OXYGEN AND HYDROGEN STABLE ISOTOPE MEASUREMENTS OF GROUND WATERS OF THE CENTRAL WEST SIDE OF THE SAN JOAQUIN VALLEY, CALIFORNIA

by Tyler B. Coplen, Carol Kendall, and George H. Davis

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CONTENTS

TABLES

CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, conversion factors for the inch-pound terms used in this report are listed below:

Multiply Inch-Pound Unit	By	To Obtain Metric Unit
mile (mi)	1.609	kilometer (km)
acres	4,047.	square meter (m^2)
cubic inch (in^3)	16.39	milliliter (ml)

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°C = (°F - 32)/1.8$$

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ABSTRACT

Oxygen and hydrogen stable isotope ratio analyses of ground waters from the Central West Side of the San Joaquin Valley, Calif., can be used to distinguish several ground-water groups, some of which had been previously identified by chemical differences. The oxygen isotope values range from -13 to -6 permil relative to SMOW, and the hydrogen isotope values range approximately from -100 to -55 permil relative to SMOW.

INTRODUCTION

In 1957, Davis and Poland inventoried and described the chemical characteristics of ground waters of the Central West Side of the San Joaquin Valley. The origin of a thick, laterally extensive body of confined ground water of lower mineral content than overlying unconfined groundwater has long been an enigma to hydrologists. In 1968, samples from wells were collected for hydrochemical and oxygen and hydrogen stable isotope ratio analysis. Bertoldi and LeBlanc (1969) give detailed well descriptions, including positions of screens, and chemical analyses for wells sampled, including major element chemistry, boron, nitrate, silica, and iron concentrations. This report presents the oxygen and hydrogen isotopic compositions of selected samples from the 1968 sampling. In addition, the concentrations of selected chemical species reported by Bertoldi and LeBlanc (1969) have been listed for these selected samples.

WELL-NUMBERING SYSTEM

The well-numbering system used by the Geological Survey in the Central Valley shows the locations of wells according to the rectangular system for the subdivision of public lands. For example, for the number 14/15-18E1, which was assigned to a well 2-1/2 miles south of Mendota, the part of the number preceding the slash indicates the township (T. 14 S.); the number following the slash, the range (R. 15 E.); the digits following the hyphen, the section (sec. 18); and the letter following the section number, the 40-acre subdivision of the section as shown in the diagram below.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within each 40-acre tract the wells are numbered consecutively, as indicated by the final digit of the number. Thus, well 14/15-18E2 is the second well to be listed in the SW 1/4 of the NW 1/4 of sec. 18.

ANALYTICAL METHODS

The water samples in this study were analyzed for hydrogen isotopic composition by conversion to hydrogen by reaction with zinc (Kendall and Coplen, 1985) and measured with an isotope ratio mass spectrometer. Water was prepared for oxygen isotope analysis by equilibrating a 2-ml aliquot with carbon dioxide (Epstein and Mayeda, 1953), which was subsequently analyzed on a double-focusing, double-collecting isotope ratio mass spectrometer (Coplen, 1973).

Stable isotope ratios are reported relative to Standard Mean Ocean Water (SMOW) in units of parts per thousand or permil. Thus, for oxygen:

$$\delta^{18}O \text{ (in } ‰) = \left[\frac{(^{18}O/^{16}O)_{sample}}{(^{18}O/^{16}O)_{standard}} - 1 \right] 1000$$

For hydrogen:

$$\delta D \text{ (in } ‰) = \left[\frac{(D/H)_{sample}}{(D/H)_{standard}} - 1 \right] 1000$$

The isotope results have been normalized such that δD of Standard Light Antarctic Precipitation (SLAP) is -428 permil and $\delta^{18}O$ of SLAP is -55.5 permil (Gonfiantini, 1978). The precision of the oxygen isotope data is ± 0.15 permil and that of the hydrogen isotope data is ± 2 permil.

RESULTS

The ground-water samples in this study can be divided by chemical and isotopic differences into 11 groups. A twelfth group contains samples of mixed ground waters. The δD, $\delta^{18}O$, and major element chemical data are listed for these groups in table 1 through table 12.

ACKNOWLEDGMENTS

We wish to acknowledge Celeste Greene and Brenda Lopez for care in preparation and analysis of ground-water samples for stable isotopic composition.

Table 1.--Geochemical analyses of ground waters from the San Joaquin River flood plain

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
11/13-34C1	57400	W-2010	19	149	2.9	32	18	185	73	172	0	0.4	544	---	-10.95
13/14-3C1	57402	W-2011	18	154	4.0	41	24	238	94	132	0	0.3	668	---	-11.30
10/12-5Q1	57468	W-1994	19	140	2.0	54	22	190	82	200	0	2.9	632	---	-11.40
10/11-13H1	57472	W-1998	19	140	3.0	54	25	180	86	180	0	2.3	644	---	-10.95
13/15-18G1	57523	W-1964	19	102	---	1.9	0.3	52	50	121	3	0.8	332	-88.0	-11.70
13/15-7L1	57524	W-1965	18	129	---	3.2	0.5	80	71	133	3	0.1	436	-91.0	-11.30
13/15-30B6	57527	W-1968	19	74	---	16	5.8	58	24	147	0	1.1	270	---	-11.05
13/14-2P1	57529	W-1944	19	88	---	32	17	86	125	120	0	0.8	444	---	-10.60
13/14-12L1	57532	W-1984	18	117	---	27	12	78	98	212	0	0.5	488	-87.0	-11.35
12/14-28L4	57559	W-1929	19	37	---	16	13	40	29	106	0	0.4	224	-89.0	-11.60
12/14-29B1	57561	W-1931	20	216	3.0	33	16	242	133	184	0	0.6	784	-87.5	-11.05
11/14-32F1	58173	W-1777	18	95	---	9.8	1.9	43	25	168	4	3.6	370	-93.5	-12.30
11/14-18N1	58174	W-1778	19	70	---	105	22	208	51	188	0	1.4	680	-86.0	-11.40
11/13-26F1	58175	W-1779	19	200	---	45	12	225	89	178	8	1.5	756	---	-11.05
11/13-28N4	58176	W-1780	--	90	---	35	18	121	93	102	0	7.1	430	---	-11.10
11/13-33K3	58177	W-1781	19	384	---	41	33	585	63	184	8	1.2	1250	---	-11.50
11/13-35G1	58178	W-1782	19	79	---	36	12	72	61	166	2	2.9	368	-90.5	-11.70
11/13-36A1	58179	W-1783	19	220	---	47	9.5	273	109	148	8	0.9	768	---	-11.65
11/13-7A1	58181	W-1784	19	265	---	72	32	410	117	196	4	1.1	1080	-79.5	-10.60
11/13-17L1	58182	W-1785	19	200	---	44	24	285	63	186	4	1.1	770	---	-11.35
11/13-21N2	58183	W-1786	19	204	---	43	23	323	47	160	4	1.0	776	---	-11.40
11/13-12P1	58184	W-1787	--	29	---	91	21	110	25	222	2	2.4	500	-86.5	-11.45
11/13-29A1	58188	W-1792	--	92	---	49	19	170	78	107	0	1.4	520	---	-10.15
11/13-2C1	58193	W-1797	18	80	---	52	13	131	38	166	0	2.3	470	-90.0	-11.65
12/14-7K1	58205	W-1807	19	86	---	11	3.9	51	63	113	0	2.1	311	-93.5	-12.10
11/13-14N1	58206	W-1808	19	120	---	46	14	61	89	295	0	1.6	512	---	-10.90

Table 2.--Geochemical analyses of ground waters from the Kings River flood plain

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
18/18-1K1	57461	W-1991	21	176	0.6	23	3.2	58	138	266	0	0.1	544	-85.5	-11.30
15/17-30B3	57617	W-1732	20	90	---	5.0	0.1	46	18	129	7	0.1	290	---	-10.65
15/17-19L1	57618	W-1733	23	148	---	24	2.2	108	33	214	13	0.0	476	---	-10.45
15/17-19N1	57619	W-1734	20	114	---	19	2.9	34	29	263	7	0.0	366	---	-9.95
15/17-29E1	57621	W-1736	20	125	---	16	2.5	25	21	303	11	0.0	382	---	-10.65
15/16-15G1	57642	W-1755	24	170	---	21	2.5	82	162	172	0	0.2	484	---	-10.60
16/17-4R2	57643	W-1756	20	99	---	49	5.1	14	57	328	6	0.3	316	---	-11.05
16/17-10L2	57644	W-1757	20	96	---	30	3.9	29	63	236	0	0.3	380	---	-11.65
16/17-3D2	57645	W-1758	20	96	---	18	1.7	12	23	262	4	0.3	320	-88.0	-11.20
16/17-5B1	57646	W-1759	24	113	---	7.8	4.1	17	49	235	10	0.5	440	---	-11.15
16/17-8F2	57647	W-1760	22	112	---	8.6	1.6	60	46	166	6	1.3	376	---	-10.95
15/16-26H1	57650	W-1763	22	155	---	40	6.4	62	207	170	6	0.5	580	---	-10.05
15/16-13Q2	57651	W-1764	25	140	---	30	5.7	95	59	228	12	1.5	468	---	-10.10
15/16-23J1	57652	W-1776	20	110	---	10	1.0	38	51	180	6	0.6	324	-80.0	-10.40
15/16-10N1	57658	W-1769	21	190	---	16	2.4	106	154	192	0	0.2	617	---	-9.70
15/17-34Q3	58191	W-1796	20	89	---	8.1	0.7	35	18	182	0	1.0	300	-85.5	-11.15
16/17-22A1	58194	W-1798	—	134	---	47	5.7	19	64	410	0	2.5	516	-92.0	-11.75
17/18-2P1	58215	W-1816	20	146	---	28	2.5	71	23	325	0	25	476	---	-11.30
17/18-22N2	58220	W-1820	20	191	---	38	5.7	81	78	382	0	1.3	606	---	-10.70
17/18-15P2	58233	W-1830	20	147	---	13	1.8	54	5	332	0	0.2	405	---	-10.85
17/18-20H1	58235	W-1906	22	176	---	39	6.8	57	99	400	0	0.1	606	---	-10.10
17/18-35Q2	58247	W-1841	22	295	---	73	13	89	420	348	0	0.2	1150	---	-11.15
18/19-7P2	58252	W-1860	24	154	---	14	1.4	52	29	321	0	0.3	428	---	-11.00

Table 3.--Geochemical analyses of ground waters from the shallow zone of the southern part of the Kings River flood plain

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
17/19-32M1	57629	W-1743	21	170	---	6.3	0.5	30	150	234	0	0.4	500	-90.5	-12.10
17/18-3N1	58217	W-1817	20	106	---	47	7.6	38	70	310	0	1.1	444	-93.5	-12.25
17/18-4D1	58218	W-1818	--	146	---	35	4.9	22	92	340	0	1.6	476	-94.0	-12.75
17/18-23N2	58246	W-1840	20	330	---	126	30	490	254	214	0	0.9	1410	---	-12.30
17/18-24P1	58248	W-1842	19	458	---	82	16	700	109	162	0	1.3	1520	-93.5	-12.35
18/19-10M1	58253	W-1846	21	158	---	16	3.7	60	137	191	0	0.2	512	-94.0	-12.35
18/19-17C3	58255	W-1847	22	140	---	6.5	0.8	59	51	221	0	0.2	400	-93.5	-12.25

Table 4.--Geochemical analyses of ground waters from the upper zone, axial aquifer

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
15/16-11F1	57405	W-2014	25	201	2.9	12	1.7	184	29	240	0	2.4	576	-73.0	-9.50
14/16-35P1	57498	W-2003	27	288	---	20	2.2	342	7	244	0	1.3	768	-74.5	-9.55
14/15-36J2	57539	W-1951	25	400	---	9.2	1.8	445	27	310	0	1.2	1090	---	-8.90
15/16-12B2	57605	W-1720	26	278	---	19	2.3	348	5	230	0	1.0	796	-71.0	-9.25
15/16-1M1	57606	W-1721	25	250	---	15	1.7	300	3	220	0	1.2	680	-70.0	-9.00
15/16-5L1	58195	W-1799	21	338	---	11	1.2	365	17	304	0	1.2	920	-72.0	-9.35

Table 5.—Geochemical analyses of ground waters from the upper zone, basal aquifer

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
18/18-9N1	58210	W-1811	25	170	---	43	15	42	315	186	0	1.6	698	-69.0	-9.35
18/18-6N1	58211	W-1812	25	184	---	65	29	52	480	116	0	1.4	882	---	-8.00
18/18-5Q1	58212	W-1813	24	180	---	55	15	46	375	168	0	3.0	782	---	-9.30
18/18-23P1	58241	W-1835	25	207	---	54	7.3	84	355	162	0	0.1	810	---	-9.30
18/18-22Q1	58243	W-1837	26	188	---	42	8.2	41	350	158	0	0.2	728	-65.0	-8.50
20/20-19D1	58430	W-1861	22	220	---	23	3.5	25	305	224	6	3.2	730	---	-8.65
20/19-12R2	58439	W-1868	24	206	---	29	3.0	24	295	202	6	6.4	690	-66.0	-8.70

Table 6.--Geochemical analyses of upper zone, superficial ground waters

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
14/14-17Q2	57404	W-2013	29	226	6.2	166	161	130	1220	168	0	12	2230	-56.5	-7.15
10/11-25E1	57469	W-1995	27	1300	7.0	250	260	2000	1300	450	0	11	5710	---	-7.10
13/12-36D2	57533	W-1946	---	256	---	172	158	182	1170	158	0	42	2310	-60.0	-7.80
12/11-14A1	57535	W-1947	---	307	---	200	64	490	540	150	0	45	1940	-57.5	-7.35
15/13-9N2	57547	W-1956	30	353	---	165	150	160	1380	180	10	2.8	2650	-57.0	-7.25
14/13-4P1	57552	W-1922	33	230	---	184	173	138	1280	172	0	21	2220	-61.0	-7.30
13/14-30N1	57554	W-1924	---	181	---	120	110	126	805	174	4	4.2	1530	-61.5	-7.95
13/13-6P2	57557	W-1927	---	278	---	240	131	163	1350	156	0	23	2320	-61.0	-7.85
17/16-11N3	57614	W-1729	25	268	---	252	27	64	1070	74	0	0.9	1790	---	-7.90
16/16-20R1	57627	W-1741	25	220	---	131	50	76	770	112	6	1.0	1370	---	-7.75
16/16-5N2	57628	W-1742	23	765	---	290	127	255	2260	150	0	0.8	3940	-65.0	-8.35
17/17-23N2	58196	W-1800	---	315	---	281	86	145	1460	75	0	1.1	2380	-54.0	-6.70
17/17-28R5	58214	W-1815	---	375	---	342	92	162	1640	44	0	0.7	2580	---	-7.00
18/17-27J1	58250	W-1844	---	300	---	112	115	128	1130	26	0	0.0	1880	-51.0	-6.40
19/16-35Q1	58256	W-1848	25	264	---	144	138	123	1090	178	0	9.3	2000	-57.5	-7.20
19/16-13M1	58261	W-1852	28	202	---	96	81	80	760	130	0	4.3	1340	---	-7.40
19/17-32N1	58450	W-1877	24	288	---	153	139	120	1150	176	0	20	2020	---	-6.80

Table 7.—Geochemical analyses of Los Gatos Fan ground waters

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
20/17-29N1	57445	W-2026	25	134	2.4	76	48	37	492	160	0	2.8	892	-54.0	-7.15
20/17-36E1	58423	W-1854	26	124	—	72	39	25	420	140	0	15	798	-53.5	-7.10
20/17-34C1	58424	W-1855	24	151	—	72	58	56	460	154	0	43	914	—	-7.15
20/17-21M1	58441	W-1870	28	152	—	68	49	48	465	158	6	11	978	—	-7.20
21/17-4G1	58471	W-1892	27	128	—	49	28	17	350	134	0	2.3	710	-57.5	-7.75
21/17-1D1	58480	W-1901	26	123	—	63	37	26	395	132	0	8.1	790	—	-7.20
21/17-11E1	58481	W-1902	27	126	—	74	36	22	440	142	0	4.3	826	-53.5	-7.15
21/18-7N1	58482	W-1903	27	126	—	79	32	25	440	114	0	7.9	820	-53.0	-7.45
21/17-25F1	58487	W-1909	27	186	—	90	36	130	460	84	0	24	1040	—	-7.25
20/17-26C2	58490	W-1912	25	148	—	66	44	36	480	138	0	7.4	904	—	-7.20

Table 8.--Geochemical analyses of ground waters from the northern part of the lower zone

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
12/11-13D2	57392	W-2007	27	293	2.9	52	31	137	535	178	0	1.2	1190	-71.5	-9.30
15/13-12M1	57395	W-2008	35	320	2.0	25	2.8	80	525	156	0	0.6	1060	---	-9.25
15/13-25M1	57397	W-2006	35	264	2.0	37	6.5	48	510	140	0	0.2	976	-69.0	-9.40
15/13-3N2	57403	W-2012	34	296	2.9	68	26	75	690	154	0	1.1	1330	---	-8.95
16/14-3H1	57413	W-2021	37	355	2.8	12	1.6	100	500	200	0	1.0	1100	-69.5	-9.05
12/11-10Q1	57470	W-1996	27	250	1.0	23	8.0	210	170	180	0	9.2	800	---	-9.40
15/13-6J1	57493	W-2000	33	316	---	45	35	88	640	224	0	4.1	1250	---	-9.00
15/13-20C1	57494	W-2001	35	264	---	34	5.8	50	500	98	0	2.4	972	---	-9.50
15/13-22M1	57497	W-2002	37	239	---	19	2.0	48	372	156	0	1.5	880	-72.5	-9.50
14/14-27D1	57499	W-2004	28	333	---	24	3.1	132	460	188	0	1.0	1100	---	-9.20
14/14-33E2	57500	W-1969	30	301	---	21	3.1	98	415	180	6	1.0	1040	-70.0	-8.80
15/13-35Q1	57504	W-1972	35	254	---	30	4.3	40	464	144	0	1.0	948	---	-9.45
15/14-15B1	57505	W-1973	30	320	---	25	1.5	80	496	152	0	0.9	1100	---	-9.20
15/14-32N2	57506	W-1974	33	229	---	39	4.4	40	468	108	0	1.1	872	---	-9.35
15/14-19E1	57507	W-1975	35	294	---	30	1.6	80	476	134	0	1.4	920	-72.5	-9.40
15/14-34E1	57508	W-1976	32	322	---	34	3.2	78	596	120	0	1.3	1100	-69.5	-9.20
15/14-21P1	57509	W-1977	29	229	---	45	1.9	52	452	116	0	1.9	892	---	-9.30
15/14-36Q2	57510	W-1978	30	290	---	39	8.5	84	544	126	0	1.5	1220	---	-9.10
13/12-22Q1	57513	W-1980	29	339	---	43	22	142	510	202	6	2.2	1260	---	-9.15
15/13-23N1	57518	W-1959	36	231	---	28	3.9	32	416	144	0	0.9	828	---	-9.55
15/13-23H1	57520	W-1961	34	309	---	29	4.5	70	526	144	0	0.2	1030	---	-9.25
15/13-26N1	57522	W-1963	38	304	---	21	4.4	50	466	208	0	0.3	1070	---	-8.85
12/11-12H1	57534	W-1985	---	334	---	35	13	165	440	246	0	2.7	1150	---	-8.55
12/12-25J2	57538	W-1950	---	255	---	24	6.2	57	285	320	6	2.3	856	-69.0	-9.05
14/12-2R2	57540	W-1952	29	302	---	47	24	115	520	206	0	2.8	1190	---	-8.85
14/14-20P1	57541	W-1953	30	256	---	17	2.2	67	345	218	0	1.3	824	---	-9.10
15/13-8E1	57548	W-1957	34	250	---	43	27	57	540	172	0	2.7	1030	-69.0	-9.15
14/13-18Q1	57550	W-1958	33	364	---	30	7.0	92	590	188	0	0.0	1230	-69.0	-9.35
14/13-29R1	57565	W-1933	33	264	---	42	30	56	540	186	0	0.3	1080	-69.0	-9.25
16/14-25R1	57600	W-1939	33	87	---	94	64	58	428	226	0	1.3	884	---	-9.10

Table 8.--Geochemical analyses of ground waters from the northern part of the lower zone--Continued

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
16/14-27P1	57601	W-1940	34	223	---	50	16	55	460	180	0	0.6	920	-70.5	-9.35
16/14-24E1	57602	W-1941	35	232	---	64	20	56	535	176	0	0.6	1050	-70.0	-9.15
16/14-25D1	57603	W-1942	30	154	---	64	35	52	430	166	0	0.6	828	---	-9.10
16/14-22K1	57604	W-1943	32	238	---	108	33	72	700	146	0	0.6	1320	---	-9.40
16/14-1Q2	57641	W-1754	28	201	---	67	16	46	504	108	0	0.5	868	---	-9.15
16/14-10Q1	57661	W-1772	32	202	---	88	22	25	565	120	0	0.1	1030	---	-9.15
16/14-4D1	57662	W-1773	33	260	---	31	2.8	34	460	138	0	0.2	904	---	-9.50
16/14-15Q1	57663	W-1774	32	220	---	128	31	32	725	132	0	0.2	1270	---	-9.35
16/14-17H1	57664	W-1775	32	278	---	76	15	45	645	138	0	0.3	1170	---	-9.40
13/12-22K1	58189	W-1793	29	301	---	30	14	90	450	216	0	3.4	1050	---	-9.45
14/14-26N1	58190	W-1794	28	285	---	24	3.2	62	450	174	0	1.6	908	---	-9.50
14/15-32N2	58192	W-1795	27	310	---	23	2.6	90	460	160	0	0.7	468	---	-9.40
14/14-26D1	58197	W-1878	28	329	---	28	4.1	130	445	184	0	0.8	1110	---	-9.40
13/12-9M1	58200	W-1802	28	286	---	34	22	97	435	208	0	2.8	1080	---	-9.60
15/16-5N2	58208	W-1809	24	242	---	26	3.5	58	375	136	0	0.6	864	---	-9.05

Table 9.--Geochemical analyses of ground waters from the southern part of the lower zone

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
17/15-16B1	57399	W-2009	33	274	2.1	36	14	78	520	122	0	1.5	1020	-70.5	-9.00
16/16-18P1	57406	W-2015	28	253	3.7	56	29	140	500	140	0	2.8	856	---	-8.60
17/14-13H1	57407	W-2016	32	234	3.4	36	31	84	440	208	0	3.3	964	---	-8.60
21/19-20D1	57444	W-2025	26	168	1.1	19	2.7	18	280	140	0	2.2	564	-66.5	-8.75
19/16-10E1	57448	W-2029	32	236	3.3	48	19	103	455	128	0	1.8	932	---	-8.25
20/18-33E2	57453	W-2032	29	172	1.6	37	9.5	31	365	106	0	1.0	696	---	-8.40
17/16-22E1	57456	W-1989	29	219	1.7	44	4.0	74	395	92	0	1.1	836	---	-8.55
19/16-1Q1	57458	W-1990	33	214	1.3	41	5.8	89	406	66	0	0.3	784	-63.5	-8.45
21/18-30P1	57466	W-1993	33	169	1.2	26	6.0	28	336	94	2	1.7	628	---	-8.70
16/15-35Q2	57608	W-1723	32	239	---	26	8.4	65	426	100	4	1.5	844	-64.5	-8.45
16/15-32Q1	57609	W-1724	26	212	---	43	23	65	438	132	6	2.9	860	---	-8.25
16/15-35E2	57610	W-1725	31	255	---	28	12	60	474	108	0	1.8	700	---	-8.30
17/16-28F1	57612	W-1727	30	255	---	53	5.5	75	525	72	0	2.3	968	-64.0	-8.60
17/15-13A1	57622	W-1737	30	232	---	58	34	92	520	104	0	3.1	1040	---	-8.30
16/15-19Q1	57630	W-1744	31	241	0.0	50	17	68	506	118	0	0.3	980	---	-9.30
16/15-31L1	57632	W-1746	33	215	---	43	24	64	450	140	0	2.7	896	-69.0	-9.10
16/15-23E3	57633	W-1747	30	250	---	34	7.5	78	430	116	0	1.9	888	---	-8.10
16/15-19R1	57635	W-1749	35	325	---	27	6.6	100	525	162	0	1.3	1080	---	-8.90
17/15-36B1	57639	W-1752	37	292	---	39	2.4	100	505	88	0	2.4	1230	---	-8.60
16/15-17M1	57653	W-1765	31	256	---	41	16	66	510	118	6	1.0	994	---	-8.70
16/15-9E1	57654	W-1766	30	247	---	45	5.4	43	500	98	2	0.2	942	---	-8.65
16/15-6P1	57659	W-1770	30	297	---	45	6.6	72	555	108	0	0.1	1090	---	-9.00
16/15-18M1	57660	W-1771	31	188	---	90	38	57	530	184	0	0.1	1040	---	-9.00
18/16-1Q1	58224	W-1824	30	186	---	48	13	46	405	104	0	2.5	810	---	-8.35
19/16-34P1	58258	W-1849	32	258	---	45	17	79	490	122	0	0.7	1030	---	-8.25
19/16-9N1	58259	W-1850	31	306	---	70	22	154	555	118	0	2.7	1250	---	-8.30
19/16-27M1	58260	W-1851	33	290	---	50	16	103	525	122	0	0.6	1130	---	-8.10
21/18-26C1	58425	W-1856	27	150	---	30	2.3	26	285	94	0	0.7	584	---	-8.80
20/18-29N3	58428	W-1859	29	174	---	46	16	43	390	122	0	1.1	772	---	-8.15
22/18-12P1	58433	W-1863	26	151	---	24	4.2	25	260	99	0	5.4	562	---	-8.80

Table 9.—Geochemical analyses of ground waters from the southern part of the lower zone—Continued

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
20/18-27C2	58434	W-1864	30	176	---	30	6.1	26	305	127	3	1.8	686	---	-8.70
21/19-19E2	58436	W-1865	24	147	---	25	2.1	34	255	81	0	1.9	542	---	-8.75
20/18-28E2	58469	W-1876	28	175	---	37	7.4	38	330	113	0	1.5	720	---	-8.15
21/19-20N1	58470	W-1891	26	162	---	26	3.5	22	280	150	0	4.5	620	---	-8.75
21/18-32B1	58472	W-1893	28	157	---	40	6.3	55	310	64	0	0.2	662	---	-8.90
21/18-29Q1	58485	W-1907	32	148	---	32	7.3	27	295	104	0	1.6	597	-66.5	-8.95
21/18-2D3	58495	W-1917	29	166	---	26	3.4	22	310	108	0	0.1	630	---	-8.35

Table 10.--Geochemical analyses of ground waters from the reduced sulfate zone

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
20/19-19B1	57450	W-2031	34	284	1.7	20	7.0	228	116	302	0	0.9	831	-70.5	-9.30
19/18-11N1	58426	W-1857	31	264	---	20	1.3	200	180	202	0	0.7	788	---	-9.00
20/18-35E1	58427	W-1858	34	292	---	26	2.9	223	205	240	0	0.7	912	---	-8.70
20/18-24G1	58429	W-1920	35	365	---	16	5.7	385	56	332	0	0.8	1010	-72.5	-9.65
19/19-19K1	58431	W-1862	30	232	---	33	1.1	104	195	294	0	0.7	760	---	-9.00
20/18-14E1	58437	W-1866	33	380	---	25	6.2	365	165	248	0	1.7	1100	-62.0	-8.35
19/18-36N1	58438	W-1867	32	310	---	20	2.5	260	145	244	0	1.9	890	---	-9.05
19/18-34N1	58440	W-1869	36	424	---	18	7.1	440	39	332	24	2.4	1160	-72.5	-9.45
19/18-15M1	58458	W-1882	34	329	---	19	4.8	290	115	284	0	1.5	954	-70.0	-9.15
19/18-13M1	58460	W-1884	30	230	---	23	1.4	125	220	178	0	0.0	728	---	-8.95
19/18-3N2	58461	W-1885	31	232	---	20	2.0	148	180	202	0	0.0	708	-63.0	-8.85
19/18-9N2	58462	W-1886	33	325	---	19	4.8	300	130	254	0	0.7	924	---	-8.95
20/19-5D1	58464	W-1887	32	307	---	15	1.2	232	75	346	0	1.0	860	---	-9.45
20/19-6N1	58467	W-1889	31	276	---	22	1.5	202	185	204	0	1.0	830	---	-9.15
21/18-12D1	58483	W-1904	37	498	---	25	7.6	458	125	436	12	0.7	1390	---	-9.00
19/18-26E2	58493	W-1915	33	314	---	25	8.6	258	175	280	0	0.9	972	---	-9.20

Table 11.--Geochemical analyses of ground waters from the pre-Tulare aquifers

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
17/14-13R1	57611	W-1726	31	228	---	42	37	85	464	184	8	2.5	948	---	-7.40
17/15-30M1	57640	W-1753	31	340	---	37	45	140	630	180	0	1.1	1340	-62.0	-7.80
19/16-29K1	58232	W-1829	37	370	---	68	28	138	685	160	6	1.7	1460	-60.5	-7.75
20/17-31Q1	58420	W-1853	32	255	---	33	5.4	45	475	120	6	0.8	920	---	-7.75
21/17-22G1	58489	W-1911	34	830	---	66	24	350	1290	230	0	5.8	2750	-64.5	-7.25

Table 12.--Geochemical analyses of mixed ground waters

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
13/12-10R1	57393	W-2005	--	237	2.5	125	62	106	795	142	0	7.1	1460	---	-8.25
13/13-32N3	57409	W-2017	30	686	---	84	26	775	500	164	8	2.2	2270	---	-8.95
14/12-11P1	57410	W-2018	29	555	9.8	116	82	590	805	228	0	1.1	2390	---	-8.40
15/16-7C1	57411	W-2019	30	350	1.5	14	0.4	280	235	176	4	1.8	1000	---	-8.80
15/16-5E3	57412	W-2020	30	302	1.2	16	9.7	164	225	360	0	0.8	1100	---	-9.70
16/17-21C1	57414	W-2022	25	346	1.5	46	27	85	570	348	0	24	1310	---	-10.85
17/15-23J1	57415	W-2023	35	297	2.6	39	17	90	580	132	0	4.8	1310	---	-7.90
21/18-29N1	57443	W-2024	29	151	1.8	38	7.0	51	315	78	0	5.8	635	---	-8.60
20/16-12N1	57446	W-2027	30	231	3.4	44	27	57	520	142	0	1.4	973	-62.0	-7.80
19/18-5N1	57447	W-2028	32	300	2.1	33	15	278	214	224	0	0.4	978	---	-8.60
18/15-13N1	57449	W-2030	28	436	5.1	215	82	320	1200	100	0	7.3	2370	---	-8.55
19/19-10E2	57454	W-2033	24	328	1.4	56	6.8	120	435	322	0	0.2	1100	---	-9.75
21/18-27Q2	57455	W-2034	26	181	1.7	83	11	82	430	54	0	25	876	---	-7.60
19/17-35P1	57464	W-1992	29	157	3.0	68	70	48	588	164	0	3.1	976	---	-7.05
14/14-30E3	57503	W-1971	31	465	---	34	5.2	352	492	160	8	1.4	1510	---	-8.70
13/14-31N4	57512	W-1979	25	206	---	193	108	550	465	188	0	12	2600	---	-8.75
13/12-24N2	57514	W-1981	31	441	---	38	11	154	675	174	0	0.3	1560	---	-8.80
13/12-35N2	57516	W-1982	29	416	---	61	41	288	590	216	8	10	1640	---	-8.65
15/13-22P1	57517	W-1983	37	242	---	20	2.4	40	412	140	4	0.7	852	---	-9.05
14/15-18E2	57519	W-1960	26	454	---	25	4.9	312	498	170	0	1.6	1450	---	-8.70
15/13-24N1	57521	W-1962	36	49	---	28	14	63	53	100	0	1.1	310	---	-8.70
14/12-35H1	57525	W-1966	28	405	---	115	56	176	955	202	0	31	1940	---	-8.85
14/12-23A1	57526	W-1967	30	420	---	120	76	255	960	228	0	7.4	2120	---	-8.70
13/14-10D1	57531	W-1945	--	410	---	32	6.3	348	342	202	4	2.3	1280	---	-9.20
12/11-25Q1	57536	W-1948	26	350	---	119	62	350	660	196	0	13	1710	---	-8.60
12/12-25N1	57537	W-1949	--	329	---	173	73	135	1040	202	4	2.9	1940	---	-8.35
14/14-18N2	57542	W-1954	32	472	---	49	10	445	410	172	8	1.7	1550	---	-8.75
14/14-10N4	57546	W-1955	27	393	---	56	19	215	610	196	0	4.7	1420	---	-8.70
14/13-11R1	57551	W-1921	30	238	---	52	36	55	455	232	12	4.6	1010	---	-8.80
13/13-28M1	57553	W-1923	34	1000	---	69	17	1220	540	160	0	2.7	3050	---	-8.00

Table 12.--Geochemical analyses of mixed ground waters--Continued

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
13/13-20Q3	57555	W-1925	33	790	---	53	13	810	540	202	0	1.5	2380	---	-8.15
13/13-26N3	57556	W-1926	27	245	---	48	26	74	410	240	8	2.0	1010	---	-8.90
13/13-16E2	57558	W-1928	--	262	---	154	76	137	865	134	8	30	1700	---	-8.80
12/14-31D3	57560	W-1930	19	534	---	200	142	495	1240	228	0	1.0	2890	---	-8.55
13/13-34N4	57562	W-1932	30	686	---	84	26	775	500	164	8	2.2	2270	---	-8.35
14/13-26D1	57567	W-1986	29	229	---	68	60	102	670	200	8	1.4	1370	---	-8.50
13/14-31Q2	57568	W-1987	30	700	---	312	219	1130	1340	258	0	5.2	4110	---	-8.30
15/15-7P1	57593	W-1988	30	161	---	28	14	33	166	316	0	0.8	576	---	-9.85
15/15-12G1	57594	W-1934	--	343	---	20	2.9	240	292	232	0	0.7	1090	---	-9.20
15/15-8B1	57595	W-1935	19	470	---	99	58	170	1100	208	0	0.5	2140	---	-8.80
15/15-34P1	57597	W-1936	24	122	---	120	107	68	764	162	0	3.8	1360	---	-8.70
15/15-20N5	57598	W-1937	23	174	---	134	86	88	755	206	0	6.2	1200	---	-8.95
16/14-36E1	57599	W-1938	33	235	---	97	50	82	705	142	6	0.9	1330	---	-9.40
15/16-7Q2	57607	W-1722	29	272	---	9.5	0.0	135	302	146	0	0.3	660	---	-8.25
17/16-5K1	57613	W-1728	31	320	---	29	2.3	250	294	132	0	1.0	928	---	-8.35
17/16-32D1	57615	W-1730	39	350	---	40	3.1	140	540	112	4	2.5	1160	---	-7.40
17/16-26N4	57616	W-1731	28	249	---	60	7.6	110	446	104	0	1.8	940	---	-7.75
17/15-6Q1	57620	W-1735	29	182	---	87	79	85	645	156	4	3.6	1220	---	-9.15
17/15-19E1	57623	W-1738	29	251	---	46	42	90	485	176	12	2.7	1070	---	-8.40
17/15-1P1	57624	W-1739	28	170	---	86	90	71	640	170	8	17	1230	---	-7.65
16/16-30M1	57626	W-1740	28	178	---	49	25	40	435	104	6	6.3	824	---	-8.70
16/15-29N1	57631	W-1745	34	291	---	42	36	110	535	214	0	15	956	---	-8.20
16/15-22D1	57634	W-1748	30	279	---	45	20	73	585	104	0	4.8	1100	---	-8.70
16/16-32F1	57636	W-1750	30	278	---	32	4.0	194	298	138	0	2.0	888	---	-8.80
17/15-21N1	57638	W-1751	28	263	---	106	160	275	905	152	0	12	1900	---	-8.40
15/16-23R1	57648	W-1761	23	100	---	7.6	0.9	38	43	158	6	0.4	304	---	-10.50
16/16-30B1	57656	W-1767	26	176	---	80	57	40	630	130	0	2.3	1090	---	-8.25
16/16-10N3	57657	W-1768	24	295	---	138	28	122	745	142	4	1.6	1520	---	-8.50
15/15-21B1	58185	W-1789	22	324	---	231	168	178	1440	180	0	2.0	2580	---	-8.60
13/14-15B3	58186	W-1790	--	389	---	43	17	470	180	218	0	2.2	1290	---	-9.45

Table 12.--Geochemical analyses of mixed ground waters--Continued

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
13/12-2D1	58199	W-1801	29	501	---	71	16	320	690	170	0	1.2	1760	---	-8.95
15/15-22Q1	58201	W-1803	22	270	---	229	173	175	1380	174	0	1.0	2470	---	-8.60
15/14-3H1	58202	W-1804	26	318	---	109	58	230	620	252	0	0.9	1440	---	-9.40
15/15-25N2	58203	W-1805	23	410	---	255	167	200	1640	204	0	1.0	2920	---	-8.60
15/15-22N1	58204	W-1806	23	176	---	125	94	78	755	184	0	1.0	1420	---	-9.15
18/18-3N1	58209	W-1810	25	166	---	31	3.9	34	174	257	0	1.7	556	-73.5	-9.80
18/18-9Q1	58213	W-1814	24	193	---	98	53	74	570	172	0	1.8	1130	---	-8.45
14/14-23E1	58219	W-1819	28	442	---	34	4.8	290	460	184	0	1.4	1400	---	-8.80
18/16-20C1	58222	W-1822	32	240	---	96	18	108	600	100	0	4.0	1030	---	-8.45
18/17-36N3	58223	W-1823	33	348	---	24	4.8	365	135	194	10	1.7	1030	---	-8.60
18/16-14N2	58226	W-1825	32	303	---	48	2.8	265	320	66	0	1.5	1020	---	-8.25
18/17-32P1	58228	W-1826	32	200	---	29	7.8	51	330	128	0	2.0	746	---	-8.45
18/16-34N1	58229	W-1827	29	165	---	39	9.1	45	320	120	0	3.1	666	---	-8.80
18/17-13N2	58231	W-1828	31	219	---	24	0.7	148	230	110	0	1.1	712	-68.5	-8.90
17/18-33N1	58238	W-1832	24	164	---	46	13	58	240	242	0	0.0	662	---	-9.95
17/18-29N1	58239	W-1833	24	233	---	106	28	88	565	220	0	0.0	1150	---	-9.90
18/18-32E1	58240	W-1834	31	205	---	23	1.3	140	207	120	0	0.1	664	---	-8.75
18/18-23N1	58242	W-1836	26	179	---	31	2.5	38	220	230	0	0.3	634	---	-8.95
18/18-31N2	58244	W-1838	35	400	---	18	2.7	415	120	280	0	1.8	1100	-69.5	-9.10
17/18-28D2	58245	W-1839	20	365	---	150	46	88	970	298	0	0.0	1760	---	-11.60
18/17-12N1	58249	W-1843	30	198	---	28	0.9	76	310	80	0	0.1	704	---	-8.95
18/18-36N2	58251	W-1845	26	186	---	41	2.6	31	342	142	0	0.2	1410	---	-8.75
19/17-36D2	58442	W-1871	32	289	---	40	34	235	340	224	0	2.6	1140	---	-7.95
20/16-26D2	58445	W-1873	30	335	---	92	42	138	775	112	0	2.0	1530	---	-7.75
20/16-3R1	58446	W-1874	28	249	---	93	94	110	825	128	0	6.1	1530	---	-7.45
20/19-26H1	58447	W-1875	29	228	---	11	3.7	142	29	328	0	22	648	-76.0	-9.25
21/18-34Q1	58451	W-1919	26	204	---	60	7.8	170	292	54	0	11	836	---	-8.55
19/17-9Q1	58454	W-1879	30	212	---	57	34	134	396	132	0	2.9	990	---	-7.95
19/18-18N3	58457	W-1881	33	268	---	28	12	215	200	216	0	2.9	878	---	-8.35
19/18-8N1	58459	W-1883	33	294	---	23	5.7	262	175	184	0	0.7	902	---	-8.70

Table 12.--Geochemical analyses of mixed ground waters--Continued

[Dashes indicate that sample was not analyzed for this constituent.]

Well No.	Sample No.	Isotope laboratory No.	Temperature in °C	Analyses in milligrams per liter										Analyses in permil relative to SMOW	
				Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Nitrate (NO_3)	Dissolved solids	δD	$\delta^{18}O$
20/19-16M1	58466	W-1888	28	198	---	37	1.3	42	305	166	0	0.3	732	---	-8.20
20/19-25R1	58473	W-1894	--	228	---	9.5	2.1	19	180	340	12	0.6	700	-66.0	-8.90
20/19-25C1	58474	W-1895	27	310	---	11	5.8	98	10	685	0	40	856	-77.0	-10.00
20/19-23J1	58475	W-1896	32	210	---	8.7	2.1	108	5	364	0	61	572	-75.0	-10.00
20/19-29J1	58476	W-1897	26	196	---	28	4.5	29	345	111	0	6.8	710	---	-7.60
20/19-35M1	58477	W-1898	32	270	---	19	7.9	268	2	308	0	11	786	-74.0	-10.05
20/16-4P1	58478	W-1899	28	302	---	61	33	104	680	82	0	6.8	1290	---	-7.75
20/17-4J1	58479	W-1900	26	183	---	94	98	76	740	138	0	7.4	1420	---	-6.95
21/18-33B1	58484	W-1905	27	172	---	43	6.7	69	330	74	0	11	708	---	-8.05
22/19-18N3	58486	W-1908	26	157	---	16	3.8	24	265	116	0	1.2	539	---	-8.85
21/17-24E1	58488	W-1910	30	142	---	57	28	42	380	124	0	6.3	784	---	-8.40
21/18-19G1	58491	W-1913	27	124	---	69	28	55	370	98	0	10	754	---	-7.95
19/17-14G1	58492	W-1914	36	704	---	36	28	850	190	432	0	4.1	2060	---	-8.60
21/18-8R1	58494	W-1916	28	135	---	63	21	34	375	108	0	3.6	744	---	-8.00
21/18-15C1	58496	W-1918	28	155	---	49	7.8	29	365	82	0	3.0	691	---	-8.25

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