5,640	do.	do.	do.	½E	S	59° to 65°	-
19.7.22.114	Los Alamos Spring		South wall of Los Alamos Canyon	6,000	Basaltic Rocks Unit 4	Contact	do.	½E	U	47° to 55°	-
19.7.22.131	Basalt Spring		do.	6,000	Basaltic Rocks Unit 3	do.	do.	3E	U	49° to 54°	-
19.7.24.222	La Mesita Spring		Slope on east side of Rio Grande	5,580	Tesuque Formation	Sandy bed	do.	6M	S	59°	-

Table 65.--Springs of the Los Alamos area, New Mexico - Concluded

USGS location number	USGS designation	AEC and LASL corrdinates	Topographic situation	Altitude (feet)	Geologic formation	Structure	Opening	Yield (gpm) 1/	Use 2/	Temperature (°F)	Remarks
S19.7.24.332	Spring 1		Slope on west side of Rio Grande Canyon	5,615	Tesuque Formation	Sandy bed	Seep	< 1E	U	65°	-
S19.7.25.111	Spring 2		do.	5,600	do.	do.	do.	< 1E	U	61°	-
S19.7.35.121	Sandia Spring		do.	5,640	do.	do.	do.	< ½E	U	67°	-
S20.5.26.113	-		Floor of Guaje Canyon	8,850	Tshirege Member	Contact between welded Ash flows	Fractures	25E	U	-	-
S20.5.26.311	-		Floor of Canyon	8,840	do.	do.	do.	40M	U	-	-
S20.5.35.433	-		Floor of Quemazon Canyon	8,660	Talus	Contact	Seep	15M	U	-	-

1/ M-measured; E-estimated

2/ U-Unused; S-stock

Table 66.--Chemical and radiochemical quality of water springs in the Los Alamos area, New Mexico

(Analyses by the Los Alamos Scientific Laboratory)

USGS Location Number	USGS designation	Date of collection	Chemical: Parts per million: Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness	Specific conductance (micromhos at 25°C)	pH	Radiochemical: Plutonium (disintegrations per minute per liter)	Uranium (micrograms per liter)	Beta (gross) emitters (disintegrations per minute per liter; Bg: background)
1/ 818.5. 2.131	Sawyer Spring	6- 7-61	-	-	4.8	0	67	1.2	0.1	0.1	-	44	119	7.1	<0.4	<0.5	<10
818.7. 3.421	Spring 3	6-20-63	18	2	14	2	77	4	.4	.1	183	52	66	8.0	< .4	< .5	<10
818.7. 3.421a	Spring 3A	8-26-64	19	2	13	0	82	4	.4	.2	185	56	81	7.9	< .4	< .5	10.0
818.7. 3.443	Spring 3AA	8-26-64	18	0	20	0	81	3	.8	.3	163	46	81	7.7	< .4	< .5	17.0
818.7. 9.422	Spring 4A	6- 8-65	17	1	21	0	78	2	.3	.6	169	49	66	7.9	< .4	< .5	11.0
818.7.10.113	Spring 4	8-26-64	22	5	13	0	90	6	.4	.8	192	75	108	7.7	< .4	< .5	9.0
818.7.10.224	Spring 3B	8-26-64	14	9	122	0	345	5	.8	2.1	538	72	304	7.6	< .4	9.8	15.0
818.7.16.234	Spring 5	8-27-64	18	5	12	0	82	5	.4	.3	187	70	91	7.9	< .4	< .5	10.0
818.7.16.424	Spring 5A	8-27-64	21	2	22	0	107	4	.4	.2	235	62	108	7.4	1.3	1.2	7.0
818.7.20.312	Ancho Spring	9-28-65	13	3	7	0	53	3	.5	.5	124	44	66	7.7	< .4	< .5	< 1.0
818.7.20.431	Spring 6	8-27-64	14	4	10	0	66	2	.4	.2	218	50	66	7.7	< .4	< .5	8.0
818.7.21.131	Spring 5B	8-27-64	18	5	13	0	83	3	.4	.2	196	65	81	7.7	< .4	< .5	25.0
818.7.29.112	Spring 6A	8-27-64	12	3	10	0	61	2	.4	.0	201	43	53	7.3	< .4	< .5	9.0
818.7.30.123	Doe Spring	7- 2-65	21	15	13	3	159	5	.2	.1	218	115	160	7.8	< .4	< .5	8.2
818.7.30.124	Spring 9	8-27-64	15	4	12	0	78	3	.4	.2	243	54	81	7.5	< .4	1.8	14.0
818.7.30.213	Spring 8A	8-27-64	12	3	12	0	67	3	.4	.1	275	41	66	7.4	< .4	< .5	9.0
818.7.30.223	Spring 7	8-27-64	16	4	16	0	85	3	.4	.4	248	57	91	7.0	< .4	< .5	14.0
819.5.12.141	-	6- 7-61	-	-	3.2	0	30	1	.1	.2	-	21	64	7.4	< .4	< .5	<10
1/ 819.5.14.431	Pajarito Spring	6- 7-61	-	-	3	0	34	.3	.1	.0	-	25	67	6.9	< .4	< .5	<10
1/ 819.5.26.332	Armstead Spring	6- 7-61	-	-	4	0	44	1.2	.2	.2	-	36	92	7.4	< .4	< .5	< .10

Table 66.--Chemical and radiochemical quality of water from springs in the Los Alamos area, New Mexico - Concluded

USGS Location Number	USGS designation	Date of collection	Chemical: Parts per million: Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness	Specific conductance (micromhos at 25°C)	pH	Radiochemical: Plutonium (disintegrations per minute per liter)	Uranium (micrograms per liter)	Beta (gamma) emitters (disintegrations per minute per liter; Bg: background)
1/ S19.5.33.234	-	5-22-60	-	-	4	-	-	1.4	-	-	-	28	89	-	<0.4	<0.5	<10
1/ S19.5.35.114	American Spring	6- 7-61	-	-	4	0	64	1.4	0.1	0.1	-	44	117	-	< .4	< .5	<10
S19.7.12.233	Sacred Spring	11- 5-63	21	0	25	0	82	3	.4	.6	128	54	108	7.1	< .4	1.5	6
S19.7.13.112	Indian Spring	11- 5-63	22	3	25	0	98	2	.4	.2	154	68	108	7.7	< .4	1.6	4
S19.7.18.124	Hamilton Bend Spring	64-8-65	8	6	78	0	122	10	2.8	.5	336	47	200	7.3	< .4	1.2	8.0
S19.7.18.241	Otowi Seep	10-21-64	9	10	87	0	164	33	2.0	1.0	387	62	267	7.6	< .4	< .5	21.0
S19.7.22.114	Los Alamos Spring	10-22-64	30	10	30	0	98	20	1.2	3.0	238	116	173	8.0	< .4	1.7	15.0
S19.7.22.131	Basalt Spring 2/	9-23-65	26	11	10	0	79	14	.2	3	201	108	132	7.8	< .4	.7	1.5
S19.7.24.322	La Mesita Spring	10-21-64	28	3	40	0	142	7	.4	2.0	191	84	147	7.7	< .4	9.0	8.0
S19.7.24.331	Spring 1	8-25-64	16	1	27	0	90	3	.4	.4	218	45	108	7.7	< .4	.7	9.0
S19.7.25.111	Spring 2	8-25-64	18	1	40	0	122	4	.8	.0	235	48	121	7.6	< .4	.7	15.0
S19.7.35.121	Sandia Spring	11-11-63	22	13	20	0	120	4	.4	.8	180	108	132	7.7	< .4	2.7	6

1/ Chemical analysis by the U.S. Geological Survey

2/ Tritium Units 2.5, Mar. 1959

3/ Tritium Units 2.5, Mar. 1965

Surface-water sampling stations

Surface-water samples are collected at several stations along the streams on the Pajarito Plateau and along the Rio Grande. Because a majority of the streams are intermittent, samples can be collected only when storm runoff or waste water is present. Samples are analyzed by the Los Alamos Scientific Laboratory for chemical and radiochemical contamination. Most samples are collected in connection with the study of disposal of radioactive wastes. Results of these studies are found in various reports. In general, there has been no contamination found. Data on surface-water sampling stations are shown on table 67 and locations on Figure 2.

Table 67.--Miscellaneous surface-water sample sites

sampled by the U.S. Geological Survey

Description of sampling sites	USGS location number	Remarks
	Los Alamos Canyon	
At reservoir	S19. 5.13.224	Also one sample taken 200 yds. above reservoir
At fence below Omega site	S19. 6.15.323	-
1.2 miles below Omega site	S19. 6.14.341	-
Near TW-3	S19. 6.24.111	-
At Highway 4	S19. 7.21.121	-
100 yds. above Guaje Canyon	S19. 7.14.222	-
At confluence with Guaje Canyon	S19. 7.14.222a	-
0.5 mile upstream from Rio Grande	S19. 7.13.234	-
	Frijoles Canyon	
At Park Headquarters	S18. 6.23.211	-
At confluence with Rio Grande	S18. 6.25.443	-
	Guaje Canyon	
At reservoir	S20. 6.31.114	Also one sample taken 100 yds. above reservoir
Return flow 500 yds. below G-1	S19. 7. 4.444	-

Table 67.--Miscellaneous surface-water sample sites - Concluded

Description of sampling sites	USGS location number	Remarks
	Guaje Canyon - Continued	
At Highway 4	S19. 7.14.222b	Also one sample taken 100 yds. below Highway 4
	Rio Grande	
At Embudo	S23. 9.23.333	-
At Otowi	S19. 5.18.331	-
At Cochiti	S16. 6.17.243	-
	Rio Chama	
At Chamita	S21. 8. 8.221	-
	Pajarito Canyon	
At gravel pit	S19. 6.36.233	-
At confluence with Rio Grande	S19. 7.10.313	-
	Fence Canyon	
At Highway 4	S19. 7. 6.344	Floodflow
	Bayo Canyon	
Below Bayo Site (at county line)	S19. 7. 7.331	Effluent
	DP Canyon	
Near test well 3	S19. 6.13.343	Also called Turkey Creek Surface pool

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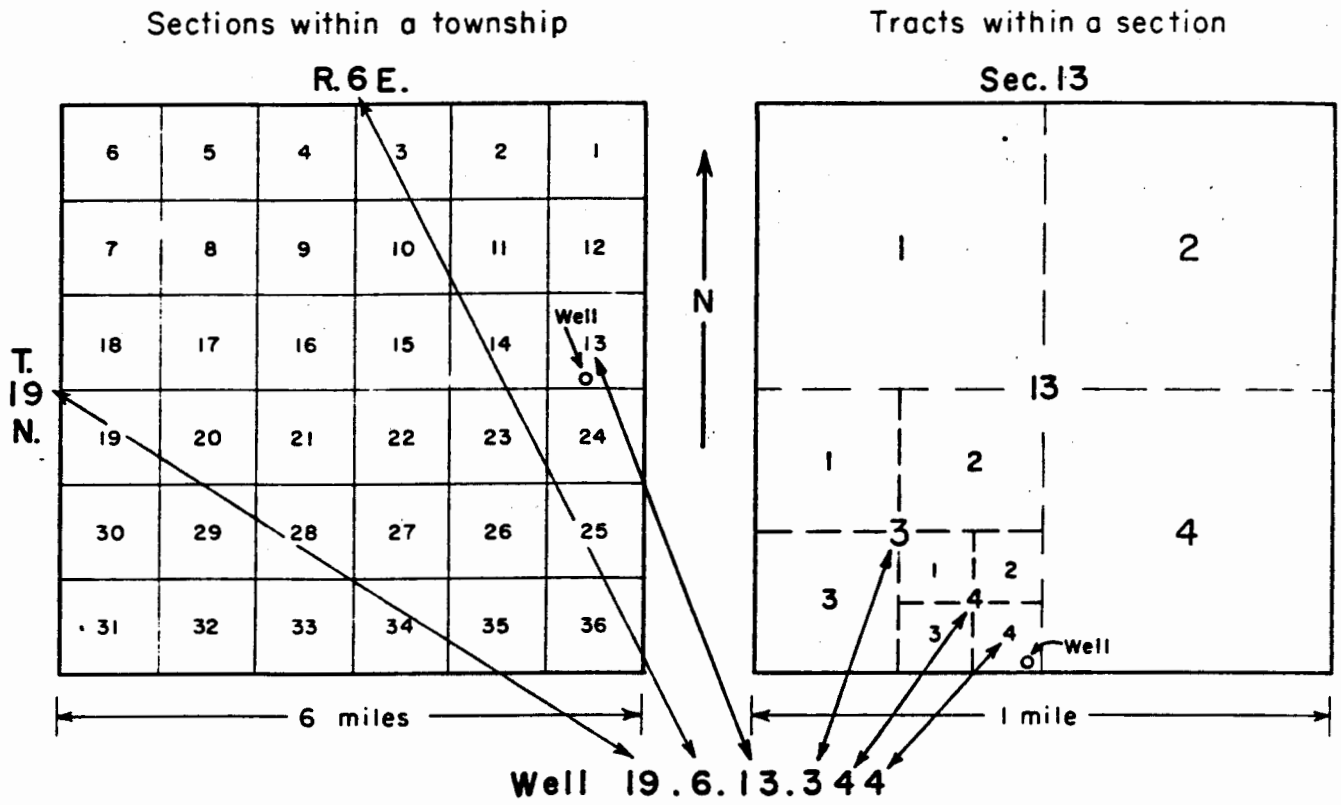


Figure 1.--System of numbering wells in New Mexico

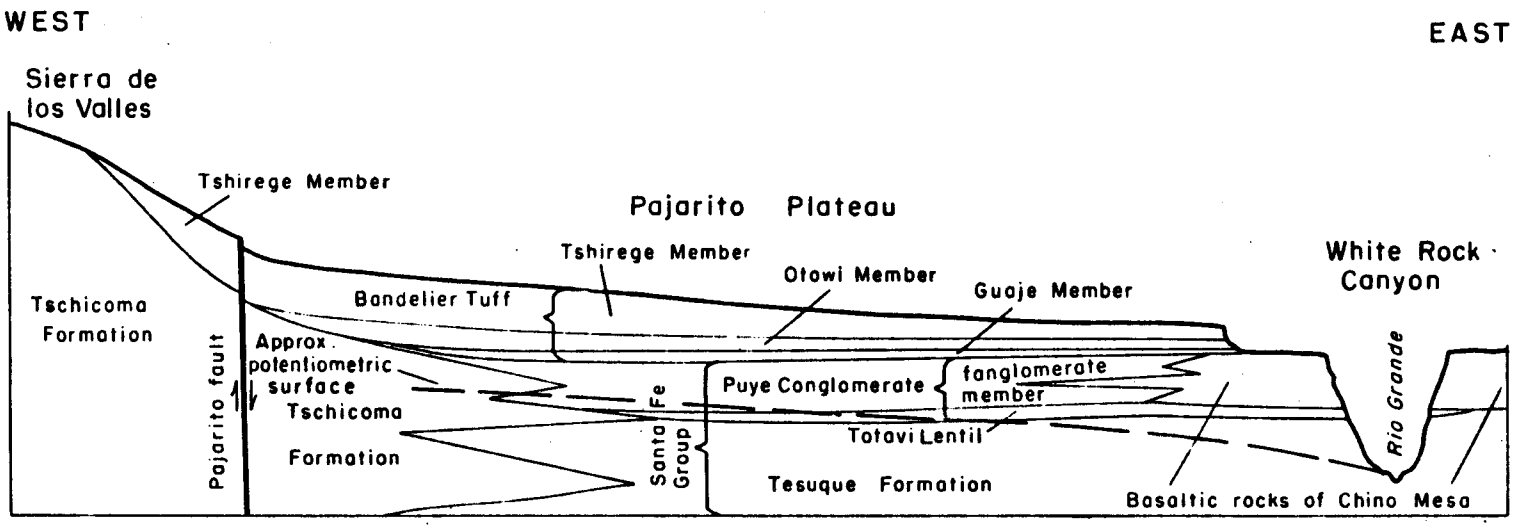


Figure 3.-- Diagrammatic cross section showing generalized stratigraphic relations of rocks in the Los Alamos area

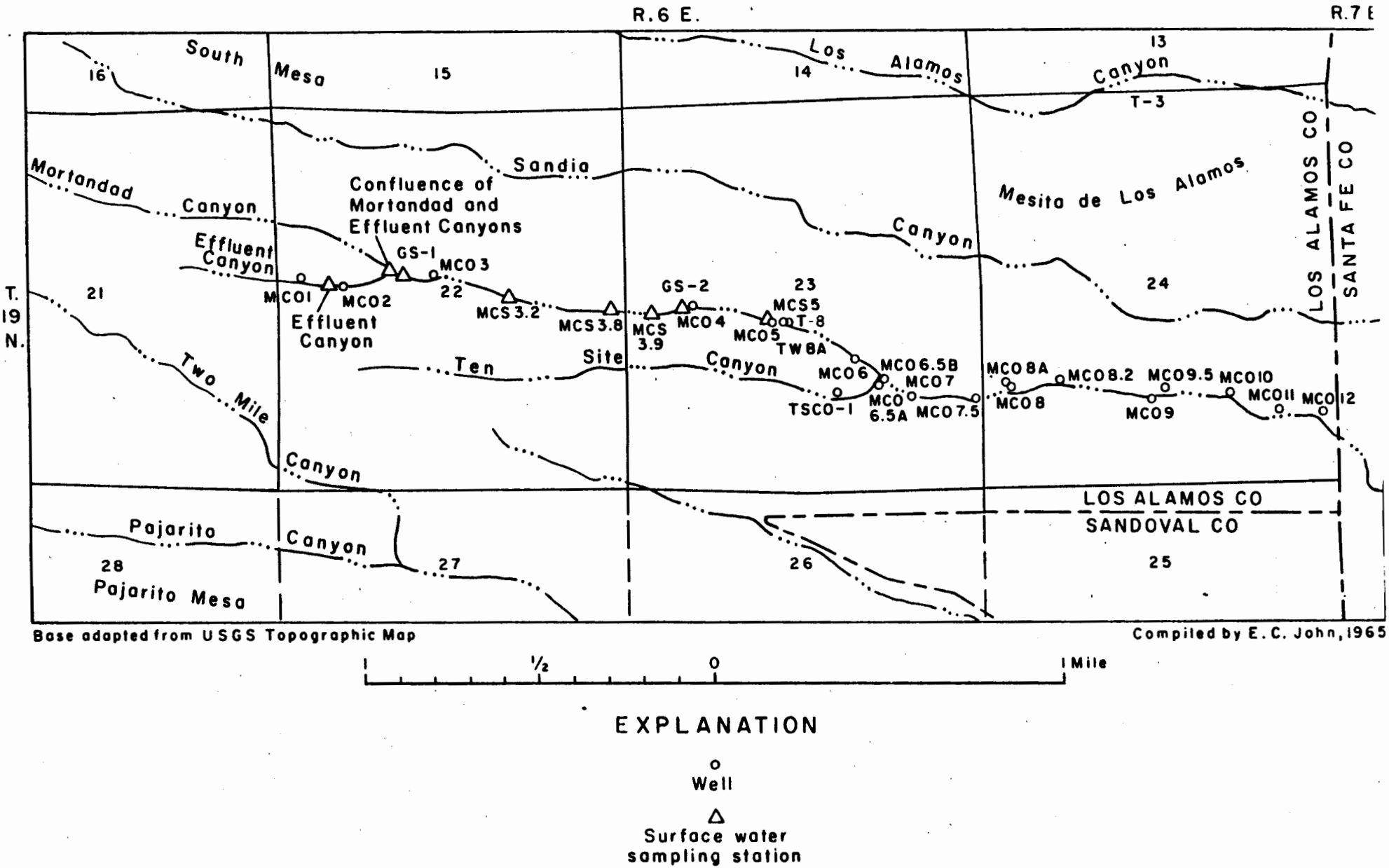


Figure 6.--Mortandad Canyon disposal area

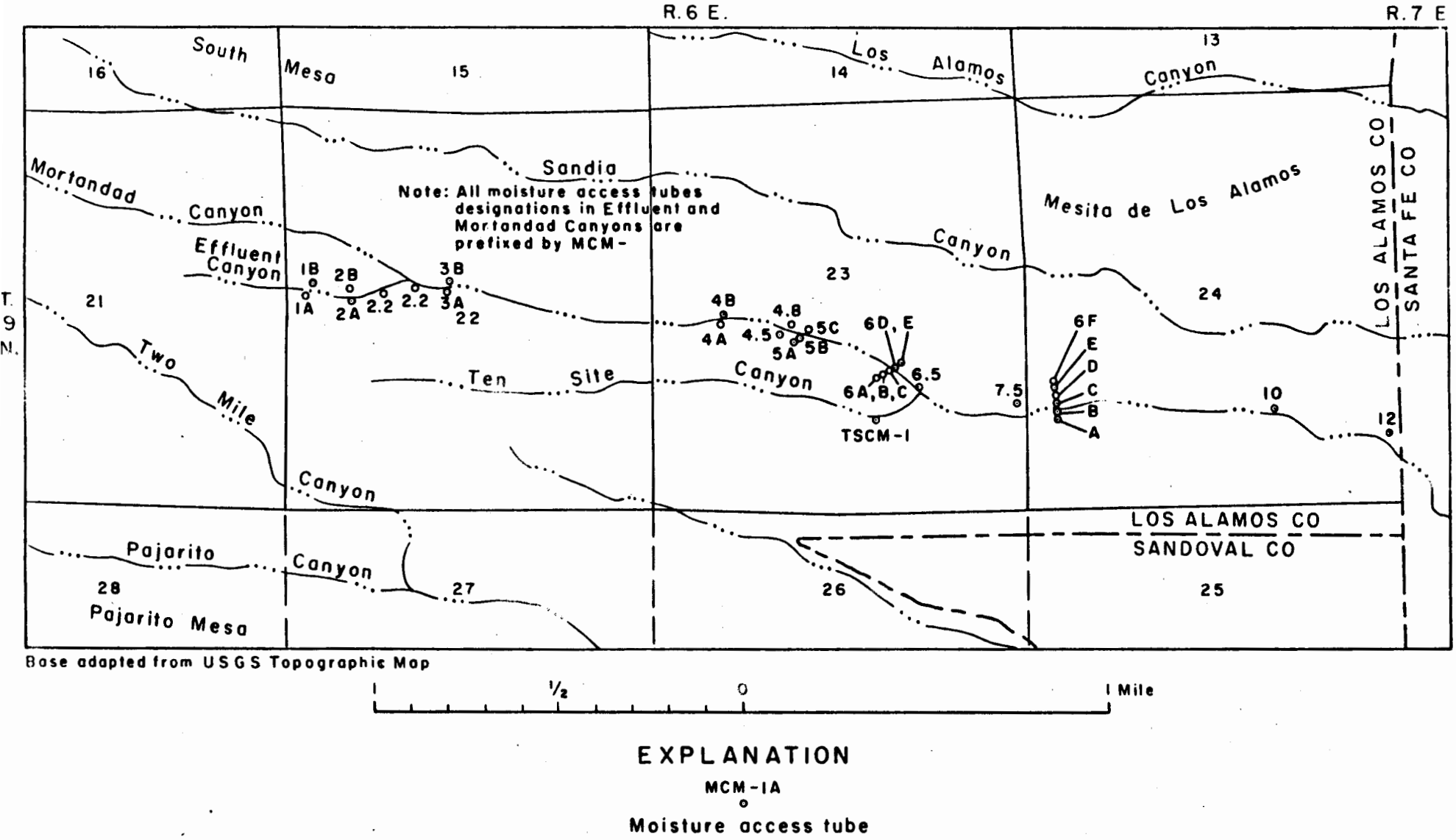
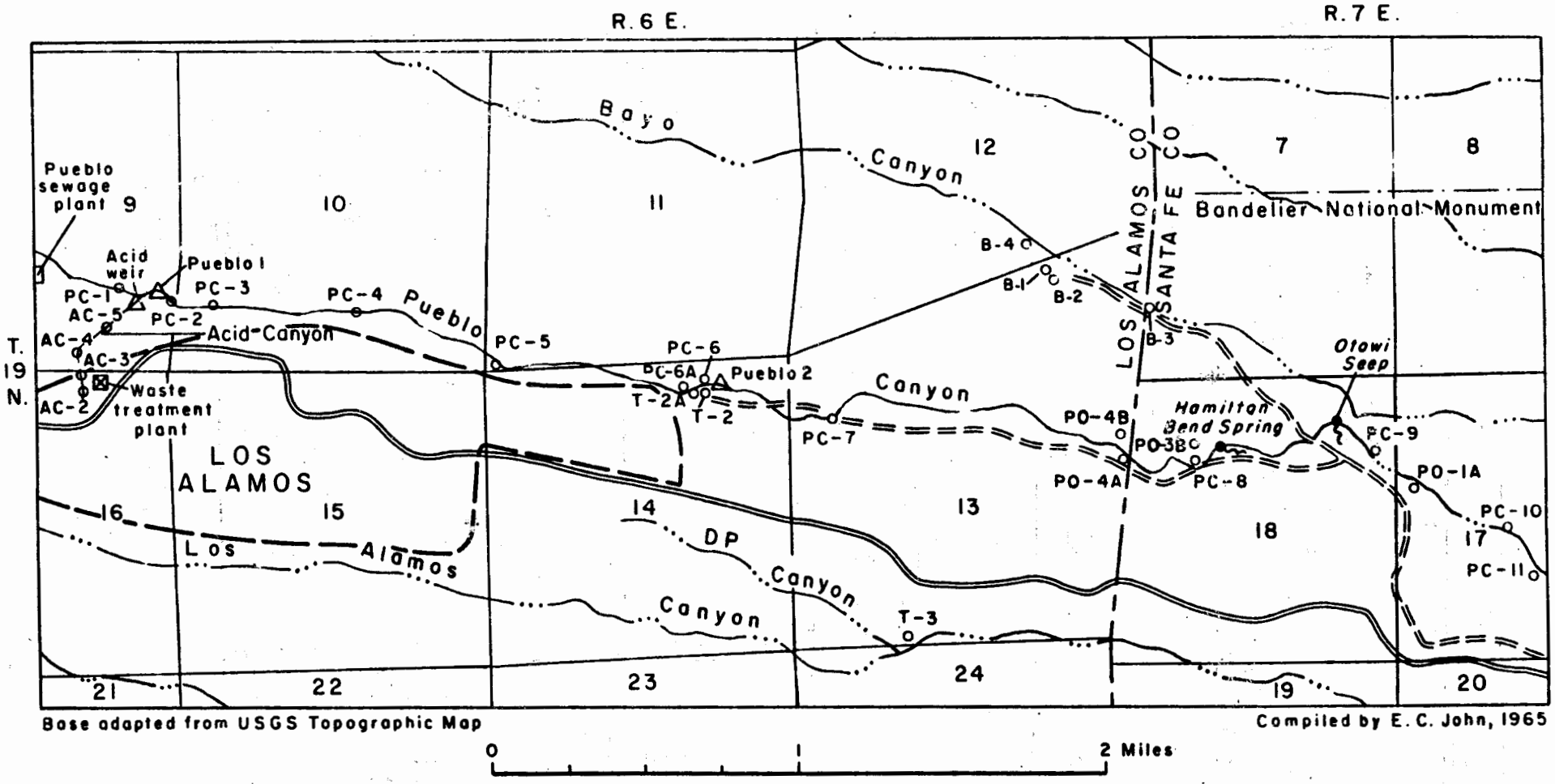


Figure 7.--Location of moisture access tubes in Mortandad Canyon disposal area.

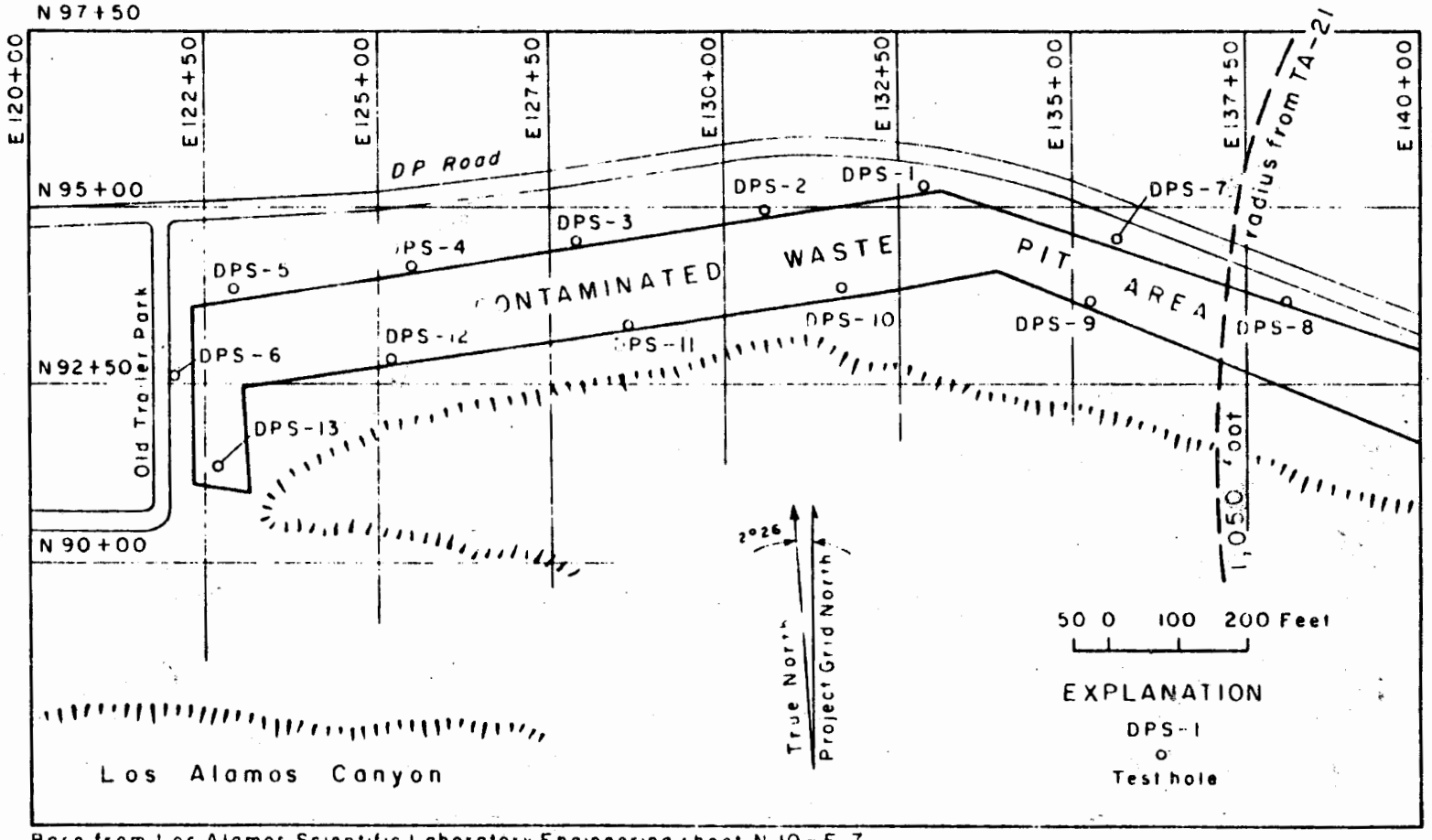


EXPLANATION

○ PC-6
Test or observation well

△ Pueblo 1
Surface water sampling station

Figure 8.--Location of well, spring, stream, and alluvium sampling points in Acid, Pueblo, and Bayo Canyons.



Base from Los Alamos Scientific Laboratory Engineering sheet N 10-E 7

Figure 10.--Location of test holes drilled near the contaminated waste pit west of TA-21.

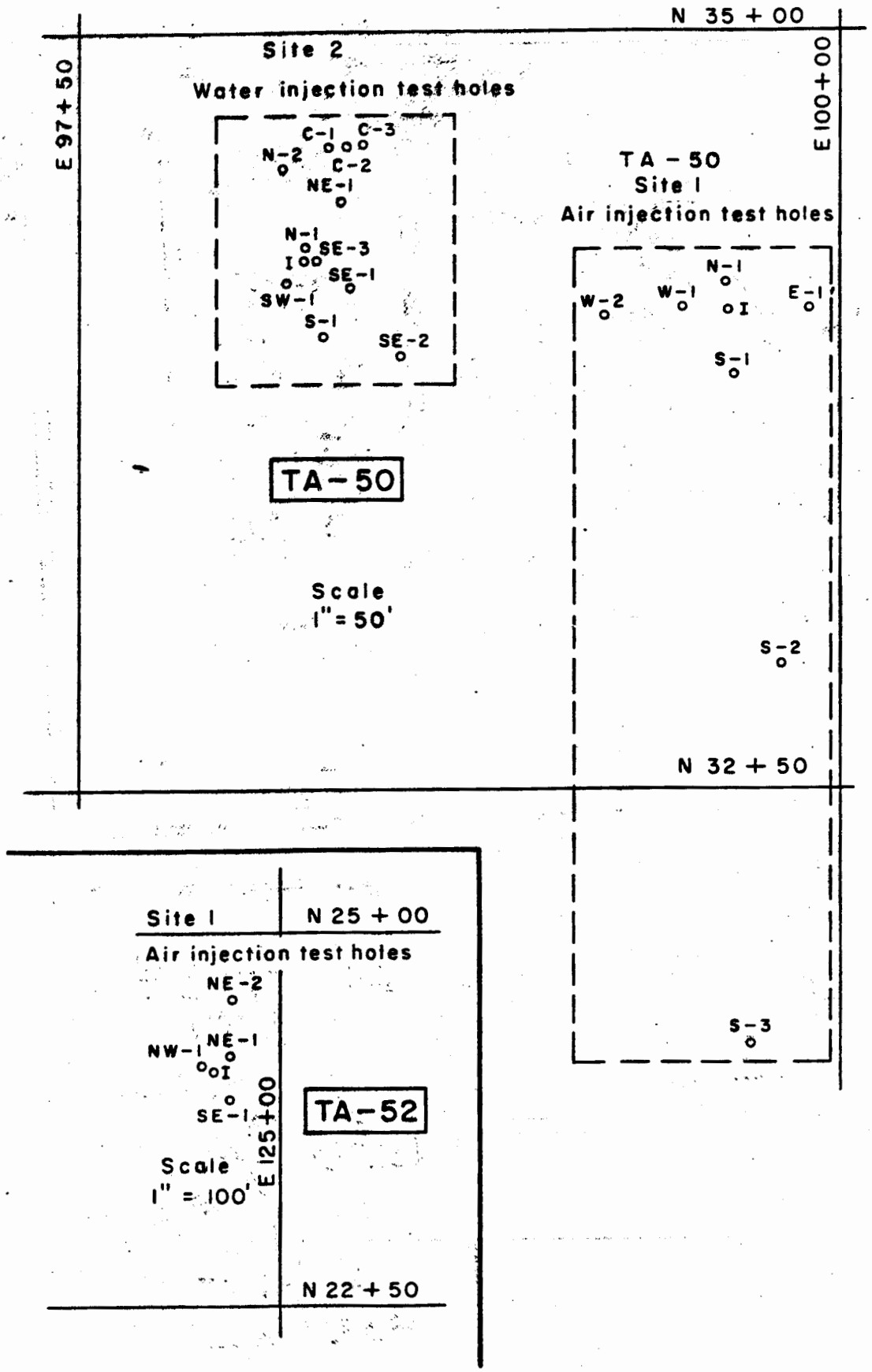
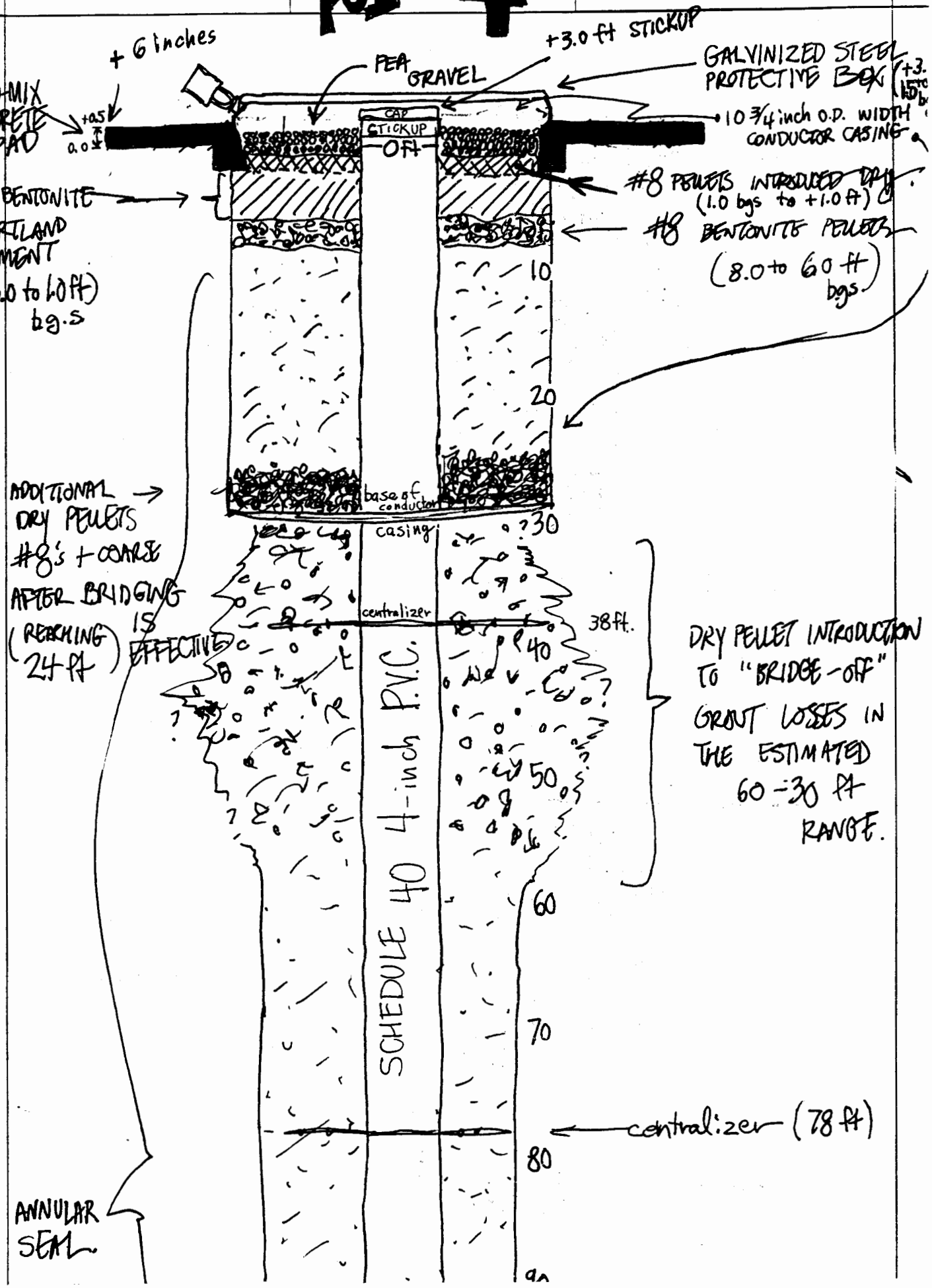
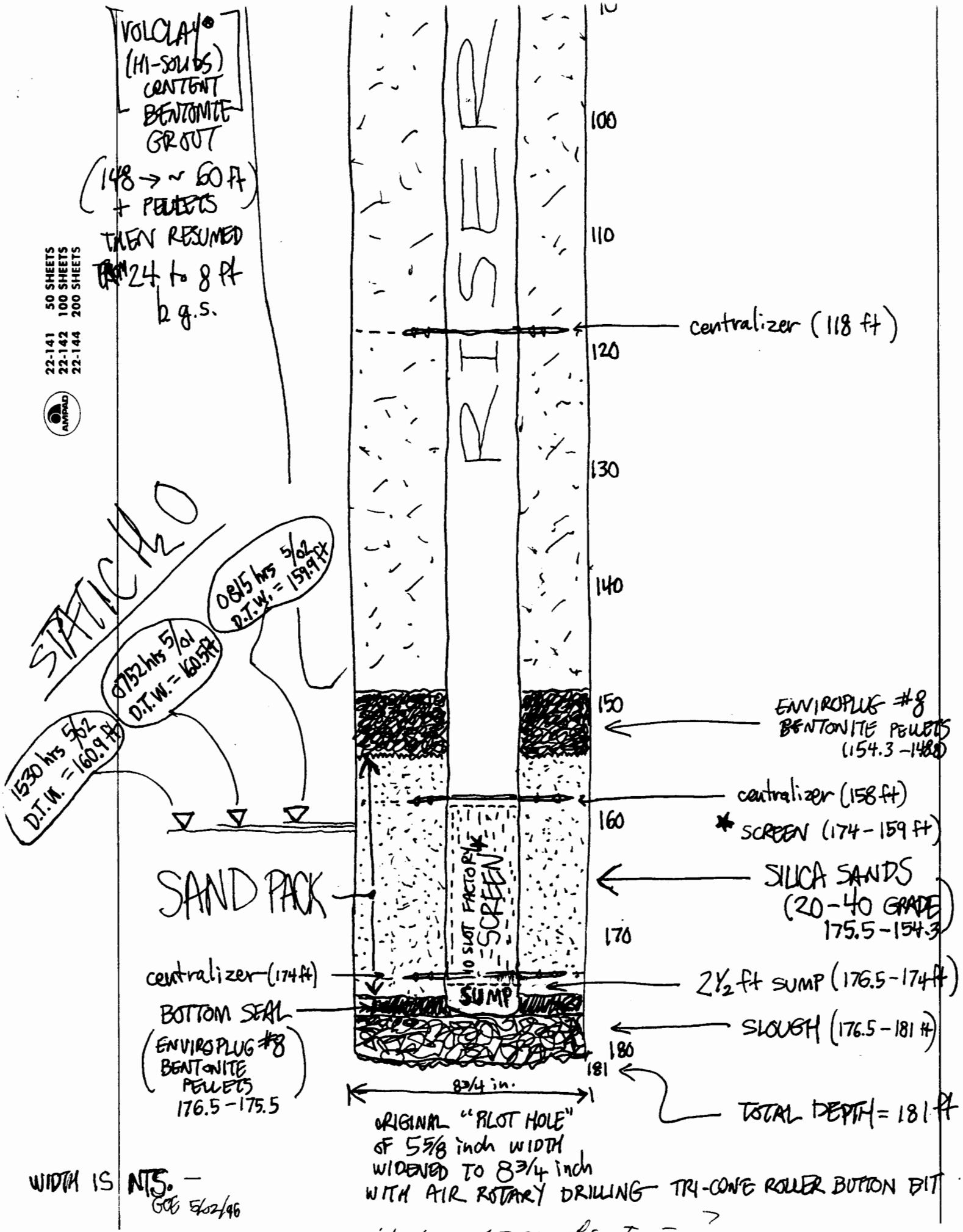


Figure 9.--Location of test holes at site 1 and 2, TA-50 and site 1, TA-52.

POI - 4

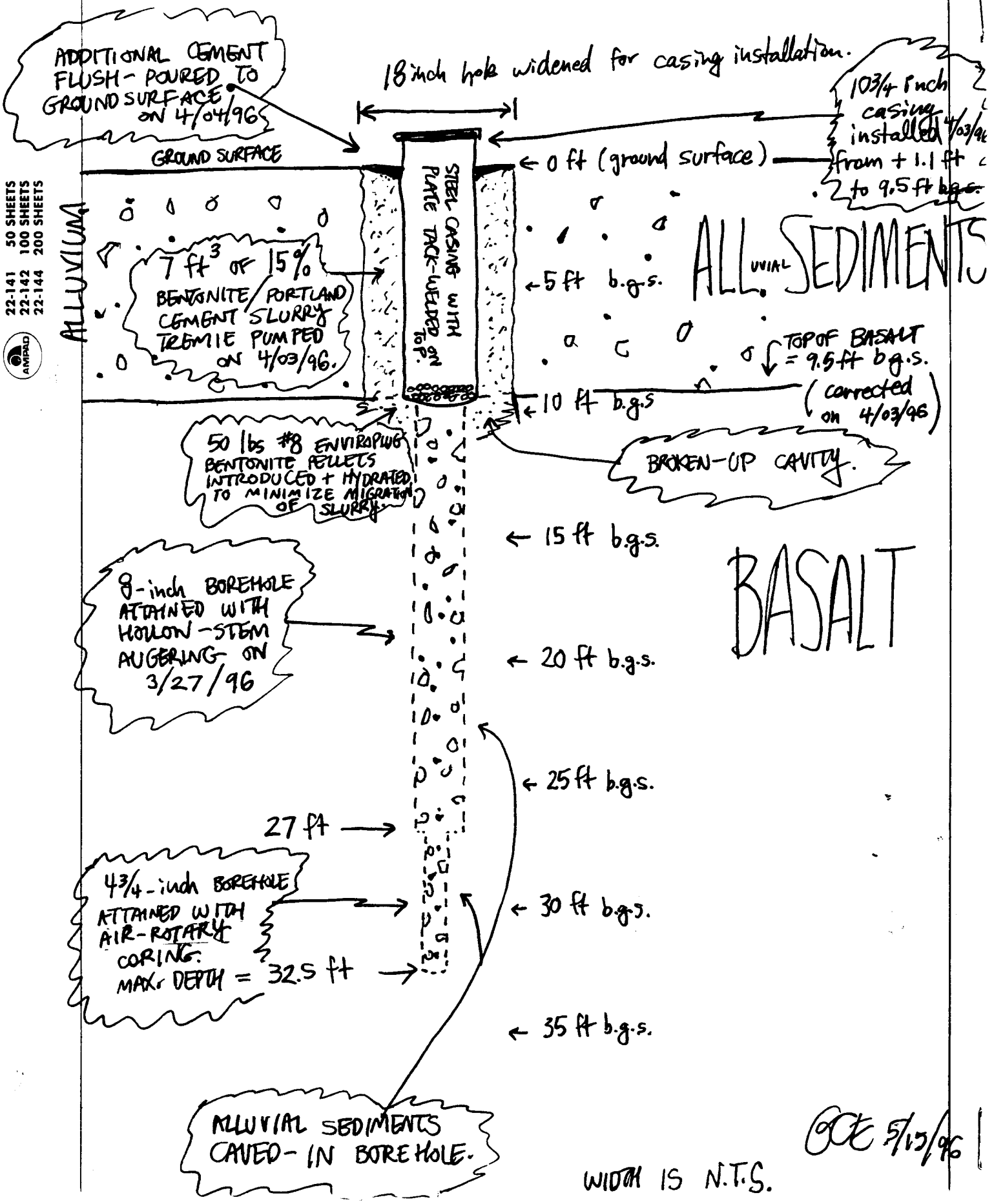


22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD


VOLCLAY® (HI-SOLIDS) CONTENT BENTONITE GROUT
(148 → ~ 60 ft) + PELLETS
THEN RESUMED FROM 24 to 8 ft b.g.s.
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD
STATIC H2O
1530 hrs 5/02 D.T.W. = 160.9 ft
0752 hrs 5/01 D.T.W. = 160.5 ft
0815 hrs 5/02 D.T.W. = 159.9 ft
SAND PACK
centralizer (174 ft)
BOTTOM SEAL
(ENVIROPLUG #8 BENTONITE PELLETS 176.5 - 175.5)
10 SLOT FACTORY SCREEN
SUMP
8 3/4 in.
ORIGINAL "PILOT HOLE" OF 5 5/8 inch WIDTH WIDENED TO 8 3/4 inch WITH AIR ROTARY DRILLING TRI-CONE ROLLER BUTTON BIT
WIDTH IS NTS. —
GOB 5/02/96
10
100
110
120
130
140
150
160
170
180
181
centralizer (118 ft)
ENVIROPLUG #8 BENTONITE PELLETS (154.3 - 148.0)
centralizer (158 ft)
* SCREEN (174 - 159 ft)
SILICA SANDS (20-40 GRADE) 175.5 - 154.3
2 1/2 ft SUMP (176.5 - 174 ft)
SLOUGH (176.5 - 181 ft)
TOTAL DEPTH = 181 ft
thickness of zone fest — ?

LAOI-7

- Auger
- Air rotary



GCE 5/15/96

AMPAD 22-141 50 SHEETS 22-142 100 SHEETS 22-144 200 SHEETS

PRE-WELL INSTALLATION SKETCH
GCC 5/15/96

(LAO-1.6 g)

3/20/96 RECAP

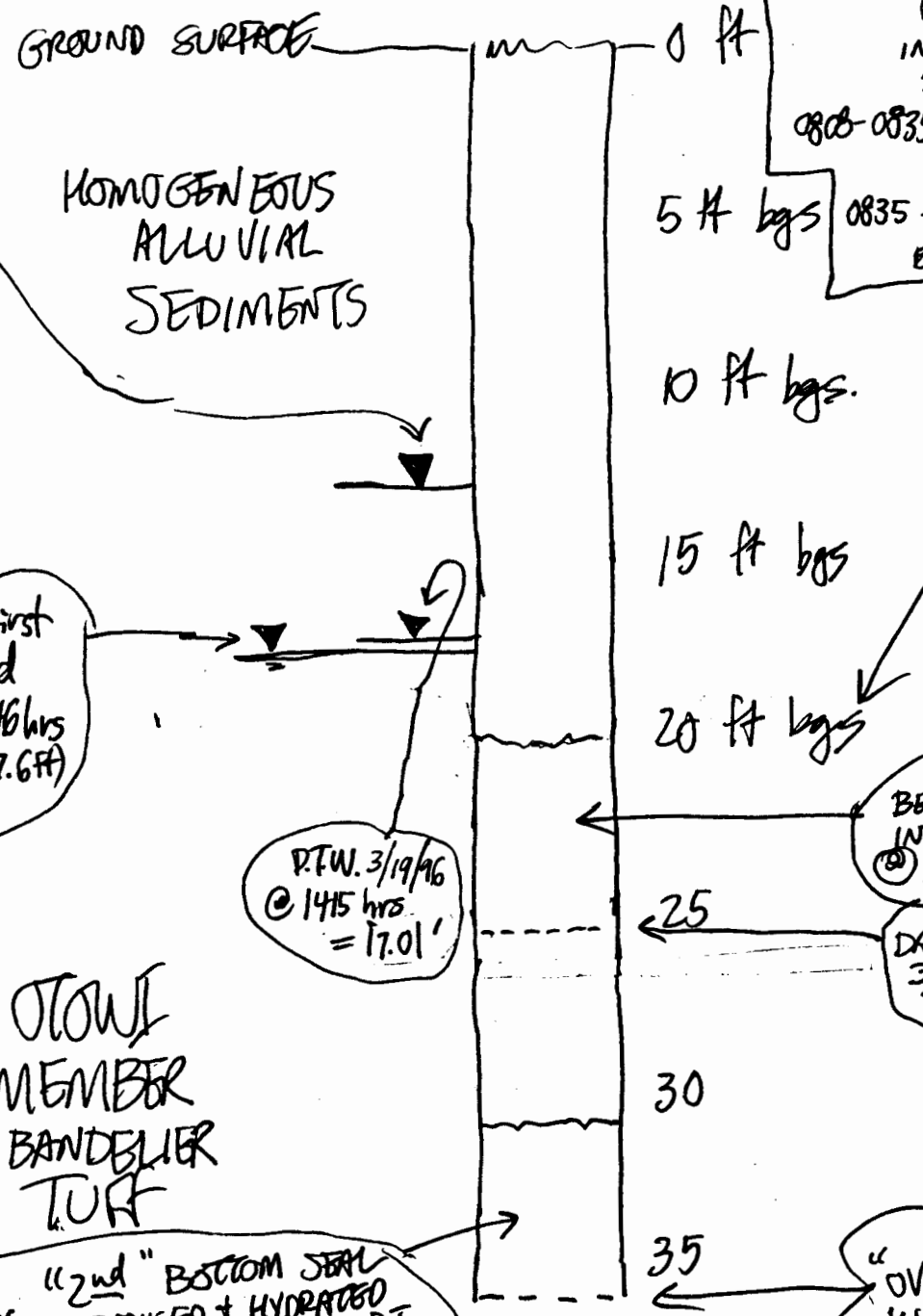
0645 hrs GILKESON WANTS DRILLING TO PENETRATE THROUGH SATURATION.

0740 D.T.W. = 12.9 ft bgs.

0740-0808 DRILL THROUGH BOTTOM SEAL AND INSPECT CORE (25.0-27.5 ft) ONLY SLIGHTLY DAMP.

0808-0835 "OVER DRILL" TO 36'

0835 → CGB WIDEN HOLE + INSTALL BOTTOM SEAL 31 to 36 ft



TOP LEVEL OF BENTONITE, ALSO TUFF/ALLUVIUM INTERFACE (20.0 ft)

H_2O first encountered 3/19/96 1146 hrs (D.T.W. = 17.6 ft)

D.T.W. 3/19/96 @ 1415 hrs = 17.01'

(#8's) BENTONITE PELLETS INTRODUCED TO 20 ft bgs @ 1345 hrs AFTER DAILY T.D. IS ATTAINED

DAILY TOTAL DEPTH 3/19/96 1320 hrs (= 25.6 ft)

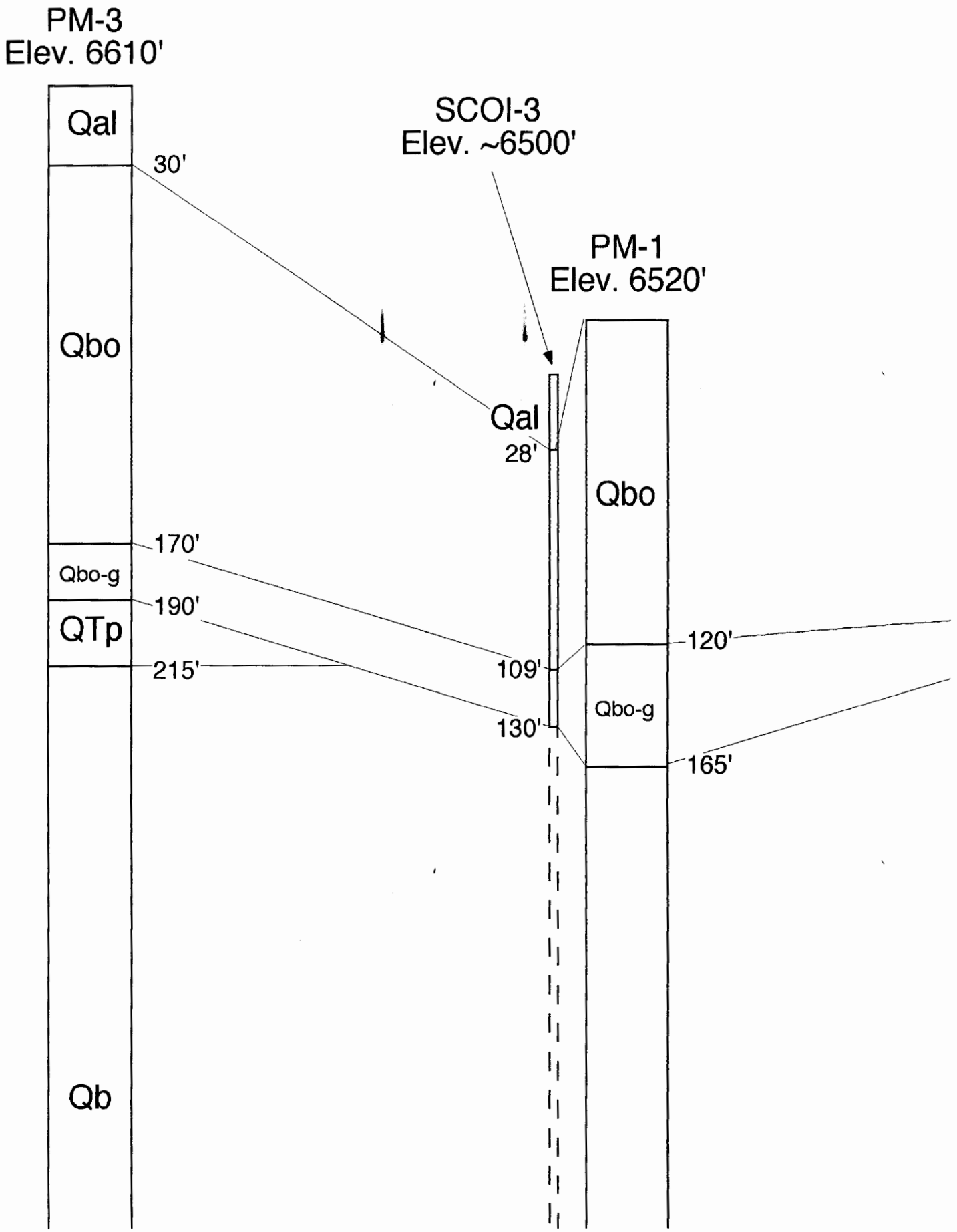
3/20/96 "2nd" BOTTOM SEAL INTRODUCED + HYDRATED w/ 10 gallons of DI H_2O

"OVER DRILL" FOR WELL BUILDING AFTER 25.0-27.5 ft CORE INSPECTION (BELOW SATURATION)

3/21/96 → am. CHECK D.T.W = DRY @ 0752
→ pm. INSTALL WELL IN HOPE OF "RECOVERY".

then 3/22 to date — DRY

AMPAD 22-141 50 SHEETS 22-142 100 SHEETS 22-144 200 SHEETS


PM-3
Elev. 6610'
Qal
30'
Qbo
170'
Qbo-g
190'
QTp
215'
Qb
SCOI-3
Elev. ~6500'
Qal
28'
109'
130'
PM-1
Elev. 6520'
Qbo
120'
Qbo-g
165'