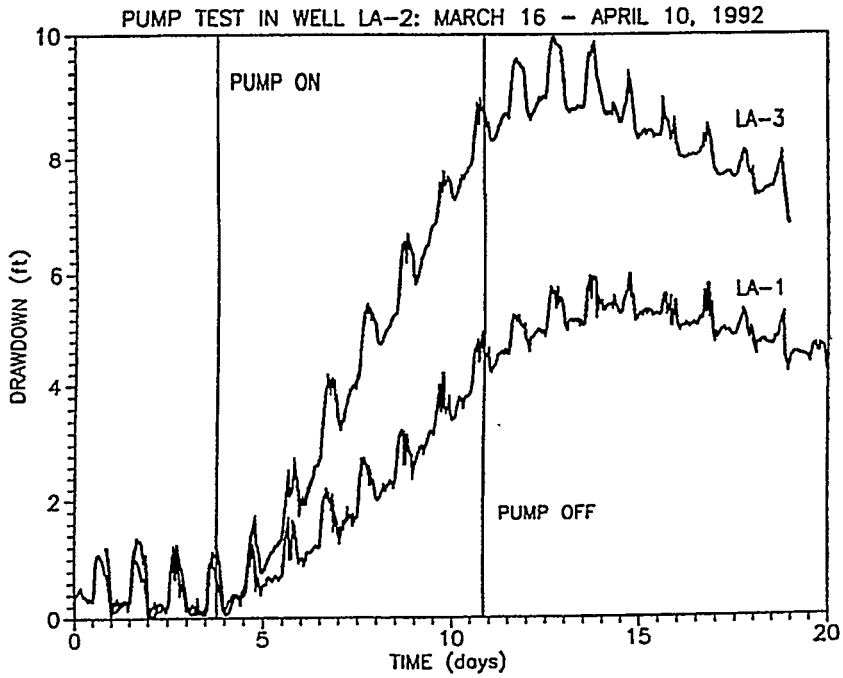
LA-12926-PR
Progress Report

Water Supply at Los Alamos during 1992



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The four most recent reports in this series, unclassified, are LA-11679-PR, LA-12276-PR, LA-12471-PR, and LA-12770-PR.

Cover Illustration: *The graph depicts measured water levels in observation wells during a pump test of a supply well. The periodic variations on the main curves show the combined effect of lunar earth tides and barometric pressure variations.*

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Water Supply at Los Alamos during 1992

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Los Alamos
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WATER SUPPLY AT LOS ALAMOS DURING 1992

by

W. D. Purtymun, S. G. McLin, A. K. Stoker, and M. N. Maes

ABSTRACT

Municipal potable water supply during 1992 was 1,516 × 10^6 gallons from wells in the Guaje and Pajarito well fields. About 13 × 10^6 gallons were pumped from the Los Alamos Well Field and used in the construction of State Road 501 adjacent to the field. The last year the Los Alamos Field was used for municipal supply was 1991. The nonpotable water supply used for steam plant support was about 0.12 × 10^6 gallons from the spring gallery in Water Canyon. No nonpotable water was used for irrigation from Guaje and Los Alamos Reservoirs. Thus, the total water usage in 1992 was about 1,529 × 10^6 gallons. Neither of the two new wells in the Otowi Well Field were operational in 1992.

I. INTRODUCTION

This report summarizes production and aquifer conditions for water wells in the Guaje and Pajarito well fields (Figure 1). These wells supplied all of the potable water used for municipal purposes and some industrial purposes in Los Alamos County and Los Alamos National Laboratory (LANL or the Laboratory) during 1992. Only one well (LA-2) in the Los Alamos Well Field was operational in 1992. Water from that well was used for construction of the new road adjacent to the field. An aquifer test was performed on the well during pumpage to support construction. Ownership of the wells in the Los Alamos Well Field was transferred to San Ildefonso Pueblo in 1992. The two new wells in the Otowi Well Field were not operational in 1992. The spring gallery in Water Canyon supplies nonpotable water for industrial use. Surface water from the Guaje and Los Alamos Reservoirs is generally used for irrigation; however, in 1992 no water was diverted from the reservoirs.

This report is the result of a joint effort between the Laboratory Environmental Protection Group and the Utilities Department of Johnson Controls World Services Inc. (JCI). The purpose of this report is to provide a continuing historical record and to provide guidance for the management of water resources in long-range planning for the water supply system. We have issued one summary report for the period of 1947–1971 and 21 annual reports that contain the results of our studies of these water supplies.[1–22] An additional report summarized the hydrology of the main aquifer with reference to future development of groundwater supplies.[23] A report was issued in 1988 to examine the current status of wells and future water supply.[24] On the basis of that report, two new supply wells were drilled in 1989–1990.

JCI, the support contractor to the Laboratory and the Department of Energy (DOE) at Los Alamos, maintains and operates the water supply system. Water from the system is sold to the county, for distribution to the communities of Los Alamos and White Rock, and to the National Park Service for water needs at Bandelier National Monument.

After the potable water is pumped from the wells into the distribution lines, it is lifted by booster pumps into reservoirs (tanks) for storage and distribution. The entire water supply is disinfected before distribution to Los Alamos, White Rock, Bandelier National Monument, and Laboratory areas. The

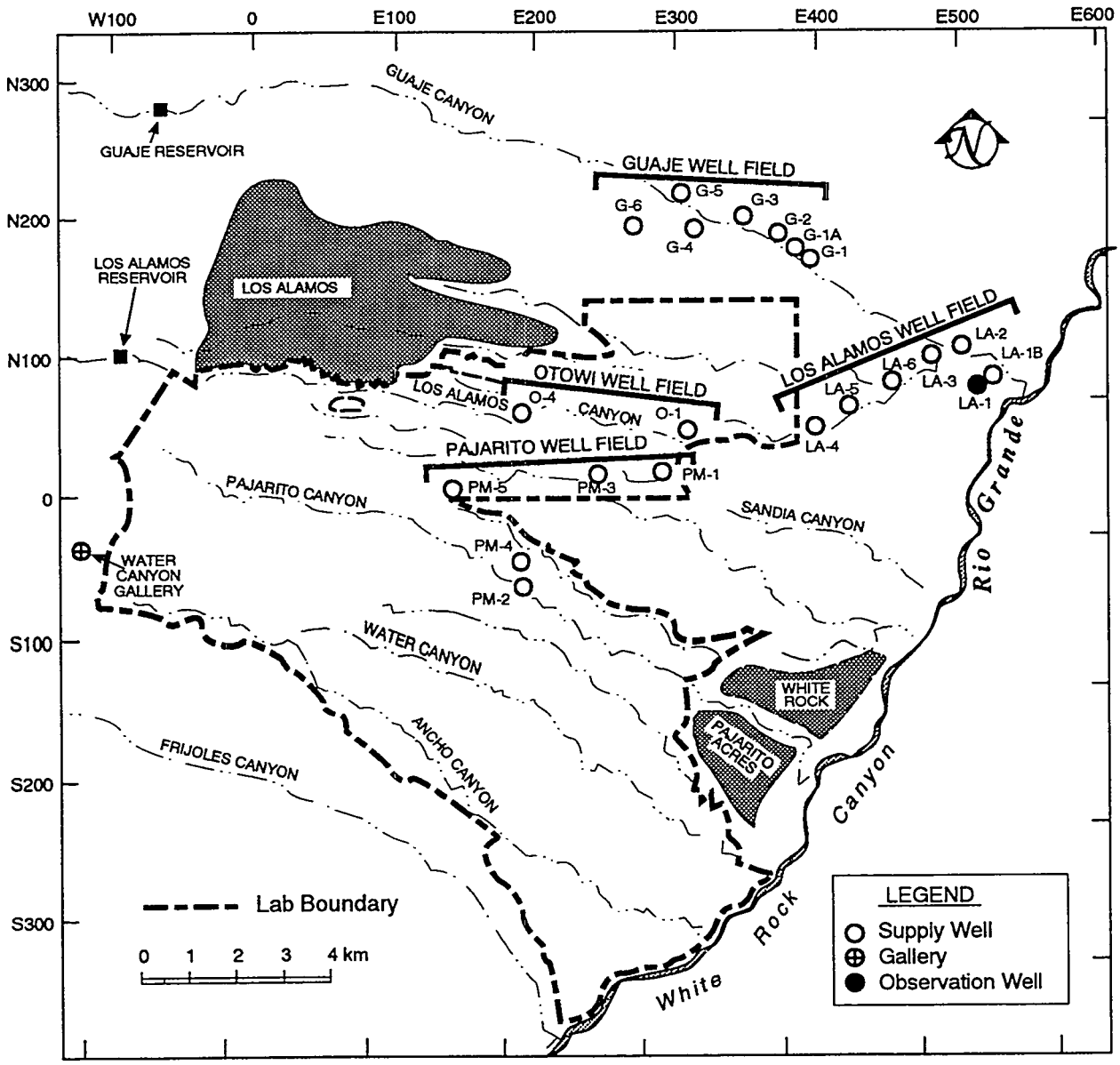

Figure 1. Locations of reservoirs, well fields, water supply wells, and gallery water supply. Letter designations on the figure indicate wells in the Guaje (G), Pajarito (PM), Los Alamos (LA), and Otowi (O) Well Fields.

nonpotable water for industrial use at TA-16 flows by gravity from the gallery in Water Canyon to the steam plant. The transmission line from the gallery to the steam plant is separate from those used for the potable supply.

JCI collects data on the hours of operation for each well, records of daily and monthly water production, and continuous circular charts of water levels. Monthly production records are transmitted to the New Mexico State Engineer Office in compliance with the DOE Water Rights Permit. The monthly average of nonpumping and pumping water levels is computed from air line pressure or transducer data recorded at each well. These data are used by the Environmental Protection Group to calculate the pumping rates, drawdown, and other well field statistics that are included in this report. The Appendix contains annual pumping and production information for each water supply well and the gallery for the period of record.

During 1992, water for the Laboratory, the communities of Los Alamos and White Rock, and Bandelier National Monument was supplied from 11 deep wells in 2 well fields. The well fields are located on the Pajarito Plateau and in Guaje Canyon east of the plateau (Figure 1). The wells are completed in the main aquifer of the Los Alamos area, the only aquifer capable of municipal and industrial water supply. The piezometric surface of the main aquifer ranges from near ground level (artesian) in the well field in lower Los Alamos Canyon to about 760 ft along the eastern edge of the plateau to more than 1,200 ft near the center of the plateau at Well PM-5. Water in the aquifer moves eastward beneath the plateau to the Rio Grande, where a part is discharged into the river through seeps and springs and the rest is retained within the aquifer.

The Water Canyon gallery, which is located west of the Laboratory on the flanks of the Sierra de los Valles, discharges water from a small aquifer perched in the volcanic rocks (Figure 1).

II. WELL FIELD CHARACTERISTICS

Production from the 3 well fields increased 81×10^6 gallons, from $1{,}448 \times 10^6$ gallons in 1991 to $1{,}529 \times 10^6$ gallons in 1992 (Table 1). The months of heaviest production in 1992 were June, July, and September. The production during these months was 511×10^6 gallons, a decrease of 12×10^6 gallons for a similar period of heavy production in 1991. The months of lightest production were February, November, and December, with production of 260×10^6 gallons, the same amount that was used for a similar period in 1991.

The peak demand period for 1992 was a nine-day period from July 1 to 9, with a total production of 73.9×10^6 gallons (Table 2). The demand period in 1992 was longer than in 1991 and required about 8.2×10^6 gallons per day (gpd) compared to 7.6×10^6 gallons in 1991.

Although cumulative well field production has remained fairly constant for more than 20 years (Table 1), it does not reflect the changes in the proportionate contributions of the different well fields. Production generally declines with the age of a well field. The production from the Los Alamos Well Field peaked in 1951 as the wells in the Guaje Well Field became operational (Table 1). Production from the Guaje Well Field peaked in 1964 as the wells in the Pajarito Well Field began producing. The last year of municipal supply from the Los Alamos Well Field was in 1991. As a result the loss of production from the Los Alamos Well Field, production from the Pajarito Well Field was increased substantially in 1992 (Table 3).

The present yield generally reflects the distribution of production with the loss of the Los Alamos Well Field: about 29% from the Guaje Well Field and 71% from the Pajarito Well Field (Table 3).

The difference in demand between periods of heavy and light production (i.e., summer and winter) is primarily attributed to landscape irrigation. The water levels in the wells respond accordingly, with the highest water levels observed during months of least production and the lowest water levels occurring during months of greatest production.

Table 1. Production of Potable Water from Wells and Gallery, 1947–1992 (in Millions of Gallons)

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	1,111
1961	546	624	0	54	1,224
1962	577	597	0	67	1,241
1963	539	654	0	51	1,244
1964	627	665	0	45	1,337
1965	447	571	99	72	1,189
1966	450	613	127	82	1,272
1967	373	464	481	56	1,374
1968	345	474	584	65	1,468
1969	331	435	569	80	1,415
1970	360	423	595	65	1,443
1971	412	484	657	37	1,590
1972	380	467	662	40	1,549
1973	406	475	685	49	1,615
1974	369	453	802	35	1,659
1975	356	431	749	42	1,578
1976	343	531	817	41	1,732
1977	345	515	614	57	1,531
1978	302	444	690	45	1,481
1979	289	456	662	44	1,451
1980	339	485	743	32	1,599
1981	336	469	701	45	1,551
1982	317	422	773	46	1,558
1983	221	338	904	38	1,501
1984	326	460	780	34	1,600
1985	290	456	841	37	1,624
1986	179	460	858	28	1,525
1987	217	485	892	34	1,628
1988	158	477	824	—[a]	1,459
1989	219	506	961	—[a]	1,686
1990	187	532	923	—[a]	1,642
1991	125	502	820	—[a]	1,447
1992	13	472	1,044	—[a]	1,529
Total	16,445	19,672	19,857	2,129	58,103

[a]Water Canyon Gallery no longer a potable water supply (see nonpotable production, Table 6).

Table 2. Peak Demand Periods 1982–1992

	Demand Period							
	June 29–July 16 1985	July 28–August 10 1986	July 2–July 17 1987	June 18–June 26 1988	June 18–July 11 1989	May 31–July 3 1990	June 24–June 29 1991	July 1–July 9 1992
No. of days	18	14	16	9	24	34	6	9
Total production (gal.)	138×10^6	91×10^6	134×10^6	63×10^6	216×10^6	297×10^6	45.8×10^6	73.9×10^6
Average daily production (gal.)	7.7×10^6	6.5×10^6	8.4×10^6	7.0×10^6	9.0×10^6	8.7×10^6	7.6×10^6	8.2×10^6
$>10 \times 10^6$ gal.	—	—	—	—	4	8	—	—
$>9 \times 10^6$ gal.	3	—	4	—	9	13	—	2
$>8 \times 10^6$ gal.	4	2	7	2	10	3	4	3
$>7 \times 10^6$ gal.	9	2	4	3	0	4	—	4
$<7 \times 10^6$ gal.	2	10	1	4	1	6	2	—

Table 3. Well Production Characteristics for 1991 and 1992

	Production					
	Amount (10^6 gal.)		Well Field (%)		Total Production (%)	
	1991	1992	1991	1992	1991	1992
Los Alamos Field						
Well LA-1	—	—	—	—	—	—
Well LA-1B	50.4	—	40	—	3	—
Well LA-2	32.7	13.4	26	100	2	<1
Well LA-3	23.4	—	19	—	2	—
Well LA-4	—	—	—	—	—	—
Well LA-5	18.5	—	15	—	1	—
Well LA-6	—	—	—	—	—	—
Subtotal	125.0	13.4	100	100	9	<1
Guaje Field						
Well G-1	20.9	12.0	4	3	1	<1
Well G-1A	150.2	134.1	30	28	10	9
Well G-2	123.3	129.0	25	27	8	8
Well G-3	—	—	—	—	—	—
Well G-4	13.7	12.0	3	3	<1	<1
Well G-5	113.0	114.4	22	24	8	7
Well G-6	81.2	70.2	16	15	6	5
Subtotal	502.3	471.7	100	100	34	29
Pajarito Field						
Well PM-1	88.6	92.7	11	9	6	6
Well PM-2	170.7	277.7	21	27	11	18
Well PM-3	229.5	307.4	28	29	16	20
Well PM-4	219.5	158.3	27	15	15	10
Well PM-5	112.1	208.4	13	20	8	14
Subtotal	820.4	1,044.5	100	100	56	71
Total Potable	1,447.7	1,529.6	—	—	99	100
Water Canyon (Gallery)	12.0	0.12	—	—	<0.01	—
Guaje Reservoir	1.5	—	—	—	<0.01	—
Los Alamos Reservoir	2.4	—	—	—	<0.01	<0.01
Total Nonpotable	15.9	0.12	—	—	<0.01	<0.01
Total Production from Permitted Sources	1,463.6	1,529.7	—	—	100	100

The growing season that requires irrigation runs from April through September. About 60% of the total water used is consumed during this time. The annual and monthly variation in water usage cannot be correlated with annual or monthly precipitation.

A. Patterns of Water Use

The production and use of water at the Laboratory, the community, and Bandelier increased from about 230x 10^6 gallons in 1947 to 1,730 x 10^6 gallons in 1976. Water usage in 1977 declined to about 1,500x 10^6 gallons and has varied between 1,450 x 10^6 gallons in 1979 and 1,686 x 10^6 gallons in 1989 (Figure 2). The production in 1991 was about 1,448 x 10^6 gallons. The water production increased to 1,529 x 10^6 gallons in 1992.

The long-term change in water use in the late 1970s is partly attributable to the annual water use per person in Los Alamos County, which has varied from a high of 74 x 10^3 gallons per person in 1974 to a low of 48 x 10^3 gallons per person in 1979 between 1972 and 1990 (Figure 3). The annual use per person has stabilized since 1980 at about 55 x 10^3 gallons, or about 150 gallons per day. This daily use is in general agreement with the average per capita in the United States. The population during this period increased from about 15,000 in 1972 to 18,400 in 1990.

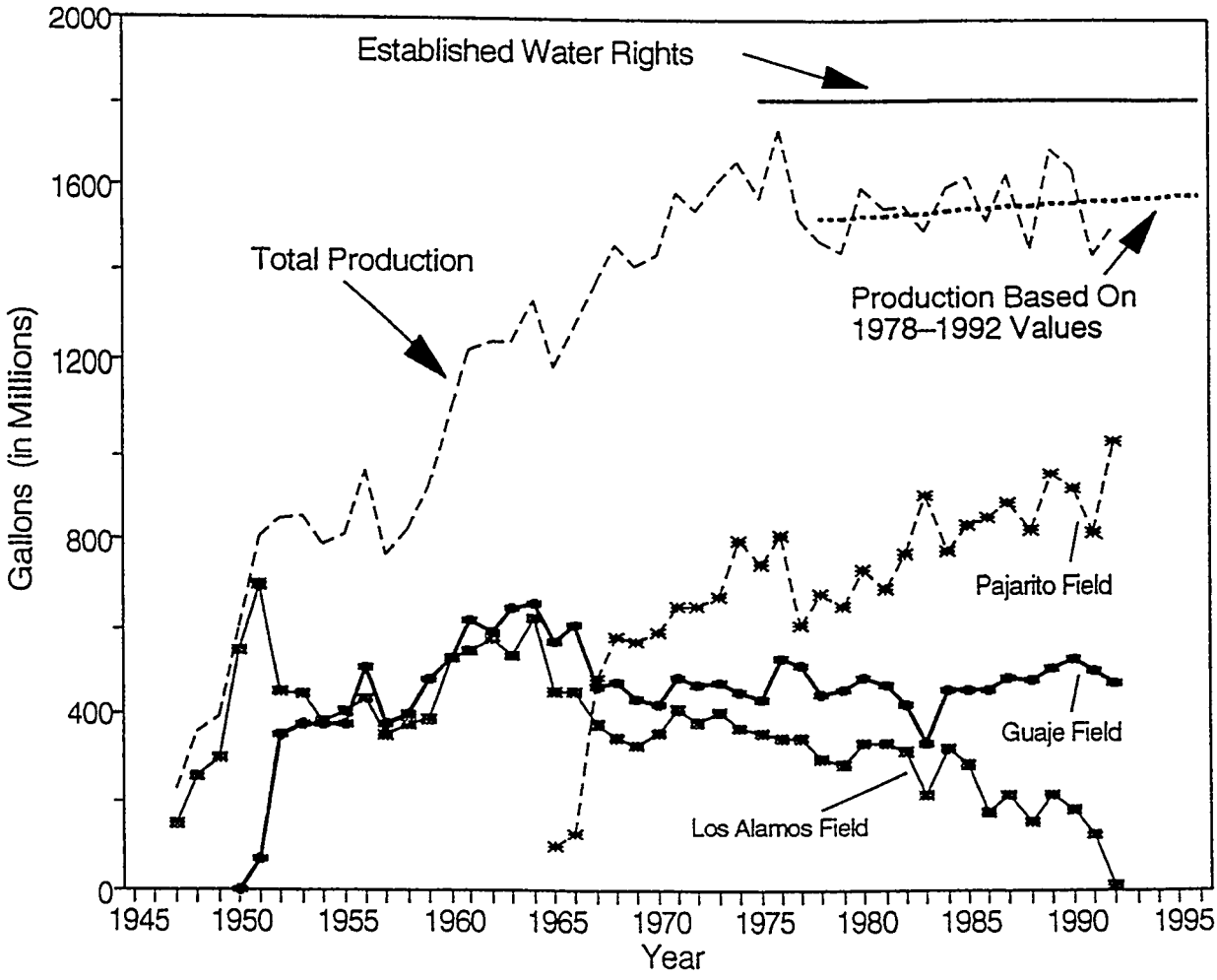

Figure 2. Water production and usage from 1947 to 1991, and projected demand.

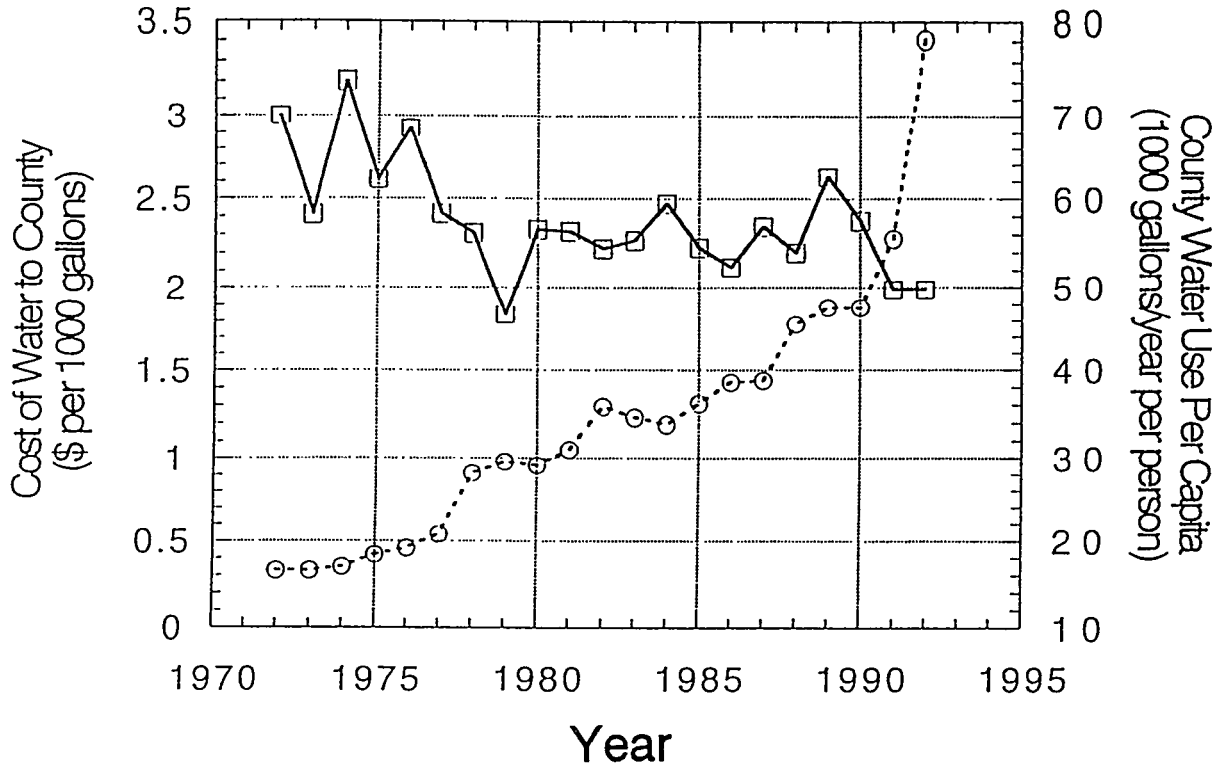

Figure 3. Per capita water use and water cost.

The change in per capita use may have been influenced by higher water costs (Figure 3). The wholesale water rates to Los Alamos County increased gradually from $0.25 per 1,000 gallons in 1968 to $0.46 per 1,000 gallons in 1976. The rate of increase rose rapidly from $0.54 per 1,000 gallons in 1977 to $0.98 per 1,000 gallons in 1979 (Figure 3). The wholesale cost has continued to rise, to $2.28 per 1,000 gallons in 1991 and $3.41 per 1,000 gallons in 1992.

A projection of future total water demand was made as an extrapolation of a least-squares line fitted to the actual data for 1978 through 1992, and has an annual rate of increase of about 6 million gallons. The 1992 water usage was less than the 15-year trend (Figure 2).

During the 15-year period analyzed for long-range water supply planning, Laboratory usage was almost constant at about 500 million gallons a year, or less than 0.1% per year increase. The county usage showed an increase of about 6 million gallons per year (or about a 0.5% per year increase) (Figure 4).

B. Los Alamos Well Field

The Los Alamos Well Field originally consisted of seven supply wells. Three wells (LA-1, LA-2, and LA-3) were completed in 1947 to depths of about 870 ft. Because Well LA-1 produced water containing excessive sand that rapidly wore out the pumps, it was replaced by Well LA-1B in 1960. Well LA-1B was completed to a depth of 1,750 ft. During the period 1948 through 1950, Wells LA-4, LA-5, and LA-6 were completed to depths of about 2,000 ft.

With declining production due to the age of the wells in the field, and with the alignment and construction of the state road adjacent to the well field, it was not economically feasible to renovate the distribution lines, booster station, and wells. 1991 was the last year that the well field provided municipal supply. One well (LA-2) was used to supply water to the contractor for road construction in

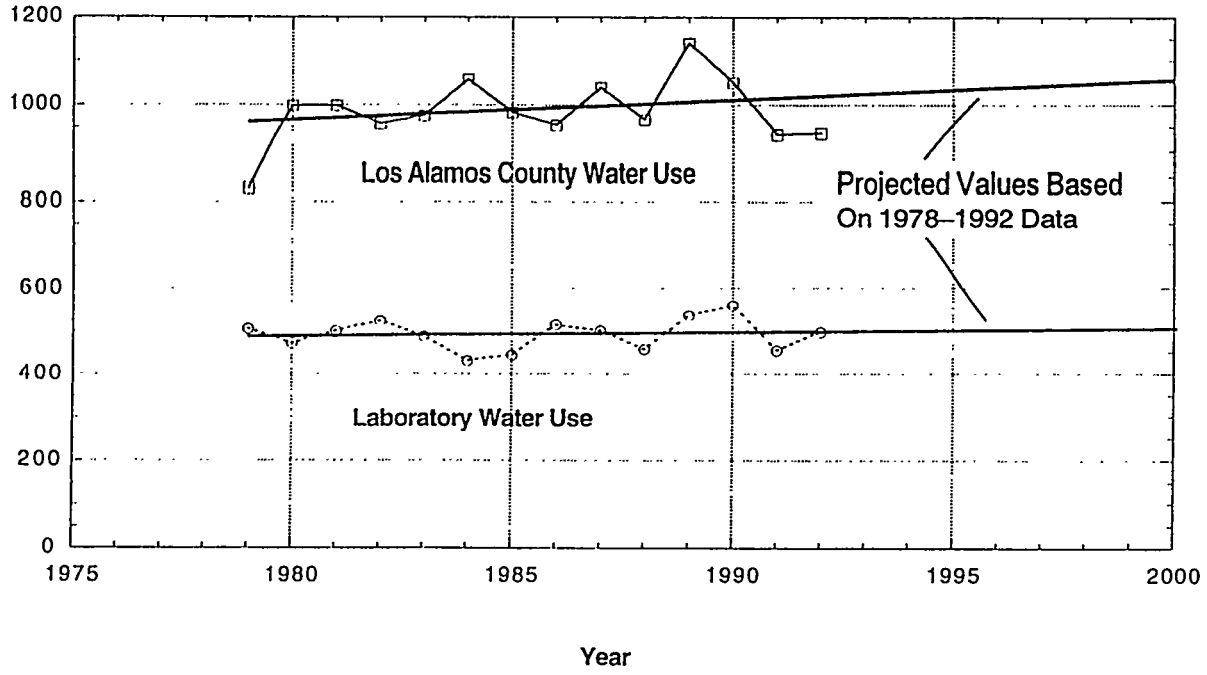

Figure 4. Laboratory and county water use from 1978 through 1992 and projected use from 1993 through 2000.

1992. The pumps, pump houses, and water lines were removed from Wells LA-1, LA-3, LA-4, and LA-6. The pump was removed from LA-1B; the well will be used to monitor water levels. The pump was also removed from well LA-5. The Bureau of Indian Affairs (BIA) had the well reconditioned and equipped with a smaller pump to provide water to several houses at Totavi. The well field, which was located on Pueblo land, was turned over to San Ildefonso Pueblo.

The production in 1992 from well LA-2 for road construction amounted to 13.4×10^6 gallons (Table 3). Pumping for that use provided an opportunity to use the well for an aquifer test. The results of that test are discussed in section V of this report. Water levels taken in observation wells LA-1B and LA-3 and the pumped well (LA-2) are also reported in that section and Appendix B.

A report issued in 1977 documents the hydrologic characteristics of the Los Alamos Well Field and the occurrence of arsenic in well LA-6.[25] A summary of the hydrologic characteristics, production, and chemical quality of water from the Los Alamos Well Field from 1947 through 1991 was reported in "Water Supply at Los Alamos during 1991."[22] Appendix A of this report contains historical data on the hydrologic characteristics of the wells in the Los Alamos Well Field.

C. Guaje Well Field

The Guaje Well Field includes seven wells ranging in depths from 1,500 to 2,000 ft. Wells G-1, G-2, G-3, G-4, and G-5 were completed in 1950. The first well, G-1A, was completed in 1954, and the last well, G-6. was placed in service in 1964. The 1992 production came from six of these wells. Attempted rehabilitation of Well G-3 in 1986 damaged the casing beyond repair, and the well was taken out of production. Water-level recorders were nonoperational from January through August of 1992.

The production from the Guaje Well Field decreased 30×10^6 gallons (from 502×10^6 gallons in 1991 to 472×10^6 gallons) in 1992. The well field contributed 29% of the total production in 1992 (Table 3).

The average pumping rate of the 6 wells ranged from 179 to 478 gpm (Table 4). The combined pumping rate declined 32 gpm from 1,944 gpm in 1991 to 1,912 gpm in 1992. There was a slight increase in the specific capacities of the wells from 1991 to 1992 (Table 4).

Table 4. Average Pumping Rate and Specific Capacity, 1991 and 1992

	Average Pumping Rate (gpm)		Average Specific Capacity (gpm/ft of drawdown)	
	1991	1992	1991	1992
Los Alamos Field				
Well LA-1	—	—	—	—
Well LA-1B	565	—	4.5	—
Well LA-2	320	280[a]	1.5	—
Well LA-3	278	—	1.6	—
Well LA-4	—	—		—
Well LA-5	394	—	—	—
Well LA-6	—	—	—	—
Subtotal	1,557	280[a]	2.5[b]	—
Guaje Field				
Well G-1	201	186	1.2	1.2
Well G-1A	489	478	13.6	13.3
Well G-2	428	424	13.4	13.7
Well G-3	—	—	—	—
Well G-4	181	179	1.0	1.1
Well G-5	378	376	8.0	9.9
Well G-6	267	268	3.2	3.3
Subtotal	1,944	1,911	6.7[b]	7.1[b]
Pajarito Field				
Well PM-1	568	617	25.8	25.7
Well PM-2	1,329	1,328	21.1	19.2
Well PM-3	1,385	1,419	60.2	59.1
Well PM-4	1,292	1,278	30.8	31.2
Well PM-5	1,248	1,233	11.7	12.7
Subtotal	5,822	5,875	29.9[b]	29.6[b]
Total	9,323	8,067	—	—

[a]Estimated
[b]Average Specific Capacity

The average nonpumping 1992 water levels in the well field remained about the same when compared to the 1991 water levels (Table 5). Increased or decreased pumpage from the individual wells during the year resulted in slight declines or increases, respectively, in the water levels in individual wells. These water level changes are expected and not considered significant (Figure 5).

D. Pajarito Well Field

The Pajarito Well Field includes five wells. The wells were completed over a 17-year period, from 1965 through 1982. They range in depths from 2,300 to 3,100 ft. Because they are located on the Pajarito Plateau, the depths to water range from about 750 ft at Well PM-1 to more than 1,200 ft at Well PM-5.

The production from the Pajarito Well Field in 1992 was $1,044 \times 10^6$ gallons, an increaseof 224×10^6 gallons from the 820×10^6 gallons produced in 1991 (Table 3). The field contributed 71% of the total 1992 production. The production from Wells PM-2, PM-3, and PM-4 represented 48% of the total water produced at Los Alamos in 1992 (Table 3). Well PM-4 was inoperative from August through December of 1992 due to equipment failures.

Table 5. Average Water Levels for Nonpumping and Pumping Wells and Average Drawdown, 1991 and 1992

	Average Water Levels				Average Drawdown (ft)	
	Nonpumping (ft)		Pumping (ft)			
	1991	1992	1991	1992	1991	1992
Los Alamos Field						
Well LA-1	—	—	—	—	—	—
Well LA-1B	55	—	180	—	125	—
Well LA-2	123	—	333	—	210	—
Well LA-3	112	—	284	—	172	—
Well LA-4	—	—	—	—	—	—
Well LA-5	—	—	—	—	—	—
Well LA-6	—	—	—	—	—	—
Average per field	97	—	266	—	169	—
Guaje Field						
Well G-1	282	283	451	439	169	156
Well G-1A	325	325	361	361	36	36
Well G-2	369	370	401	401	32	31
Well G-3	—	—	—	—	—	—
Well G-4	382	387	559	544	177	157
Well G-5	487	470	534	508	47	38
Well G-6	591	591	674	673	83	82
Average per field	406	404	497	487	91	83
Pajarito Field						
Well PM-1	752	756	774	780	22	24
Well PM-2	855	860	918	929	63	69
Well PM-3	768	770	791	794	23	24
Well PM-4	1,081	1,084	1,123	1,125	42	41
Well PM-5	1,239	1,248	1,346	1,345	107	97
Average per field	939	944	990	994	51	51

The average pumping rates for the Pajarito wells ranged from 617 to 1,419 gpm (Table 4). Four of the wells (PM-2, PM-3, PM-4, and PM-5) are high-yield wells with pumping rates over 1,000 gpm (Table 4). The pumping rates from the individual wells varied slightly from 1991 to 1992, with a slight increase in the combined rate of 53 gpm, from 5,822 gpm in 1991 to 5,875 gpm in 1992.

The specific capacities of the wells in 1992 ranged from 12.7 to 59.1 gpm/ft of drawdown. There was no significant change in the overall specific capacities of the wells from 1991 to 1992, though there was some slight variation in the specific capacities of individual wells (Table 4).

The water levels in these wells fluctuated as would be expected from variations in the amount of pumpage (Figure 6). The 1992 average nonpumping water levels in the field were slightly lower than the 1991 average water levels (Table 5).

E. Otowi Well Field

The Otowi Well Field consists of two wells that were completed in 1990. Otowi 1 was completed to a depth of 2,497 ft with a static water level in the main aquifer at a depth of 695 ft. Otowi Well 4 was completed to a depth of 2,585 ft, with a static water level at 790 ft. At the end of 1992 neither of the wells was operational. It is anticipated that Otowi 4 will become operational in early 1993.

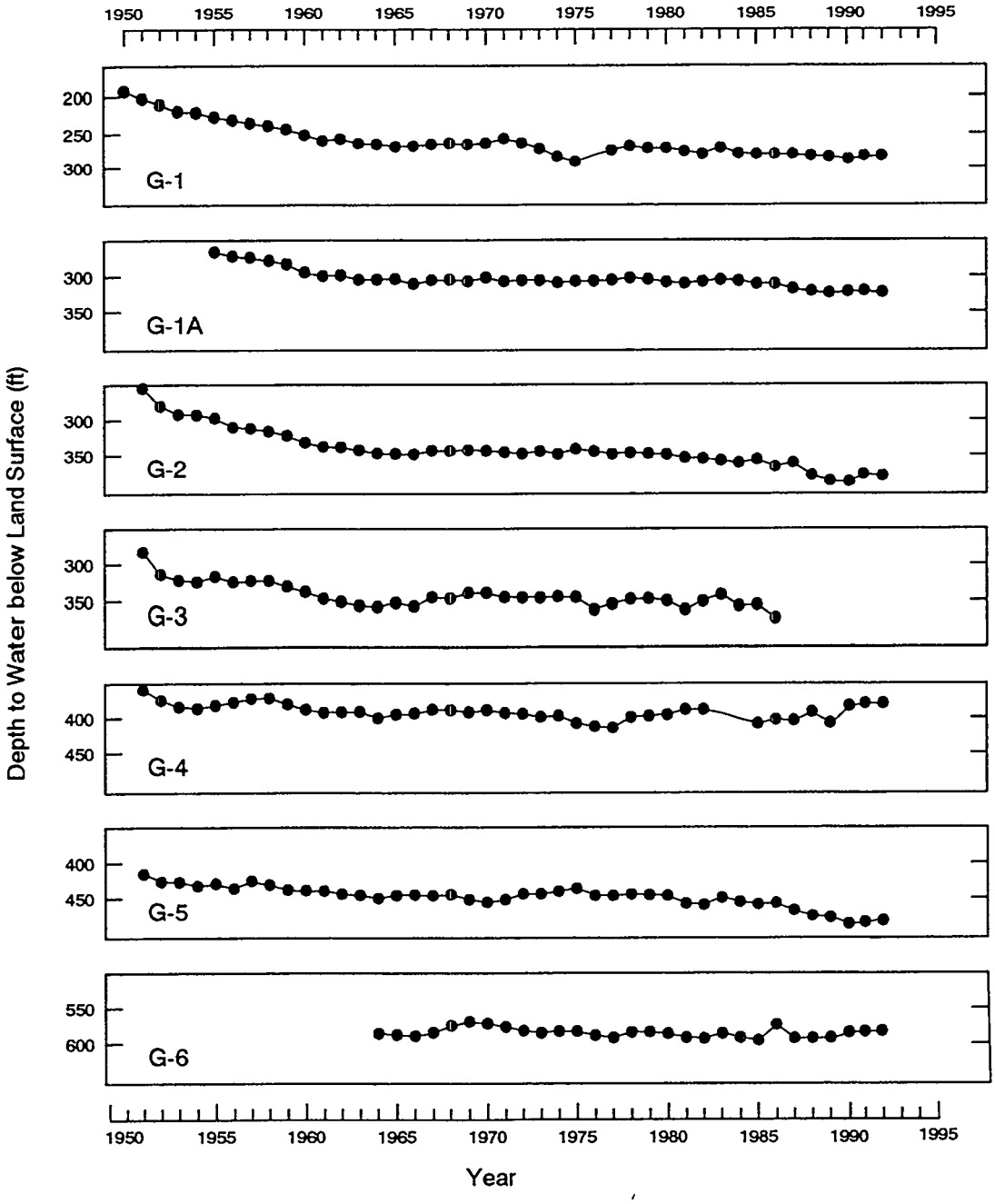

Figure 5. Nonpumping water levels in wells in the Guaje Well Field.

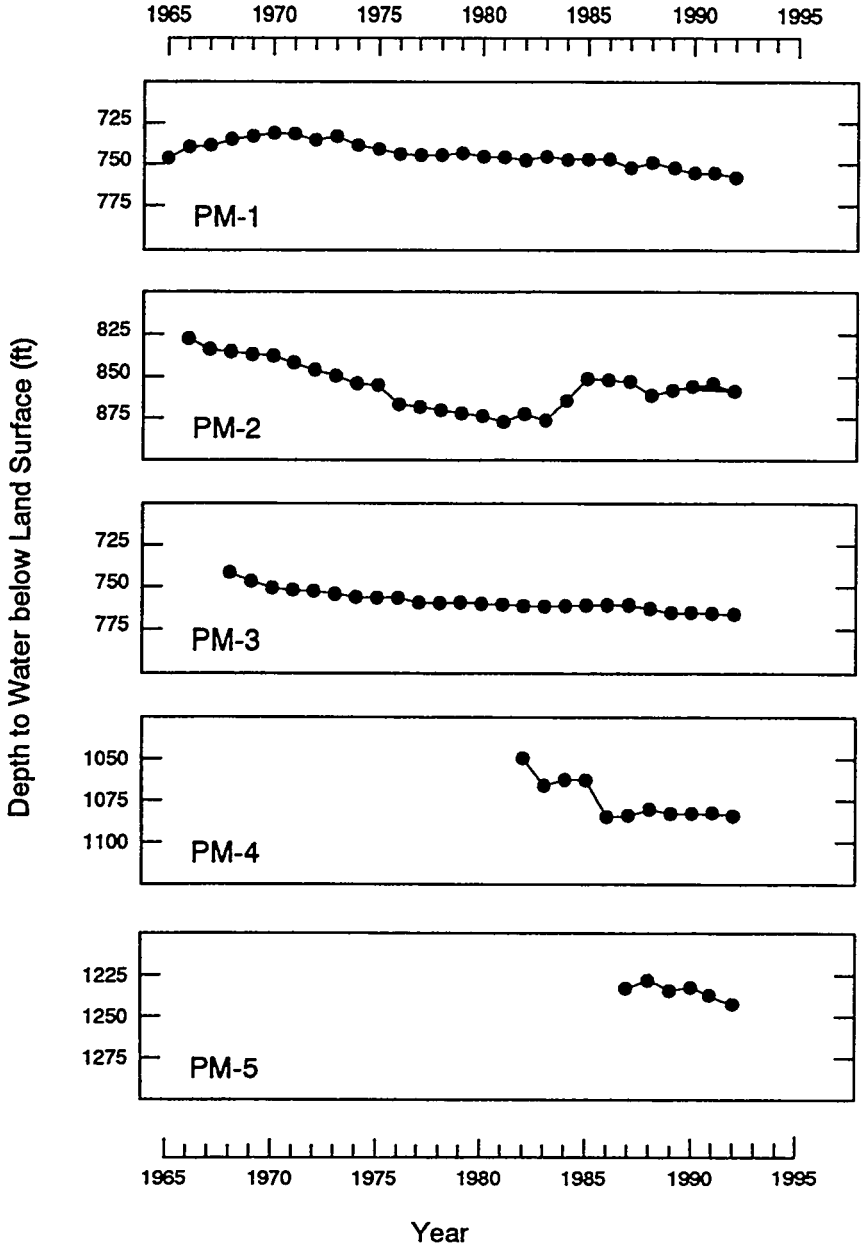

Figure 6. Nonpumping water levels in wells in the Pajarito Well Field.

III. WATER CANYON GALLERY, GUAJE AND LOS ALAMOS RESERVOIRS

Water Canyon Gallery was a source of potable water from the early days of the Manhattan Project until 1989 (Table 1). Rapid recharge to the gallery caused heavy sediment loads to enter the potable system. In 1989, to keep the sediments out of the potable system, the use of the gallery was ended. The water from the gallery now provides a nonpotable supply for the TA-16 steam plant.

The spring gallery in Water Canyon is dug about 30 ft horizontally into the Bandelier Tuff. The gallery or tunnel is framed with timbers and sheet metal to keep the walls and ceiling from collapsing. The floor of the gallery forms a basin to collect the spring flow. About 1 mi of water line connects the gallery to the steam plant at TA-16 (S-Site). The water line is not part of the potable water system.

The water in the gallery comes from fractures in the welded tuff, which is underlain by a nonwelded tuff (the fractures in the welded tuff contain the water, which is perched on the nonwelded tuff). The gallery furnished only a small amount of water, about 0.12×10^6 gallons, to the steam plant during 1992 (Table 6). The excess gallery discharge was released to the surface drainage of Water Canyon. The annual use, potable and nonpotable, during the period 1947–1992, is shown in Appendix A.

Water from Guaje and Los Alamos Reservoirs was used for municipal and industrial water supply at Los Alamos during the early days of the Manhattan Project. Use of the reservoirs for potable water supply was discontinued in 1959 because of intermittent periods of turbidity caused by storm run-off, and because of difficulties in maintaining bacteriological levels below limits allowed for a municipal supply.

The water from the reservoirs is available for irrigation of lawns and shrubs in the community and the 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. During 1992 no water was diverted for irrigation from either of the reservoirs. The age of the nonpotable water distribution system and its need for rehabilitation and cost of operation may cause LANL to abandon the irrigation system. The production from the Guaje and Los Alamos Reservoirs for the period of record is shown on Table 6.

IV. QUALITY OF WATER

The Laboratory conducts two separate programs to monitor the quality of groundwater in the area and to meet regulatory requirements. The first program, under the Laboratory's long-term environmental surveillance program, includes monitoring the quality of water from the supply wells, the gallery in Water Canyon, and reservoirs in Guaje and Los Alamos Canyons. The results of this program are documented in detail in the annual surveillance report for 1992.[26]

The second program monitors the quality of water in the Laboratory and County distribution systems to ensure compliance with the Safe Drinking Water Act (SDWA). During 1992, all water collected under the SDWA program at Los Alamos was in compliance with the regulations.[26]

V. AQUIFER TEST AT SUPPLY WELL LA-2

A seven-day pump test was conducted Well LA-2 in the Los Alamos Well Field from March 16–23, 1992. LA-1B and LA-3 Wells were used as observation wells during this period. The Los Alamos well field was removed from the municipal and industrial supply by the end of 1991 due to highway construction. Well LA-2 was sporadically used throughout the summer and fall of 1991 as a water source to support these construction activities. From mid-October 1991 through March 1992, there was no water production from any of these wells; hence, water levels recovered to near-static conditions. During the pump test, water levels were recorded at 15-min intervals in LA-1B, located approximately 1,200 feet east of LA-2, and in LA-3, located about 950 feet northwest of LA-2. Water production rates in LA-2 showed a continuously declining discharge rate over the test duration because of declining water levels in the well in response to pumpage. Data analysis procedures followed that of Aron and Scott (1965) [27] for variable

Table 6. Production from Water Canyon Gallery and from Guaje and Los Alamos Reservoirs[a]

Year	Water Canyon Gallery (10^6 gal.)	Guaje Reservoir[b] (10^6 gal.)	Los Alamos Reservoir (10^6 gal.)
Municipal Water-Supply Production			
1947		87.8	21.7
1948		119.8	21.9
1949		116.1	14.7
1950		79.9	20.6
1951		41.0	10.5
1952		131.0	33.6
1953		58.0	14.8
1954		66.0	16.9
1955		71.0	18.1
1956		24.0	4.8
1957		213.0	54.8
1958		193.0	49.4
Production			
1972		5.8	—
1973		9.7	—
1974		4.9	—
1975		5.3	—
1976		4.4	—
1977		4.1	—
1978		2.8	—
1979		3.7	1.3
1980		4.7	2.3
1981		2.7	2.1
1982		3.4	2.8
1983		3.4	1.4
1984		3.0	1.3
1985		2.8	0.9
1986		2.4	1.5
1987		2.8	3.2
1988		2.4	1.4
1989		4.6	3.3
1990	9.30	2.2	4.6
1991	12.00	1.5	2.4
1992	0.12	—	—

[a]Guaje and Los Alamos Reservoir municipal supply 1947–1958; irrigation 1972–1991; Water Canyon Gallery municipal supply 1947–1987; industrial supply 1990–1992 (see Table 1 and Appendix A).

[b]Production from Guaje Reservoir for 1951–1958 is estimated.

discharge rates; this technique is a variation of the widely utilized Cooper-Jacob method for constant discharge pumping tests. These analyses indicate that aquifer transmissivity (T) and storage coefficient (S) for the formation surrounding LA-1B are about 893 sq ft per day and 0.00422, respectively. For LA-3, these values are about 501 sq ft per day and 0.00330, respectively. These results are comparable to those previously obtained by Theis and Conover (1962)[28] in a pump test conducted at LA-3, and using LA-2 as an observation well. Recorded drawdown histories during the pump test from observation wells LA-1B and LA-3, and water production rates from LA-2, are listed in Appendix B (Table B-1) of this report.

Initially observation wells LA-1B and LA-3 were equipped with automatic recording pressure transducers so that drawdown (s) histories could be obtained at 15-min intervals. At frequent intervals throughout the pump test, water production rates (Q) in well LA-2 were measured with a totalizer-type in-line flowmeter and stopwatch. Total flows were averaged over 5- to 10-min intervals to establish flow rates. Drawdown data from wells LA-1B and LA-3 are plotted in Figure 7. These data begin before the LA-2 pump was turned on, and continue well beyond the time when the pump was turned off. The drawdown effects in wells LA-1B and LA-3 in response to pumpage at well LA-2 are obvious. In addition, a combined diurnal barometric pressure and earth tide effect is clearly evident. In Figure 7 these smaller amplitude effects are represented by the small repeating "bumps" that are superimposed onto the drawdown trends of each well. While these combined barometric and earth tide effects were not used in the subsequent data analyses, they apparently represent the first recorded evidence that such phenomena are observable in main aquifer wells on the Pajarito Plateau.

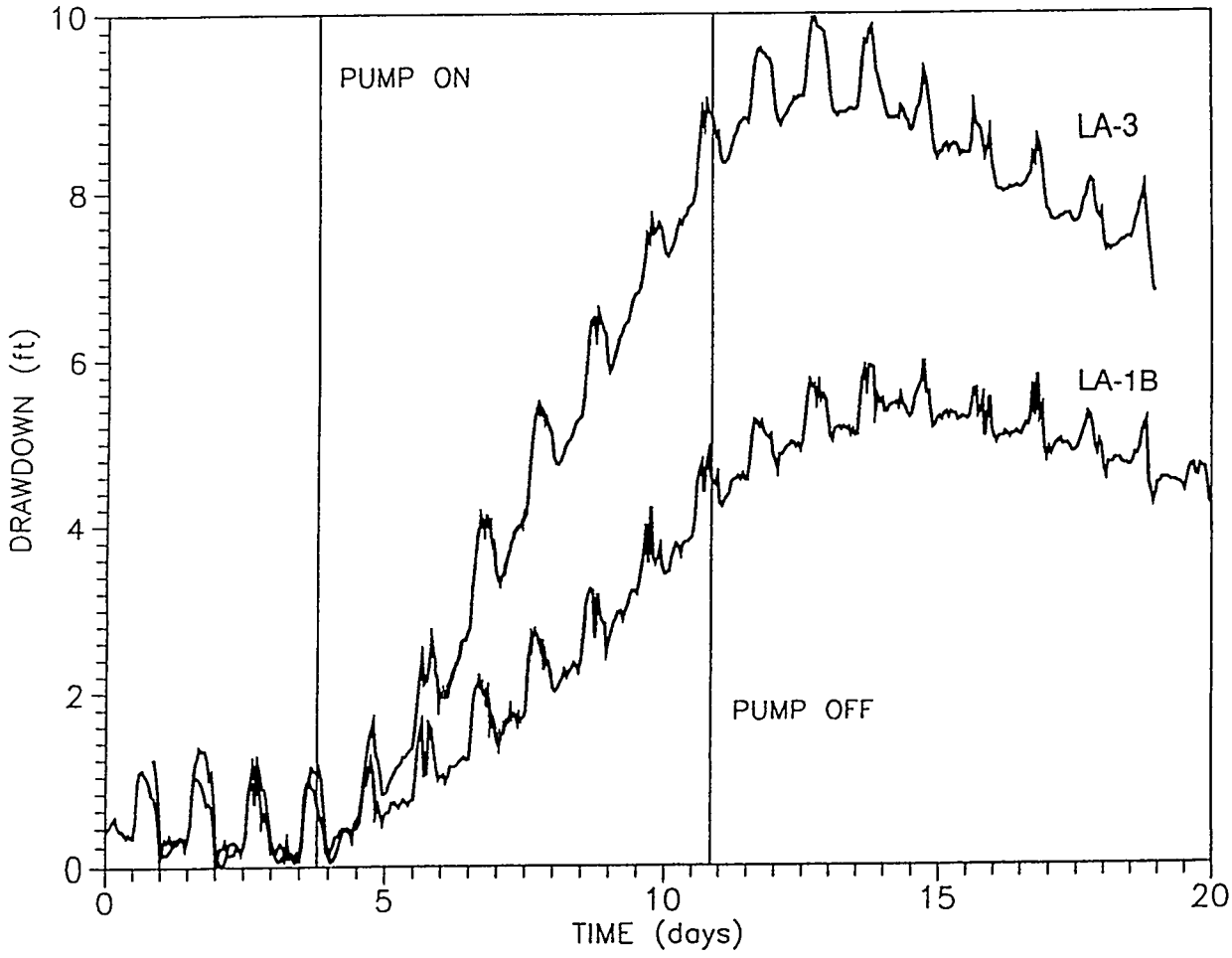

Figure 7. Drawdown in Wells LA-1B and LA-3 in response to pumpage at LA-2.

The Aron-Scott procedure is straightforward. For each observation well, s/Q values are plotted against time using a single logarithmic scale (on the time axis). The best-fitting straight line is drawn through this graph, giving more weight to the later data points. The slope (m) of this line is measured over one log cycle, and T and S are computed from:

$$T = 2.303/(4*pi*m) \quad \text{and} \quad S = 2.25*T*t_0/r^2$$

where t_0 represents the time-intercept from the best-fitting straight line.

Because the discharge in LA-2 was not always measured at the same time as drawdown values in observation wells LA-1B and LA-3, the following additional modification was used in the data preparation phase of the analyses. Initially, a fourth-order polynomial was fitted to the measured water production data using the form:

$$Q = at^4 + bt^3 + ct^2 + dt + e$$

where Q is the observed instantaneous LA-2 pumping rate (gallons per minute, or gpm), t is elapsed time (days) since pumping began at LA-2, and a, b, c, d, and e are least-squares regression coefficients; these observed Q versus t data are summarized in Appendix B of this report. Once these regression coefficients were found, then additional Q values were computed at those times when drawdown data were available from observation wells LA-1B and LA-3. These computed Q values were then used to find s/Q, where both s and Q are taken at the same time t. Results of these procedures are shown in Figures 8 and 9, respectively, for wells LA-1B and LA-3. The two top graphs in each of these figures show drawdown versus time in the observation well and discharge versus time in LA-2. The two bottom graphs in each of these figures show s/Q versus time for the raw and smoothed cases. These final graphs also show the least-squares linear regression line.

All of the observed data used in this pump test analysis are contained in Appendix B, Table B-1. In addition, a computer program written in the MATLAB language is listed in Table B-2; this program automatically performs all of the computational steps required in the Aron-Scott procedure to estimate T and S for the variable discharge case.

VI. SUMMARY

Operations of wells and well fields in 1992 were satisfactory. Water-level trends in the wells were as expected under the current annual amount of pumpage. Future operations of the wells and water supply system should be continued as in the past. Continued collection of data from wells and well fields is necessary to evaluate present and future wells and well-field operations.

ACKNOWLEDGMENTS

Statistics on well production were collected by personnel from Johnson Control World Services Inc. and were compiled for this report by the Laboratory's Environmental Protection Group.

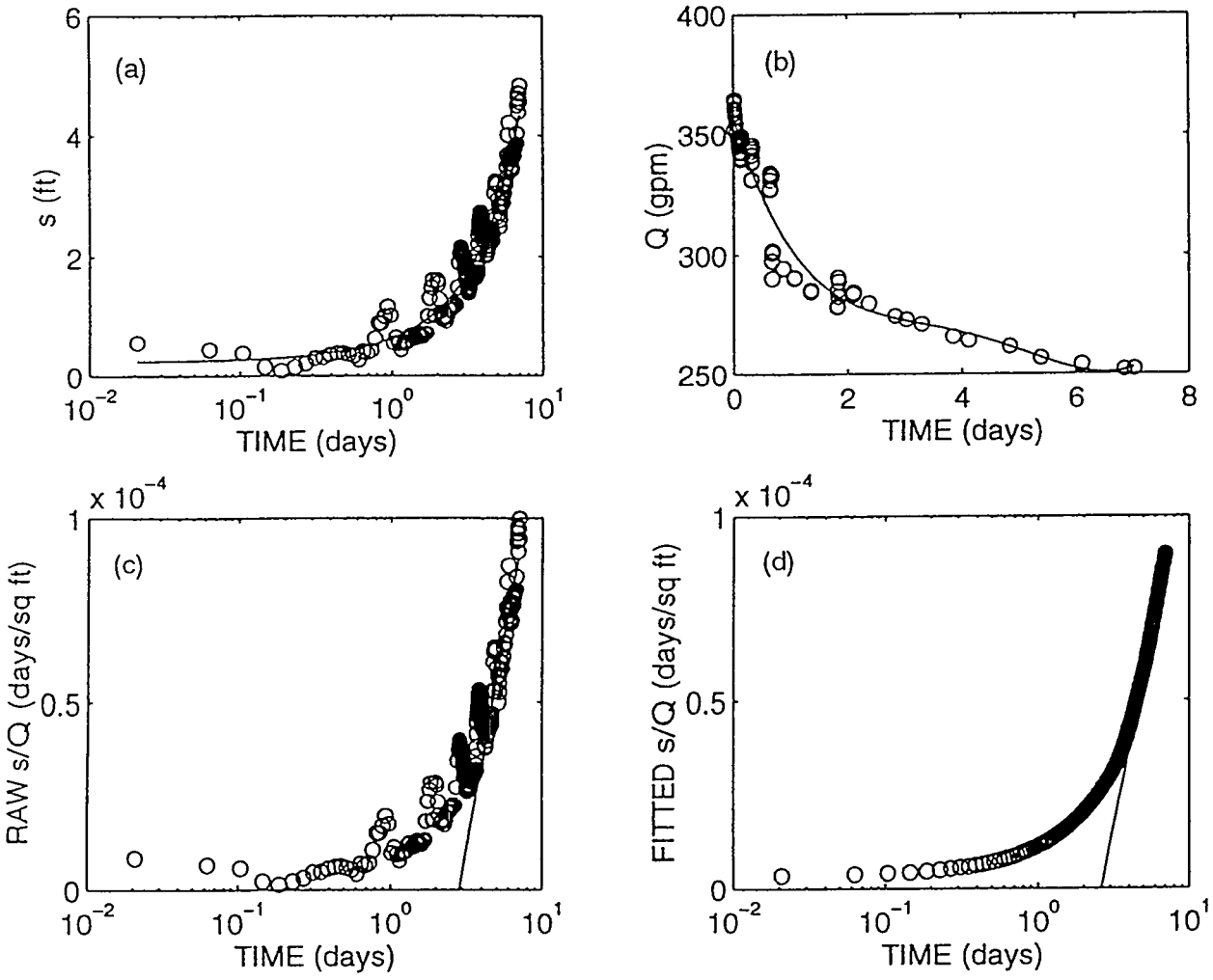

Figure 8. Pump test analysis at Well LA-1B: (a) drawdown (s) vs. time; (b) discharge (Q) vs. time in Well LA-2; (c) raw plot of s/Q vs. time for LA-1B; and (d) fitted plot of s/Q vs. time for LA-1B. The computed T and S values are 893 sq ft per day, and 0.00422, respectively.

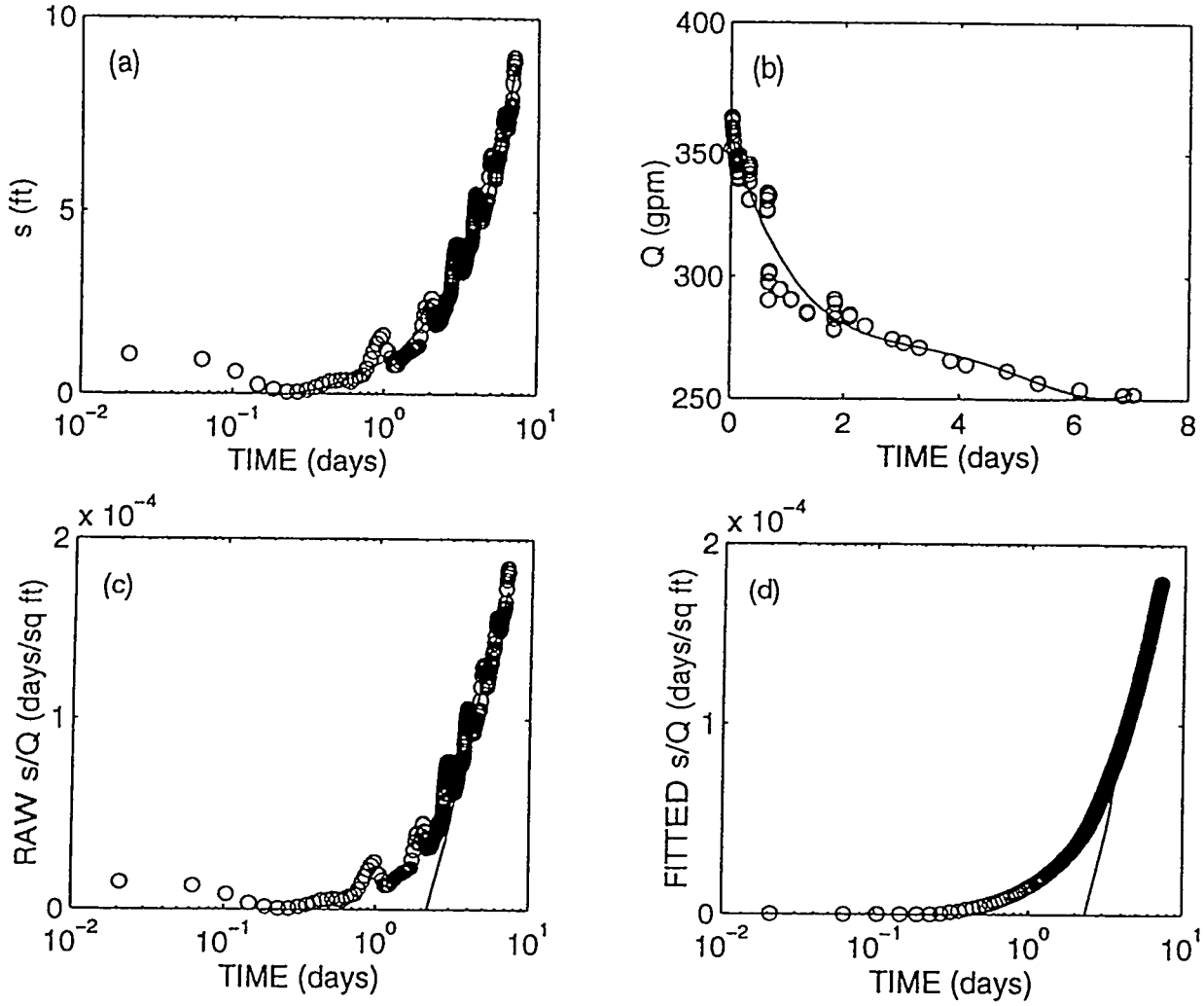

Figure 9. Pump test analysis at Well LA-3: (a) drawdown (s) vs. time; (b) discharge (Q) vs. time in Well LA-2; (c) raw plot of s/Q vs. time for LA-3; and (d) fitted plot of s/Q vs. time for LA-3. The computed T and S values are 501 sq ft per day, and 0.00330, respectively.

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Appendix A

Annual Statistics on Aquifer Characteristics

Well LA-1

Year	Pumping Time (h)	Production (10^6 gal.)	Pumping Rate (gpm)	Nonpumping Water Level (ft)
1947	3,468	54.0	259.5	—
1948	2,988	34.7	193.6	—
1949	1,361	26.7	327.0	—
1950	563	10.5	310.8	19.0
1951	1,215	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
1980	0	0.0	0.0	40.0
1981	0	0.0	0.0	51.0
1982	0	0.0	0.0	98.0
1983	0	0.0	0.0	46.0
1984	0	0.0	0.0	71.0
1985	0	0.0	0.0	63.0
1986	0	0.0	0.0	34.0
1987	0	0.0	0.0	70.0
1988	0	0.0	0.0	66.0
1989	0	0.0	0.0	77.0
1990	0	0.0	0.0	84.0

NOTE: Air line and recorder removed 1990; water level on 3/12/92 was 7.61 ft below top of brass valve. Facility was demolished in 1990 and the well transferred to San Ildefonso Pueblo in 1992.

Well LA-1B

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1960	415	36.3	1,457.8	7.0	111.0	104.0	14.0
1961	3,727	124.7	557.6	54.0	154.0	100.0	5.6
1962	3,936	129.1	546.7	72.0	169.0	97.0	5.6
1963	3,649	117.4	536.2	74.0	170.0	96.0	5.6
1964	4,174	130.3	520.3	81.0	183.0	102.0	5.1
1965	3,007	97.9	542.6	63.0	170.0	107.0	5.1
1966	2,589	83.9	540.1	50.0	169.0	119.0	4.5
1967	2,519	84.9	561.7	39.0	153.0	114.0	4.9
1968	2,183	74.0	565.0	32.0	147.0	115.0	4.9
1969	2,244	75.7	562.2	22.0	142.0	120.0	4.7
1970	2,369	79.7	560.7	22.0	143.0	121.0	4.6
1971	2,633	89.1	564.0	31.0	162.0	131.0	4.3
1972	2,215	75.3	566.6	31.0	163.0	132.0	4.3
1973	2,628	87.2	553.0	37.0	170.0	133.0	4.2
1974	2,282	73.9	539.7	35.0	161.0	126.0	4.3
1975	2,308	74.4	537.3	42.0	168.0	126.0	4.3
1976	2,521	79.6	526.2	50.0	176.0	126.0	4.2
1977	2,782	84.2	504.4	47.0	167.0	120.0	4.2
1978	2,306	75.6	546.3	42.0	162.0	120.0	4.6
1979	1,354	45.9	564.6	13.0	134.0	121.0	4.7
1980	1,955	62.9	536.3	21.0	146.0	125.0	4.3
1981	2,299	73.9	537.7	26.0	144.0	118.0	4.5
1982	3,707	108.1	486.0	71.0	180.0	109.0	4.5
1983	407	12.1	495.0	61.0	160.0	99.0	5.0
1984	2,673	96.9	604.0	75.0	201.0	126.0	4.8
1985	1,919	68.5	595.0	55.0	179.0	124.0	4.8
1986	1,598	54.9	573.0	25.0	144.0	119.0	4.8
1987	2,753	97.3	589.0	66.0	187.0	121.0	4.9
1988	2,187	75.4	574.0	60.0	192.0	132.0	4.4
1989	2,864	97.8	569.0	73.0	197.0	124.0	4.6
1990	2,072	68.6	552.0	70.0	196.0	126.0	4.4
1991	1,488	50.4	565.0	55.0	180.0	125.0	4.5

NOTE: Well out of service in 1992. The well and pump were transferred to San Ildefonso Pueblo in 1992.

Well LA-2

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1947	963	27.6	477.7	—	—	—	—
1948	3,659	59.3	270.1	—	—	—	—
1949	1,654	41.8	421.2	—	—	—	—
1950	614	15.6	423.5	59.0	285.0	226.0	1.9
1951	2,415	57.7	398.2	111.0	305.0	194.0	2.1
1952	1,980	46.3	389.7	101.0	300.0	199.0	2.0
1953	2,201	47.2	357.4	100.0	301.0	201.0	1.8
1954	2,601	56.8	364.0	116.0	—	—	—
1955	2,223	49.4	370.4	110.0	—	—	—
1956	1,805	44.2	408.1	84.0	—	—	—
1957	1,066	29.6	462.8	53.0	277.0	224.0	2.1
1958	1,166	31.1	444.5	60.0	270.0	210.0	2.1
1959	1,599	40.7	424.2	71.0	303.0	232.0	1.8
1960	2,169	51.6	396.5	76.0	305.0	229.0	1.7
1961	2,149	44.4	344.3	101.0	313.0	212.0	1.6
1962	1,823	35.7	326.4	111.0	314.0	203.0	1.6
1963	1,999	40.7	339.3	127.0	332.0	205.0	1.7
1964	1,924	34.2	296.3	137.0	347.0	210.0	1.4
1965	1,911	39.8	347.1	121.0	330.0	209.0	1.7
1966	1,070	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	1,787	31.8	296.6	88.0	318.0	230.0	1.3
1972	2,189	39.3	299.2	96.0	322.0	226.0	1.3
1973	2,625	46.7	296.5	106.0	334.0	228.0	1.3
1974	2,033	36.8	301.7	109.0	325.0	216.0	1.4
1975	2,310	40.2	290.0	103.0	320.0	217.0	1.3
1976	2,488	39.9	267.3	113.0	322.0	209.0	1.3
1977	2,775	42.5	255.3	118.0	314.0	196.0	1.3
1978	2,299	39.5	286.4	112.0	338.0	226.0	1.3
1979	1,353	26.2	323.0	75.0	316.0	241.0	1.3
1980	1,960	33.8	287.4	84.0	318.0	234.0	1.2
1981	1,991	34.4	300.0	94.0	336.0	242.0	1.2
1982	3,174	51.2	269.0	161.0	348.0	187.0	1.4
1983	2,752	54.5	330.0	121.0	321.0	200.0	1.6
1984	2,753	53.7	325.0	130.0	323.0	193.0	1.7
1985	2,027	37.1	305.0	112.0	291.0	179.0	1.7
1986	1,289	24.1	312.0	74.0	252.0	178.0	1.8
1987	2,619	39.6	252.0	129.0	319.0	190.0	1.3
1988	1,936	33.0	284.0	117.0	296.0	179.0	1.6
1989	2,647	43.2	272.0	141.0	329.0	188.0	1.4
1990	2,399	40.3	280.0	134.0	330.0	196.0	1.4
1991	1,705	32.7	320.0	123.0	333.0	210.0	1.5
1992	—	13.4	280.0[a]	—	—	—	—

NOTE: 1992 well out of service to supply water to Los Alamos; 1992 production was for road construction. The well and pump were transferred to San Ildefonso Pueblo in 1992.

[a]Estimated.

Well LA-3

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1947	1,476	64.9	732.8	—	—	—	—
1948	3,647	82.5	377.0	—	—	—	—
1949	1,505	41.7	461.8	—	—	—	—
1950	2,793	57.8	344.9	97.0	231.0	134.0	2.6
1951	3,554	66.9	313.7	116.0	233.0	117.0	2.7
1952	2,514	58.6	388.5	94.0	218.0	124.0	3.1
1953	3,104	69.7	374.2	103.0	229.0	126.0	3.0
1954	2,595	57.3	368.0	101.0	225.0	124.0	3.0
1955	2,195	48.7	369.8	91.0	226.0	135.0	2.7
1956	1,849	42.1	379.5	74.0	222.0	148.0	2.6
1957	1,080	26.1	402.8	56.0	219.0	163.0	2.5
1958	1,612	33.6	347.4	49.0	225.0	176.0	2.0
1959	1,821	35.0	320.3	54.0	231.0	177.0	1.8
1960	2,174	38.4	294.4	68.0	230.0	162.0	1.8
1961	1,939	34.7	298.3	85.0	189.0	104.0	2.9
1962	2,361	45.4	320.5	93.0	192.0	99.0	3.2
1963	2,128	42.5	332.9	81.0	197.0	116.0	2.9
1964	2,574	50.4	326.3	104.0	217.0	113.0	2.9
1965	1,961	43.3	368.9	79.0	220.0	141.0	2.6
1966	2,236	46.1	343.6	81.0	219.0	138.0	2.5
1967	2,274	47.4	347.4	86.0	218.0	132.0	2.6
1968	2,127	42.7	334.6	82.0	251.0	169.0	2.0
1969	2,072	40.1	322.6	58.0	246.0	188.0	1.7
1970	2,303	44.0	318.4	55.0	241.0	186.0	1.7
1971	2,556	45.4	296.0	77.0	250.0	173.0	1.7
1972	2,205	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	2,291	43.5	316.5	73.0	244.0	171.0	1.9
1975	2,306	43.3	313.0	80.0	253.0	173.0	1.8
1976	2,474	42.3	285.0	88.0	260.0	172.0	1.7
1977	2,779	47.3	283.7	89.0	248.0	159.0	1.8
1978	2,308	42.4	306.4	87.0	250.0	163.0	1.9
1979	1,343	28.1	348.1	58.0	243.0	185.0	1.9
1980	1,952	35.1	299.9	61.0	237.0	176.0	1.7
1981	2,297	41.5	301.1	70.0	240.0	170.0	1.8
1982	3,691	54.9	247.0	118.0	246.0	128.0	1.9
1983	949	14.7	258.0	89.0	203.0	129.0	2.0
1984	838	16.6	329.0	142.0	301.0	159.0	2.0
1985	2,078	41.9	336.0	104.0	280.0	176.0	1.9
1986	1,328	26.9	338.0	88.0	255.0	167.0	2.0
1987	2,710	50.9	313.0	118.0	289.0	171.0	1.8
1988	2,130	40.1	313.0	119.0	272.0	153.0	2.0
1989	2,808	51.9	308.0	122.0	298.0	176.0	1.8
1990	2,461	44.6	302.0	122.0	295.0	173.0	1.8
1991	1,398	23.4	278.0	112.0	284.0	172.0	1.6

NOTE: Air line and recorder were removed in late 1991; water level on 3/13/92 was 39.55 ft below brass valve. Well was out of service in 1992. Facilities demolished in 1992 and the well was transferred to San Ildefonso Pueblo in 1992.

Well LA-4

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1948	1,570	42.7	453.3	—	—	—	—
1949	940	37.5	664.9	—	—	—	—
1950	4,350	164.9	631.8	278.0	353.0	75.0	8.4
1951	4,909	173.6	589.4	285.0	357.0	72.0	8.2
1952	3,429	119.6	581.3	267.0	339.0	72.0	8.1
1953	3,034	109.1	599.3	264.0	335.0	71.0	8.4
1954	2,133	78.2	611.0	255.0	329.0	74.0	8.3
1955	2,647	94.5	595.0	268.0	341.0	73.0	8.2
1956	3,402	120.0	588.9	273.0	346.0	73.0	8.1
1957	2,844	105.4	617.7	270.0	345.0	75.0	8.2
1958	2,973	110.3	618.3	270.0	342.0	72.0	8.6
1959	3,084	113.5	613.4	275.0	346.0	71.0	8.6
1960	4,084	145.6	594.2	296.0	365.0	69.0	8.6
1961	3,687	129.7	586.3	296.0	365.0	69.0	8.5
1962	3,688	129.3	584.3	286.0	359.0	73.0	8.0
1963	3,718	130.5	585.0	280.0	351.0	71.0	8.2
1964	4,500	155.0	574.1	291.0	361.0	70.0	8.2
1965	3,110	111.4	597.0	279.0	349.0	70.0	8.5
1966	3,279	115.6	587.6	285.0	356.0	71.0	8.3
1967	2,127	77.1	604.1	278.0	350.0	72.0	8.4
1968	2,276	81.7	598.3	280.0	351.0	71.0	8.4
1969	1,694	61.8	608.0	282.0	358.0	76.0	8.0
1970	2,333	83.5	596.5	286.0	363.0	77.0	7.7
1971	2,519	89.0	588.9	287.0	373.0	86.0	6.8
1972	2,322	82.6	592.9	282.0	367.0	85.0	7.0
1973	2,616	92.4	588.7	294.0	377.0	83.0	7.1
1974	2,306	82.2	594.1	286.0	367.0	81.0	7.3
1975	2,319	82.3	591.5	272.0	355.0	83.0	7.1
1976	2,802	98.2	584.1	277.0	373.0	96.0	6.1
1977	2,741	96.4	586.2	278.0	374.0	96.0	6.1
1978	2,248	80.1	594.2	271.0	368.0	97.0	6.1
1979	2,964	104.6	587.9	280.0	376.0	96.0	6.1
1980	3,322	115.3	578.5	284.0	385.0	101.0	5.7
1981	2,573	89.4	579.1	289.0	393.0	104.0	5.6
1982	0	0	0	—	—	—	—
1983	1,840	61.5	577.0	287.0	392.0	105.0	5.3
1984	2,695	87.1	539.0	290.0	383.0	93.0	5.8
1985	2,667	86.4	540.0	292.0	378.0	86.0	6.3
1986	1,172	38.8	552.0	284.0	377.0	93.0	5.9
1987	38	1.6	—	269.0	357.0	88.0	—

NOTE: Well out of service in 1988. Air line and recorder were removed in 1990; water level was 244.4 ft on 6/22/90 and 244.2 ft on 3/11/91, both measurements were below top of brass valve. Facilities were demolished in 1992; well transferred to San Ildefonso Pueblo.

Well LA-5

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1948	1,171	40.4	575.0	—	—	—	—
1949	1,763	58.5	553.0	—	—	—	—
1950	4,052	130.1	535.1	131.0	254.0	123.0	4.4
1951	6 004	187.4	520.2	162.0	272.0	110.0	4.7
1952	3,425	109.6	533.3	147.0	259.0	112.0	4.8
1953	3,278	103.9	528.3	141.0	257.0	116.0	4.6
1954	2,546	80.1	524.4	137.0	259.0	122.0	4.3
1955	3,158	97.3	513.5	145.0	267.0	122.0	4.2
1956	3,476	104.5	501.1	150.0	276.0	126.0	4.0
1957	2,868	86.0	499.8	150.0	277.0	127.0	3.9
1958	3,009	89.9	498.0	151.0	277.0	126.0	4.0
1959	3,088	93.5	504.6	155.0	280.0	125.0	4.0
1960	4,088	119.1	485.6	168.0	288.0	120.0	4.0
1961	3,534	100.3	473.0	165.0	288.0	123.0	3.8
1962	3,735	107.7	480.6	172.0	—	—	—
1963	3,726	105.0	469.7	171.0	—	—	—
1964	4,236	118.8	467.4	184.0	—	—	—
1965	1,740	50.5	483.7	180.0	—	—	—
1966	2,817	79.3	469.2	180.0	—	—	—
1967	2,533	73.7	484.9	168.0	—	—	—
1968	2,233	63.3	472.5	161.0	300.0	139.0	3.4
1969	2,402	68.5	475.3	161.0	298.0	137.0	3.5
1970	2,353	66.1	468.2	157.0	300.0	143.0	3.3
1971	2,659	74.4	466.3	155.0	302.0	147.0	3.2
1972	2,301	64.4	466.5	153.0	304.0	151.0	3.1
1973	2,476	68.3	459.7	156.0	308.0	152.0	3.0
1974	1,903	52.5	459.8	154.0	306.0	152.0	3.0
1975	2,318	63.9	459.4	149.0	309.0	160.0	2.9
1976	2,799	77.6	462.1	150.0	310.0	160.0	2.9
1977	2,665	74.8	467.8	147.0	303.0	156.0	3.0
1978	2,274	64.9	475.8	145.0	299.0	154.0	3.1
1979	2,964	84.0	472.4	149.0	301.0	152.0	3.1
1980	3,316	92.2	463.6	153.0	300.0	147.0	3.2
1981	3,523	96.5	456.5	158.0	304.0	146.0	3.1
1982	3,654	102.3	467.0	168.0	299.0	136.0	3.4
1983	2,842	78.1	458.0	154.0	295.0	141.0	3.2
1984	2,889	72.1	416.0	156.0	281.0	125.0	3.1
1985	2,153	55.8	432.0	174.0	308.0	134.0	3.2
1986	1,376	34.6	419.0	168.0	310.0	142.0	2.9
1987	1,148	27.9	405.0	167.0	314.0	147.0	2.8
1988	351	9.9	406.0	—	—	—	—
1989	1,074	26.5	411.0	—	—	—	—
1990	1,388	33.3	400.0	—	—	—	—
1991	783	18.5	394	—	—	—	—

NOTE: Air line and recorder were removed in late 1991; water level on 12/4/91 (TV Log) was 158 ft below top of pump base (5,856.5 ft elevation). Well out of service in 1992; well and pump transferred to San Ildefonso Pueblo in 1992.

Well LA-6

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1948	116	4.9	704.0	—	—	—	—
1949	2,451	95.8	651.4	—	—	—	—
1950	4,490	167.9	623.2	83.0	136.0	53.0	11.8
1951	5 882	201.6	571.2	115.0	160.0	45.0	12.7
1952	3,168	110.3	580.3	108.0	151.0	43.0	13.5
1953	3,177	113.8	597.0	95.0	139.0	44.0	13.6
1954	2,894	107.1	616.8	92.0	135.0	43.0	14.3
1955	2,911	108.0	618.3	97.0	140.0	43.0	14.4
1956	3,438	125.8	609.9	106.0	149.0	43.0	14.2
1957	2,833	102.4	602.4	107.0	152.0	45.0	13.4
1958	2,957	106.9	602.5	108.0	131.0	43.0	14.0
1959	3,096	108.3	583.0	115.0	158.0	43.0	13.6
1960	4,084	138.6	565.6	130.0	172.0	42.0	13.5
1961	3,284	112.5	571.0	129.0	171.0	42.0	13.6
1962	3,886	129.4	555.0	135.0	175.0	40.0	13.9
1963	2,953	102.9	580.8	125.0	171.0	46.0	12.6
1964	4,244	138.3	543.1	132.0	172.0	40.0	13.6
1965	3,145	103.8	550.1	120.0	160.0	40.0	13.8
1966	3,173	104.0	546.3	129.0	169.0	40.0	13.7
1967	2,511	85.4	566.8	118.0	158.0	40.0	14.2
1968	2,111	71.6	565.3	109.0	150.0	41.0	13.8
1969	2,402	81.6	566.2	109.0	151.0	42.0	13.5
1970	2,337	79.1	564.1	106.0	149.0	43.0	13.1
1971	2,472	82.5	556.2	119.0	160.0	41.0	13.6
1972	2,317	79.2	569.7	117.0	155.0	38.0	15.0
1973	2,638	90.6	572.4	118.4	155.0	37.0	15.5
1974	2,337	79.8	569.1	120.0	156.0	36.0	15.8
1975	1,571	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
1980	4	0.1	520.8	82.0	142.0	60.0	8.7
1981	2.3	0.08	579.8	84.0	141.0	57.0	10.2
1982	—	—	—	90.0	—	—	—
1983	—	—	—	81.0	—	—	—
1984	—	—	—	83.0	—	—	—
1985	—	—	—	92.0	—	—	—
1986	—	—	—	—	—	—	—
1987	—	<0.1	—	—	—	—	—
1988	—	<0.1	—	—	—	—	—
1989	—	<0.1	—	—	—	—	—
1990	—	—	—	—	—	—	—

NOTE: Air line and recorder were removed in 1990; water level on 5/9/90 was ~82.5 ft below LSD (5,770 ft elevation); on 3/11/92 it was 98.35 below brass valve. Well out of service in 1977; pumped since that time for quality-of-water samples. Pump was removed in 1990. Facilities demolished in 1991, and the well was transferred to San Ildefonso Pueblo in 1992.

Well G-1

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1950	0	2.8	0.0	195.0	—	—	—
1951	1,168	37.7	538.0	202.0	309.0	107.0	5.0
1952	2,476	75.5	508.2	213.0	295.0	82.0	6.2
1953	3,275	97.3	495.2	221.0	292.0	71.0	7.0
1954	2,616	77.8	495.7	221.0	290.0	69.0	7.2
1955	2,406	70.5	448.4	226.0	295.0	69.0	7.1
1956	2,958	83.2	468.8	235.0	303.0	68.0	6.9
1957	2,098	55.9	444.1	236.0	307.0	71.0	6.3
1958	2,460	68.1	461.4	238.0	308.0	70.0	6.6
1959	2,952	82.4	465.2	245.0	314.0	69.0	6.7
1960	3,564	96.0	448.9	254.0	325.0	71.0	6.3
1961	4,236	112.4	442.2	260.0	333.0	73.0	6.1
1962	3,431	93.6	454.7	258.0	342.0	84.0	5.4
1963	4,519	114.9	423.8	265.0	348.0	83.0	5.1
1964	4,374	113.8	433.6	269.0	352.0	83.0	5.2
1965	3,530	90.7	428.2	268.0	352.0	84.0	5.1
1966	4,074	102.6	419.7	269.0	363.0	94.0	4.5
1967	2,615	69.9	445.5	266.0	362.0	96.0	4.6
1968	2,996	78.9	438.9	264.0	366.0	102.0	4.3
1969	2,657	68.3	428.4	266.0	376.0	110.0	3.9
1970	2,712	64.7	397.6	264.0	377.0	113.0	3.5
1971	2,908	67.9	389.2	258.0	378.0	120.0	3.2
1972	2,865	66.1	384.5	264.0	389.0	125.0	3.1
1973	2,997	67.5	375.4	271.0	403.0	132.0	2.8
1974	2,767	62.3	375.3	283.0	412.0	129.0	2.9
1975	2,467	55.7	376.3	293.0	411.0	118.0	3.2
1976	2,962	65.1	366.3	—	—	—	—
1977	2,734	57.9	353.0	275.0	426.0	151.0	2.3
1978	2,656	56.0	351.4	270.0	419.0	149.0	2.4
1979	2,998	61.7	342.9	271.0	422.0	151.0	2.3
1980	3,459	68.3	329.0	273.0	428.0	155.0	2.1
1981	4,427	81.6	307.2	275.0	444.0	169.0	1.8
1982	3,678	69.0	313.0	278.0	443.0	165.0	1.9
1983	2,871	52.2	303.0	272.0	443.0	171.0	1.8
1984	3,804	62.8	275.0	276.0	448.0	172.0	1.5
1985	3,004	48.3	268.0	278.0	450.0	172.0	1.6
1986	2,027	30.3	249.0	279.0	450.0	171.0	1.5
1987	2,070	29.2	235.0	280.0	451.0	171.0	1.4
1988	395	5.4	227.0	280.0	445.0	165.0	1.4
1989	2,010	26.9	223.0	282.0	451.0	169.0	1.3
1990	2,121	30.8	242.0	284.0	454.0	170.0	1.4
1991	1,730	20.9	201.0	282.0	451.0	169.0	1.2
1992	1,077	12.0	186.0	283.0	439.0	156.0	1.2

Well G-1A

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1954	108	4.6	709.0	—	—	—	—
1955	1,531	53.0	577.0	265.0	316.0	51.0	11.3
1956	3,130	107.7	573.5	273.0	323.0	50.0	11.5
1957	2,470	87.0	587.0	274.0	327.0	53.0	11.1
1958	2,670	92.5	577.4	279.0	331.0	52.0	11.1
1959	2,965	102.7	577.3	284.0	333.0	49.0	11.8
1960	3,641	122.8	562.1	291.0	342.0	51.0	11.0
1961	4,297	147.3	571.3	298.0	350.0	52.0	11.0
1962	3,972	136.1	571.1	295.0	344.0	49.0	11.7
1963	4,525	149.7	551.4	301.0	350.0	49.0	11.3
1964	3,852	129.3	559.4	302.0	353.0	51.0	11.0
1965	3,505	116.5	554.0	302.0	353.0	51.0	10.9
1966	3,964	133.4	560.9	306.0	355.0	49.0	11.4
1967	2,720	91.3	559.4	302.0	351.0	49.0	11.4
1968	3,089	103.2	556.8	302.0	352.0	50.0	11.1
1969	2,695	90.7	560.9	303.0	356.0	53.0	10.6
1970	2,772	92.5	556.2	300.0	357.0	57.0	9.8
1971	3,313	111.8	562.4	303.0	361.0	58.0	9.7
1972	2,879	94.0	544.2	302.0	361.0	59.0	9.2
1973	2,760	87.9	530.8	302.0	362.0	60.0	8.8
1974	2,974	92.7	519.5	307.0	355.0	48.0	10.8
1975	2,740	85.3	518.9	304.0	351.0	47.0	11.0
1976	2,983	91.6	511.8	302.0	350.0	48.0	10.7
1977	2,942	88.7	502.5	302.0	350.0	48.0	10.5
1978	2,631	77.9	493.5	300.0	345.0	45.0	11.0
1979	2,974	88.0	493.9	301.0	345.0	44.0	11.0
1980	3,480	103.2	494.4	305.0	345.0	40.0	12.4
1981	4,212	131.2	519.1	307.0	347.0	40.0	13.0
1982	3,618	109.7	505.0	305.0	347.0	42.0	12.0
1983	2,901	86.7	498.0	301.0	336.0	35.0	14.2
1984	3,789	113.9	501.0	302.0	345.0	43.0	11.7
1985	4,430	128.4	483.0	306.0	348.0	42.0	11.5
1986	4,644	130.4	468.0	310.0	351.0	41.0	11.4
1987	4,468	122.5	457.0	320.0	362.0	42.0	10.9
1988	5,016	133.5	443.0	323.0	364.0	41.0	10.8
1989	4,663	131.5	470.0	323.0	359.0	36.0	13.1
1990	4,860	145.5	499.0	322.0	362.0	40.0	12.5
1991	5,120	150.2	489.0	325.0	361.0	36.0	13.6
1992	4,676	134.1	478.0	325.0	361.0	36.0	13.3

Well G-2

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1951	123	3.9	528.5	259.0	—	—	—
1952	2,372	78.3	550.2	279.0	327.0	48.0	11.5
1953	3,254	105.6	540.9	290.0	334.0	44.0	12.3
1954	2,682	86.3	536.3	291.0	335.0	44.0	12.2
1955	2,487	78.8	528.1	299.0	345.0	46.0	11.5
1956	3,109	95.8	513.6	310.0	357.0	47.0	10.9
1957	2,458	76.1	516.0	311.0	360.0	49.0	10.5
1958	2,707	80.1	493.2	315.0	361.0	46.0	10.7
1959	2,938	84.6	479.9	320.0	363.0	43.0	11.2
1960	3,535	96.6	455.4	328.0	370.0	42.0	10.8
1961	3,982	105.3	440.7	336.0	375.0	39.0	11.3
1962	4,076	99.8	408.1	338.0	374.0	36.0	11.3
1963	4,563	105.7	386.1	344.0	379.0	35.0	11.0
1964	4,541	105.3	386.5	346.0	380.0	34.0	11.4
1965	3,535	82.6	389.4	346.0	381.0	35.0	11.1
1966	3,994	94.7	395.2	349.0	383.0	34.0	11.6
1967	2,743	67.6	410.7	344.0	379.0	35.0	11.7
1968	2,732	66.5	405.7	344.0	379.0	35.0	11.6
1969	2,679	68.6	426.8	344.0	381.0	37.0	11.5
1970	2,431	62.8	430.5	343.0	381.0	38.0	11.3
1971	3,420	87.4	425.9	345.0	384.0	39.0	10.9
1972	2,887	73.4	423.7	348.0	388.0	40.0	10.6
1973	2,816	72.4	428.5	344.0	385.0	41.0	10.5
1974	3,056	82.0	447.2	347.0	390.0	43.0	10.4
1975	2,724	74.5	455.8	341.0	384.0	43.0	10.6
1976	2,990	81.1	452.1	344.0	388.0	44.0	10.3
1977	2,981	80.4	449.5	346.0	388.0	42.0	10.7
1978	2,562	71.6	451.9	345.0	386.0	41.0	11.0
1979	2,975	80.0	448.0	347.0	388.0	41.0	11.0
1980	3,478	92.4	443.0	350.0	389.0	39.0	11.4
1981	1,432	38.3	445.8	352.0	390.0	38.0	11.7
1982	2,833	25.7	476.0	352.0	399.0	47.0	10.1
1983	624	16.5	441.0	356.0	399.0	43.0	10.3
1984	2,018	43.7	361.0	358.0	385.0	27.0	13.4
1985	4,339	96.6	371.0	352.0	381.0	29.0	12.8
1986	4,769	109.3	382.0	369.0	395.0	26.0	14.7
1987	4,526	109.7	404.0	366.0	399.0	33.0	12.2
1988	4,836	132.8	457.0	367.0	400.0	33.0	13.9
1989	4,820	133.9	463.0	375.0	408.0	33.0	14.0
1990	5,060	134.5	443.0	374.0	407.0	33.0	13.4
1991	4,792	123.3	428.0	369.0	401.0	32.0	13.4
1992	5,075	129.0	424.0	370.0	401.0	31.0	13.7

Well G-3

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1951	192	7.3	633.7	281.0	—	—	—
1952	2,379	65.4	458.2	310.0	358.0	48.0	9.5
1953	3,192	76.4	398.9	322.0	360.0	38.0	10.5
1954	2,675	66.1	411.8	322.0	370.0	48.0	8.6
1955	2,369	69.4	488.3	316.0	368.0	52.0	9.4
1956	3,149	87.9	465.2	324.0	380.0	56.0	8.3
1957	2,517	70.2	464.8	324.0	385.0	61.0	7.6
1958	2,562	69.5	452.1	323.0	386.0	63.0	7.2
1959	2,931	74.6	424.2	326.0	395.0	69.0	6.1
1960	3,591	82.5	382.9	335.0	407.0	72.0	5.3
1961	3,612	79.9	368.7	343.0	414.0	71.0	5.2
1962	4,057	83.7	343.9	348.0	418.0	70.0	4.9
1963	4,555	86.7	317.2	352.0	422.0	70.0	4.5
1964	4,487	78.6	292.0	355.0	424.0	69.0	4.2
1965	3,498	65.6	312.6	350.0	419.0	69.0	4.5
1966	3,991	73.7	307.8	353.0	420.0	67.0	4.6
1967	2,752	52.9	320.4	344.0	418.0	74.0	4.3
1968	3,086	56.5	305.1	341.0	418.0	77.0	4.0
1969	2,672	50.8	316.9	338.0	417.0	79.0	4.0
1970	2,736	55.4	337.5	336.0	419.0	83.0	4.1
1971	3,337	64.2	320.6	342.0	423.0	81.0	4.0
1972	2,838	50.9	298.9	341.0	421.0	80.0	3.7
1973	2,843	47.3	277.3	341.0	418.0	77.0	3.6
1974	3,006	49.3	273.3	342.0	424.0	82.0	3.3
1975	2,632	43.1	272.9	341.0	428.0	87.0	3.1
1976	2,971	82.6	463.4	359.0	447.0	88.0	5.3
1977	2,961	78.9	444.1	353.0	448.0	95.0	4.7
1978	2,590	66.4	427.5	345.0	443.0	98.0	4.4
1979	3,014	69.0	381.0	345.0	450.0	105.0	3.6
1980	3,448	61.8	298.6	348.0	453.0	105.0	2.8
1981	4,315	66.6	257.2	357.0	467.0	110.0	2.3
1982	3,550	51.0	239.0	349.0	459.0	110.0	2.2
1983	2,183	31.3	239.0	340.0	463.0	123.0	1.9
1984	1,211	19.0	267.0	355.0	475.0	120.0	2.2
1985	1,587	22.1	232.0	351.0	470.0	119.0	2.0
1986	2,266	26.7	196.0	375.0	492.0	117.0	1.7
1987	—	<0.1	—	—	—	—	—
1988	—	3.4	—	—	—	—	—
1989	—	<0.1	—	—	—	—	—

NOTE: Well out of service in 1986 due to pumpage of excessive sand; tested in 1987, 1988, and 1989.

Well G-4

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1951	—	12.5	—	357.0	477.0	120.0	—
1952	2,401	56.9	395.0	374.0	474.0	100.0	3.9
1953	2,677	55.2	343.7	380.0	472.0	92.0	3.7
1954	2,256	58.8	434.4	383.0	526.0	143.0	3.0
1955	1,172	22.7	322.8	378.0	481.0	103.0	3.1
1956	1,800	33.9	313.9	377.0	491.0	114.0	2.8
1957	1,324	24.2	304.6	373.0	498.0	125.0	2.4
1958	1,970	35.9	303.7	370.0	490.0	120.0	2.5
1959	1,819	31.6	289.5	378.0	494.0	116.0	2.5
1960	2,457	37.0	251.0	385.0	509.0	124.0	2.0
1961	2,787	45.0	269.1	389.0	512.0	123.0	2.2
1962	2,738	41.7	253.8	386.0	505.0	119.0	2.1
1963	3,519	46.4	219.8	388.0	504.0	116.0	1.9
1964	3,561	42.9	200.8	396.0	499.0	103.0	1.9
1965	2,100	23.8	188.9	394.0	492.0	98.0	1.9
1966	2,219	33.6	252.4	391.0	498.0	107.0	2.4
1967	2,690	44.8	277.6	388.0	509.0	121.0	2.3
1968	2,083	31.4	251.2	386.0	509.0	123.0	2.0
1969	1,309	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	1,640	21.0	213.4	389.0	503.0	114.0	1.9
1972	2,840	33.3	195.4	391.0	507.0	116.0	1.7
1973	3,006	37.2	206.3	392.0	521.0	129.0	1.6
1974	2,672	34.3	213.9	392.0	519.0	127.0	1.7
1975	1,977	41.0	345.6	403.0	559.0	156.0	2.2
1976	2,859	57.8	336.9	406.0	571.0	165.0	2.0
1977	2,954	62.4	352.1	406.0	589.0	183.0	1.9
1978	2,607	49.5	316.5	398.0	589.0	191.0	1.7
1979	2,974	52.9	296.4	395.0	586.0	191.0	1.6
1980	2,235	35.6	265.7	394.0	580.0	186.0	1.4
1981	432	8.2	316.4	385.0	573.0	188.0	1.7
1982	3,657	65.2	297.0	386.0	578.0	192.0	1.5
1983	2,604	42.2	270.0	—	—	—	—
1984	3,766	49.7	220.0	—	—	—	—
1985	1,747	21.7	207.0	402.0	572.0	170.0	1.2
1986	2,678	33.9	211.0	396.0	574.0	178.0	1.2
1987	2,011	25.1	208.0	398.0	573.0	175.0	1.2
1988	301	4.1	227.0	390.0	545.0	155.0	1.4
1989	1,739	21.6	207.0	401.0	562.0	161.0	1.3
1990	1,539	16.8	182.0	381.0	564.0	183.0	1.0
1991	1,254	13.7	181.0	382.0	559.0	177.0	1.0
1992	1,116	12.0	179.0	387.0	544.0	157.0	1.1

Well G-5

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1951	—	6.7	—	414.0	—	—	—
1952	2,579	73.8	476.9	422.0	480.0	58.0	8.2
1953	1,433	37.8	439.6	425.0	467.0	42.0	10.5
1954	2,617	80.9	515.2	429.0	473.0	44.0	11.7
1955	2,529	80.4	529.9	427.0	472.0	45.0	11.8
1956	3,052	97.0	529.7	431.0	478.0	47.0	11.3
1957	2,385	64.1	447.9	424.0	466.0	42.0	10.7
1958	1,523	49.1	537.3	428.0	477.0	49.0	11.0
1959	2,917	101.7	581.1	435.0	495.0	60.0	9.7
1960	2,828	98.0	577.6	437.0	501.0	64.0	9.0
1961	3,908	134.0	571.5	438.0	507.0	69.0	8.3
1962	4,186	142.0	565.4	440.0	511.0	71.0	8.0
1963	4,528	151.0	555.8	441.0	513.0	72.0	7.7
1964	4,532	150.4	553.1	446.0	516.0	70.0	7.9
1965	3,520	117.1	554.5	443.0	516.0	73.0	7.6
1966	2,555	83.2	542.7	445.0	520.0	75.0	7.2
1967	2,405	80.0	554.4	444.0	519.0	75.0	7.4
1968	2,513	81.2	538.5	443.0	517.0	74.0	7.3
1969	2,649	83.3	524.1	450.0	520.0	70.0	7.5
1970	2,771	88.9	534.7	453.0	521.0	68.0	7.9
1971	2,657	88.3	553.9	450.0	521.0	71.0	7.8
1972	2,902	92.4	530.7	441.0	514.0	73.0	7.3
1973	3,003	97.5	541.1	444.0	515.0	71.0	7.6
1974	2,054	69.0	559.9	440.0	513.0	73.0	7.7
1975	2,266	74.7	549.4	433.0	500.0	67.0	8.2
1976	2,955	95.0	535.8	442.0	504.0	62.0	8.6
1977	2,836	92.1	541.3	444.0	504.0	60.0	9.0
1978	2,608	84.2	538.4	442.0	502.0	60.0	9.0
1979	2,766	86.5	521.5	442.0	502.0	60.0	8.7
1980	2,896	89.0	512.4	442.0	502.0	60.0	8.5
1981	2,124	66.7	523.4	451.0	528.0	77.0	6.8
1982	1,219	38.2	522.0	455.0	510.0	55.0	9.5
1983	2,904	73.2	420.0	445.0	492.0	47.0	8.9
1984	3,838	115.4	501.0	452.0	507.0	55.0	9.4
1985	2,193	67.9	516.0	453.0	509.0	56.0	9.2
1986	2,219	52.5	394.0	453.0	494.0	41.0	9.6
1987	5,732	116.7	379.0	462.0	504.0	42.0	9.0
1988	4,841	115.3	396.0	466.0	507.0	41.0	9.7
1989	4,715	110.9	392.0	474.0	514.0	40.0	9.8
1990	5,094	119.2	390.0	485.0	526.0	41.0	9.5
1991	4,981	113.0	378.0	487.0	534.0	47.0	8.0
1992	5,006	114.4	376.0	470.0	508.0	38.0	9.9

Well G-6

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1964	1,912	45.0	392.3	581.0	659.0	78.0	5.0
1965	3,200	74.9	390.1	582.0	660.0	78.0	5.0
1966	3,931	92.2	390.9	585.0	658.0	73.0	5.4
1967	2,454	57.8	392.6	580.0	653.0	73.0	5.4
1968	2,597	56.2	360.7	574.0	647.0	73.0	4.9
1969	2,698	55.6	343.5	568.0	636.0	68.0	5.1
1970	2,765	51.0	307.4	569.0	634.0	65.0	4.7
1971	2,932	42.8	243.3	573.0	629.0	56.0	4.3
1972	2,516	57.0	377.6	578.0	670.0	92.0	4.1
1973	2,991	65.3	363.9	579.0	667.0	88.0	4.1
1974	2,950	63.8	360.5	579.0	665.0	86.0	4.2
1975	2,717	56.7	347.8	577.0	659.0	82.0	4.2
1976	2,966	57.8	324.8	584.0	662.0	78.0	4.2
1977	2,954	54.4	306.9	586.0	659.0	73.0	4.2
1978	2,218	38.4	288.9	581.0	645.0	64.0	4.5
1979	1,030	18.2	295.1	579.0	645.0	66.0	4.8
1980	1,789	34.5	321.5	583.0	670.0	87.0	3.7
1981	4,302	76.5	296.4	586.0	673.0	87.0	3.4
1982	3,763	63.6	281.0	588.0	669.0	81.0	3.5
1983	1,960	35.4	301.0	582.0	668.0	86.0	3.5
1984	3,010	55.3	306.0	589.0	666.0	77.0	3.9
1985	3,980	71.4	299.0	586.0	664.0	78.0	3.8
1986	4,420	76.7	293.0	576.0	654.0	78.0	3.8
1987	5,100	81.4	266.0	595.0	671.0	76.0	3.5
1988	5,121	82.1	267.0	591.0	669.0	78.0	3.4
1989	5,000	81.6	272.0	592.0	669.0	77.0	3.5
1990	5,202	84.9	272.0	589.0	670.0	81.0	3.4
1991	5,063	81.2	267.0	591.0	674.0	83.0	3.2
1992	4,382	70.2	268.0	591.0	673.0	82.0	3.3

Well PM-1

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1965	2,754	99.2	600.3	746.0	786.0	40.0	15.0
1966	3,086	108.0	583.3	740.0	779.0	39.0	15.0
1967	2,870	111.0	644.6	737.0	781.0	44.0	14.6
1968	1,846	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	1,781	66.2	619.5	733.0	769.0	36.0	17.2
1971	2,728	101.0	617.1	733.0	766.0	33.0	18.7
1972	2,415	84.9	585.9	735.0	762.0	27.0	21.7
1973	1,688	46.5	459.1	736.0	755.0	19.0	24.2
1974	2,649	96.3	605.9	740.0	768.0	28.0	21.6
1975	2,567	94.8	615.5	741.0	766.0	25.0	24.6
1976	2,933	106.8	606.9	744.0	767.0	23.0	26.4
1977	2,969	105.4	591.7	745.0	767.0	22.0	26.9
1978	2,544	90.6	593.3	745.0	767.0	22.0	27.0
1979	2,350	83.4	591.5	744.0	766.0	22.0	26.9
1980	2,786	98.5	588.6	746.0	769.0	23.0	25.7
1981	2,789	98.5	588.6	747.0	769.0	22.0	26.8
1982	2,820	99.6	589.0	748.0	770.0	22.0	26.8
1983	2,464	86.5	585.0	747.0	769.0	22.0	26.6
1984	2,667	92.8	580.0	749.0	772.0	23.0	25.6
1985	2,760	95.4	576.0	749.0	770.0	21.0	27.4
1986	2,130	73.9	578.0	748.0	770.0	22.0	26.3
1987	2,912	102.4	586.0	752.0	773.0	21.0	27.9
1988	2,758	98.0	592.0	751.0	775.0	24.0	24.7
1989	3,014	104.9	580.0	752.0	774.0	22.0	26.4
1990	2,620	88.2	561.0	752.0	772.0	20.0	28.0
1991	2,600	88.6	568.0	752.0	774.0	22.0	25.8
1992	2,503	92.7	617.0	756.0	780.0	24.0	25.7

Well PM-2

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1966	221	18.9	1,425.3	826.0	889.0	63.0	22.6
1967	4,336	370.0	1,422.2	834.0	888.0	54.0	26.3
1968	3,865	328.2	1,415.3	838.0	889.0	51.0	27.8
1969	3,304	279.9	1,411.9	838.0	890.0	52.0	27.2
1970	3,529	300.6	1,419.7	839.0	893.0	54.0	26.3
1971	4,035	339.5	1,402.3	841.0	898.0	57.0	24.6
1972	4,611	385.3	1,392.7	845.0	902.0	57.0	24.4
1973	4,571	380.6	1,387.7	849.0	907.0	58.0	23.9
1974	5,443	450.9	1,380.7	853.0	912.0	59.0	23.4
1975	4,644	385.3	1,382.8	854.0	913.0	59.0	23.4
1976	5,382	442.0	1,368.8	866.0	924.0	58.0	23.6
1977	3,306	272.8	1,375.3	868.0	924.0	56.0	24.6
1978	4,743	388.4	1,364.9	871.0	928.0	57.0	23.9
1979	4,671	381.8	1,262.2	872.0	924.0	52.0	26.2
1980	5,023	409.6	1,359.2	873.0	931.0	58.0	23.4
1981	4,551	370.1	1,355.4	876.0	934.0	58.0	23.4
1982	4,319	359.3	1,386.0	874.0	934.0	60.0	23.1
1983	1,922	157.9	1,369.0	876.0	935.0	59.0	23.2
1984	996	81.6	1,365.0	866.0	930.0	64.0	21.7
1985	1,749	143.3	1,365.0	851.0	916.0	65.0	21.0
1986	1,036	84.4	1,359.0	851.0	915.0	64.0	21.2
1987	351	28.3	1,340.0	851.0	907.0	56.0	23.9
1988	1,843	146.8	1,328.0	869.0	931.0	62.0	21.4
1989	1,639	130.0	1,322.0	860.0	920.0	60.0	22.0
1990	3,164	250.4	1,319.0	860.0	928.0	68.0	19.4
1991	2,141	170.7	1,329.0	855.0	918.0	63.0	21.1
1992	3,486	277.7	1,328.0	860.0	929.0	69.0	19.2

Well PM-3

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1968	2,327	187.4	1,342.2	743.0	771.0	28.0	47.9
1969	3,241	254.7	1,309.8	746.0	772.0	26.0	50.4
1970	2,905	227.8	1,306.9	750.0	774.0	24.0	54.5
1971	2,774	216.3	1,299.6	751.0	774.0	23.0	56.5
1972	2,445	192.1	1,309.5	752.0	775.0	23.0	56.9
1973	3,256	257.8	1,319.6	755.0	778.0	23.0	57.4
1974	3,241	255.3	1,312.9	756.0	779.0	23.0	57.1
1975	3,421	269.3	1,312.0	757.0	780.0	23.0	57.0
1976	3,171	268.3	1,410.2	758.0	784.0	26.0	54.2
1977	2,792	235.5	1,405.8	758.0	784.0	26.0	54.1
1978	2,516	211.0	1,397.6	759.0	784.0	25.0	55.9
1979	2,359	197.2	1,393.0	760.0	784.0	24.0	58.0
1980	2,796	234.4	1,397.2	760.0	785.0	25.0	55.9
1981	2,784	232.4	1,391.3	761.0	786.0	25.0	55.6
1982	2,831	238.1	1,402.0	762.0	785.0	23.0	60.9
1983	2,496	207.6	1,386.0	762.0	785.0	23.0	60.3
1984	3,317	275.6	1,385.0	762.0	787.0	25.0	55.4
1985	2,643	221.2	1,395.0	762.0	784.0	22.0	63.4
1986	2,920	244.8	1,397.0	763.0	787.0	24.0	58.2
1987	2,984	250.2	1,397.0	763.0	788.0	25.0	55.9
1988	2,766	232.0	1,397.0	764.0	788.0	24.0	58.2
1989	2,656	221.0	1,386.0	765.0	791.0	26.0	53.3
1990	2,949	244.6	1,382.0	767.0	790.0	23.0	60.0
1991	2,752	229.5	1,385.0	768.0	791.0	23.0	60.2
1992	3,610	307.4	1,419.0	770.0	794.0	24.0	59.1

Well PM-4

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1982	869	76.2	1,460	1,050	1,091	41	35.6
1983	5,267	452.5	1,432	1,066	1,101	35	40.9
1984	4,059	325.8	1,338	1,065	1,104	39	34.3
1985	4,759	379.2	1,328	1,066	1,101	35	37.9
1986	3,925	307.4	1,305	1,084	1,119	35	37.3
1987	5,071	392.2	1,289	1,081	1,117	36	35.8
1988	2,435	218.7	1,313	1,079	1,117	38	34.6
1989	5,387	418.9	1,296	1,085	1,122	37	35.0
1990	2,827	219.3	1,293	1,083	1,123	40	32.3
1991	2,832	219.5	1,292	1,081	1,123	42	30.8
1992	2,064	158.3	1,278	1,084	1,125	41	31.2

Well PM-5

Year	Pump Time (h)	Production (10^6 gal.)	Pump Rate (gpm)	Water Level		Drawdown (ft)	Specific Capacity (gpm/ft)
				Nonpumping (ft)	Pumping (ft)		
1985	—	2.0	—	—	—	—	—
1986	2,047	147.3	1,199	—	—	—	—
1987	1,620	118.6	1,220	1,237	1,345	108	11.3
1988	1,754	128.6	1,221	1,233	1,345	112	10.9
1989	1,184	86.2	1,213	1,239	1,352	113	10.7
1990	1,611	121.0	1,252	1,234	1,347	113	11.1
1991	1,497	112.1	1,248	1,239	1,346	107	11.7
1992	2,823	208.4	1,233	1,248	1,345	97	12.7

Water Canyon Gallery

Year	Time (h)	Production (10^6 gal.)	Discharge Rate (gpm)
1947	8,760	84.00	159.8
1948	8,784	97.00	184.0
1949	8,760	92.00	175.0
1950	8,760	54.00	102.7
1951	8,760	39.00	74.2
1952	8,784	48.00	91.1
1953	8,760	39.00	74.2
1954	8,760	40.00	76.1
1955	8,760	33.00	62.8
1956	8,784	23.00	43.6
1957	8,760	40.00	76.1
1958	8,760	60.00	114.2
1959	8,760	54.00	102.7
1960	8,784	48.00	91.1
1961	8,760	54.00	102.7
1962	8,760	67.00	127.5
1963	8,760	51.00	97.0
1964	8,784	45.00	85.4
1965	8,760	72.00	137.0
1966	8,760	82.00	156.0
1967	8,760	56.00	106.5
1968	8,784	65.00	123.3
1969	8,760	80.00	152.2
1970	8,760	65.00	123.7
1971	8,760	37.00	70.4
1972	8,784	40.00	75.9
1973	8,760	49.00	93.2
1974	8,760	35.00	66.6
1975	8,760	42.00	79.9
1976	8,784	41.00	77.8
1977	8,760	57.00	108.4
1978	8,760	45.00	86.2
1979	8,760	44.00	83.7
1980	8,784	32.00	60.7
1981	8,760	45.50	86.6
1982	8,760	45.90	94.9
1983	8,760	38.20	72.7
1984	8,784	34.00	65.4
1985	8,760	36.60	69.6
1986	8,760	28.20	53.6
1987	8,760	34.20	65.1
1988	8,784	34.50	65.5
1989	8,760	23.00	43.8
1990	8,760	9.30[a]	—
1991	—	12.00[a]	—
1992	—	0.12[a]	—

[a]Industrial use, the rest released as Water Canyon surface drainage.

Appendix B

Pump Test of Well LA-1

Table B-1. Drawdown, Time, and Discharge Observations

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
1.0900000e+00	2.0830000e-02	5.7000000e-01	2.0830000e-02	3.6485000e+02	6.9000000e-04
9.4000000e-01	6.2500000e-02	4.5000000e-01	6.2500000e-02	3.5216000e+02	4.1700000e-03
6.1000000e-01	1.0417000e-01	3.9000000e-01	1.0417000e-01	3.6134000e+02	6.2500000e-03
2.6000000e-01	1.4583000e-01	1.5000000e-01	1.4583000e-01	3.6513000e+02	8.3300000e-03
1.2000000e-01	1.8750000e-01	9.0000000e-02	1.8750000e-01	3.6358000e+02	1.1810000e-02
5.0000000e-02	2.2917000e-01	1.5000000e-01	2.2917000e-01	3.6041000e+02	1.7360000e-02
6.0000000e-02	2.7083000e-01	2.1000000e-01	2.7083000e-01	3.5917000e+02	2.0830000e-02
1.1000000e-01	3.1250000e-01	3.0000000e-01	3.1250000e-01	3.5891000e+02	2.3610000e-02
1.8000000e-01	3.5417000e-01	3.1000000e-01	3.5417000e-01	3.5746000e+02	3.1940000e-02
2.7000000e-01	3.9583000e-01	3.6000000e-01	3.9583000e-01	3.5445000e+02	3.9580000e-02
3.5000000e-01	4.3750000e-01	3.9000000e-01	4.3750000e-01	3.5160000e+02	5.8330000e-02
3.6000000e-01	4.7917000e-01	3.9000000e-01	4.7917000e-01	3.4863000e+02	6.7360000e-02
3.9000000e-01	5.2083000e-01	3.6000000e-01	5.2083000e-01	3.4712000e+02	7.6390000e-02
3.8000000e-01	5.6250000e-01	3.4000000e-01	5.6250000e-01	3.4771000e+02	8.1250000e-02
3.3000000e-01	6.0417000e-01	2.7000000e-01	6.0417000e-01	3.4702000e+02	8.8190000e-02
4.2000000e-01	6.4583000e-01	4.2000000e-01	6.4583000e-01	3.4594000e+02	9.0280000e-02
4.8000000e-01	6.8750000e-01	3.9000000e-01	6.8750000e-01	3.4488000e+02	9.1670000e-02
5.3000000e-01	7.2917000e-01	4.3000000e-01	7.2917000e-01	3.4222000e+02	1.0417000e-01
7.1000000e-01	7.7083000e-01	6.3000000e-01	7.7083000e-01	3.4309000e+02	1.0764000e-01
9.7000000e-01	8.1250000e-01	9.0000000e-01	8.1250000e-01	3.4261000e+02	1.1597000e-01
1.1800000e+00	8.5417000e-01	9.0000000e-01	8.5417000e-01	3.4047000e+02	1.1736000e-01
1.3900000e+00	8.9583000e-01	1.0100000e+00	8.9583000e-01	3.4057000e+02	1.2014000e-01
1.5200000e+00	9.3750000e-01	1.1700000e+00	9.3750000e-01	3.3985000e+02	1.2153000e-01
1.6300000e+00	9.7917000e-01	1.0200000e+00	9.7917000e-01	3.3961000e+02	1.2292000e-01
1.2500000e+00	1.0208300e+00	5.6000000e-01	1.0208300e+00	3.3937000e+02	1.2431000e-01
1.1800000e+00	1.0625000e+00	6.5000000e-01	1.0625000e+00	3.3970000e+02	1.2569000e-01
1.0100000e+00	1.1041700e+00	5.4000000e-01	1.1041700e+00	3.4247000e+02	1.2847000e-01
7.9000000e-01	1.1458300e+00	4.5000000e-01	1.1458300e+00	3.4256000e+02	1.2986000e-01

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
7.9000000e-01	1.1875000e+00	5.4000000e-01	1.1875000e+00	3.4848000e+02	1.3125000e-01
8.2000000e-01	1.2291700e+00	5.7000000e-01	1.2291700e+00	3.4716000e+02	1.3542000e-01
9.1000000e-01	1.2708300e+00	5.7000000e-01	1.2708300e+00	3.4934000e+02	1.3681000e-01
9.7000000e-01	1.3125000e+00	6.8000000e-01	1.3125000e+00	3.4811000e+02	1.3750000e-01
1.0300000e+00	1.3541700e+00	6.9000000e-01	1.3541700e+00	3.3145000e+02	3.1528000e-01
1.0900000e+00	1.3958300e+00	6.5000000e-01	1.3958300e+00	3.3109000e+02	3.1944000e-01
1.1200000e+00	1.4375000e+00	6.3000000e-01	1.4375000e+00	3.3827000e+02	3.2083000e-01
1.1500000e+00	1.4791700e+00	6.8000000e-01	1.4791700e+00	3.3898000e+02	3.2222000e-01
1.2200000e+00	1.5208300e+00	7.2000000e-01	1.5208300e+00	3.4130000e+02	3.2361000e-01
1.2200000e+00	1.5625000e+00	6.9000000e-01	1.5625000e+00	3.4423000e+02	3.2431000e-01
1.2700000e+00	1.6041700e+00	6.6000000e-01	1.6041700e+00	3.4169000e+02	3.2639000e-01
1.3000000e+00	1.6458300e+00	7.1000000e-01	1.6458300e+00	3.4305000e+02	3.2778000e-01
1.3300000e+00	1.6875000e+00	7.2000000e-01	1.6875000e+00	3.4552000e+02	3.2917000e-01
1.6000000e+00	1.7291700e+00	1.0100000e+00	1.7291700e+00	3.4433000e+02	3.3194000e-01
1.9000000e+00	1.7708300e+00	1.3200000e+00	1.7708300e+00	3.4433000e+02	3.3542000e-01
2.1800000e+00	1.8125000e+00	1.5000000e+00	1.8125000e+00	3.2773000e+02	6.3194000e-01
2.3900000e+00	1.8541700e+00	1.6100000e+00	1.8541700e+00	3.2684000e+02	6.3333000e-01
2.1100000e+00	1.8958300e+00	1.0100000e+00	1.8958300e+00	3.3099000e+02	6.3681000e-01
2.1400000e+00	1.9375000e+00	1.0200000e+00	1.9375000e+00	3.3301000e+02	6.3819000e-01
2.3200000e+00	1.9791700e+00	1.6100000e+00	1.9791700e+00	3.3292000e+02	6.3958000e-01
2.6200000e+00	2.0208300e+00	1.5600000e+00	2.0208300e+00	3.3403000e+02	6.4097000e-01
2.4400000e+00	2.0625000e+00	1.2900000e+00	2.0625000e+00	3.3306000e+02	6.4375000e-01
2.4100000e+00	2.0833300e+00	1.0800000e+00	2.1041700e+00	3.3282000e+02	6.5278000e-01
2.2300000e+00	2.0937500e+00	9.6000000e-01	2.1458300e+00	3.3273000e+02	6.5556000e-01
2.2000000e+00	2.1041700e+00	9.9000000e-01	2.1875000e+00	3.3273000e+02	6.6667000e-01
2.2000000e+00	2.1145800e+00	1.0100000e+00	2.2291700e+00	2.9045000e+02	6.6736000e-01
2.1700000e+00	2.1250000e+00	9.3000000e-01	2.2708300e+00	2.9045000e+02	6.6875000e-01
2.0500000e+00	2.1354200e+00	9.9000000e-01	2.3125000e+00	2.9758000e+02	6.7014000e-01
2.0200000e+00	2.1458300e+00	1.1100000e+00	2.3541700e+00	3.0094000e+02	6.7431000e-01

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
1.9100000e+00	2.1562500e+00	1.1100000e+00	2.3958300e+00	3.0189000e+02	6.7708000e-01
1.9600000e+00	2.1666700e+00	1.1100000e+00	2.4375000e+00	3.0102000e+02	6.7917000e-01
1.9900000e+00	2.1770800e+00	1.1300000e+00	2.4791700e+00	2.9462000e+02	8.6250000e-01
1.9700000e+00	2.1875000e+00	1.1700000e+00	2.5208300e+00	2.9474000e+02	8.6736000e-01
1.9700000e+00	2.1979200e+00	1.2000000e+00	2.5625000e+00	2.9042000e+02	1.0569400e+00
1.9400000e+00	2.2083300e+00	1.2200000e+00	2.6041700e+00	2.9074000e+02	1.0590300e+00
1.9400000e+00	2.2187500e+00	1.1900000e+00	2.6458300e+00	2.8483000e+02	1.3430600e+00
1.9400000e+00	2.2291700e+00	1.2000000e+00	2.6875000e+00	2.8563000e+02	1.3451400e+00
1.9900000e+00	2.2395800e+00	1.4900000e+00	2.7291700e+00	2.7829000e+02	1.8125000e+00
1.9600000e+00	2.2500000e+00	1.9000000e+00	2.7708300e+00	2.7875000e+02	1.8180600e+00
1.9400000e+00	2.2604200e+00	2.0500000e+00	2.8125000e+00	2.8548000e+02	1.8194400e+00
1.9400000e+00	2.2708300e+00	2.0900000e+00	2.8437500e+00	2.8287000e+02	1.8243100e+00
1.9600000e+00	2.2812500e+00	2.0900000e+00	2.8541700e+00	2.9080000e+02	1.8256900e+00
1.9700000e+00	2.2916700e+00	2.1200000e+00	2.8645800e+00	2.8909000e+02	1.8298600e+00
2.0200000e+00	2.3020800e+00	2.1500000e+00	2.8750000e+00	2.8463000e+02	2.0951400e+00
2.0000000e+00	2.3125000e+00	2.1200000e+00	2.8854200e+00	2.8373000e+02	2.0979200e+00
2.0500000e+00	2.3229200e+00	2.0500000e+00	2.8958300e+00	2.8001000e+02	2.3645800e+00
2.0300000e+00	2.3333300e+00	2.0500000e+00	2.9062500e+00	2.8000000e+02	2.3659700e+00
2.0800000e+00	2.3437500e+00	2.0600000e+00	2.9166700e+00	2.7462000e+02	2.8333300e+00
2.1400000e+00	2.3541700e+00	2.0800000e+00	2.9270800e+00	2.7321000e+02	3.0361100e+00
2.1700000e+00	2.3645800e+00	2.0200000e+00	2.9375000e+00	2.7112000e+02	3.3055600e+00
2.1500000e+00	2.3750000e+00	1.9900000e+00	2.9479200e+00	2.6580000e+02	3.8437500e+00
2.1800000e+00	2.3854200e+00	1.9900000e+00	2.9583300e+00	2.6409000e+02	4.1145800e+00
2.2400000e+00	2.3958300e+00	1.9700000e+00	2.9687500e+00	2.6161000e+02	4.8340300e+00
2.2600000e+00	2.4062500e+00	1.9700000e+00	2.9791700e+00	2.5667000e+02	5.3798600e+00
2.2300000e+00	2.4166700e+00	1.9900000e+00	2.9895800e+00	2.5404000e+02	6.1006900e+00
2.2600000e+00	2.4270800e+00	1.9400000e+00	3.0000000e+00	2.5176000e+02	6.8562500e+00
2.2700000e+00	2.4375000e+00	1.8200000e+00	3.0104200e+00	2.5215000e+02	7.0333300e+00
2.2900000e+00	2.4479200e+00	2.0200000e+00	3.0208300e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
2.3500000e+00	2.4583300e+00	1.8700000e+00	3.0312500e+00	0.0000000e+00	0.0000000e+00
2.3500000e+00	2.4687500e+00	1.9400000e+00	3.0416700e+00	0.0000000e+00	0.0000000e+00
2.3500000e+00	2.4791700e+00	1.8800000e+00	3.0520800e+00	0.0000000e+00	0.0000000e+00
2.3900000e+00	2.4895800e+00	1.7500000e+00	3.0625000e+00	0.0000000e+00	0.0000000e+00
2.4100000e+00	2.5000000e+00	1.6300000e+00	3.0729200e+00	0.0000000e+00	0.0000000e+00
2.4100000e+00	2.5104200e+00	1.6700000e+00	3.0833300e+00	0.0000000e+00	0.0000000e+00
2.4700000e+00	2.5208300e+00	1.7200000e+00	3.0937500e+00	0.0000000e+00	0.0000000e+00
2.5300000e+00	2.5312500e+00	1.6900000e+00	3.1041700e+00	0.0000000e+00	0.0000000e+00
2.5100000e+00	2.5416700e+00	1.6900000e+00	3.1145800e+00	0.0000000e+00	0.0000000e+00
2.5600000e+00	2.5520800e+00	1.6400000e+00	3.1250000e+00	0.0000000e+00	0.0000000e+00
2.5900000e+00	2.5625000e+00	1.6600000e+00	3.1354200e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.5729200e+00	1.6300000e+00	3.1458300e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.5833300e+00	1.6000000e+00	3.1562500e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.5937500e+00	1.4900000e+00	3.1666700e+00	0.0000000e+00	0.0000000e+00
2.6300000e+00	2.6041700e+00	1.4900000e+00	3.1770800e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.6145800e+00	1.4300000e+00	3.1875000e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.6250000e+00	1.4100000e+00	3.1979200e+00	0.0000000e+00	0.0000000e+00
2.6200000e+00	2.6354200e+00	1.4300000e+00	3.2083300e+00	0.0000000e+00	0.0000000e+00
2.6500000e+00	2.6458300e+00	1.4400000e+00	3.2187500e+00	0.0000000e+00	0.0000000e+00
2.6800000e+00	2.6562500e+00	1.4700000e+00	3.2291700e+00	0.0000000e+00	0.0000000e+00
2.7100000e+00	2.6666700e+00	1.4000000e+00	3.2395800e+00	0.0000000e+00	0.0000000e+00
2.7100000e+00	2.6770800e+00	1.4400000e+00	3.2500000e+00	0.0000000e+00	0.0000000e+00
2.7400000e+00	2.6875000e+00	1.4400000e+00	3.2604200e+00	0.0000000e+00	0.0000000e+00
2.7500000e+00	2.6979200e+00	1.5000000e+00	3.2708300e+00	0.0000000e+00	0.0000000e+00
2.8000000e+00	2.7083300e+00	1.5000000e+00	3.2812500e+00	0.0000000e+00	0.0000000e+00
2.8700000e+00	2.7187500e+00	1.5000000e+00	3.2916700e+00	0.0000000e+00	0.0000000e+00
2.9800000e+00	2.7291700e+00	1.5200000e+00	3.3020800e+00	0.0000000e+00	0.0000000e+00
3.1000000e+00	2.7395800e+00	1.5800000e+00	3.3125000e+00	0.0000000e+00	0.0000000e+00
3.2200000e+00	2.7500000e+00	1.5600000e+00	3.3229200e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
3.2800000e+00	2.7604200e+00	1.6000000e+00	3.3333300e+00	0.0000000e+00	0.0000000e+00
3.3700000e+00	2.7708300e+00	1.6100000e+00	3.3437500e+00	0.0000000e+00	0.0000000e+00
3.4600000e+00	2.7812500e+00	1.6400000e+00	3.3541700e+00	0.0000000e+00	0.0000000e+00
3.5500000e+00	2.7916700e+00	1.6300000e+00	3.3645800e+00	0.0000000e+00	0.0000000e+00
3.6400000e+00	2.8020800e+00	1.6600000e+00	3.3750000e+00	0.0000000e+00	0.0000000e+00
3.7100000e+00	2.8125000e+00	1.6700000e+00	3.3854200e+00	0.0000000e+00	0.0000000e+00
3.7400000e+00	2.8229200e+00	1.6700000e+00	3.3958300e+00	0.0000000e+00	0.0000000e+00
3.8300000e+00	2.8333300e+00	1.6600000e+00	3.4062500e+00	0.0000000e+00	0.0000000e+00
3.8900000e+00	2.8437500e+00	1.6900000e+00	3.4166700e+00	0.0000000e+00	0.0000000e+00
3.9400000e+00	2.8541700e+00	1.7200000e+00	3.4270800e+00	0.0000000e+00	0.0000000e+00
3.9700000e+00	2.8645800e+00	1.7600000e+00	3.4375000e+00	0.0000000e+00	0.0000000e+00
3.9800000e+00	2.8750000e+00	1.7000000e+00	3.4479200e+00	0.0000000e+00	0.0000000e+00
3.9800000e+00	2.8854200e+00	1.6900000e+00	3.4583300e+00	0.0000000e+00	0.0000000e+00
4.0900000e+00	2.8958300e+00	1.7200000e+00	3.4687500e+00	0.0000000e+00	0.0000000e+00
4.0600000e+00	2.9062500e+00	1.7500000e+00	3.4791700e+00	0.0000000e+00	0.0000000e+00
4.0300000e+00	2.9166700e+00	1.7500000e+00	3.4895800e+00	0.0000000e+00	0.0000000e+00
4.0400000e+00	2.9270800e+00	1.7200000e+00	3.5000000e+00	0.0000000e+00	0.0000000e+00
4.0000000e+00	2.9375000e+00	1.7200000e+00	3.5104200e+00	0.0000000e+00	0.0000000e+00
3.9800000e+00	2.9479200e+00	1.7300000e+00	3.5208300e+00	0.0000000e+00	0.0000000e+00
3.9500000e+00	2.9583300e+00	1.7200000e+00	3.5312500e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	2.9687500e+00	1.7000000e+00	3.5416700e+00	0.0000000e+00	0.0000000e+00
4.0000000e+00	2.9791700e+00	1.6600000e+00	3.5520800e+00	0.0000000e+00	0.0000000e+00
4.0400000e+00	2.9895800e+00	1.6400000e+00	3.5625000e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	3.0000000e+00	1.7000000e+00	3.5729200e+00	0.0000000e+00	0.0000000e+00
4.0000000e+00	3.0104200e+00	1.7200000e+00	3.5833300e+00	0.0000000e+00	0.0000000e+00
4.0400000e+00	3.0208300e+00	1.6900000e+00	3.5937500e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	3.0312500e+00	1.6900000e+00	3.6041700e+00	0.0000000e+00	0.0000000e+00
4.0400000e+00	3.0416700e+00	1.6900000e+00	3.6145800e+00	0.0000000e+00	0.0000000e+00
4.0900000e+00	3.0520800e+00	1.6700000e+00	3.6250000e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
3.9500000e+00	3.0625000e+00	1.6900000e+00	3.6354200e+00	0.0000000e+00	0.0000000e+00
3.8600000e+00	3.0729200e+00	1.6900000e+00	3.6458300e+00	0.0000000e+00	0.0000000e+00
3.8300000e+00	3.0833300e+00	1.7000000e+00	3.6562500e+00	0.0000000e+00	0.0000000e+00
3.7900000e+00	3.0937500e+00	1.7000000e+00	3.6666700e+00	0.0000000e+00	0.0000000e+00
3.8200000e+00	3.1041700e+00	1.7200000e+00	3.6770800e+00	0.0000000e+00	0.0000000e+00
3.8200000e+00	3.1145800e+00	1.7200000e+00	3.6875000e+00	0.0000000e+00	0.0000000e+00
3.7600000e+00	3.1250000e+00	1.7500000e+00	3.6979200e+00	0.0000000e+00	0.0000000e+00
3.7300000e+00	3.1354200e+00	1.8100000e+00	3.7083300e+00	0.0000000e+00	0.0000000e+00
3.6700000e+00	3.1458300e+00	1.9300000e+00	3.7187500e+00	0.0000000e+00	0.0000000e+00
3.5200000e+00	3.1562500e+00	2.0500000e+00	3.7291700e+00	0.0000000e+00	0.0000000e+00
3.4600000e+00	3.1666700e+00	2.2100000e+00	3.7395800e+00	0.0000000e+00	0.0000000e+00
3.4300000e+00	3.1770800e+00	2.3500000e+00	3.7500000e+00	0.0000000e+00	0.0000000e+00
3.4000000e+00	3.1875000e+00	2.4400000e+00	3.7604200e+00	0.0000000e+00	0.0000000e+00
3.4000000e+00	3.1979200e+00	2.4700000e+00	3.7708300e+00	0.0000000e+00	0.0000000e+00
3.3500000e+00	3.2083300e+00	2.5300000e+00	3.7812500e+00	0.0000000e+00	0.0000000e+00
3.3400000e+00	3.2187500e+00	2.5700000e+00	3.7916700e+00	0.0000000e+00	0.0000000e+00
3.3400000e+00	3.2291700e+00	2.6300000e+00	3.8020800e+00	0.0000000e+00	0.0000000e+00
3.3200000e+00	3.2395800e+00	2.5900000e+00	3.8125000e+00	0.0000000e+00	0.0000000e+00
3.3500000e+00	3.2500000e+00	2.6700000e+00	3.8229200e+00	0.0000000e+00	0.0000000e+00
3.3500000e+00	3.2604200e+00	2.6700000e+00	3.8333300e+00	0.0000000e+00	0.0000000e+00
3.3800000e+00	3.2708300e+00	2.6800000e+00	3.8437500e+00	0.0000000e+00	0.0000000e+00
3.4000000e+00	3.2812500e+00	2.7100000e+00	3.8541700e+00	0.0000000e+00	0.0000000e+00
3.4000000e+00	3.2916700e+00	2.7300000e+00	3.8645800e+00	0.0000000e+00	0.0000000e+00
3.4300000e+00	3.3020800e+00	2.7100000e+00	3.8750000e+00	0.0000000e+00	0.0000000e+00
3.4400000e+00	3.3125000e+00	2.7000000e+00	3.8854200e+00	0.0000000e+00	0.0000000e+00
3.4900000e+00	3.3229200e+00	2.7000000e+00	3.8958300e+00	0.0000000e+00	0.0000000e+00
3.4700000e+00	3.3333300e+00	2.6700000e+00	3.9062500e+00	0.0000000e+00	0.0000000e+00
3.5200000e+00	3.3437500e+00	2.6500000e+00	3.9166700e+00	0.0000000e+00	0.0000000e+00
3.5500000e+00	3.3541700e+00	2.6200000e+00	3.9270800e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
3.5900000e+00	3.3645800e+00	2.5900000e+00	3.9375000e+00	0.0000000e+00	0.0000000e+00
3.6100000e+00	3.3750000e+00	2.5900000e+00	3.9479200e+00	0.0000000e+00	0.0000000e+00
3.6400000e+00	3.3854200e+00	2.6000000e+00	3.9583300e+00	0.0000000e+00	0.0000000e+00
3.6700000e+00	3.3958300e+00	2.5400000e+00	3.9687500e+00	0.0000000e+00	0.0000000e+00
3.7000000e+00	3.4062500e+00	2.5600000e+00	3.9791700e+00	0.0000000e+00	0.0000000e+00
3.7000000e+00	3.4166700e+00	2.5000000e+00	3.9895800e+00	0.0000000e+00	0.0000000e+00
3.7600000e+00	3.4270800e+00	2.4700000e+00	4.0000000e+00	0.0000000e+00	0.0000000e+00
3.7900000e+00	3.4375000e+00	2.5000000e+00	4.0104200e+00	0.0000000e+00	0.0000000e+00
3.7900000e+00	3.4479200e+00	2.3800000e+00	4.0208300e+00	0.0000000e+00	0.0000000e+00
3.8200000e+00	3.4583300e+00	2.2700000e+00	4.0312500e+00	0.0000000e+00	0.0000000e+00
3.8500000e+00	3.4687500e+00	2.3600000e+00	4.0416700e+00	0.0000000e+00	0.0000000e+00
3.8500000e+00	3.4791700e+00	2.4100000e+00	4.0520800e+00	0.0000000e+00	0.0000000e+00
3.9100000e+00	3.4895800e+00	2.3600000e+00	4.0625000e+00	0.0000000e+00	0.0000000e+00
3.9100000e+00	3.5000000e+00	2.3600000e+00	4.0729200e+00	0.0000000e+00	0.0000000e+00
3.9400000e+00	3.5104200e+00	2.3800000e+00	4.0833300e+00	0.0000000e+00	0.0000000e+00
3.9400000e+00	3.5208300e+00	2.3800000e+00	4.0937500e+00	0.0000000e+00	0.0000000e+00
3.9400000e+00	3.5312500e+00	2.2400000e+00	4.1458300e+00	0.0000000e+00	0.0000000e+00
3.9700000e+00	3.5416700e+00	2.0500000e+00	4.1875000e+00	0.0000000e+00	0.0000000e+00
3.9700000e+00	3.5520800e+00	2.0200000e+00	4.2291700e+00	0.0000000e+00	0.0000000e+00
3.9800000e+00	3.5625000e+00	2.0500000e+00	4.2708300e+00	0.0000000e+00	0.0000000e+00
3.9700000e+00	3.5729200e+00	2.1200000e+00	4.3125000e+00	0.0000000e+00	0.0000000e+00
3.9800000e+00	3.5833300e+00	2.1700000e+00	4.3541700e+00	0.0000000e+00	0.0000000e+00
4.0000000e+00	3.5937500e+00	2.2600000e+00	4.3958300e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	3.6041700e+00	2.2000000e+00	4.4375000e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	3.6145800e+00	2.2600000e+00	4.4791700e+00	0.0000000e+00	0.0000000e+00
4.0300000e+00	3.6250000e+00	2.2900000e+00	4.5208300e+00	0.0000000e+00	0.0000000e+00
4.0100000e+00	3.6354200e+00	2.3500000e+00	4.5625000e+00	0.0000000e+00	0.0000000e+00
4.0600000e+00	3.6458300e+00	2.3200000e+00	4.6041700e+00	0.0000000e+00	0.0000000e+00
4.0700000e+00	3.6562500e+00	2.2600000e+00	4.6458300e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
4.1200000e+00	3.6666700e+00	2.3800000e+00	4.6875000e+00	0.0000000e+00	0.0000000e+00
4.1000000e+00	3.6770800e+00	2.6700000e+00	4.7291700e+00	0.0000000e+00	0.0000000e+00
4.1200000e+00	3.6875000e+00	3.0400000e+00	4.7708300e+00	0.0000000e+00	0.0000000e+00
4.1200000e+00	3.6979200e+00	3.1900000e+00	4.8125000e+00	0.0000000e+00	0.0000000e+00
4.1600000e+00	3.7083300e+00	3.2400000e+00	4.8541700e+00	0.0000000e+00	0.0000000e+00
4.2400000e+00	3.7187500e+00	3.2200000e+00	4.8958300e+00	0.0000000e+00	0.0000000e+00
4.3300000e+00	3.7291700e+00	2.6500000e+00	4.9375000e+00	0.0000000e+00	0.0000000e+00
4.4500000e+00	3.7395800e+00	3.1900000e+00	4.9791700e+00	0.0000000e+00	0.0000000e+00
4.5700000e+00	3.7500000e+00	2.9500000e+00	5.0208300e+00	0.0000000e+00	0.0000000e+00
4.6600000e+00	3.7604200e+00	2.8500000e+00	5.0625000e+00	0.0000000e+00	0.0000000e+00
4.7500000e+00	3.7708300e+00	2.8300000e+00	5.1041700e+00	0.0000000e+00	0.0000000e+00
4.8400000e+00	3.7812500e+00	2.5000000e+00	5.1458300e+00	0.0000000e+00	0.0000000e+00
4.9300000e+00	3.7916700e+00	2.6200000e+00	5.1875000e+00	0.0000000e+00	0.0000000e+00
5.0200000e+00	3.8020800e+00	2.7300000e+00	5.2291700e+00	0.0000000e+00	0.0000000e+00
5.0700000e+00	3.8125000e+00	2.8300000e+00	5.2708300e+00	0.0000000e+00	0.0000000e+00
5.1300000e+00	3.8229200e+00	2.8900000e+00	5.3125000e+00	0.0000000e+00	0.0000000e+00
5.1900000e+00	3.8333300e+00	2.9700000e+00	5.3541700e+00	0.0000000e+00	0.0000000e+00
5.2500000e+00	3.8437500e+00	2.9800000e+00	5.3958300e+00	0.0000000e+00	0.0000000e+00
5.3100000e+00	3.8541700e+00	2.8900000e+00	5.4375000e+00	0.0000000e+00	0.0000000e+00
5.3400000e+00	3.8645800e+00	2.9800000e+00	5.4791700e+00	0.0000000e+00	0.0000000e+00
5.3500000e+00	3.8750000e+00	3.0400000e+00	5.5208300e+00	0.0000000e+00	0.0000000e+00
5.3500000e+00	3.8854200e+00	3.1600000e+00	5.5625000e+00	0.0000000e+00	0.0000000e+00
5.4100000e+00	3.8958300e+00	3.2200000e+00	5.6041700e+00	0.0000000e+00	0.0000000e+00
5.4400000e+00	3.9062500e+00	3.2200000e+00	5.6458300e+00	0.0000000e+00	0.0000000e+00
5.4600000e+00	3.9166700e+00	3.1900000e+00	5.6875000e+00	0.0000000e+00	0.0000000e+00
5.4400000e+00	3.9270800e+00	3.3100000e+00	5.7291700e+00	0.0000000e+00	0.0000000e+00
5.3800000e+00	3.9375000e+00	3.4900000e+00	5.7708300e+00	0.0000000e+00	0.0000000e+00
5.4000000e+00	3.9479200e+00	3.6700000e+00	5.8125000e+00	0.0000000e+00	0.0000000e+00
5.4000000e+00	3.9583300e+00	4.0100000e+00	5.8541700e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
5.4100000e+00	3.9687500e+00	3.5500000e+00	5.8958300e+00	0.0000000e+00	0.0000000e+00
5.4000000e+00	3.9791700e+00	4.2200000e+00	5.9375000e+00	0.0000000e+00	0.0000000e+00
5.3200000e+00	3.9895800e+00	3.6100000e+00	5.9791700e+00	0.0000000e+00	0.0000000e+00
5.3200000e+00	4.0000000e+00	3.5500000e+00	6.0208300e+00	0.0000000e+00	0.0000000e+00
5.3400000e+00	4.0104200e+00	3.6100000e+00	6.0625000e+00	0.0000000e+00	0.0000000e+00
5.3200000e+00	4.0208300e+00	3.7200000e+00	6.1041700e+00	0.0000000e+00	0.0000000e+00
5.2600000e+00	4.0312500e+00	3.4900000e+00	6.1458300e+00	0.0000000e+00	0.0000000e+00
5.2800000e+00	4.0416700e+00	3.4200000e+00	6.1875000e+00	0.0000000e+00	0.0000000e+00
5.2900000e+00	4.0520800e+00	3.4300000e+00	6.2291700e+00	0.0000000e+00	0.0000000e+00
5.2500000e+00	4.0625000e+00	3.4600000e+00	6.2708300e+00	0.0000000e+00	0.0000000e+00
5.2200000e+00	4.0729200e+00	3.6100000e+00	6.3125000e+00	0.0000000e+00	0.0000000e+00
5.2200000e+00	4.0833300e+00	3.7000000e+00	6.3541700e+00	0.0000000e+00	0.0000000e+00
5.1100000e+00	4.1458300e+00	3.7700000e+00	6.3958300e+00	0.0000000e+00	0.0000000e+00
4.8400000e+00	4.1875000e+00	3.7400000e+00	6.4375000e+00	0.0000000e+00	0.0000000e+00
4.7500000e+00	4.2291700e+00	3.6600000e+00	6.4791700e+00	0.0000000e+00	0.0000000e+00
4.7400000e+00	4.2708300e+00	3.7700000e+00	6.5208300e+00	0.0000000e+00	0.0000000e+00
4.7800000e+00	4.3125000e+00	3.8000000e+00	6.5625000e+00	0.0000000e+00	0.0000000e+00
4.8600000e+00	4.3541700e+00	3.8000000e+00	6.6041700e+00	0.0000000e+00	0.0000000e+00
4.9500000e+00	4.3958300e+00	3.8300000e+00	6.6458300e+00	0.0000000e+00	0.0000000e+00
5.0100000e+00	4.4375000e+00	3.8600000e+00	6.6875000e+00	0.0000000e+00	0.0000000e+00
5.0400000e+00	4.4791700e+00	4.0400000e+00	6.7291700e+00	0.0000000e+00	0.0000000e+00
5.1000000e+00	4.5208300e+00	4.5200000e+00	6.7708300e+00	0.0000000e+00	0.0000000e+00
5.2000000e+00	4.5625000e+00	4.6400000e+00	6.8125000e+00	0.0000000e+00	0.0000000e+00
5.2600000e+00	4.6041700e+00	4.7300000e+00	6.8541700e+00	0.0000000e+00	0.0000000e+00
5.2900000e+00	4.6458300e+00	4.4000000e+00	6.8958300e+00	0.0000000e+00	0.0000000e+00
5.3200000e+00	4.6875000e+00	4.7100000e+00	6.9375000e+00	0.0000000e+00	0.0000000e+00
5.5600000e+00	4.7291700e+00	4.8500000e+00	6.9791700e+00	0.0000000e+00	0.0000000e+00
5.9400000e+00	4.7708300e+00	4.5800000e+00	7.0208300e+00	0.0000000e+00	0.0000000e+00
6.2700000e+00	4.8125000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
6.4600000e+00	4.8541700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.4900000e+00	4.8958300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.3100000e+00	4.9375000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.5500000e+00	4.9791700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.4600000e+00	5.0208300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.3600000e+00	5.0625000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.3100000e+00	5.1041700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
5.9700000e+00	5.1458300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
5.8600000e+00	5.1875000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
5.9100000e+00	5.2291700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.0300000e+00	5.2708300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.1200000e+00	5.3125000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.2500000e+00	5.3541700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.3000000e+00	5.3958300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.3900000e+00	5.4375000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.4300000e+00	5.4791700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.4600000e+00	5.5208300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.6100000e+00	5.5625000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.7200000e+00	5.6041700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.7800000e+00	5.6458300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.7900000e+00	5.6875000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.8500000e+00	5.7291700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
6.9900000e+00	5.7708300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.1800000e+00	5.8125000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.4800000e+00	5.8541700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.4200000e+00	5.8958300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.6500000e+00	5.9375000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.5100000e+00	5.9791700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.5400000e+00	6.0208300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00

Table B-1. (Cont.)

s3 (feet)	t3 (days)	s1b (feet)	t1b (days)	Q2 (gpm)	t2 (days)
7.6200000e+00	6.0625000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.5700000e+00	6.1041700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.4200000e+00	6.1458300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.2700000e+00	6.1875000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.2400000e+00	6.2291700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.2900000e+00	6.2708300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.3500000e+00	6.3125000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.4400000e+00	6.3541700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.5600000e+00	6.3958300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.6500000e+00	6.4375000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.6200000e+00	6.4791700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.6900000e+00	6.5208300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.7200000e+00	6.5625000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.8100000e+00	6.6041700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.8300000e+00	6.6458300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
7.8700000e+00	6.6875000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.0100000e+00	6.7291700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.3900000e+00	6.7708300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.6300000e+00	6.8125000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.8700000e+00	6.8541700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.7500000e+00	6.8958300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.9600000e+00	6.9375000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.8700000e+00	6.9791700e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00
8.8500000e+00	7.0208300e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00	0.0000000e+00

NOTES:

s3 = observed drawdown in well LA-3
t3 = observed time of s3
s1b = observed drawdown in well LA-1B
t1b = observed time of s1b
Q2 = observed discharge at well LA-2
t2 = observed time of Q2
Zero values indicate no data

R3 = Distance from LA-3 to LA-2
R3 = 950 feet
R1 = Distance from LA-1B to LA-2
R1 = 1200 feet

Table B-2. Program Listing for Aron-Scott Procedure

```
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function [TS] = ptaron(dt,qt,r,an,n)
%PTARON analyzes pump test data using the Aron-Scott method for variable Q.
%        dt = column vector of observed drawdowns (col 1) at time t (col 2).
%        qt = column vector of observed discharge (col 1) at time tq (col 2).
%         r = radial distance of observation well from pump well.
%        an = % of ns pts removed from curve fit (default = .25)
%         n = nth degree polynominal for q vs. tq (default = 4).
%     units = s (ft); t&tq (days); q (gpm); r (ft).
%        TS = answer matrix: column 1 = raw data; column 2 = smoothed data.
%         T = row 1 = transmissivity (sq ft/day).
%         S = row 2 = storage coefficient (dimensionless).
%        to = row 3 = t value of intercept point%.
%       err = row 4 = error term = r*r*S/[4T(tmax-to)] < 0.01.
%
%        Ref: G.P. Kruseman and N.A. De Ridder, 1976,
%             Analysis and Evaluation of Pumping Test Data, pp.140-142,
%             International Institute for Land Reclamation & Improvement,
%             Wageningen, The Netherlands.
%
%         Written by:                    Written on: 6-16-94
%         Stephen G. McLin
%         Los Alamos National Laboratory
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%         Los Alamos, NM 87545
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%
if any(imag(dt)) | any(dt < 0)
   error('Input drawdown s at time t must be real and > 0')
end
if any(imag(qt)) | any(qt < 0)
   error('Input pumping rate q at time t must be real and > 0')
end
if any(imag(r)) | any(r < 0)
   error('Input radial distance r must be real and > 0')
end
if nargin < 4
   an=0.25;
end
if nargin < 5
   n=4;
end
format short e
[ns,ms]=size(dt); [nq,mq]=size(qt);
if ns < ms
   dt=dt'
end
if nq < mq
   qt=qt'
end
nsc=round(ns*(1-an)); nqc=round(nq*(1-an));
s=dt(:,1); ts=dt(:,2); q=qt(:,1); tq=qt(:,2); tmax=max(ts);
pq=polyfit(tq,q,n); qs=polyval(pq,ts);
ps=polyfit(ts,s,2); ss=polyval(ps,ts); a=7.48/1440;
for i=1:ns
    if ss(i) < 0
```

Table B-2. (Cont.)

```
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    ss(i)=0.0;
    end
end
axis('auto')
no1=subplot(2,2,1);
semilogx(ts,s,'o',ts,ss,'-');          % plots raw and fitted s vs. t
xlabel('TIME (days)')
ylabel('s (ft)')
no2=subplot(2,2,2);
plot(tq,q,'o',ts,qs,'-');              % plots raw and fitted q vs. T
xlabel('TIME (days)')
ylabel('Q (gpm)')
TS=ones(4,2);
RSQ=a.*s./qs; SSQ=a.*ss./qs; tx=log(ts(nsc:ns));
psqr=polyfit(tx,RSQ(nsc:ns),1); psqs=polyfit(tx,SSQ(nsc:ns),1);
T1=1/(4*pi*psqr(1,1)); T2=1/(4*pi*psqs(1,1));
qmr=zeros(nq,1); qms=zeros(ns,1);
for i=1:nq
    qmr(i)=mean(q(1:i));
    mmRSQ(i)=(qmr(i)/q(i)-1)/(2.25*pi*T1);
end
mRSQ=mean(mmRSQ(nqc:nq));
for i=1:ns
    qms(i)=mean(qs(1:i));
    mmSSQ(i)=(qms(i)/qs(i)-1)/(2.25*pi*T2);
end
mSSQ=mean(mmSSQ(nsc:ns));
to1=exp((mRSQ-psqr(1,2))/psqr(1,1));  too1=exp(-psqr(1,2)/psqr(1,1));
to2=exp((mSSQ-psqs(1,2))/psqs(1,1));  too2=exp(-psqs(1,2)/psqs(1,1));
tfit1=[too1:0.1:ts(ns)]; tx1=log(tfit1); sfit1=polyval(psqr,tx1);
tfit2=[too2:0.1:ts(ns)]; tx2=log(tfit2); sfit2=polyval(psqs,tx2);
S1=2.25*T1*to1/(r*r); err1=(r*r*S1)./(4*T1*(tmax-too1));
S2=2.25*T2*to2/(r*r); err2=(r*r*S2)./(4*T2*(tmax-too2));
TS(1,1)=T1; TS(1,2)=T2; TS(2,1)=S1; TS(2,2)=S2;
TS(3,1)=to1; TS(3,2)=to2; TS(4,1)=err1; TS(4,2)=err2;
no3=subplot(2,2,3);
semilogx(ts,RSQ,'o',tfit1,sfit1,'-');
xlabel('TIME (days)')
ylabel('RAW s/Q (days/sq ft)')
no4=subplot(2,2,4);
semilogx(ts,SSQ,'o',tfit2,sfit2,'-');
xlabel('TIME (days)')
ylabel('FITTED s/Q (days/sq ft)')
subplot(no1);
end
```