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Water Supply at Los Alamos During 1979

William D. Purtymun

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WATER SUPPLY AT LOS ALAMOS DURING 1979

by

William D. Purtymun

ABSTRACT

The municipal and industrial water supply for Los Alamos for 1979 consisted of 1407 × 10^6 gal from wells in three fields and 44 × 10^6 gal from the gallery in Water Canyon. Another 0.2 × 10^6 gal of water were pumped to waste during the testing of Well LA-6. About 3.7 × 10^6 gal of water from Guaje Reservoir and 1.3 × 10^6 gal of water from Los Alamos Reservoir were used for irrigation; thus, the total use was about 1456 × 10^6 gal. Water level trends in the wells were as anticipated under current production practices. Well and distribution system rehabilitation should be continued. The rehabilitation of older wells and drilling and development of new wells are necessary to ensure an adequate and reliable water supply for municipal and industrial use at Los Alamos.

I. INTRODUCTION

This report summarizes chemical quality pumpage and aquifer conditions for wells in the Los Alamos, Guaje, and Pajarito well fields (Fig. 1). These wells supply most of the water used for municipal and industrial purposes in Los Alamos and Los Alamos Scientific Laboratory (LASL). The gallery in Water Canyon supplies the balance to the system. Also included is a summary of surface water from Guaje and Los Alamos Reservoirs used for irrigation. This report is a joint effort between Group H-8 of LASL and the Utilities and Engineering Division of the Zia Company (Zia U/E). Its purpose is to ensure a continuing historical record and to provide guidance for management of water resources and long-range planning for the water supply system. One summary report and eight annual reports have been issued as the result of these studies.[1-9] The tenth report extrapolates water-level trends in the well fields to 1983 under current production.[10]

The Zia U/E, the Department of Energy (DOE) support contractor at LASL, maintains and operates the water supply system. Water is pumped from wells, through transmission lines, and lifted by booster pumps into reservoirs for storage and distribution to the community and Laboratory areas (Fig. 1). Water from the gallery flows by gravity through a microfilter station and is pumped into one of the system reservoirs for distribution. Zia U/E maintains monthly records of hours of operation on each well, along with daily and monthly production records. Monthly average nonpumping and pumping water levels are computed from air-line pressure data recorded continuously at each well. These data provide input for calculating pumping rates, drawdown (difference between nonpumping and pumping water levels), specific capacity (pump rate per unit drawdown), and other well-field statistics included in this report.

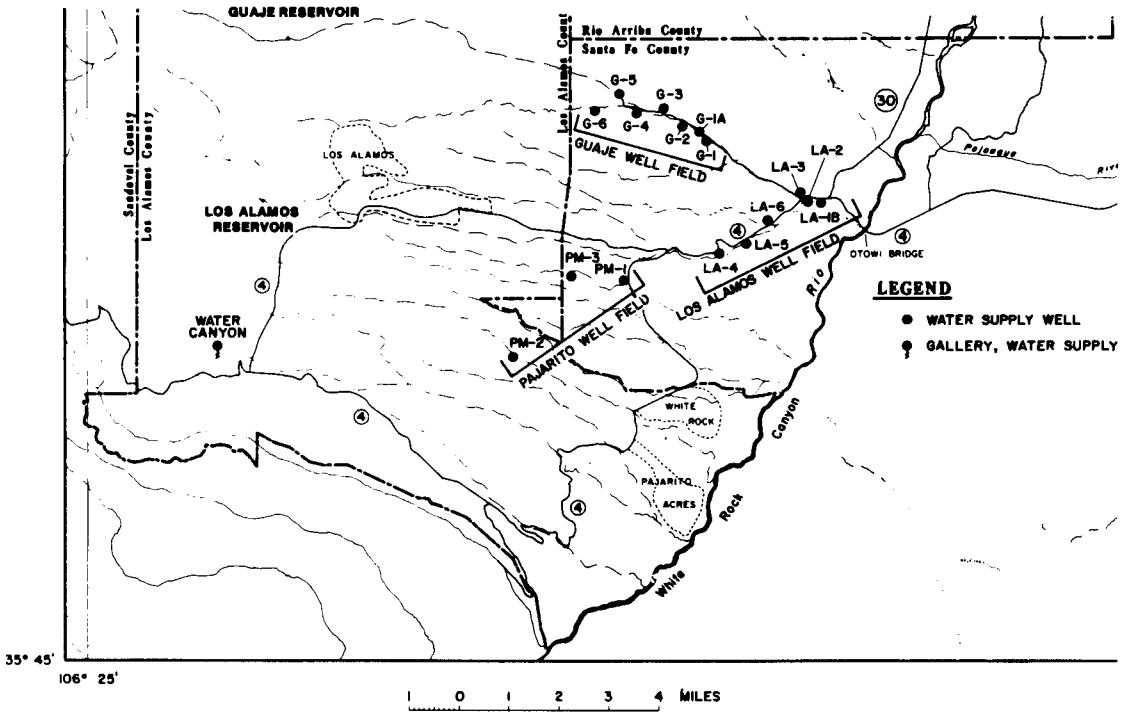


Fig. 1.
Location of well fields, supply wells, and gallery water supply.

Hydrographs have been prepared for one observation well, one standby supply well, 15 supply wells, and the gallery in Water Canyon. The hydrographs for the wells show annual average nonpumping and pumping water levels, specific capacity, and annual pumpage for the years during which the wells have been in production. The hydrographs for the gallery present annual production and the annual average discharge rates. Appendixes A and B contain basic pumping and production information for each supply well, monthly for 1979, and annually for the period of record. Chemical and radiochemical quality of water from wells and distribution systems are shown in Appendixes C, D, and E.

II. WELL-FIELD CHARACTERISTICS

Production from the three well fields decreased 29 $\times 10^6$ gal from 1436 $\times 10^6$ gal in 1978 to 1407 $\times 10^6$ gal in 1979 (Table I). Water production fell below the projected demand in 1974 by 760 $\times 10^6$ gal (Fig. 2).[11]

The peak demand period was for the 15-day period of July 24 through August 7 when pumpage was 115 $\times 10^6$ gal or about 7.7 $\times 10^6$ gal/day (Table II). The peak demand period decreased three days in 1979 when compared to 1978, with only four days in 1979 exceeding 7 $\times 10^6$ gal, while in 1978, seven days exceeded 7 $\times 10^6$ gal. The number of peak demand days and amount of pumpage has decreased from 1976 to 1979.

The months of heaviest pumpage in 1979 were June, July, and August. The production during these three months was 526 $\times 10^6$ gal, declining from 559 $\times 10^6$ gal for a similar period in 1978. The months of least pumpage were December, January, and February. The production in 1979 for these three months was 255 $\times 10^6$ gal, up from 239 $\times 10^6$ gal produced for the similar period in 1978.

The difference in demand for periods of heavy to light production (summer to winter) is use of water for lawn and yard irrigation. During 1979, an additional 151 housing units were added in Los Alamos County. In spite of the additional housing, the peak demand and production declined. These declines are due to water conservation by the residents of the County and by the Laboratory. The decline in part

TABLE I

PRODUCTION IN MILLIONS OF GALLONS FROM WELLS AND GALLERY

1947—1977

Year	Los Alamos Field	Guaje Field	Pajarito Field	Water Canyon Gallery	Production Total
1947	147	0	0	84	231
1948	264	0	0	97	361
1949	302	0	0	92	394
1950	547	3	0	54	604
1951	702	68	0	39	809
1952	448	350	0	48	846
1953	444	372	0	39	855
1954	380	374	0	40	794
1955	407	375	0	33	815
1956	437	506	0	23	966
1957	350	378	0	40	768
1958	372	395	0	60	827
1959	391	478	0	54	923
1960	530	533	0	48	1111
1961	546	624	0	54	1224
1962	577	597	0	67	1241
1963	539	654	0	51	1244
1964	627	665	0	45	1337
1965	447	571	99	72	1189
1966	450	613	127	82	1272
1967	373	464	481	56	1374
1968	345	474	584	65	1468
1969	331	435	569	80	1415
1970	360	423	595	65	1443
1971	412	484	657	37	1590
1972	380	467	662	40	1549
1973	406	475	685	49	1615
1974	369	453	802	35	1659
1975	356	431	749	42	1578
1976	343	531	817	41	1732
1977	345	515	614	57	1531
1978	302	444	690	45	1481
1979	289	456	662	44	1451
Total	13 518	13 608	8793	1778	37 697

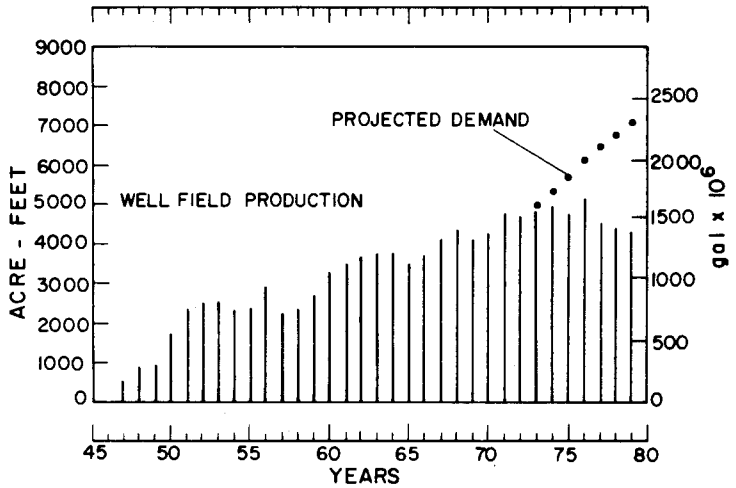


Fig. 2.
Well-field production 1947-79 and projected demand 1973-79.

TABLE II

PEAK DEMAND PERIODS

1976-1979

	Demand Period			
	June 11-July 12 1976	**May 31-June 18 1977**	**June 9-June 28 1978**	**July 24-Aug. 7 1979**
No. of Days	32	19	20	15
Total Production (gal)	299×10^6	149×10^6	149×10^6	115×10^6
Ave. Daily Production (gal)	9.3×10^6	7.8×10^6	7.4×10^6	7.7×10^6
No. of Days Exceeding (gal)				
10×10^6	14	2	---	---
9×10^6	9	4	---	---
8×10^6	4	4	7	4
7×10^6	3	4	8	6
$<7 \times 10^6$	2	5	5	5

may also be caused by above normal precipitation in the winter and spring of 1978-1979.

Water levels in the wells fluctuate with production. The highest water levels were during months of least pumpage (December, January, and February); whereas the lowest water levels were during months of greatest production (June, July, and August).

Total production from the well fields and gallery since 1947 has been 37 697 $\times 10^6$ gal. Of this, wells have produced 35 919 $\times 10^6$ gal or 95% (Table I). The annual production, per cent pumpage by well fields, and per cent pumpage by individual wells are given in Table III. The average annual pumping rates for individual wells for the period 1973 through 1979 are shown in Table IV.

A. Los Alamos Field

The Los Alamos well field is composed of six supply wells and one observation well. The production in 1979 was from five supply wells. The sixth is on standby status for emergency use only.[12] Pumpage from the field decreased 13 $\times 10^6$ gal, from 302 $\times 10^6$ gal in 1978 to 289 $\times 10^6$ gal in 1979. Production declined to its lowest amount since 1947. The field produced about 20% of the total

About 35% of the production was from the lower part of the field (LA-1B, LA-2, and LA-3), and about 65% of production from the upper point of the field (LA-4 and LA-5). As a result, the water levels rose slightly in wells LA-1, LA-1B, LA-2, and LA-3, and declined slightly in wells LA-4, LA-5, and LA-6, compared to those levels in 1978 (Figs. 3 through 9, respectively). The distribution of pumpage in 1979 from the individual wells in the field is as recommended in the 1978 report to reduce projected excessive water level decline in the lower part of the well field.[9]

Well LA-6, on standby status, pumped about 0.2 $\times 10^6$ gal for testing and pump maintenance during the year. Water was pumped to waste, not into the system.

The average annual pumping rates from the five producing wells increased about 88 gpm from 2208 gpm in 1978 to 2296 gpm in 1979 (Table IV). The pumping rate increase in the lower part of the field (LA-1B, LA-2, and LA-3) is because of higher water levels; the decrease in pumping rates in the upper part of the field (LA-4 and LA-5) is because of lower water levels in 1979 than in 1978. The specific capacities of the well showed no significant change in 1979 when compared to 1978 data.

B. Guaje Well Field

The Guaje Well Field is composed of seven wells (Fig. 1). Pumpage from the field increased 12 $\times 10^6$ gal from 444 $\times 10^6$ gal in 1978 to 456 $\times 10^6$ gal in 1979 (Table I). The field produced about 30% of the total production (Table III).

The production in individual wells G-1, G-1A, G-2, G-3, G-4, and G-5 increased 3 $\times 10^6$ to 11 $\times 10^6$ gal in 1979 when compared to similar production in 1979 (Figs. 10 through 15, respectively). The production from well G-6 decreased 30 $\times 10^6$ gal from 1978 to 1979, as the well was out of service for repairs (Fig. 16). There were slight, but not significant, changes in water levels from the previous year.

Well G-6 was taken out of service in November 1978 and returned to service in mid June 1979. During this period the pump was pulled from the well and replaced. The well was rehabilitated by cleaning the screen and casing. About 120 ft of sediments were bailed from the well. The well was taken out of service again in August as the pump could not be adjusted and the well was pumping large amounts of sand and some gravel pack. The pump was pulled for repairs in December. Inspection of the well was made with a television monitor, which showed some new scale forming on the screen from a depth of about 900 to 1100 ft. The scale indicates that most of the yield of the well is probably in the 200 ft interval. The well was open to 1480 ft in December. The total depth of the well is 1520 ft. The production from the well was 18 $\times 10^6$ gal, a decline of 30 $\times 10^6$ gal from 1978 to 1979. Water levels remained about the same (Fig. 16).

The pump in well G-5 failed in December and was pulled from the well. Inspection of the well indicated some scale on screen openings, but not enough to require rehabilitation. The depth of the well was logged at 700 ft. At that depth the screen in the casing is badly damaged allowing sand, gravel, and small boulders to enter the well. As this condition has existed for over 20 years, and the yield of the well has been sufficient, no attempt was initiated to clean out

TABLE III

PRODUCTION PERCENTAGES

1979

	Production in Million Gal	Per Cent by Well Field	Per Cent by Total Production
Los Alamos Well Field			
LA-1	0.0	0	0
LA-1B	45.9	16	3
LA-2	26.2	9	2
LA-3	28.1	10	2
LA-4	104.6	36	7
LA-5	84.0	29	6
LA-6[a]	0.2	<1	<1
Subtotal	289.0	100	20
Guaje Well Field			
G-1	61.7	13	4
G-1A	88.0	19	6
G-2	80.0	18	5
G-3	69.0	15	5
G-4	52.9	12	4
G-5	86.5	19	6
G-6	18.2	4	1
Subtotal	456.3	100	31
Pajarito Well Field			
PM-1	83.4	12	6
PM-2	381.8	58	26
PM-3	197.2	30	14
Subtotal	662.4	100	46
Water Canyon Gallery			
Subtotal	44.0	100	3
Total	1451.7	---	100

[a]Well pumped to waste during tests.

the well to its total depth of 1840 ft. There was no significant change in water levels from 1978 to 1979.

The average annual pumping rate of wells in the field declined 88 gpm from 2868 gpm in 1978 to 2780 gpm in 1979 (Table IV). The largest declines occurred in wells G-3 (46 gpm) and G-4 (20 gpm). The pump in G-3 was pulled for repairs and the well rehabilitated in 1976. The average annual pumping rate has declined from 463 gpm in 1976 to 382 gpm in 1979 (Table IV). The specific capacities have also declined from 5.3 gpm per ft of drawdown in 1976 to 3.6 gpm per ft of drawdown in 1979 (Fig. 13). In June

TABLE IV

AVERAGE ANNUAL PUMPING RATE OF WELLS AND DISCHARGE FROM GALLERY
1973-1979
(in gpm)

	1973	1974	1975	1976	1977	1978	1979
Los Alamos Well Field							
LA-1	0	0	0	0	0	0	0
LA-1B	553	540	537	526	504	546	565
LA-2	297	302	290	267	255	286	323
LA-3	346	316	313	285	284	306	348
LA-4	589	594	591	584	586	594	588
LA-5	460	460	450	462	468	476	472
LA-6[a]	572	569	551	486	0	0	0
Subtotal	2817	2781	2742	2610	2097	2208	2296
Guaje Well Field							
G-1	375	275	376	366	353	351	343
G-1A	531	520	519	512	502	494	494
G-2	429	447	456	452	450	452	448
G-3	277	273	273	463	444	428	382
G-4	206	214	346	337	352	316	296
G-5	541	560	549	536	541	538	522
G-6	364	360	348	325	307	289	295
Subtotal	2723	2750	2867	2991	2949	2868	2780
Pajarito Well Field							
PM-1	459	606	616	607	592	593	592
PM-2	1388	1381	1383	1369	1375	1365	1362
PM-3	1320	1313	1312	1410	1406	1398	1393
Subtotal	3166	3299	3310	3386	3373	3356	3347
Water Canyon Gallery							
Subtotal	93	67	80	78	108	86	84
Total	8800	8896	8999	9065	8528	8518	8507

[a]Well on standby.

1979, it was discovered that the backflow preventer was not closing properly; thus, at times the well was receiving drainage from the transmission line or, if well G-3 were shut down and other wells on the line were pumping, well G-3 was receiving the discharge from the other wells. This discharge into the well may have damaged the pump, reducing the pumping rate, and may have washed excess sand from gravel pack around the screen, decreasing the effective depth of the well. The large change in pumping rate and specific capacity occurred in June 1979 (Appendix A).

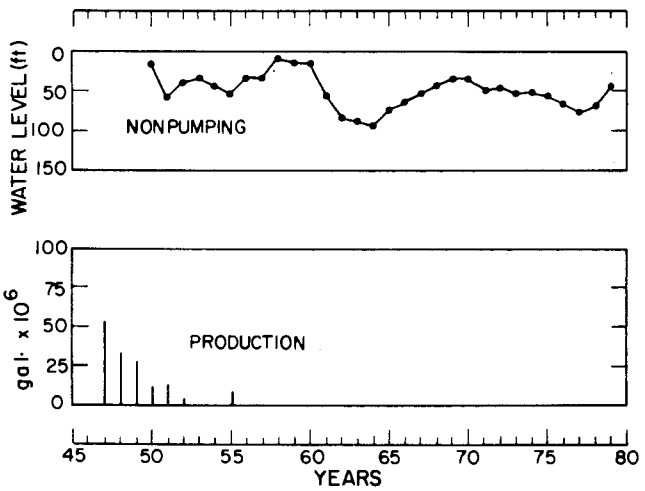


Fig. 3.
Annual average nonpumping water level and annual production, Los Alamos Well LA-1.

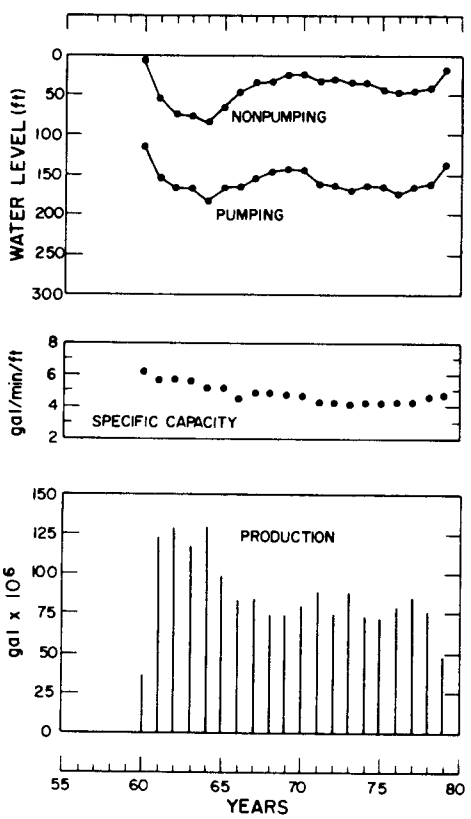


Fig. 4.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-1B.

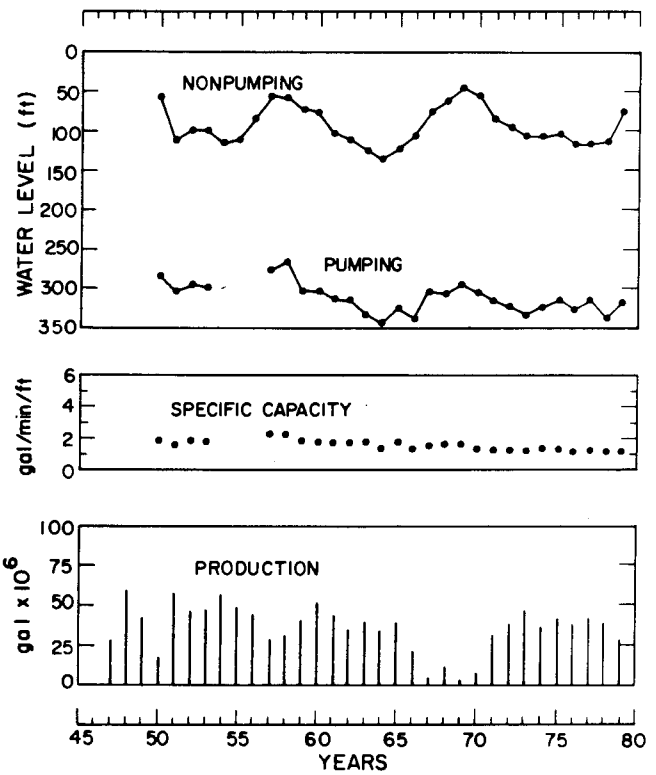


Fig. 5.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-2.

Decline in the pumping rate of G-4 is probably due mainly to wear on the pump. The well pumps a considerable amount of sand. Since the well was rehabilitated in 1975, the pumping rate has declined from 346 gpm to 296 gpm (Table IV). Specific capacities have declined slightly indicating some deterioration of the well by sand covering the screen openings.

C. Pajarito Well Field

The Pajarito well field is composed of three wells (Fig. 1). Pumpage from the wells declined 28 × 10^6 gal from 690 × 10^6 gal in 1978 to 662 × 10^6 gal in 1979 (Table I). The field produced 46% of the total production in 1979 (Table III).

Water levels in wells PM-1, PM-2, and PM-3 remained about the same in 1979 (Figs. 17 through 19, respectively). Pumping rates and specific

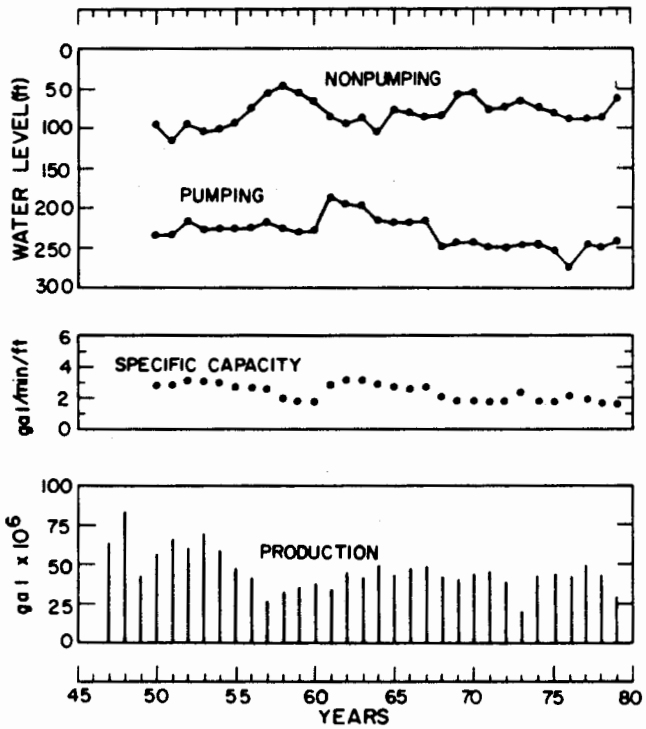


Fig. 6.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-3.

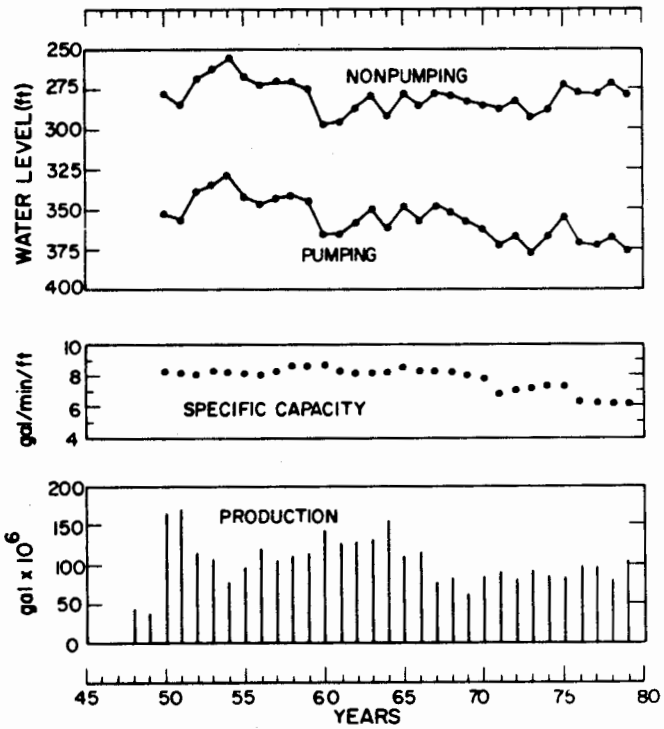


Fig. 7.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-4.

capacities varied only slightly and these variations are not considered significant in high yield wells such as in this field.

III. WATER CANYON GALLERY

The gallery in Water Canyon is dug into the Bandelier Tuff, which forms the surface outcrops along the mountains. Production from the gallery declined 1×10^6 gal from 45×10^6 gal in 1978 to 44×10^6 gal in 1979 (Table I). The annual discharge for 1979 was 84 gpm, down slightly from the 1978 average of 86 gpm (Fig. 20).

IV. GUAJE AND LOS ALAMOS RESERVOIRS

Guaje Reservoir in Upper Guaje Canyon has a capacity of 0.25×10^6 gal, with a drainage area above the intake of 5.6 mi^2. The reservoir is for diversion rather than storage, as perennial flow is maintained by springs in the canyon above the reservoir. Water is conveyed by gravity flow through about 6.8 mi of transmission line for irrigation of lawns and shrubs at the Cumbres Jr. High School or Guaje Pines Cemetery. The line from the reservoir is not connected to the municipal distribution system. The amount used for irrigation in 1979 was 3.7×10^6 gal, an increase of 0.4×10^6 gal from 3.3×10^6 gal used in 1978.

Los Alamos Reservoir in upper Los Alamos Canyon has a capacity of 13.4×10^6 gal, with a drainage area above the intake of 6.4 mi^2. The reservoir is used for storage and recreation. The water is conveyed by gravity flow through about 2.6 mi of transmission line for irrigation of lawns and shrubs at the Los Alamos High School and Mesa School. The line from the reservoir is not connected to the municipal distribution system. The amount used for irrigation in 1979 was 1.3×10^6 gal. No water was diverted from the reservoir in 1978.

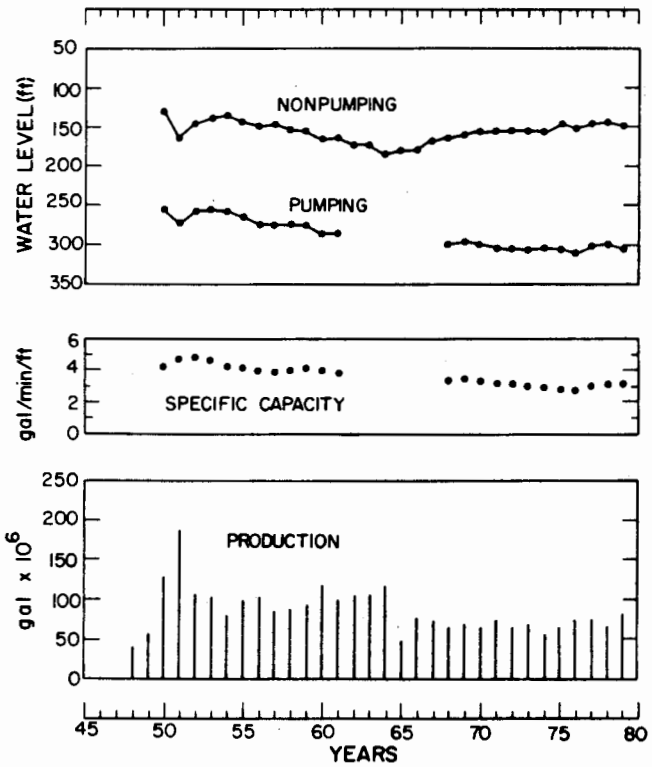
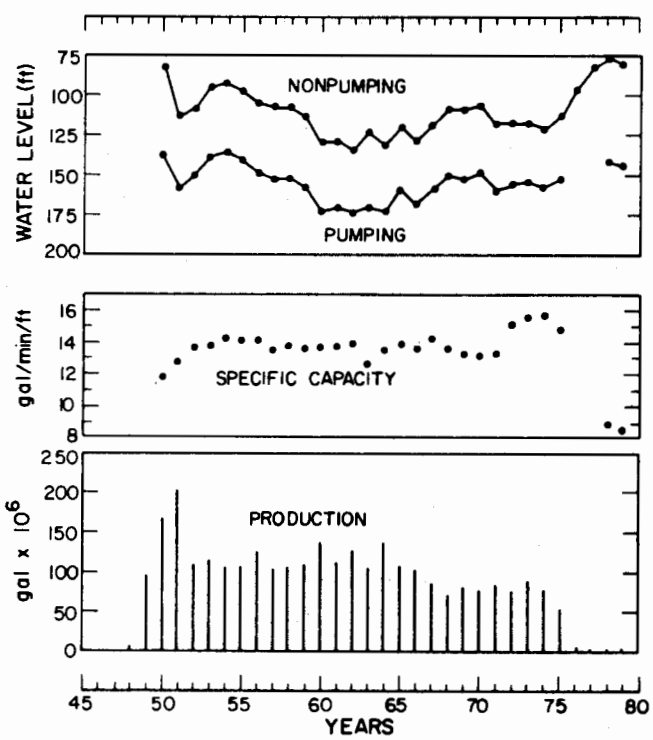


Fig. 8.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-5.



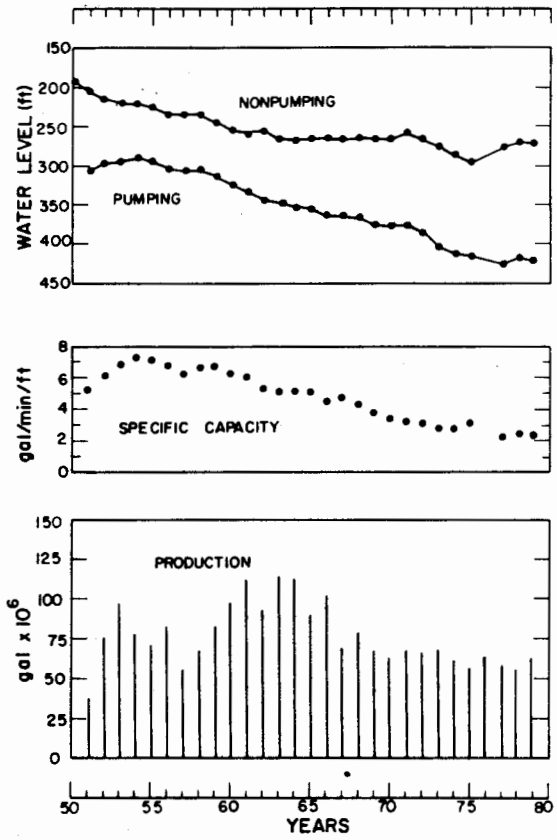


Fig. 10.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-1.

Fig. 9.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Los Alamos Well LA-6.

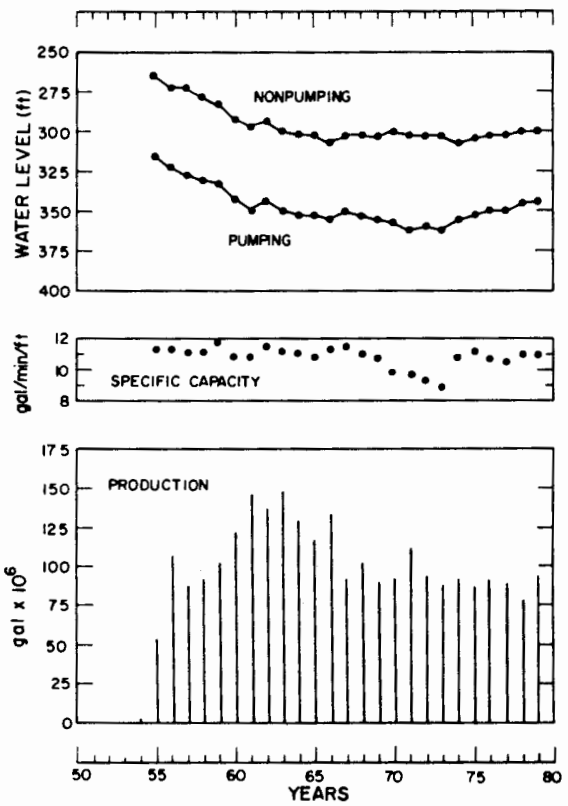


Fig. 11.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-1A.

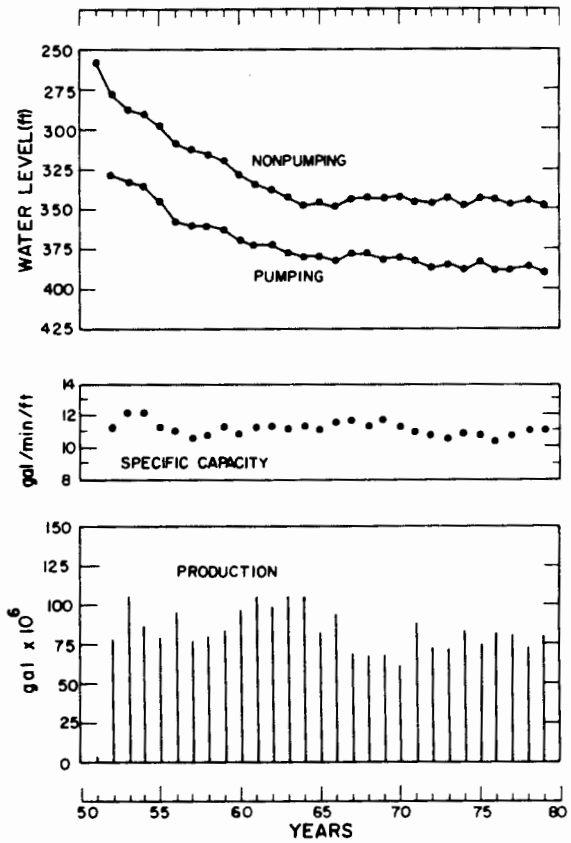


Fig. 12.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-2.

V. QUALITY OF WATER

Chemical analyses are made of water from individual wells and the distribution system to determine if there is any deterioration of water quality with continued production and distribution. Routine analyses are made for SiO_2, Ca, Mg, K, Na, CO_3, HCO_3, PO_4, Cℓ, total dissolved solids (TDS), hardness, pH, and specific conductance (see Appendix C). Slight changes in water quality occur seasonally from periods of light pumpage (winter) to heavy pumpage (summer). Quality of water data collected in 1979, when compared to data collected in prior years is within the expected levels caused by the seasonal variations.

Certain constituents, Ag, As, Ba, Cd, F, Hg, NO_3, Pb, and Se are monitored to determine if the water from the wells and distribution system meet State and Federal requirements for municipal supplies (Appendix D).[13,14] Arsenic (0.05 mg/ℓ) and fluoride (2.2 mg/ℓ) were at or above the maximum contaminant level (MPL) in water from well LA-1B. Lead (0.19 mg/ℓ) in water from well G-6 exceeded the MPL. The lead is caused by wear on the pump (finely divided brass in the pumpage). The well was in service from June to early August during 1979, and the pump has been removed from the well for repairs. Though the water from the two wells (LA-1B and G-6) contained constituents above the MPL, the water in the distribution system (five locations) meets the State and Federal criteria for municipal supplies. Water from wells LA-1B and G-6 is mixed with water from other wells in the system reducing the arsenic, fluoride, and lead to acceptable levels.

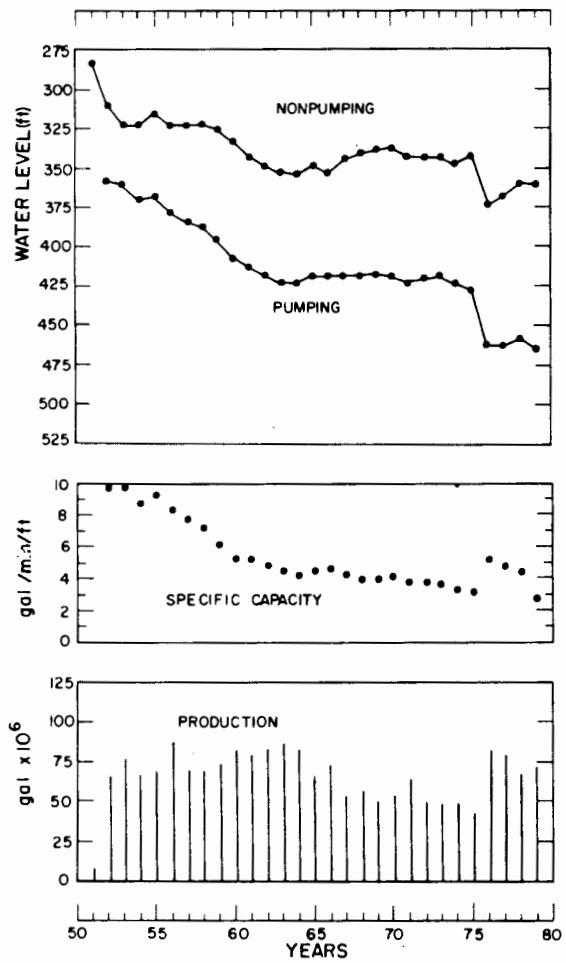


Fig. 13.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-3.

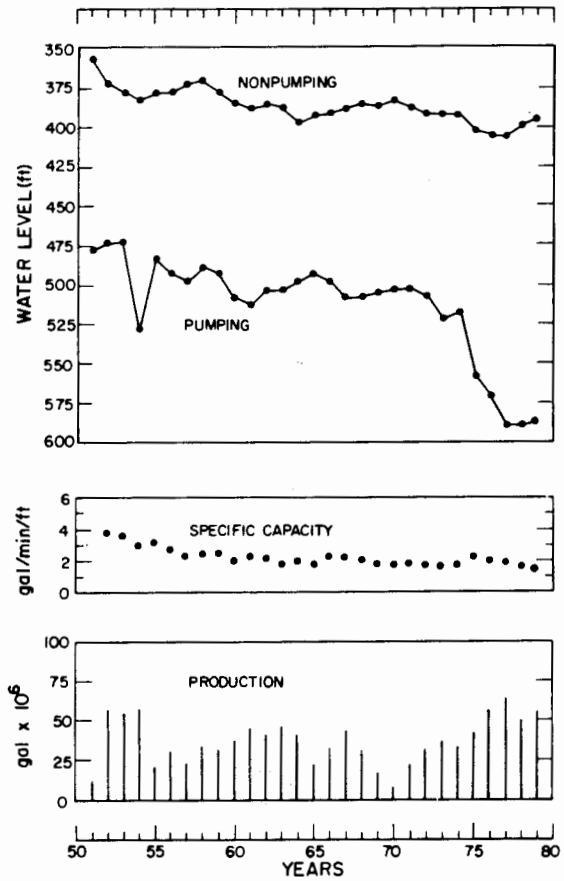


Fig. 14.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guage Well G-4.

Arsenic (0.23 mg/ℓ) and fluoride (2.2 mg/ℓ) in water from well LA-6 was above the MPL. This well is on standby; pumpage is not used for municipal supply, except in extreme emergency, such as fire.[12]

Maximum contaminant levels have been established for radioactivity in municipal water supplies for ^{137}Cs, ^{238}Pu, ^{239}Pu, and ^{3}H (Appendix E).[14] Gross alpha concentrations are used to determine whether specific radium analyses must be performed. In comparing the radioactivity in water with the MPL, only the gross alpha radioactivity exceeds the screening limit of 5 pCi/ℓ at one well. Well LA-1B contained 9 pCi/ℓ of gross alpha (Appendix E). Because the water is mixed with other wells in the field, the gross alpha is below MPL at all times and locations in the distribution system. The ^{137}Cs, ^{238}Pu, ^{239}Pu, and ^{3}H are below the MPL. The total U is present as naturally-occurring radioactivity in the aquifer and is well below the MPL (Appendix E).

VI. SUMMARY AND CONCLUSIONS

Production from the three well fields declined 29 × 10^6 gal from 1978 to 1979. The past three years of declining demand should not be construed to mean additional wells are not needed for the system. Continued expansion of the LASL facilities and increased population and housing in the County will

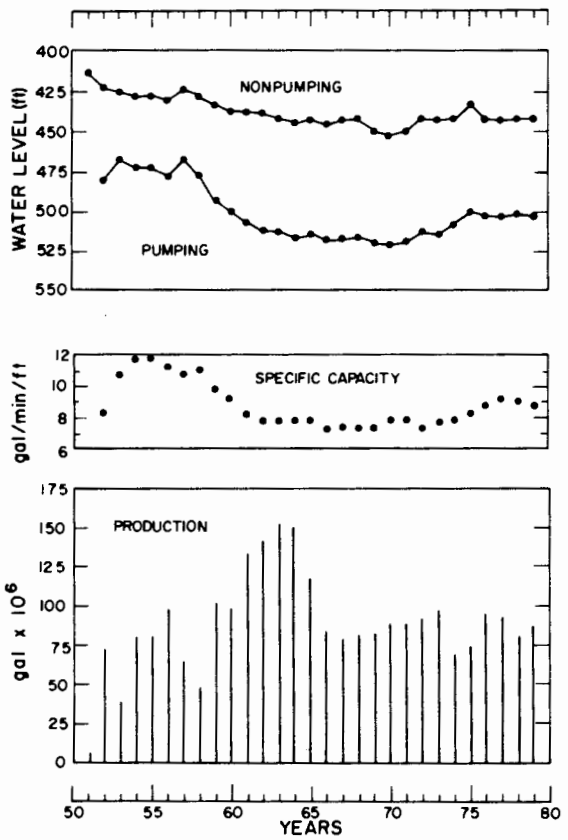


Fig. 15.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-5.

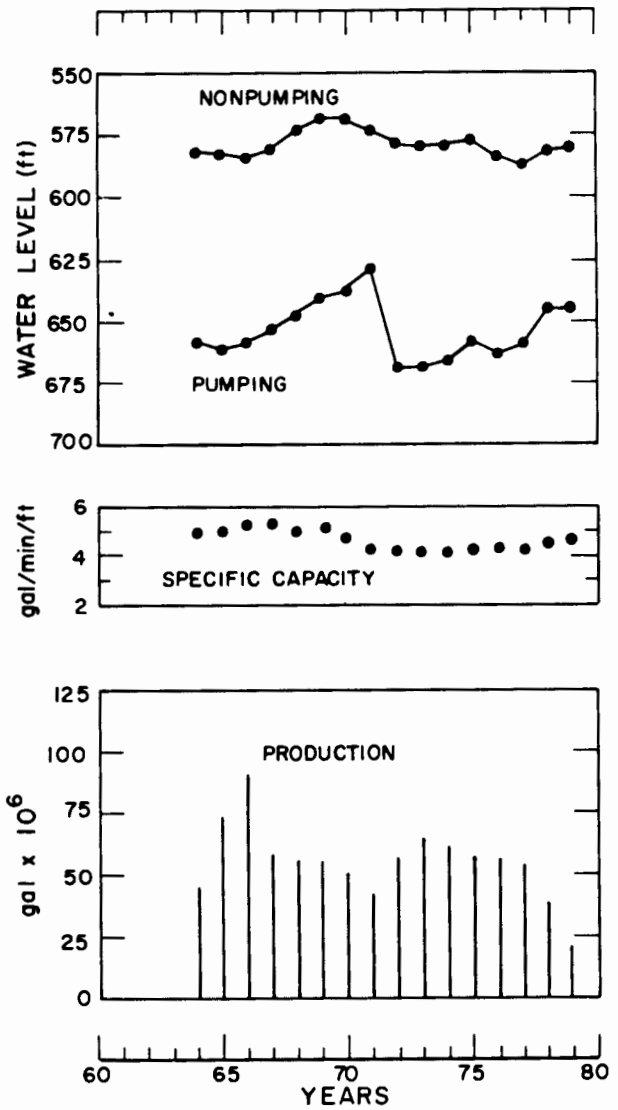


Fig. 16.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Guaje Well G-6.

require more water. The completion time of a new well and transmission lines is over two years.

Well field operations in 1979 were satisfactory. Pumpage from the lower part of the Los Alamos well field was reduced, while production from the upper part of the field was increased to allow an equal withdrawal of water from the aquifer. As previously recommended, about 60% of the production should be from the upper part of the field (LA-4 and LA-5), and 40% from the lower part of the field (LA-1B, LA-2, and LA-3).

Well and pump rehabilitation should be continued. Wells to be considered for rehabilitation and inspection are LA-5, G-3, G-4, and PM-2. The sequence of listing does not indicate priority.

The pump at well LA-5 was pulled for inspection and repair in 1962. Zia U/E reports a larger line shaft is needed to keep the pump in adjustment and the motor needs to be rewound.

The pumping rates of wells G-3 and G-4 have declined, indicating wear on the pump and some well deterioration. The pump was pulled from G-3 in 1976. Since that time, the pumping rate has decreased from 463 gpm to 382 gpm in 1979. The specific capacity has also declined from 5.3 to 3.6 gpm/ft of drawdown. The pump was pulled from well

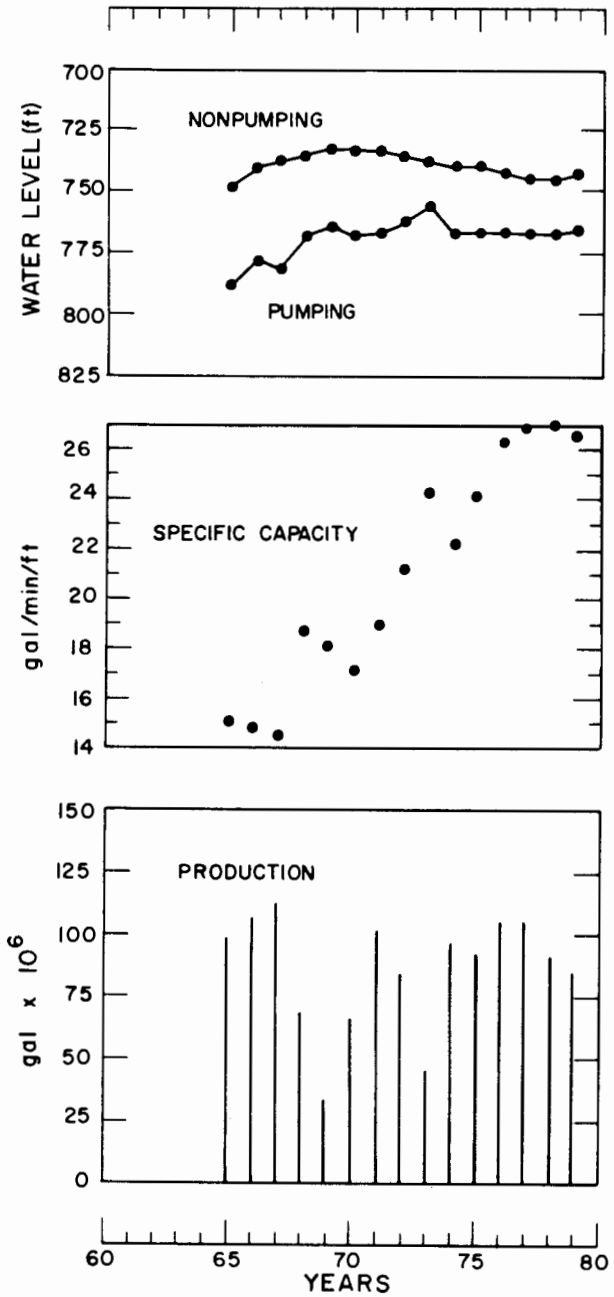


Fig. 17.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-1.

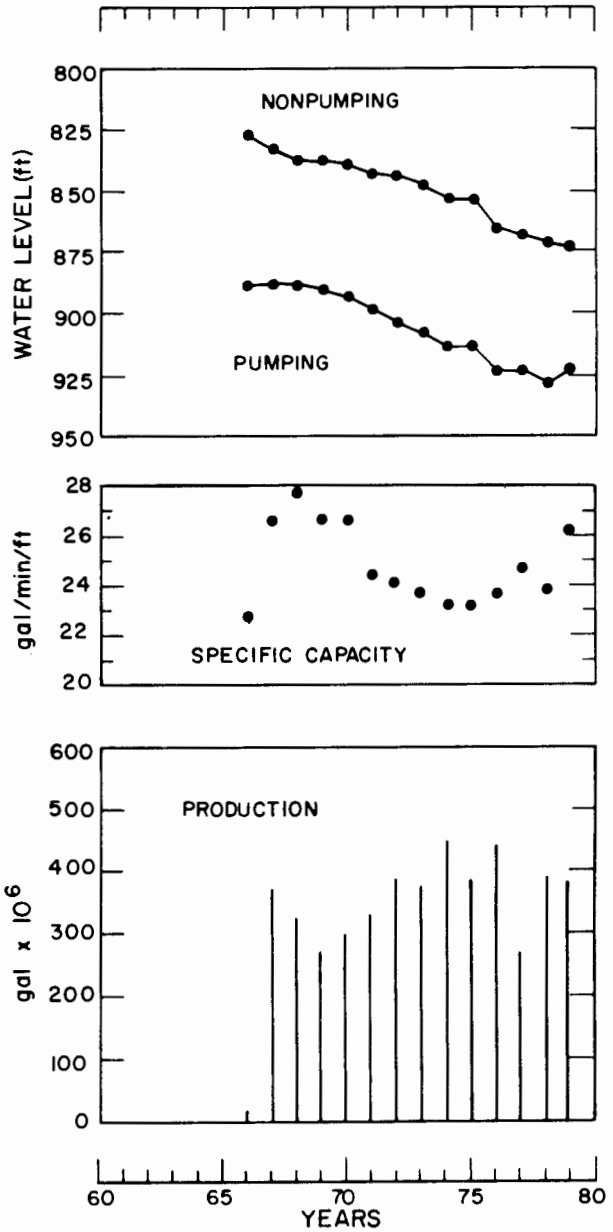


Fig. 18.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-2.

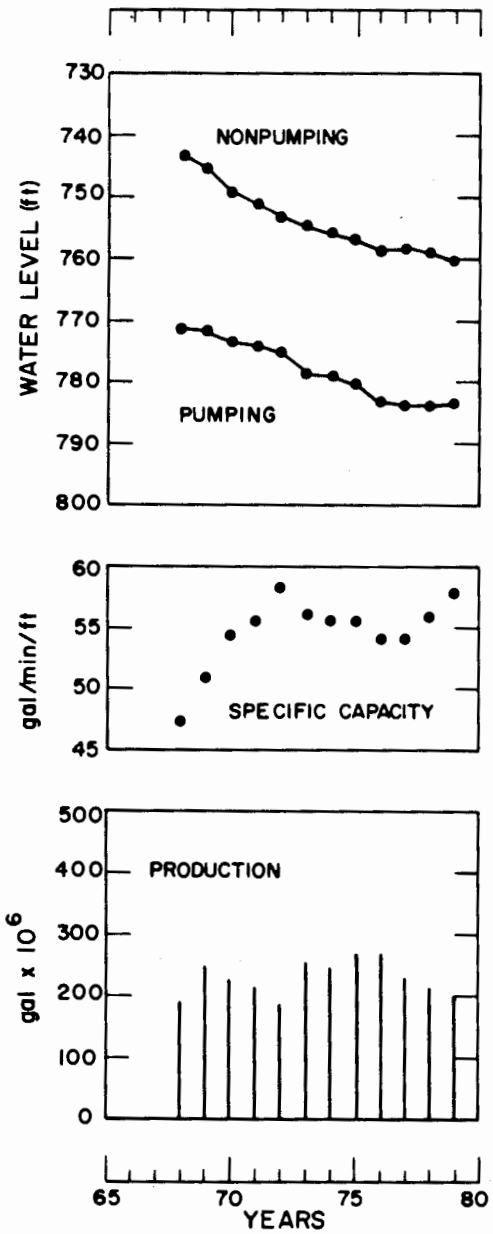


Fig. 19.
Annual average nonpumping and pumping water levels, annual average specific capacity, and annual production, Pajarito Well PM-3.

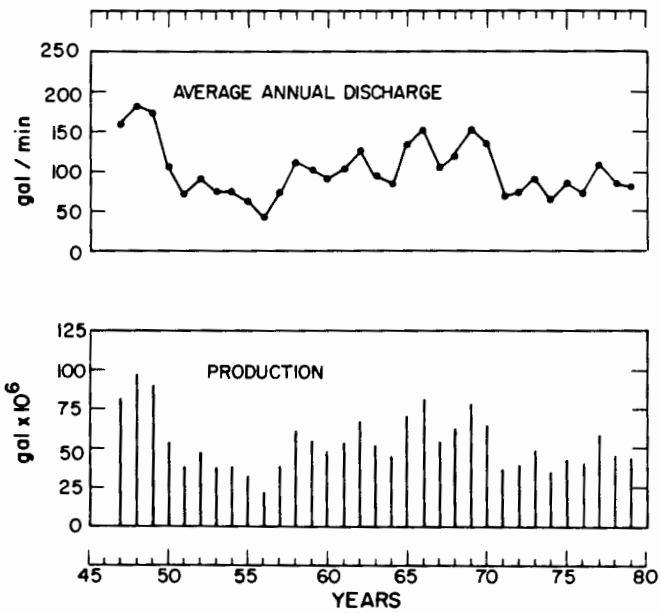


Fig. 20.
Annual average discharge and annual production from the gallery in Water Canyon.

G-4 in 1975. Since that time, the pumping rate has declined from 345 gpm to 296 gpm in 1979. Specific capacities have also declined, only slightly, from 2.2 to 1.6 gpm/ft of drawdown.

Well PM-2 is a high yield well that has been in operation since 1966. The pumping characteristics indicate no obvious problems with the pump; however, the period of operation (57,000 h) has exceeded the manufacturer's recommended life (35 000 h) of the pump. Because the well is a high yield producer (26% of total production), failure during the summer could cause a short-term water shortage.

Zia U/E recommends that the motor on well G-1A be rewound. Work is now in progress to replace electric starters on pump motors on wells in the Los Alamos and Guaje fields and the replacement of pumps and motors in booster stations in the Los Alamos and Guaje fields.

ACKNOWLEDGMENTS

Pumping statistics were compiled by Glenn Bryant (Zia U/E), Max Maes, Charlene Wardlow, and Georgia Fox (H-8).

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APPENDIX A

MONTHLY AQUIFER CHARACTERISTICS

Well LA-1

1979

Month	Water Level Nonpump (ft)
Jan	54
Feb	44
Mar	36
Apr	28
May	25
June	27
July	38
Aug	48
Sept	---
Oct	---
Nov	---
Dec	---

Well LA-1B

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	153	5173	563	27	145	118	4.8
Feb	62	2133	569	20	134	114	5.0
Mar	60	2080	578	10	126	116	4.9
Apr	53	1856	579	5	121	116	4.9
May	84	2911	578	2	121	119	4.9
June	115	3948	572	2	127	125	4.5
July	193	6509	555	16	138	122	4.6
Aug	139	4658	558	21	144	123	4.5
Sept	92	3132	565	5	132	127	4.4
Oct	279	9238	551	25	150	125	4.4
Nov	74	2497	557	19	143	124	4.5
Dec	50	1733	579	2	123	121	4.8

APPENDIX A (cont)

Well LA-2

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	153	2973	323	92	320	228	1.4
Feb	62	1269	339	78	306	228	1.5
Mar	60	1268	352	68	298	230	1.5
Apr	53	1124	350	60	302	242	1.4
May	83	1761	354	61	303	242	1.5
June	115	2346	340	63	308	245	1.4
July	193	3629	309	79	329	250	1.2
Aug	139	2637	316	88	331	243	1.3
Sept	92	1808	327	69	318	249	1.3
Oct	279	4943	295	103	343	240	1.2
Nov	74	1412	315	81	324	243	1.3
Dec	50	1051	351	63	306	243	1.4

Well LA-3

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	153	3209	349	70	246	176	2.0
Feb	62	1364	364	60	241	181	2.0
Mar	60	1369	380	52	239	187	2.0
Apr	53	1218	380	47	240	193	1.9
May	84	1923	381	45	232	187	2.0
June	107	2412	376	47	239	192	2.0
July	185	3790	341	60	247	187	1.8
Aug	139	2865	343	68	246	178	1.9
Sept	97	2045	351	52	244	192	1.8
Oct	279	5269	314	77	251	174	1.8
Nov	74	1467	333	65	246	181	1.8
Dec	50	1120	374	49	241	192	1.9

APPENDIX A (cont)

Well LA-4

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	153	5574	606	263	361	98	6.2
Feb	149	5350	602	268	362	94	6.4
Mar	177	6379	604	267	364	97	6.2
Apr	172	6271	605	266	362	96	6.3
May	222	8004	601	272	369	97	6.2
June	299	10 616	592	272	372	97	6.1
July	452	15 622	575	297	391	94	6.1
Aug	389	13 349	571	303	400	97	5.9
Sept	237	8257	580	293	394	101	5.7
Oct	367	12 779	580	292	386	94	6.2
Nov	192	6793	590	285	382	97	6.1
Dec	156	5573	595	278	372	94	6.3

Well LA-5

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	153	4485	488	142	296	154	3.2
Feb	148	4321	487	144	294	150	3.3
Mar	176	5144	487	144	295	151	3.2
Apr	172	5062	488	141	293	152	3.2
May	222	6451	484	143	297	154	3.1
June	299	8507	474	145	302	157	3.0
July	453	12 484	459	157	308	151	3.0
Aug	389	10 743	460	160	309	149	3.1
Sept	238	6677	469	156	311	155	3.0
Oct	367	10 102	458	156	306	150	3.1
Nov	191	5512	479	152	301	149	3.2
Dec	156	4519	482	149	299	150	3.2

APPENDIX A (cont)

LA-6

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	---	---	---	75	---	---	---
Feb	---	---	---	75	---	---	---
Mar	2	72	600	73	137	64	8.5
Apr	---	---	---	75	---	---	---
May	---	---	---	75	---	---	---
June	---	---	---	75	---	---	---
July	---	---	---	79	---	---	---
Aug	3.5	124	590	87	156	69	8.4
Sept	---	---	---	87	---	---	---
Oct	---	---	---	85	---	---	---
Nov	---	---	---	87	---	---	---
Dec	---	---	---	82	---	---	---

Well G-1

1979

Month	Pump time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	165	3613	364	269	417	148	2.5
Feb	172	3579	363	269	413	144	2.5
Mar	186	4051	362	269	416	147	2.5
Apr	207	4484	360	269	414	145	2.5
May	260	5522	354	269	417	148	2.4
June	301	6247	346	270	419	149	2.3
July	439	8732	331	273	429	156	2.1
Aug	400	7824	325	276	433	157	2.1
Sept	346	6850	330	273	427	154	2.1
Oct	146	2851	325	272	436	164	2.0
Nov	160	3398	353	269	419	150	2.4
Dec	216	4523	348	270	422	152	2.3

APPENDIX A (cont)

Well G-1A

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	165	4916	495	298	342	44	11.3
Feb	172	5102	492	297	343	46	10.7
Mar	186	5538	495	298	341	43	11.5
Apr	207	6122	492	298	343	45	10.9
May	260	7717	495	299	344	45	11.0
June	301	8907	493	299	345	46	11.7
July	435	12 747	487	305	347	42	11.6
Aug	401	11 867	493	307	350	43	11.5
Sept	346	10 112	496	306	349	43	11.5
Oct	125	3732	495	307	349	42	11.8
Nov	160	4761	495	299	342	43	11.5
Dec	216	6481	499	302	342	40	12.5

Well G-2

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	165	4606	466	342	382	40	11.6
Feb	172	4693	453	341	383	42	10.8
Mar	186	5089	455	344	386	42	10.8
Apr	208	5648	453	341	384	43	10.5
May	260	7069	453	344	385	41	11.1
June	301	8054	446	345	387	42	10.6
July	435	11 501	440	352	391	39	11.3
Aug	400	10 549	439	354	393	39	11.2
Sept	346	9186	442	352	393	41	10.8
Oct	125	3309	439	354	393	39	11.3
Nov	160	4360	452	343	386	43	10.5
Dec	217	5910	454	347	387	40	11.4

APPENDIX A (cont)

Well G-3

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	161	4307	444	358	452	94	4.7
Feb	169	4434	436	351	445	94	4.6
Mar	194	5218	450	351	445	94	4.8
Apr	206	5250	424	347	444	97	4.4
May	258	6689	432	353	458	105	4.1
June	305	7110	388	354	476	122	3.2
July	448	9696	360	369	477	108	3.3
Aug	399	8291	346	375	477	102	3.4
Sept	346	7088	341	372	477	105	3.3
Oct	145	2910	333	374	477	103	3.2
Nov	168	3654	361	353	476	123	2.9
Dec	215	4356	337	364	476	112	3.0

Well G-4

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	161	2988	308	390	586	196	1.6
Feb	165	3026	305	389	582	193	1.6
Mar	193	3576	309	387	582	195	1.6
Apr	207	3748	302	389	582	193	1.6
May	258	4724	305	394	589	195	1.6
June	305	5327	291	394	591	197	1.5
July	443	7685	289	407	592	185	1.5
Aug	399	6885	287	413	589	176	1.6
Sept	334	5758	287	406	592	186	1.5
Oct	125	2131	282	403	594	191	1.5
Nov	168	3009	297	386	579	189	1.6
Dec	216	4033	310	387	573	186	1.7

APPENDIX A (cont)

Well G-5

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	161	5241	541	437	496	59	9.2
Feb	165	5326	536	437	496	59	9.1
Mar	193	6168	532	437	497	58	9.2
Apr	207	6570	529	438	497	59	9.0
May	258	8193	529	439	499	60	8.8
June	305	9547	522	442	502	60	8.7
July	448	13 757	512	451	514	63	8.1
Aug	399	12 164	508	457	516	59	8.6
Sept	343	10 619	516	448	510	62	8.3
Oct	126	3865	511	450	512	62	8.2
Nov	161	5098	525	434	494	60	8.7
Dec	---	---	---	438	498	60	---

Well G-6

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	---	---	---	573	---	---	---
Feb	---	---	---	---	---	---	---
Mar	---	---	---	---	---	---	---
Apr	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	219	3666	279	578	640	62	4.5
July	447	7868	293	587	646	59	4.9
Aug	353	6500	306	593	654	61	5.0
Sept	11	203	319	581	643	62	5.0
Oct	---	---	---	574	---	---	---
Nov	---	---	---	566	---	---	---
Dec	---	---	--	---	---	---	---

APPENDIX A (cont)

Well PM-1

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	136	4739	582	742	763	21	27.7
Feb	113	3947	583	742	764	22	26.5
Mar	118	4158	585	742	762	20	29.2
Apr	159	5639	589	742	765	23	25.6
May	197	6881	582	743	765	22	26.5
June	248	8842	594	743	767	24	24.8
July	362	12 978	595	748	771	23	25.8
Aug	293	10 501	596	749	771	22	27.1
Sept	268	9618	597	746	770	24	24.9
Oct	217	7727	593	746	769	23	28.8
Nov	122	4269	581	745	766	21	27.6
Dec	117	4105	584	744	765	21	27.8

Well PM-2

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	307	25 164	1365	870	923	53	25.7
Feb	249	20 458	1370	870	924	54	25.4
Mar	372	30 556	1366	871	927	56	24.4
Apr	426	34 888	1364	873	927	54	25.2
May	458	37 499	1365	872	928	56	24.4
June	442	36 026	1358	873	928	55	24.7
July	515	41 916	1355	875	930	55	24.6
Aug	414	33 787	1358	873	930	57	23.8
Sept	365	29 782	1359	873	929	56	24.3
Oct	383	31 307	1360	872	929	57	23.9
Nov	385	31 409	1360	873	927	54	25.2
Dec	355	28 984	1360	873	927	54	25.2

APPENDIX A (cont)

Well PM-3

1979

Month	Pump Time (h)	Pumpage (1000 gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down (ft)	Specific Capacity (gpm/ft)
Jan	138	11 468	1381	759	783	24	57.4
Feb	117	9736	1377	759	783	24	57.4
Mar	120	9926	1376	759	783	24	57.3
Apr	159	13 305	1388	758	783	25	55.5
May	198	16 508	1390	760	783	23	60.4
June	248	20 732	1393	760	784	24	58.0
July	362	30 369	1397	760	785	25	55.8
Aug	290	24 324	1395	761	785	24	58.1
Sept	268	22 485	1397	760	785	25	55.9
Oct	217	18 169	1391	760	785	25	55.6
Nov	125	10 427	1385	760	784	24	57.7
Dec	117	9741	1384	760	783	23	60.2

Water Canyon Gallery

1978

Month	Discharge Time (h)	Volume (1000 gal)	Discharge Rate (gpm)
Jan	744	3382	76
Feb	672	3330	83
Mar	744	1892	42
Apr	720	557	13
May	744	2292	51
June	720	3480	81
July	744	7554	169
Aug	744	6385	143
Sept	720	4435	103
Oct	744	3934	88
Nov	720	3653	85
Dec	744	3119	70

APPENDIX B

ANNUAL AQUIFER CHARACTERISTICS

WELL LA-1

Year	Pump Time (h)	Pumpage (million (gal)	Pump Rate (gpm)	Water Level Non Pump (ft)
1947	3468	54.0	259.5	---
1948	2988	34.7	193.6	---
1949	1361	26.7	327.0	---
1950	563	10.5	310.8	19.0
1951	1215	14.6	200.3	59.0
1952	286	3.4	198.1	40.0
1953	0	0.0	0.0	36.0
1954	0	0.0	0.0	44.0
1955	690	9.7	234.3	51.0
1956	39	0.0	0.0	33.0
1957	0	0.0	0.0	33.0
1958	0	0.0	0.0	10.0
1959	0	0.0	0.0	13.0
1960	0	0.0	0.0	13.0
1961	0	0.0	0.0	59.0
1962	0	0.0	0.0	84.0
1963	0	0.0	0.0	90.0
1964	0	0.0	0.0	95.0
1965	0	0.0	0.0	76.0
1966	0	0.0	0.0	70.0
1967	0	0.0	0.0	52.0
1968	0	0.0	0.0	42.0
1969	0	0.0	0.0	38.0
1970	0	0.0	0.0	37.0
1971	0	0.0	0.0	51.0
1972	0	0.0	0.0	49.0
1973	0	0.0	0.0	55.0
1974	0	0.0	0.0	53.0
1975	0	0.0	0.0	58.0
1976	0	0.0	0.0	69.0
1977	0	0.0	0.0	74.0
1978	0	0.0	0.0	68.0
1979	0	0.0	0.0	38.0

APPENDIX B (cont)

WELL LA-1B

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1960	415	36.3	1457.8	7.0	111.0	104.0	14.0
1961	3727	124.7	557.6	54.0	154.0	100.0	5.6
1962	3936	129.1	546.7	72.0	169.0	97.0	5.6
1963	3649	117.4	536.2	74.0	170.0	96.0	5.6
1964	4174	130.3	520.3	81.0	183.0	102.0	5.1
1965	3007	97.9	542.6	63.0	170.0	107.0	5.1
1966	2589	83.9	540.1	50.0	169.0	119.0	4.5
1967	2519	84.9	561.7	39.0	153.0	114.0	4.9
1968	2183	74.0	565.0	32.0	147.0	115.0	4.9
1969	2244	75.7	562.2	22.0	142.0	120.0	4.7
1970	2369	79.7	560.7	22.0	143.0	121.0	4.6
1971	2633	89.1	564.0	31.0	162.0	131.0	4.3
1972	2215	75.3	566.6	31.0	163.0	132.0	4.3
1973	2628	87.2	553.0	37.0	170.0	133.0	4.2
1974	2282	73.9	539.7	35.0	161.0	126.0	4.3
1975	2308	74.4	537.3	42.0	168.0	126.0	4.3
1976	2521	79.6	526.2	50.0	176.0	126.0	4.2
1977	2782	84.2	504.4	47.0	167.0	120.0	4.2
1978	2306	75.6	546.3	42.0	162.0	120.0	4.6
1979	1354	45.9	564.6	13.0	134.0	121.0	4.7

APPENDIX B (cont)

WELL LA-2

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1947	963	27.6	477.7	---	---	---	---
1948	3659	59.3	270.1	---	---	---	---
1949	1654	41.8	421.2	---	---	---	---
1950	614	15.6	423.5	59.0	285.0	226.0	1.9
1951	2415	57.7	398.2	111.0	305.0	194.0	2.1
1952	1980	46.3	389.7	101.0	300.0	199.0	2.0
1953	2201	47.2	357.4	100.0	301.0	201.0	1.8
1954	2601	56.8	364.0	116.0	---	---	---
1955	2223	49.4	370.4	110.0	---	---	---
1956	1805	44.2	408.1	84.0	---	---	---
1957	1066	29.6	462.8	53.0	277.0	224.0	2.1
1958	1166	31.1	444.5	60.0	270.0	210.0	2.1
1959	1599	40.7	424.2	71.0	303.0	232.0	1.8
1960	2169	51.6	396.5	76.0	305.0	229.0	1.7
1961	2149	44.4	344.3	101.0	313.0	212.0	1.6
1962	1823	35.7	326.4	111.0	314.0	203.0	1.6
1963	1999	40.7	339.3	127.0	332.0	205.0	1.7
1964	1924	34.2	296.3	137.0	347.0	210.0	1.4
1965	1911	39.8	347.1	121.0	330.0	209.0	1.7
1966	1070	21.4	333.3	108.0	340.0	232.0	1.4
1967	238	4.9	343.1	78.0	304.0	226.0	1.5
1968	502	11.3	375.2	64.0	305.0	241.0	1.6
1969	155	3.8	408.6	50.0	297.0	247.0	1.7
1970	341	7.2	351.9	59.0	310.0	251.0	1.4
1971	1787	31.8	296.6	88.0	318.0	230.0	1.3
1972	2189	39.3	299.2	96.0	322.0	226.0	1.3
1973	2625	46.7	296.5	106.0	334.0	228.0	1.3
1974	2033	36.8	301.7	109.0	325.0	216.0	1.4
1975	2310	40.2	290.0	103.0	320.0	217.0	1.3
1976	2488	39.9	267.3	113.0	322.0	209.0	1.3
1977	2775	42.5	255.3	118.0	314.0	196.0	1.3
1978	2299	39.5	286.4	112.0	338.0	226.0	1.3
1979	1353	26.2	323.0	75.0	316.0	241.0	1.3

WELL LA-3

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1947	1476	64.9	732.8	---	---	---	---
1948	3647	82.5	377.0	---	---	---	---
1949	1505	41.7	461.8	---	---	---	---
1950	2793	57.8	344.9	97.0	231.0	134.0	2.6
1951	3554	66.9	313.7	116.0	233.0	117.0	2.7
1952	2514	58.6	388.5	94.0	218.0	124.0	3.1
1953	3104	69.7	374.2	103.0	229.0	126.0	3.0
1954	2595	57.3	368.0	101.0	225.0	124.0	3.0
1955	2195	48.7	369.8	91.0	226.0	135.0	2.7
1956	1849	42.1	379.5	74.0	222.0	148.0	2.6
1957	1080	26.1	402.8	56.0	219.0	163.0	2.5
1958	1612	33.6	347.4	49.0	225.0	176.0	2.0
1959	1821	35.0	320.3	54.0	231.0	177.0	1.8
1960	2174	38.4	294.4	68.0	230.0	162.0	1.8
1961	1939	34.7	298.3	85.0	189.0	104.0	2.9
1962	2361	45.4	320.5	93.0	192.0	99.0	3.2
1963	2128	42.5	332.9	81.0	197.0	116.0	2.9
1964	2574	50.4	326.3	104.0	217.0	113.0	2.9
1965	1961	43.4	368.9	79.0	220.0	141.0	2.6
1966	2236	46.1	343.6	81.0	219.0	138.0	2.5
1967	2274	47.4	347.4	86.0	218.0	132.0	2.6
1968	2127	42.7	334.6	82.0	251.0	169.0	2.0
1969	2072	40.1	322.6	58.0	246.0	188.0	1.7
1970	2303	44.0	318.4	55.0	241.0	186.0	1.7
1971	2556	45.4	296.0	77.0	250.0	173.0	1.7
1972	2205	39.7	300.1	73.0	251.0	178.0	1.7
1973	977	20.3	346.3	65.0	248.0	183.0	1.9
1974	2291	43.5	316.5	73.0	244.0	171.0	1.9
1975	2306	43.3	313.0	80.0	253.0	173.0	1.8
1976	2474	42.3	285.0	88.0	260.0	172.0	1.7
1977	2779	47.3	283.7	89.0	248.0	159.0	1.8
1978	2308	42.4	306.4	87.0	250.0	163.0	1.9
1979	1343	28.1	348.1	58.0	243.0	185.0	1.9

WELL LA-4

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1948	1570	42.7	453.3	---	---	---	---
1949	940	37.5	664.9	---	---	---	---
1950	4350	164.9	631.8	278.0	353.0	75.0	8.4
1951	4909	173.6	589.4	285.0	357.0	72.0	8.2
1952	3429	119.6	581.3	267.0	339.0	72.0	8.1
1953	3034	109.1	599.3	264.0	335.0	71.0	8.4
1954	2133	78.2	611.0	255.0	329.0	74.0	8.3
1955	2647	94.5	595.0	268.0	341.0	73.0	8.2
1956	3402	120.2	588.9	273.0	346.0	73.0	8.1
1957	2844	105.4	617.7	270.0	345.0	75.0	8.2
1958	2973	110.3	618.3	270.0	342.0	72.0	8.6
1959	3084	113.5	613.4	275.0	346.0	71.0	8.6
1960	4084	145.6	594.2	296.0	365.0	69.0	8.6
1961	3687	129.7	586.3	296.0	365.0	69.0	8.5
1962	3688	129.3	584.3	286.0	359.0	73.0	8.0
1963	3718	130.5	585.0	280.0	351.0	71.0	8.2
1964	4500	155.0	574.1	291.0	361.0	70.0	8.2
1965	3110	111.4	597.0	279.0	349.0	70.0	8.5
1966	3279	115.6	587.6	285.0	356.0	71.0	8.3
1967	2127	77.1	604.1	278.0	350.0	72.0	8.4
1968	2276	81.7	598.3	280.0	351.0	71.0	8.4
1969	1694	61.8	608.0	282.0	358.0	76.0	8.0
1970	2333	83.5	596.5	286.0	363.0	77.0	7.7
1971	2519	89.0	588.9	287.0	373.0	86.0	6.8
1972	2322	82.6	592.9	282.0	367.0	85.0	7.0
1973	2616	92.4	588.7	294.0	377.0	83.0	7.1
1974	2306	82.2	594.1	286.0	367.0	81.0	7.3
1975	2319	82.3	591.5	272.0	355.0	83.0	7.1
1976	2802	98.2	584.1	277.0	373.0	96.0	6.1
1977	2741	96.4	586.2	278.0	374.0	96.0	6.1
1978	2248	80.1	594.2	271.0	368.0	97.0	6.1
1979	2964	104.6	587.9	280.0	376.0	96.0	6.1

APPENDIX B (cont)

WELL LA-5

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1948	1171	40.4	575.0	---	---	---	---
1949	1763	58.5	553.0	---	---	---	---
1950	4052	130.1	535.1	131.0	254.0	123.0	4.4
1951	6004	187.4	520.2	162.0	272.0	110.0	4.7
1952	3425	109.6	533.3	147.0	259.0	112.0	4.8
1953	3278	103.9	528.3	141.0	257.0	116.0	4.6
1954	2546	80.1	524.4	137.0	259.0	122.0	4.3
1955	3158	97.3	513.5	145.0	267.0	122.0	4.2
1956	3476	104.5	501.1	150.0	276.0	126.0	4.0
1957	2868	86.0	499.8	150.0	277.0	127.0	3.9
1958	3009	89.9	498.0	151.0	277.0	126.0	4.0
1959	3088	93.5	504.6	155.0	280.0	125.0	4.0
1960	4088	119.1	485.6	168.0	288.0	120.0	4.0
1961	3534	100.3	473.0	165.0	288.0	123.0	3.8
1962	3735	107.7	480.6	172.0	---	---	---
1963	3726	105.0	469.7	171.0	---	---	---
1964	4236	118.8	467.4	184.0	---	---	---
1965	1740	50.5	483.7	180.0	---	---	---
1966	2817	79.3	469.2	180.0	---	---	---
1967	2533	73.7	484.9	168.0	---	---	---
1968	2233	63.3	472.5	161.0	300.0	139.0	3.4
1969	2402	68.5	475.3	161.0	298.0	137.0	3.5
1970	2353	66.1	468.2	157.0	300.0	143.0	3.3
1971	2659	74.4	466.3	155.0	302.0	147.0	3.2
1972	2301	64.4	466.5	153.0	304.0	151.0	3.1
1973	2476	68.3	459.7	156.0	308.0	152.0	3.0
1974	1903	52.5	459.8	154.0	306.0	152.0	3.0
1975	2318	63.9	459.4	149.0	309.0	160.0	2.9
1976	2799	77.6	462.1	150.0	310.0	160.0	2.9
1977	2665	74.8	467.8	147.0	303.0	156.0	3.0
1978	2274	64.9	475.8	145.0	299.0	154.0	3.1
1979	2964	84.0	472.4	149.0	301.0	152.0	3.1

WELL LA-6

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1948	116	4.9	704.0	---	---	---	---
1949	2451	95.8	651.4	---	---	---	---
1950	4490	167.9	623.2	83.0	136.0	53.0	11.8
1951	5882	201.6	571.2	115.0	160.0	45.0	12.7
1952	3168	110.3	580.3	108.0	151.0	43.0	13.5
1953	3177	113.8	597.0	95.0	139.0	44.0	13.6
1954	2894	107.1	616.8	92.0	135.0	43.0	14.3
1955	2911	108.0	618.3	97.0	140.0	43.0	14.4
1956	3438	125.8	609.9	106.0	149.0	43.0	14.2
1957	2833	102.4	602.4	107.0	152.0	45.0	13.4
1958	2957	106.9	602.5	108.0	131.0	43.0	14.0
1959	3096	108.3	583.0	115.0	158.0	43.0	13.6
1960	4084	138.6	565.6	130.0	172.0	42.0	13.5
1961	3284	112.5	571.0	129.0	171.0	42.0	13.6
1962	3886	129.4	555.0	135.0	175.0	40.0	13.9
1963	2953	102.9	580.8	125.0	171.0	46.0	12.6
1964	4244	138.3	543.1	132.0	172.0	40.0	13.6
1965	3145	103.8	550.1	120.0	160.0	40.0	13.8
1966	3173	104.0	546.3	129.0	169.0	40.0	13.7
1967	2511	85.4	566.8	118.0	158.0	40.0	14.2
1968	2111	71.6	565.3	109.0	150.0	41.0	13.8
1969	2402	81.6	566.2	109.0	151.0	42.0	13.5
1970	2337	79.1	564.1	106.0	149.0	43.0	13.1
1971	2472	82.5	556.2	119.0	160.0	41.0	13.6
1972	2317	79.2	569.7	117.0	155.0	38.0	15.0
1973	2638	90.6	572.4	118.0	155.0	37.0	15.5
1974	2337	79.8	569.1	120.0	156.0	36.0	15.8
1975	1571	51.9	550.6	113.0	151.0	38.0	14.5
1976	175	5.1	485.7	96.0	---	---	---
1977	---	---	---	82.0	---	---	---
1978	33	1.1	572.7	77.0	142.0	65.0	8.8
1979	6	0.2	555.6	80.0	146.0	66.0	8.4

APPENDIX B (cont)

WELL G-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1950	0	2.8	0.0	195.0	---	---	---
1951	1168	37.7	538.0	202.0	309.0	107.0	5.0
1952	2476	75.5	508.2	213.0	295.0	82.0	6.2
1953	3275	97.3	495.2	221.0	292.0	71.0	7.0
1954	2616	77.8	495.7	221.0	290.0	69.0	7.2
1955	2406	70.5	488.4	226.0	295.0	69.0	7.1
1956	2958	83.2	468.8	235.0	303.0	68.0	6.9
1957	2098	55.9	444.1	236.0	307.0	71.0	6.3
1958	2460	68.1	461.4	238.0	308.0	70.0	6.6
1959	2952	82.4	465.2	245.0	314.0	69.0	6.7
1960	3564	96.0	448.9	254.0	325.0	71.0	6.3
1961	4236	112.4	442.2	260.0	333.0	73.0	6.1
1962	3431	93.6	454.7	258.0	342.0	84.0	5.4
1963	4519	114.9	423.8	265.0	348.0	83.0	5.1
1964	4374	113.8	433.6	269.0	352.0	83.0	5.2
1965	3530	90.7	428.2	268.0	352.0	84.0	5.1
1966	4074	102.6	419.7	269.0	363.0	94.0	4.5
1967	2615	69.9	445.5	266.0	362.0	96.0	4.6
1968	2996	78.9	438.9	264.0	366.0	102.0	4.3
1969	2657	68.3	428.4	266.0	376.0	110.0	3.9
1970	2712	64.7	397.6	264.0	377.0	113.0	3.5
1971	2908	67.9	389.2	258.0	378.0	120.0	3.2
1972	2865	66.1	384.5	264.0	389.0	125.0	3.1
1973	2997	67.5	375.4	271.0	403.0	132.0	2.8
1974	2767	62.3	375.3	283.0	412.0	129.0	2.9
1975	2467	55.7	376.3	293.0	411.0	118.0	3.2
1976	2962	65.1	366.3	---	---	---	---
1977	2734	57.9	353.0	275.0	426.0	151.0	2.3
1978	2656	56.0	351.4	270.0	419.0	149.0	2.4
1979	2998	61.7	342.9	271.0	422.0	151.0	2.3

WELL G-1A

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1954	108	4.6	709.9	---	---	---	---
1955	1531	53.0	577.0	265.0	316.0	51.0	11.3
1956	3130	107.7	573.5	273.0	323.0	50.0	11.5
1957	2470	87.0	587.0	274.0	327.0	53.0	11.1
1958	2670	92.5	577.4	279.0	331.0	52.0	11.1
1959	2965	102.7	577.3	284.0	333.0	49.0	11.8
1960	3641	122.8	562.1	291.0	342.0	51.0	11.0
1961	4297	147.3	571.3	298.0	350.0	52.0	11.0
1962	3972	136.1	571.1	295.0	344.0	49.0	11.7
1963	4525	149.7	551.4	301.0	350.0	49.0	11.3
1964	3852	129.3	559.4	302.0	353.0	51.0	11.0
1965	3505	116.5	554.0	302.0	353.0	51.0	10.9
1966	3964	133.4	560.9	306.0	355.0	49.0	11.4
1967	2720	91.3	559.4	302.0	351.0	49.0	11.4
1968	3089	103.2	556.8	302.0	352.0	50.0	11.1
1969	2695	90.7	560.9	303.0	356.0	53.0	10.6
1970	2772	92.5	556.2	300.0	357.0	57.0	9.8
1971	3313	111.8	562.4	303.0	361.0	58.0	9.7
1972	2879	94.0	544.2	302.0	361.0	59.0	9.2
1973	2760	87.9	530.8	302.0	362.0	60.0	8.8
1974	2974	92.7	519.5	307.0	355.0	48.0	10.8
1975	2740	85.3	518.9	304.0	351.0	47.0	11.0
1976	2983	91.6	511.8	302.0	350.0	48.0	10.7
1977	2942	88.7	502.5	302.0	350.0	48.0	10.5
1978	2631	77.9	493.5	300.0	345.0	45.0	11.0
1979	2974	88.0	493.9	301.0	345.0	44.0	11.0

APPENDIX B (cont)

WELL G-2

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1951	123	3.9	528.5	259.0	---	---	---
1952	2372	78.3	550.2	279.0	327.0	48.0	11.5
1953	3254	105.6	540.9	290.0	334.0	44.0	12.3
1954	2682	86.3	536.3	291.0	335.0	44.0	12.2
1955	2487	78.8	528.1	299.0	345.0	46.0	11.5
1956	3109	95.8	513.6	310.0	357.0	47.0	10.9
1957	2458	76.1	516.0	311.0	360.0	49.0	10.5
1958	2707	80.1	493.2	315.0	361.0	46.0	10.7
1959	2938	84.6	479.9	320.0	363.0	43.0	11.2
1960	3535	96.6	455.4	328.0	370.0	42.0	10.8
1961	3982	105.3	440.7	336.0	375.0	39.0	11.3
1962	4076	99.8	408.1	338.0	374.0	36.0	11.3
1963	4563	105.7	386.1	344.0	379.0	35.0	11.0
1964	4541	105.3	386.5	346.0	380.0	34.0	11.4
1965	3535	82.6	389.4	346.0	381.0	35.0	11.1
1966	3994	94.7	395.2	349.0	383.0	34.0	11.6
1967	2743	67.6	410.7	344.0	379.0	35.0	11.7
1968	2732	66.5	405.7	344.0	379.0	35.0	11.6
1969	2679	68.6	426.8	344.0	381.0	37.0	11.5
1970	2431	62.8	430.5	343.0	381.0	38.0	11.3
1971	3420	87.4	425.9	345.0	384.0	39.0	10.9
1972	2887	73.4	423.7	348.0	388.0	40.0	10.6
1973	2816	72.4	428.5	344.0	385.0	41.0	10.5
1974	3056	82.0	447.2	347.0	390.0	43.0	10.4
1975	2724	74.5	455.8	341.0	384.0	43.0	10.6
1976	2990	81.1	452.1	344.0	388.0	44.0	10.3
1977	2981	80.4	449.5	346.0	388.0	42.0	10.7
1978	2562	71.6	451.9	345.0	386.0	41.0	11.0
1979	2975	80.0	448.0	347.0	348.0	41.0	11.0

WELL G-3

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1951	192	7.3	633.7	281.0	---	---	---
1952	2379	65.4	458.2	310.0	358.0	48.0	9.5
1953	3192	76.4	398.9	322.0	360.0	38.0	10.5
1954	2675	66.1	411.8	322.0	370.0	48.0	8.6
1955	2369	69.4	488.3	316.0	368.0	52.0	9.4
1956	3149	87.9	465.2	324.0	380.0	56.0	8.3
1957	2517	70.2	464.8	324.0	385.0	61.0	7.6
1958	2562	69.5	452.1	323.0	386.0	63.0	7.2
1959	2931	74.6	424.2	326.0	395.0	69.0	6.1
1960	3591	82.5	382.9	335.0	407.0	72.0	5.3
1961	3612	79.9	368.7	343.0	414.0	71.0	5.2
1962	4057	83.7	343.9	348.0	418.0	70.0	4.9
1963	4555	86.7	317.2	352.0	422.0	70.0	4.5
1964	4487	78.6	292.0	355.0	424.0	69.0	4.2
1965	3498	65.6	312.6	350.0	419.0	69.0	4.5
1966	3991	73.7	307.8	353.0	420.0	67.0	4.6
1967	2752	52.9	320.4	344.0	418.0	74.0	4.3
1968	3086	56.5	305.1	341.0	418.0	77.0	4.0
1969	2672	50.8	316.9	338.0	417.0	79.0	4.0
1970	2736	55.4	337.5	336.0	419.0	83.0	4.1
1971	3337	64.2	320.6	342.0	423.0	81.0	4.0
1972	2838	50.9	298.9	341.0	421.0	80.0	3.7
1973	2843	47.3	277.3	341.0	418.0	77.0	3.6
1974	3006	49.3	273.3	342.0	424.0	82.0	3.3
1975	2632	43.1	272.9	341.0	428.0	87.0	3.1
1976	2971	82.6	463.4	374.0	462.0	88.0	5.3
1977	2961	78.9	444.1	368.0	463.0	95.0	4.7
1978	2590	66.4	427.5	360.0	458.0	98.0	4.4
1979	3014	69.0	381.6	360.0	465.0	105.0	3.6

WELL G-4

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1951	---	12.5	---	357.0	477.0	120.0	---
1952	2401	56.9	395.0	374.0	474.0	100.0	3.9
1953	2677	55.2	343.7	380.0	472.0	92.0	3.7
1954	2256	58.8	434.4	383.0	526.0	143.0	3.0
1955	1172	22.7	322.8	378.0	481.0	103.0	3.1
1956	1800	33.9	313.9	377.0	491.0	114.0	2.8
1957	1324	24.2	304.6	373.0	498.0	125.0	2.4
1958	1970	35.9	303.7	370.0	490.0	120.0	2.5
1959	1819	31.6	289.5	378.0	494.0	116.0	2.5
1960	2457	37.0	251.0	385.0	509.0	124.0	2.0
1961	2787	45.0	269.1	389.0	512.0	123.0	2.2
1962	2738	41.7	253.8	386.0	505.0	119.0	2.1
1963	3519	46.4	219.8	388.0	504.0	116.0	1.9
1964	3561	42.9	200.8	396.0	499.0	103.0	1.9
1965	2100	23.8	188.9	394.0	492.0	98.0	1.9
1966	2219	33.6	252.4	391.0	498.0	107.0	2.4
1967	2690	44.8	277.6	388.0	509.0	121.0	2.3
1968	2083	31.4	251.2	386.0	509.0	123.0	2.0
1969	1309	17.4	221.5	387.0	505.0	118.0	1.9
1970	606	7.7	211.8	384.0	504.0	120.0	1.8
1971	1640	21.0	213.4	389.0	503.0	114.0	1.9
1972	2840	33.3	195.4	391.0	507.0	116.0	1.7
1973	3006	37.2	206.3	392.0	521.0	129.0	1.6
1974	2672	34.3	213.9	392.0	519.0	127.0	1.7
1975	1977	41.0	345.6	403.0	559.0	156.0	2.2
1976	2859	57.8	336.9	406.0	571.0	165.0	2.0
1977	2954	62.4	352.1	406.0	589.0	183.0	1.9
1978	2607	49.5	316.5	398.0	589.0	191.0	1.7
1979	2974	52.9	296.4	395.0	586.0	191.0	1.6

WELL G-5

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1951	---	6.7	---	414.0	---	---	---
1952	2579	73.8	476.9	422.0	480.0	58.0	8.2
1953	1433	37.8	439.6	425.0	467.0	42.0	10.5
1954	2617	80.9	515.2	429.0	473.0	44.0	11.7
1955	2529	80.4	529.9	427.0	472.0	45.0	11.8
1956	3052	97.0	529.7	431.0	478.0	47.0	11.3
1957	2385	64.1	447.9	424.0	466.0	42.0	10.7
1958	1523	49.1	537.3	428.0	477.0	49.0	11.0
1959	2917	101.7	581.1	435.0	495.0	60.0	9.7
1960	2828	98.0	577.6	437.0	501.0	64.0	9.0
1961	3908	134.0	571.5	438.0	507.0	69.0	8.3
1962	4186	142.0	565.4	440.0	511.0	71.0	8.0
1963	4528	151.0	555.8	441.0	513.0	72.0	7.7
1964	4532	150.4	553.1	446.0	516.0	70.0	7.9
1965	3520	117.1	554.5	443.0	516.0	73.0	7.6
1966	2555	83.2	542.7	445.0	520.0	75.0	7.2
1967	2405	80.0	554.4	444.0	519.0	75.0	7.4
1968	2513	81.2	538.5	443.0	517.0	74.0	7.3
1969	2649	83.3	524.1	450.0	520.0	70.0	7.5
1970	2771	88.9	534.7	453.0	521.0	68.0	7.9
1971	2657	88.3	553.9	450.0	521.0	71.0	7.8
1972	2902	92.4	530.7	441.0	514.0	73.0	7.3
1973	3003	97.5	541.1	444.0	515.0	71.0	7.6
1974	2054	69.0	559.9	440.0	513.0	73.0	7.7
1975	2266	74.7	549.4	433.0	500.0	67.0	8.2
1976	2955	95.0	535.8	442.0	504.0	62.0	8.6
1977	2836	92.1	541.3	444.0	504.0	60.0	9.0
1978	2608	84.2	538.4	442.0	502.0	60.0	9.0
1979	2766	86.5	521.5	442.0	502.0	60.0	8.7

APPENDIX B (cont)

WELL G-6

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1964	1912	45.0	392.3	581.0	659.0	78.0	5.0
1965	3200	74.9	390.1	582.0	660.0	78.0	5.0
1966	3931	92.2	390.9	585.0	658.0	73.0	5.4
1967	2454	57.8	392.6	580.0	653.0	73.0	5.4
1968	2597	56.2	360.7	574.0	647.0	73.0	4.9
1969	2698	55.6	343.5	568.0	636.0	68.0	5.1
1970	2765	51.0	307.4	569.0	634.0	65.0	4.7
1971	2932	42.8	243.3	573.0	629.0	56.0	4.3
1972	2516	57.0	377.6	578.0	670.0	92.0	4.1
1973	2991	65.3	363.9	579.0	667.0	88.0	4.1
1974	2950	63.8	360.5	579.0	665.0	86.0	4.2
1975	2717	56.7	347.8	577.0	659.0	82.0	4.2
1976	2966	57.8	324.8	584.0	662.0	78.0	4.2
1977	2954	54.4	306.9	586.0	659.0	73.0	4.2
1978	2218	38.4	288.9	581.0	645.0	64.0	4.5
1979	1030	18.2	295.1	579.0	645.0	66.0	4.8

WELL PM-1

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump ft)	Draw Down	Specific Capacity (gpm/ft)
1965	2754	99.2	600.3	746.0	786.0	40.0	15.0
1966	3086	108.0	583.3	740.0	779.0	39.0	15.0
1967	2870	111.0	644.6	737.0	781.0	44.0	14.6
1968	1846	68.1	614.8	735.0	769.0	34.0	18.1
1969	951	34.4	602.9	733.0	766.0	33.0	18.3
1970	1781	66.2	619.5	733.0	769.0	36.0	17.2
1971	2728	101.0	617.1	733.0	766.0	33.0	18.7
1972	2415	84.9	585.9	735.0	762.0	27.0	21.7
1973	1688	46.5	459.1	736.0	755.0	19.0	24.2
1974	2649	96.3	605.9	740.0	768.0	28.0	21.6
1975	2567	94.8	615.5	741.0	766.0	25.0	24.6
1976	2933	106.8	606.9	744.0	767.0	23.0	26.4
1977	2969	105.4	591.7	745.0	767.0	22.0	26.9
1978	2544	90.6	593.3	745.0	767.0	22.0	27.0
1979	2350	83.4	591.5	744.0	766.0	22.0	26.9

APPENDIX B (cont)

WELL PM-2

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1966	221	18.9	1425.3	826.0	889.0	63.0	22.6
1967	4336	370.0	1422.2	834.0	888.0	54.0	26.3
1968	3865	328.2	1415.3	838.0	889.0	51.0	27.8
1969	3304	279.9	1411.9	838.0	890.0	52.0	27.2
1970	3529	300.6	1419.7	839.0	893.0	54.0	26.3
1971	4035	339.5	1402.3	841.0	898.0	57.0	24.6
1972	4611	385.3	1392.7	845.0	902.0	57.0	24.4
1973	4571	380.6	1387.7	849.0	907.0	58.0	23.9
1974	5443	450.9	1380.7	853.0	912.0	59.0	23.4
1975	4644	385.3	1382.8	854.0	913.0	59.0	23.4
1976	5382	442.0	1368.8	866.0	924.0	58.0	23.6
1977	3306	272.8	1375.3	868.0	924.0	56.0	24.6
1978	4743	388.4	1364.9	871.0	928.0	57.0	23.9
1979	4671	381.8	1362.2	872.0	924.0	52.0	26.2

WELL PM-3

Year	Pump Time (h)	Pumpage (million gal)	Pump Rate (gpm)	Water Level Non Pump (ft)	Water Level Pump (ft)	Draw Down	Specific Capacity (gpm/ft)
1968	2327	187.4	1342.2	743.0	771.0	28.0	47.9
1969	3241	254.7	1309.8	746.0	772.0	26.0	50.4
1970	2905	227.8	1306.9	750.0	774.0	24.0	54.5
1971	2774	216.3	1299.6	751.0	774.0	23.0	56.5
1972	2445	192.1	1309.5	752.0	775.0	23.0	56.9
1973	3256	257.8	1319.6	755.0	778.0	23.0	57.4
1974	3241	255.3	1312.9	756.0	779.0	23.0	57.1
1975	3421	269.3	1312.0	757.0	780.0	23.0	57.0
1976	3171	268.3	1410.2	758.0	784.0	26.0	54.2
1977	2792	235.5	1405.8	758.0	784.0	26.0	54.1
1978	2516	211.0	1397.6	759.0	784.0	25.0	55.9
1979	2359	197.2	1393.0	760.0	784.0	24.0	58.0

WATER CANYON GALLERY

Year	Pump Time (h)	Pumpage (million gal)	Rate (gpm)
1947	8760	84.0	159.8
1948	8784	97.0	184.0
1949	8760	92.0	175.0
1950	8760	54.0	102.7
1951	8760	39.0	74.2
1952	8784	48.0	91.1
1953	8760	39.0	74.2
1954	8760	40.0	76.1
1955	8760	33.0	62.8
1956	8784	23.0	43.6
1957	8760	40.0	76.1
1958	8760	60.0	114.2
1959	8760	54.0	102.7
1960	8784	48.0	91.1
1961	8760	54.0	102.7
1962	8760	67.0	127.5
1963	8760	51.0	97.0
1964	8784	45.0	85.4
1965	8760	72.0	137.0
1966	8760	82.0	156.0
1967	8760	56.0	106.5
1968	8784	65.0	123.3
1969	8760	80.0	152.2
1970	8760	65.0	123.7
1971	8760	37.0	70.4
1972	8784	40.0	75.9
1973	8760	49.0	93.2
1974	8760	35.0	66.6
1975	8760	42.0	79.9
1976	8784	41.0	77.8
1977	8760	57.0	108.4
1978	8760	45.0	86.2
1979	8760	44.0	83.7

APPENDIX C

CHEMICAL QUALITY OF WATER FROM WELLS AND DISTRIBUTION SYSTEMS

(concentration in mg/ℓ, one analysis)

Location	SiO_2	Ca	Mg	K	Na	CO_3	HCO_3	PO_4	SO_4	Cℓ	TDS	Hard	pH	Cond (mS/m)
Los Alamos Well Field														
Well LA-1B	26	5	<1	2.9	154	0	354	<0.1	36	15	588	30	8.5	64
Well LA-2	23	5	<1	1.3	58	0	127	<0.1	13	12	280	25	9.0	28
Well LA-3	26	9	<1	1.8	31	0	132	0.1	7	3	206	40	8.8	16
Well LA-4	29	8	<1	2.2	18	0	88	0.1	3	2	138	25	8.8	15
Well LA-5	29	5	<1	1.5	32	0	98	<0.1	4	2	184	25	9.1	15
Guaje Well Field														
Well G-1	62	7	<1	3.1	21	0	100	2.0	4	2	230	30	8.7	15
Well G-1A	56	6	<1	3.0	25	0	90	2.0	4	2	218	15	8.8	15
Well G-2	50	6	<1	2.8	39	0	151	2.0	4	3	262	25	8.9	19
Well G-3	40	7	1	1.9	22	0	95	2.0	3	2	212	30	8.7	15
Well G-4	34	10	3	2.0	14	0	80	2.0	3	2	156	50	8.7	15
Well G-5	31	10	4	2.1	11	0	88	2.0	4	3	158	60	8.6	15
Well G-6														
Pajarito Well Field														
PM-1	32	14	6	3.6	20	0	136	3.0	5	6	234	85	8.5	24
PM-2	54	5	3	2.2	11	0	71	2.0	2	2	160	30	8.4	12
PM-3	70	13	8	3,6	17	0	149	<0.1	6	7	224	30	8.4	25
Water Canyon														
Gallery	74	4	3	2	4	0	34	2.0	10	1	96	40	7.8	8
No. of Analyses	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Minimum	23	4	<1	1.3	4	0	34	<0.1	2	1	96	15	7.8	8
Maximum	74	14	8	3.6	154	---	354	3.0	36	15	588	85	9.0	64
Average	42 ± 34	8 ± 6	2 ± 4	2.4 ± 1.4	32 ± 73	0	120 ± 144	1.3 ± 2.1	7 ± 17	4 ± 8	223 ± 224	36 ± 35	8.7 ± 0.6	20 ± 26
Distribution														
Fire Station 1	64	5	3	2.1	10	0	76	2.0	2	2	190	45	8.4	12
Fire Station 2	37	7	<1	2.1	34	0	129	2.0	6	4	228	35	8.8	20
Fire Station 3	38	14	7	3.7	19	0	137	0.1	6	8	262	90	8.4	26
Fire Station 4	50	8	2	2.2	18	0	90	<0.1	4	3	210	45	8.7	20
Fire Station 5	32	6	2	2.2	28	0	95	0.1	6	4	200	25	8.5	17
No. of Analyses	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Minimum	32	5	<1	2.1	10	0	76	<0.1	2	2	190	25	8.4	12
Maximum	64	14	7	3.7	34	---	137	2.0	6	8	262	90	8.7	26
Average	44 ± 26	8 ± 7	3 ± 5	2.5 ± 1.4	22 ± 19	0	105 ± 53	0.9 ± 2.1	5 ± 4	4 ± 5	218 ± 57	48 ± 50	8.6 ± 0.4	19 ± 10
Los Alamos Well LA-6[a]	25	2	<1	1.2	71	0	190	<0.1	6	3	298	5	9.2	31

[a]Los Alamos Well LA-6 on stand by; not used (see LA-7012-MS).

APPENDIX D

QUALITY OF WATER REQUIRED FOR MUNICIPAL USE

(concentrations in mg/ℓ, one analysis)

Location	Ag	As	Ba	Cd	Cr	F	Hg	NO_3	Pb	Se
Los Alamos Well Field										
Well LA-1B	<0.001	0.05	<0.5	<0.01	0.02	2.8	<0.0005	<2	<0.01	<0.005
Well LA-2	<0.001	<0.01	<0.5	<0.01	0.02	1.2	<0.0005	<2	<0.01	<0.005
Well LA-3	<0.001	<0.01	<0.5	<0.01	0.01	0.6	<0.0005	<2	<0.01	<0.005
Well LA-4	<0.001	<0.01	<0.5	<0.01	<0.01	0.3	<0.0005	<2	<0.01	<0.005
Well LA-5	<0.001	0.04	<0.5	<0.01	<0.01	0.8	<0.0005	<2	<0.01	<0.005
Guaje Well Field										
Well G-1	<0.001	<0.01	<0.5	<0.01	<0.01	0.4	<0.0005	<2	<0.01	<0.005
Well,G-1A	<0.001	<0.01	<0.5	<0.01	<0.01	0.5	<0.0005	<2	<0.01	<0.005
Well G-2	<0.001	0.04	<0.5	<0.01	<0.01	1.2	<0.0005	<2	<0.01	<0.005
Well G-3	<0.001	<0.01	<0.5	<0.01	<0.01	0.4	<0.0005	<2	0.01	<0.005
Well G-4	<0.001	<0.01	<0.5	<0.01	<0.01	0.3	<0.0005	<2	0.01	<0.005
Well G-5	<0.001	<0.01	<0.5	<0.01	<0.01	0.3	<0.0005	<2	<0.01	<0.005
Well G-6	0.001	<0.01	<0.5	<0.01	<0.01	---	<0.0005	---	0.19	<0.005
Pajarito Well Field										
Well PM-1	<0.001	<0.01	<0.5	<0.01	<0.01	0.3	<0.0005	<2	<0.01	<0.005
Well PM-2	<0.001	<0.01	<0.5	<0.01	<0.01	0.3	<0.0005	<2	<0.01	<0.005
Well PM-3	<0.001	<0.01	<0.5	<0.01	<0.01	0.4	<0.0005	<2	<0.01	<0.005
Water Canyon										
Gallery	<0.001	<0.01	<0.5	<0.01	<0.01	0.2	<0.0005	<2	<0.01	<0.005
No. of Analyses	16	16	16	16	16	15	16	15	16	16
Minimum	<0.001	<0.01	<0.5	<0.01	<0.01	0.2	<0.0005	<2	<0.01	<0.005
Maximum	---	0.05	---	---	0.02	2.8	---	---	0.19	---
Average	<0.001	<0.01 ± 0.02	<0.5	<0.01	<0.01 ± 0.01	0.7 ± 1.3	<0.0005	<2	0.02 ± 0.09	<0.005
Distribution										
Fire Station 1	<0.001	<0.01	<0.5	<0.01	0.006	0.3	<0.0005	<2	<0.01	<0.005
Fire Station 2	<0.001	0.01	<0.5	<0.01	0.008	0.7	<0.0005	<2	<0.01	<0.005
Fire Station 3	<0.001	<0.01	<0.5	<0.01	0.003	1.0	<0.0005	<2	<0.01	<0.005
Fire Station 4	<0.001	<0.01	<0.5	<0.01	0.004	0.4	<0.0005	<2	<0.01	<0.005
Fire Station 5	<0.001	<0.01	<0.5	<0.01	<0.002	0.6	<0.0005	<2	<0.01	<0.005
No. of Analyses	5	5	5	5	5	5	5	5	5	5
Minimum	<0.001	<0.01	<0.5	<0.01	<0.002	0.3	<0.0005	<2	<0.01	<0.005
Maximum	---	0.01	---	---	0.008	1.0	---	---	---	---
Average	<0.001	<0.01 ± 0.00	<0.5	<0.01	<0.005 ± 0.005	0.6 ± 0.6	<0.0005	<2	<0.01	<0.005
USEPA and NMEIA MPL	0.05	0.05	1.0	0.01	0.05	2.0	0.002	45	0.05	0.01
Los Alamos Well LA-6*	<0.001	0.23	<0.5	<0.01	0.016	2.2	<0.0005	2.2	0.006	<0.005

*Los Alamos Well LA-6 on stand by; not used (see LA-7012-MS).

APPENDIX E

RADIOCHEMICAL AND CHEMICAL QUALITY OF WATER FROM MUNICIPAL SUPPLY AND DISTRIBUTION

Location	No. of Analyses	Radiochemical						
		^{3}H (10^{-6} μCi/mℓ)	^{137}Cs (10^{-9} μCi/mℓ)	^{238}Pu (10^{-9} μCi/mℓ)	^{239}Pu (10^{-9} μCi/mℓ)	Gross α (10^{-9} μCi/mℓ)	Gross β (10^{-9} μCi/mℓ)	Total U (μg/ℓ)
Los Alamos Well Field								
Well LA-1B	1	0.1 ± 0.6	0 ± 40	−0.04 ± 0.03	−0.03 ± 0.03	9.0 ± 6.0	5.8 ± 2.2	6.2 ± 1.2
Well LA-2	1	−0.4 ± 0.6	27 ± 30	−0.01 ± 0.02	0.00 ± 0.01	2.1 ± 2.2	5.5 ± 2.0	3.7 ± 0.8
Well LA-3	1	0.4 ± 0.6	35 ± 36	−0.02 ± 0.02	0.00 ± 0.02	0.9 ± 1.8	4.4 ± 1.8	2.1 ± 0.8
Well LA-4	1	0.0 ± 0.6	0 ± 12	−0.01 ± 0.03	0.00 ± 0.02	−0.8 ± 1.4	2.5 ± 1.6	0.9 ± 0.8
Well LA-5	1	0.2 ± 0.6	20 ± 80	−0.01 ± 0.02	0.00 ± 0.02	−0.01 ± 1.6	6.5 ± 2.0	[illegible].8 ± 0.8
Guaje Well Field								
Well G-1	1	−0.01 ± 0.6	40 ± 60	−0.04 ± 0.04	−0.01 ± 0.02	−0.8 ± 1.4	3.7 ± 1.6	0.7 ± 0.8
Well G-1A	1	0.1 ± 0.6	−4 ± 26	0.01 ± 0.03	−0.02 ± 0.03	−0.4 ± 1.4	4.0 ± 1.8	0.7 ± 0.8
Well G-2	1	−0.2 ± 0.6	0 ± 40	−0.03 ± 0.03	0.00 ± 0.02	−0.5 ± 1.6	4.4 ± 1.8	1.4 ± 0.8
Well G-3	1	0.0 ± 0.6	0 ± 40	0.00 ± 0.01	0.00 ± 0.01	−1.4 ± 1.4	3.1 ± 1.6	1.5 ± 0.8
Well G-4	1	−0.3 ± 0.6	20 ± 28	0.00 ± 0.03	−0.02 ± 0.03	−0.3 ± 1.2	3.3 ± 1.6	1.0 ± 0.8
Well G-5	1	0.3 ± 0.6	15 ± 14	−0.02 ± 0.03	0.00 ± 0.01	0.3 ± 1.4	2.5 ± 1.6	1.8 ± 0.8
Pajarito Well Field								
Well PM-1	1	0.5 ± 0.6	20 ± 80	−0.01 ± 0.03	−0.01 ± 0.03	1.1 ± 1.8	4.7 ± 2.0	2.2 ± 0.8
Well PM-2	1	0.8 ± 0.6	9 ± 38	−0.01 ± 0.03	−0.01 ± 0.02	0.0 ± 1.2	2.8 ± 1.6	0.4 ± 0.8
Well PM-3	1	0.5 ± 0.6	10 ± 40	−0.01 ± 0.02	−0.01 ± 0.01	−0.2 ± 1.8	4.2 ± 1.8	1.0 ± 0.8
Water Canyon								
Gallery	1	0.3 ± 0.6	−4 ± 26	0.00 ± 0.03	0.00 ± 0.03	−0.7 ± 1.0	5.0 ± 1.8	0.4 ± 0.8
No. of Analyses		15	15	15	15	15	15	15
Minimum		−0.4 ± 0.6	−4 ± 26	−0.04 ± 0.04	−0.03 ± 0.03	−1.4 ± 1.4	2.5 ± 1.6	0.4 ± 0.8
Maximum		0.8 ± 0.6	40 ± 60	0.01 ± 0.03	0.00 ± 0.02	9.0 ± 6.0	5.8 ± 2.2	6.2 ± 1.2
Average		0.2 ± 0.7	13 ± 28	−0.01 ± 0.03	−0.01 ± 0.02	0.6 ± 5.0	4.2 ± 2.4	1.7 ± 3.0
Distribution								
Fire Station 1	2	0.6 ± 1.3	0 ± 28	0.00 ± 0.05	−0.01 ± 0.04	0.1 ± 0.6	2.8 ± 0.1	0.8 ± 1.0
Fire Station 2	2	0.7 ± 0.3	4 ± 40	0.00 ± 0.01	−0.01 ± 0.03	1.0 ± 0.6	3.4 ± 3.0	3.1 ± 0.6
Fire Station 3	2	0.5 ± 0.3	0 ± 0	0.00 ± 0.00	0.00 ± 0.01	0.9 ± 0.6	4.4 ± 3.1	1.3 ± 1.4
Fire Station 4	2	0.4 ± 0.1	30 ± 0	−0.01 ± 0.01	0.00 ± 0.01	−0.2 ± 2.2	2.7 ± 1.7	0.6 ± 1.6
Fire Station 5	2	0.5 ± 0.6	2 ± 35	−0.01 ± 0.03	−0.01 ± 0.03	0.4 ± 1.0	3.3 ± 2.7	1.1 ± 3.1
No. of Analyses		10	10	10	10	10	10	10
Minimum		0.1 ± 0.6	−10 ± 80	−0.02 ± 0.03	−0.02 ± 0.04	−0.9 ± 0.7	2.1 ± 1.2	0.0 ± 0.8
Maximum		1.0 ± 0.6	30 ± 60	0.01 ± 0.02	0.01 ± 0.03	1.2 ± 0.6	5.5 ± 2.0	3.3 ± 0.8
Average		0.5 ± 0.5	7 ± 31	0.00 ± 0.02	0.00 ± 0.02	0.5 ± 1.3	3.4 ± 2.2	1.4 ± 2.3
Los Alamos Well LA-6[a]	1	0.2 ± 0.6	50 ± 60	0.00 ± 0.03	−0.01 ± 0.01	−1.1 ± 2.0	3.1 ± 1.8	2.0 ± 0.8

[a]Los Alamos Well LA-6 on standby; not used (see LA-7012-MS).

Note: ± value represents twice the standard deviation of the distribution of observed values unless only one analysis is reported, then the value represents twice the uncertainty term for that analysis.