Ground-Water Levels in Water Year 1987 and Estimated Ground-Water Pumpage in Water Years 1986-87, Carson Valley, Douglas County, Nevada

By David L. Berger

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ILLUSTRATIONS

[Plate is in pocket at back of report]

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CONVERSION FACTORS AND ABBREVIATIONS

"Inch-pound" units of measure used in this report may be converted to metric (International System) units by using the following factors:

Multiply	*By*	*To obtain*
Acre	0.4047	Square hectometer (hm^2)
Acre-foot (acre-ft)	0.001233	Cubic hectometer (hm^3)
Acre-foot per year (acre-ft/yr)	0.001233	Cubic hectometer per year (hm^3/yr)
Foot (ft)	0.3048	Meter (m)
Inch (in.)	25.40	Millimeter (mm)
Mile (mi)	1.609	Kilometer (km)

SEA LEVEL

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929), which is derived from a general adjustment of the first-order leveling networks of both the United States and Canada (formerly called "Sea-Level Datum of 1929").

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ABSTRACT

Measurements of ground-water levels made at 58 wells during water year 1987 and summary of estimated pumpage for water years 1986 and 1987 in Carson Valley, Douglas County, Nevada, are presented. The data were collected to provide a record of ground-water changes over the long term and pumpage estimates that can be incorporated into an existing ground-water model. The estimated total pumpage in water year 1986 was 10,200 acre-feet and in water year 1987 was 13,400 acre-feet. Ground-water levels exhibited seasonal fluctuations but remained relatively stable over the reporting period throughout most of the valley.

INTRODUCTION

Purpose and Scope

Ground-water levels were measured at 58 wells in Carson Valley as part of a cooperative data-collection program between the U.S. Geological Survey and the Douglas County Department of Public Works. Estimates of municipal, agricultural, domestic, and aquacultural pumpage were also collected and summarized. The purpose of this data-collection program was to record changes in ground-water levels over the long-term and to collect records of ground-water pumpage for incorporation into the existing ground-water flow model (Maurer, 1986). This report presents data compiled during the second year of this data-collection program. Ground-water measurements reported herein were made during the 1987 water year (October 1, 1986, through September 30, 1987). Estimates of pumping volumes are for the water years 1986-87.

Description of Study Area

Carson Valley lies on the western edge of the Great Basin and is part of the Carson River drainage basin (figure 1). The valley is bounded on the west by the Carson Range of the Sierra Nevada and on the east by the Pine Nut Mountains. The north end of the valley is approximately 4 miles south of Carson City, the capital of Nevada. The drainage basin of Carson Valley is about 280,000 acres (about 15 by 24 miles). The valley is inhabited by a population of about 25,000.

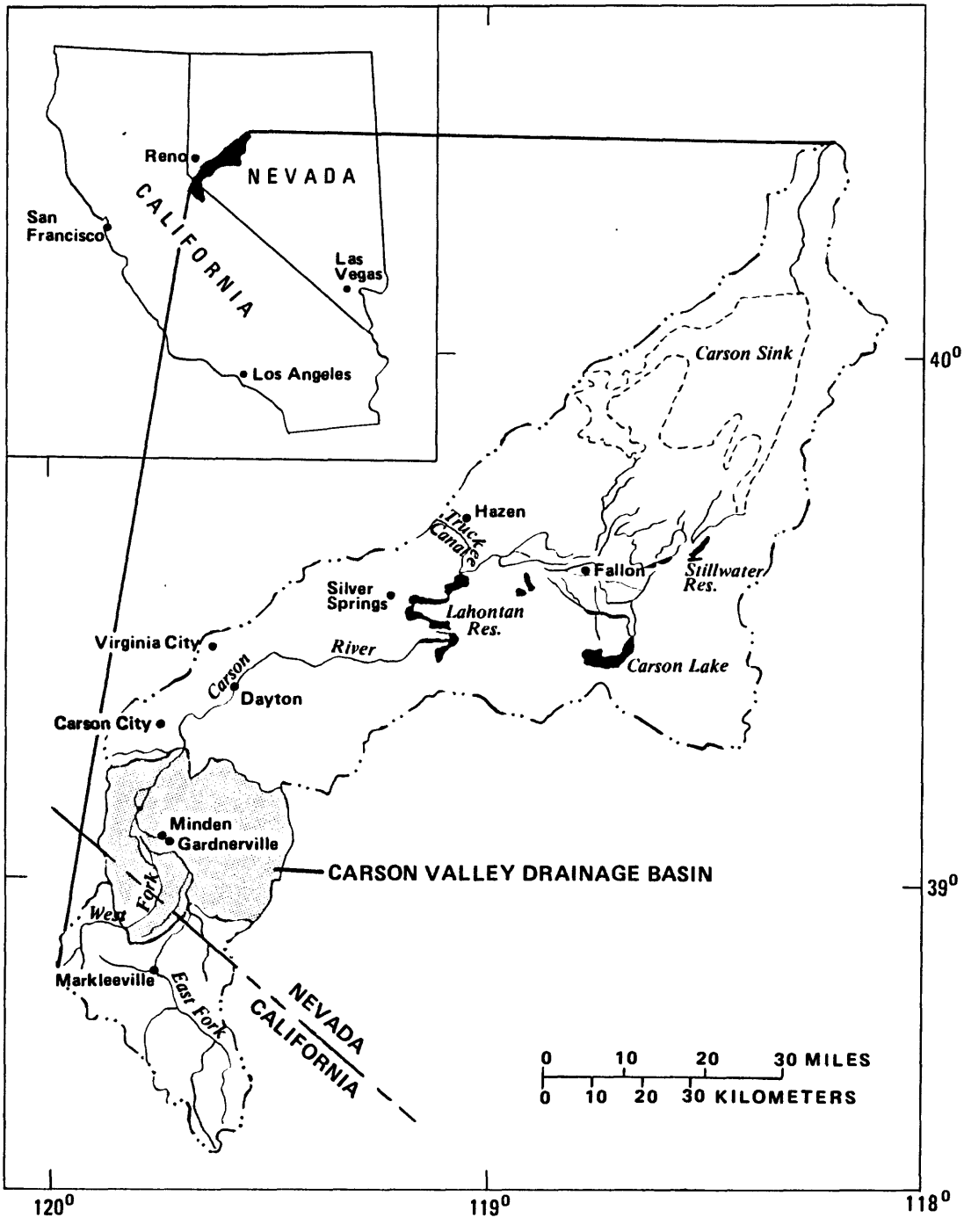

FIGURE 1.--Location of Carson Valley and the Carson River drainage basins, Nevada-California.

Previous Work

During 1981 through 1983, approximately 70 wells were measured monthly to provide input data for a ground-water model. The model was developed to simulate ground-water and surface-water interaction and to aid planners in assessing the possible effects of development alternatives in Carson Valley (Maurer, 1986, p. 42). In 1986, the first data report designed to extend the length of records at many of the original 70 wells was published (Berger, 1987). That report presents water-level measurements for 56 wells during water years 1984-86 and tabulations of estimated pumpage for water years 1984-85. As a continuing effort, this report includes data from most of the 56 sites. A few sites were deleted, however, and new sites were added to the data base to provide measurements in areas currently undergoing increasing development.

Acknowledgments

The author thanks the residents of Carson Valley for the use of their wells for measurements; Sierra Pacific Power Co., the Gardnerville Town Water Co., Minden Water Co., U.S. Bureau of Sport Fisheries and Wildlife, and Douglas County Department of Public Works for providing needed data; and James R. Swartwood of the U.S. Geological Survey for maintenance of the data base.

U.S. Geological Survey Site Designations

Standard Identification System

Sites are identified by the standard Geological Survey identification (ID), which is based on the grid system of latitude and longitude. The ID indicates the geographic location of each site, and provides a unique number for each. The ID consists of 15 digits: The first 6 denote the degrees, minutes, and seconds of latitude; the next 7 denote degrees, minutes, and seconds of longitude; and the last 2 digits (assigned sequentially) identify the sites within a 1-second grid. For example, site 385556119491501 is at 38°55'56" latitude and 119°49'15" longitude, and it is the first site recorded in that 1-second grid.

Local Identification System

The local site-identification system used in this report is based on an index of hydrographic areas in Nevada (Rush, 1968) and the rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian. Each site designation consists of four units separated by spaces: The first unit is the hydrographic area number. The second unit is the township, preceded by an N or S to indicate location north or south of the base line. The third unit is the range, preceded by an E to indicate location east of the meridian. The fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section, and so on (A, B, C, and D indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the site was recorded. For example, site 105 N12 E19 2CBAA1 is in Carson Valley (hydrographic area 105). It is the first site recorded in the northeast quarter of the northeast quarter of the northwest quarter of the southwest quarter of section 2, Township 12 North, Range 19 East, Mount Diablo base line and meridian.

BASIC DATA

Ground-Water Levels

Water-level measurements and general data on the wells monitored for this project are presented in table 1. The well network was designed to obtain adequate coverage of ground-water levels in Carson Valley for use in the ground-water model. The network was expanded to obtain water-level data where ground-water usage increased or land use changed. The land-surface altitudes of the well sites were estimated from a map with a scale of 1:4,800 and a contour interval of 5 feet (Genge Aerial Surveys, 1977). Well locations are shown on plate 1. Of the 58 wells measured, 22 were drilled by the Geological Survey. The well sites are of four types, and each type is described briefly in the following paragraphs.

The static water level was measured throughout the valley at 32 observation wells. These wells include domestic, Geological Survey, and unused irrigation wells.

Fourteen sites were developed to measure the ground-water gradient relative to the surface-water altitude of nearby bodies of water. All wells at these sites were drilled by the Geological Survey. Each gradient-monitoring site was surveyed to determine a reference point from which the surface-water altitude could be measured. At each site, either one or two shallow observation wells were located at known distances and altitudes from the surface-water reference point. The ground-water level and the surface-water altitude were measured simultaneously to determine whether the body of surface-water was gaining from or losing to the ground-water system.

Water levels in four extensively pumped observation wells were measured to determine the long-term effects of pumping on local ground-water levels. The measurements were made when the wells were not being pumped and when the water levels represented static conditions. The site status at the time each measurement was taken is recorded in the "water-level status" column in table 1.

One flowing well on the east side and five on the west side of Carson Valley are considered to penetrate a deeper aquifer system (Maurer, 1986, p. 17). Measurements were made 10 minutes after flow had been shut off with a standard pressure gauge that had been calibrated in units of inches of water. Minus signs preceding measurements in table 1 indicate water levels above land surface.

Estimated Ground-Water Pumpage

Pumpage data were collected from wells in the various subdivisions, from the Douglas County Department of Public Works, and from the U.S. Bureau of Sport Fisheries and Wildlife in Carson Valley, and are presented in table 2. Estimated ground-water pumpage increased approximately 31 percent in water year 1987 from water year 1986 (table 2). Agricultural kilowatt usage was obtained from Sierra Pacific Power Company to estimate ground-water pumpage using methods established by Maurer (1986, p. 61). Total lift values that were used to convert kilowatt usage to acre-feet of pumpage ranged from 30 to 160 feet, and the average was about 80 feet. Domestic pumpage was determined by multiplying the estimated number of residences (obtained from 1986 estimates by the Douglas County Department of Public Works) by a use factor of 0.545 acre-ft/yr per unit.

TABLE 1.--*Water levels and other data for wells, water year 1987*

Local and U.S. Geological Survey site identifications.--See section in text titled "U.S. Geological Survey Site Designations."
Water use.--H, domestic; I, irrigation; S, stock; U, unused.
Water-level depth.--Minus sign indicates water level above land surface; all other water levels are below land surface.
Site status.--D, well dry; O, obstruction in well; P, well pumping; R, well pumped recently; X, water level affected by stage of nearby surface-water body; -, no status recorded.
Water-level measurement method.--G, pressure gage; S, steel tape; T, electric tape.

[--, no data available]

U.S. Geological Survey site designations		Water use	Land-surface altitude (feet)	Well depth (feet)	Depth to first opening (feet)	Water level			
Local identification	Standard identification					Date	Depth (feet)	Site status	Measurement method
105 N11 E20 06ACCB1	385051119464101	U	4,845	15.5	13	12-02-86	3.91	X	S
						03-06-87	4.77	X	S
						06-15-87	1.94	X	S
						08-18-87	3.40	-	S
105 N12 E19 01BDCD1	385557119475701	U	4,700	18.6	18.4	12-03-86	6.64	X	S
						03-10-87	6.68	X	S
						06-15-87	5.46	X	S
						08-18-87	7.39	X	S
105 N12 E19 02BDDD1	385559119485701	S	4,696	262	--	12-03-86	-11.3	-	G
						03-10-87	-11.5	-	G
						06-16-87	-11.7	-	G
						08-17-87	-7.7	-	G
105 N12 E19 02CBAA1	385556119491501	U	4,705	22	20	12-03-86	6.12	X	S
						03-10-87	5.89	X	S
						06-15-87	5.72	X	S
						08-18-87	6.24	X	S
105 N12 E19 11CDCC1	385439119490901	S	4,714	60	--	12-03-86	-16.7	X	G
						03-10-87	-11.5	X	G
						06-16-87	-15.7	X	G
						08-18-87	-10.0	-	G
105 N12 E19 12CDCD1	385438119475501	U	4,711	18.7	12.2	12-03-86	5.98	X	S
						03-10-87	5.61	X	S
						06-15-87	5.61	X	S
						08-18-87	6.34	X	S
105 N12 E19 23CDBC1	385304119460601	U	4,795	26.8	23.8	12-02-86	3.43	-	S
						03-09-87	0.70	-	S
						06-15-87	1.25	-	S
						08-18-87	2.15	-	S
105 N12 E19 24CCAA1	385303119480201	H	4,731	82	66	12-03-86	-13.4	-	G
						03-10-87	-14.3	-	G
						07-20-87	-13.7	-	G
105 N12 E19 36ADDA1	385138119471801	U	4,794	198	108	12-02-86	2.26	X	S
						03-09-87	2.84	-	S
						06-15-87	1.70	X	S
105 N12 E20 04BAAA2	385620119453101	U	4,759	21	11	12-02-86	6.44	-	S
						03-09-87	6.70	-	S
						06-15-87	4.74	-	S
						08-17-87	6.39	-	S
105 N12 E20 06ABCC1	385612119464101	U	4,716	20.5	17.5	12-02-86	4.03	-	S
						03-10-87	3.73	-	S
						06-16-87	2.69	-	S
						08-18-87	5.51	-	S
105 N12 E20 07DBCC1	385452119464101	U	4,718	15	13	12-02-86	1.76	X	S
						03-09-87	1.71	X	S
						06-15-87	1.83	X	S
						08-18-87	2.58	-	S
105 N12 E20 09BCAD1	385512119444801	I	4,769	450	--	12-02-86	18.03	X	S
						03-09-87	20.66	X	S
						06-15-87	12.37	X	S

TABLE 1.--*Water levels and other data for wells, water year 1987*--Continued

U.S. Geological Survey site designations		Water use	Land-surface altitude (feet)	Well depth (feet)	Depth to first opening (feet)	Water level			
Local identification	Standard identification					Date	Depth (feet)	Site status	Measurement method
105 N12 E20 10AAAB1	385528119425801	U	4,821	355	130	12-02-86	28.56	-	S
						03-09-87	29.90	-	S
						06-15-87	28.29	-	S
						08-17-87	37.10	-	S
105 N12 E20 13DDBB1	385413119405001	H	5,005	250	230	12-02-86	146.66	-	S
						03-09-87	148.52	-	S
						06-15-87	146.28	-	S
						08-17-87	147.24	-	S
105 N12 E20 14BABC1	385430119422401	U	4,839	21	11	12-02-86	4.87	-	S
						03-09-87	6.60	-	S
						06-15-87	3.63	-	S
						08-17-87	6.05	-	S
105 N12 E20 19ABBB1	385343119464101	U	4,735	17.2	10.0	12-02-86	3.55	-	S
						03-09-87	3.09	X	S
						06-15-87	2.68	X	S
						08-18-87	2.55	X	S
105 N12 E20 24ADCC2	385321119405002	H	4,980	145	122	08-17-87	98.44	-	S
105 N13 E19 09ADCA1	390021119504301	H	4,810	180	156	12-02-86	115.85	-	S
						03-09-87	118.13	-	S
						06-16-87	117.95	R	S
						08-18-87	--	P	-
						08-27-87	123.90	R	S
105 N13 E19 09DAAB1	390016119504101	P	4,776	159	79	12-02-86	34.4	-	T
						03-09-87	31.1	-	T
						06-16-87	36.5	R	T
						08-18-87	41.3	R	T
105 N13 E19 11CCDD1	385951119491801	U	4,673	17.7	11.0	12-03-86	7.84	-	S
						03-10-87	7.70	-	S
						06-16-87	8.24	-	S
						08-17-87	8.12	X	S
105 N13 E19 11CCDD2	385951119492001	U	4,673	18.2	12.5	12-03-86	8.38	-	S
						03-10-87	8.32	X	S
						06-16-87	8.81	X	S
						08-18-87	8.82	X	S
105 N13 E19 12BBAD1	390037119480701	S	4,667	400	--	12-03-86	-15.1	-	G
						03-10-87	-15.2	-	G
						06-16-87	-14.3	-	G
						08-18-87	5.58	-	S
105 N13 E19 22CCAC1	385813119502601	I	4,760	172	69	12-02-86	56.02	-	S
						03-09-87	57.18	-	S
						06-15-87	57.23	-	S
						08-18-87	64.12	-	S
105 N13 E19 22DCAC1	385815119500301	U	4,677	16.3	10.3	12-03-86	6.80	X	S
						03-10-87	6.51	X	S
						06-16-87	5.80	X	S
						08-18-87	6.88	-	S
105 N13 E19 22DCAC2	385815119500202	U	4,677	18	12	12-03-86	6.35	-	S
						03-10-87	5.97	X	S
						06-16-87	5.16	X	S
						08-18-87	6.48	X	S
105 N13 E19 23DDAD1	385816119482401	U	4,681	21	18	12-03-86	3.49	-	S
						03-10-87	2.80	-	S
						06-16-87	2.17	X	S
						08-17-87	4.84	-	S
105 N13 E19 24CADD1	385821119475001	S	4,685	401	--	12-03-86	-13.9	-	G
						03-10-87	-13.9	-	G
						06-16-87	-13.8	-	G
						08-18-87	-5.8	-	G

TABLE 1.--*Water levels and other data for wells, water year 1987*--Continued

U.S. Geological Survey site designations		Water use	Land-surface altitude (feet)	Well depth (feet)	Depth to first opening (feet)	Water level			
Local identification	Standard identification					Date	Depth (feet)	Site status	Measurement method
105 N13 E19 33DADD1	385637119503701	U	4,755	80	--	12-02-86	21.46	-	S
						03-09-87	20.21	-	S
						06-15-87	21.45	-	S
						08-18-87	23.67	-	S
105 N13 E20 03BCBB1	390122119424701	U	4,756	108	--	12-02-86	32.00	-	S
						03-09-87	31.89	-	S
						06-15-87	32.10	-	S
						08-17-87	32.87	-	S
105 N13 E20 08ACBC1	390024119453501	U	4,692	21.1	19.1	12-03-86	6.33	X	S
						03-10-87	5.32	X	S
						06-15-87	1.30	X	S
						08-17-87	--	D	-
105 N13 E20 12BCAD1	390025119412701	I	4,952	280	172	12-02-86	159.32	-	S
						03-09-87	160.95	-	S
						06-15-87	161.06	-	S
						08-17-87	159.89	R	S
105 N13 E20 14AADA1	385944119414501	U	4,990	301	--	12-02-86	92.14	-	S
						03-09-87	93.13	-	S
						06-15-87	92.69	-	S
						08-17-87	92.27	-	S
105 N13 E20 18BAAA1	385948119464401	U	4,682	20.5	10.5	12-03-86	2.53	-	S
						03-10-87	3.01	X	S
						06-16-87	2.24	X	S
						08-18-87	4.05	-	S
105 N13 E20 19AAAB1	385859119461501	S	4,696	318	--	12-02-86	-5.4	-	G
						03-10-87	-1.0	-	G
						06-15-87	-4.2	-	G
						08-18-87	19.80	-	S
105 N13 E20 19ACCC1	385834119464101	U	4,694	11	2	12-02-86	3.44	-	S
						03-09-87	2.71	-	S
						06-15-87	2.23	-	S
						08-17-87	4.43	X	S
105 N13 E20 22CADD1	385821119432401	I	4,799	--	--	12-02-86	20.70	-	S
						03-09-87	23.08	-	S
						06-15-87	19.89	-	S
						08-17-87	19.35	-	S
105 N13 E20 23DDDA1	385815119413101	I	4,885	392	310	12-02-86	77.48	-	S
						03-09-87	77.73	-	S
						06-15-87	77.99	-	S
						08-17-87	81.36	-	S
105 N13 E20 26ABBB1	385801119421501	I	4,868	130	90	12-02-86	--	P	-
						03-09-87	54.30	-	S
						06-15-87	52.65	-	S
105 N13 E20 26DADD1	385729119414501	I	4,922	180	104	12-02-86	104.68	-	S
						03-09-87	105.29	-	S
						06-15-87	105.90	-	S
105 N13 E20 30DBBB1	385730119464101	U	4,702	21	18.5	12-02-86	7.94	-	S
						03-09-87	8.47	-	S
						06-15-87	6.03	-	S
105 N13 E20 32CAAA1	385630119452001	I	4,733	420	--	12-02-86	10.57	-	S
						03-09-87	10.93	-	S
						06-15-87	9.59	-	S
105 N13 E20 34ACBC1	385655119432101	I	4,791	--	--	12-02-86	6.87	-	S
						03-09-87	9.59	-	S
						06-15-87	4.31	-	S
						08-17-87	7.84	-	S

TABLE 1.--*Water levels and other data for wells, water year 1987*--Continued

U.S. Geological Survey site designations		Water use	Land-surface altitude (feet)	Well depth (feet)	Depth to first opening (feet)	Water level			
Local identification	Standard identification					Date	Depth (feet)	Site status	Measurement method
105 N13 E21 19CBBA1	385834119395901	U	5,000	140	--	12-02-86	92.49	-	S
						03-09-87	92.64	-	S
						06-15-87	92.60	-	S
						08-17-87	92.24	-	S
105 N13 E21 32BDAD1	385657119385801	I	5,141	608	--	12-02-86	27.30	-	S
						03-09-87	27.23	-	S
						06-15-87	27.23	-	S
						08-17-87	27.40	-	S
105 N14 E19 11CADC1	390519119490201	H	5,167	165	116	12-02-86	73.36	-	S
						03-09-87	71.51	-	S
						06-15-87	75.42	-	S
						08-18-87	82.40	-	S
105 N14 E19 12ADAB1	390542119472001	H	4,909	155	120	12-02-86	37.21	-	S
						03-09-87	33.47	-	S
						06-15-87	52.64	-	S
						08-18-87	61.59	R	S
105 N14 E19 15BBAB1	390501119502401	I	5,138	290	125	12-02-86	9.83	-	S
						03-09-87	10.09	-	S
						06-15-87	20.53	-	S
						08-18-87	--	P	-
105 N14 E19 26ABBC1	390315119485001	I	4,776	--	--	12-02-86	19.74	-	S
						03-09-87	19.67	-	S
						06-15-87	19.49	-	S
						08-17-87	20.14	-	S
105 N14 E19 34DBAD1	390156119495401	I	4,740	248	48	12-02-86	39.81	-	S
						03-09-87	37.14	-	S
						06-15-87	41.45	-	S
						08-18-87	43.02	-	S
105 N14 E20 07CBAD1	390525119465901	U	4,835	246	--	12-02-86	105.62	-	S
						03-09-87	104.49	-	S
						06-16-87	103.33	-	S
						08-17-87	105.66	-	S
105 N14 E20 08BBBB1	390557119460701	P	4,900	340	270	12-02-86	232.45	-	S
						03-09-87	232.42	-	S
						06-15-87	232.31	-	S
						08-17-87	232.63	-	S
105 N14 E20 18ABAB1	390503119463501	H	4,760	425	151	12-01-86	130.58	-	S
						12-02-86	130.54	-	T
						03-10-87	119.4	-	T
						06-15-87	--	P	-
						07-20-87	159.0	-	T
105 N14 E20 29ACCC1	390307119452201	U	4,657	17.4	13.3	12-02-86	6.72	-	S
						03-09-87	6.13	-	S
						06-15-87	6.24	-	S
						08-17-87	7.80	-	S
105 N14 E20 30DCCB1	390205119464301	U	4,654	20.5	10.5	12-02-86	--	O	-
						03-09-87	4.6	-	T
						06-15-87	4.81	-	S
						08-17-87	5.73	-	S
105 N14 E20 32DCCC1	390137119453601	U	4,679	21	11	12-03-86	4.99	X	S
						03-10-87	4.64	X	S
						06-15-87	3.55	-	S
						08-17-87	7.33	-	S
105 N14 E20 33BCDA1	390208119444601	U	4,683	220	60	12-02-86	0.10	-	S
						03-06-87	-0.13	-	S
						06-15-87	0.03	-	S
						08-17-87	2.00	-	S
105 N14 E20 34BAAA1	390228119432501	U	4,782	126	102	07-20-87	59.67	-	S
						08-17-87	59.80	-	S

TABLE 2.--*Estimated ground-water pumpage, water years 1986-87*

[Rounded to nearest 100 acre-feet]

Pumpage category	1986	1987
Agriculture	3,400	6,500
Domestic	1,400	1,500
Aquaculture[1]	1,900	1,800
Municipal	3,500	3,600
TOTAL[2]	10,200	13,400

[1] Termed "industrial" in previous report (Berger, 1987, p. 16).

[2] Estimated totals for water years 1981-85, in acre-feet per year (Berger, 1987, p. 16): 1981, 14,500; 1982, 7,400; 1983, 7,000; 1984, 7,700; and 1985, 10,800.

SUMMARY

Total estimated ground-water pumpage for water year 1987 (13,400 acre-feet) was approximately 31 percent higher than estimated pumpage for water year 1986. While the domestic, aquacultural, and municipal pumpage remained relatively the same, agricultural pumpage increased and reflects the lack of available surface water for irrigation during the 1987 water year. Ground-water levels fluctuated in response to agricultural practices but remained at or near the same level throughout the 1987 water year.

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