GEOLOGICAL SURVEY CIRCULAR 232

THE INDUSTRIAL UTILITY OF PUBLIC WATER SUPPLIES IN THE PACIFIC STATES, 1952

By E. W. Lohr, R. T. Kiser C. S. Howard, and I. W. Walling

UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

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INTRODUCTION

The location of industrial plants is dependent on an ample water supply of suitable quality. Information relating to the chemical characteristics of the water supplies is not only essential to the location of many plants but also is an aid in the manufacture and distribution of many commodities.

Public water supplies are utilized extensively as a source of supply for many industrial plants, used either as delivered for domestic consumption or with further treatment if necessary to meet specific needs of the plant, such as water for processing, cooling, and steam generation. The industrial use of water in the United States in 1950 was estimated to be more than 75 billion gallons per day from private sources. In addition, about 6 billion gallons per day was estimated to be taken from public water supplies.

U. S. Geological Survey Water-Supply Paper 658, "The industrial utility of public water supplies in the United States, 1932" contains information pertaining to the public water supplies of 670 of the larger cities throughout the United States. This report, which is still in print and being distributed, has filled an important need in the field of water-supply engineering. The demand for more up-to-date information and more extended coverage has led to studies by the Geological Survey for revision of the information contained in the 1932 report. The revised report, which will include data pertaining to public water supplies of more than 1,200 cities in the United States, will eventually be published as a Geological Survey Water-Supply Paper. However, in order that the information might be available at the earliest possible time, nine preliminary reports are being issued which give data on the larger cities in each state. These nine reports are being released as Geological Survey Circulars, each covering a group of states as delineated by the Bureau of Census in taking the census of the population of the country. (See fig. 1). The reports give descriptive inforamtion and analytical data for approximately three-fourths of the cities that will be included in the final report for each of the states.

This circular is the fifth of the series and includes data for the States of California, Oregon, and Washington. (See fig. 1). The report gives the population (1950) of the city, the population supplied, ownership, sources and treatment of supplies, capacity of treatment plants, storage facilities for both raw and finished waters, and chemical analyses of the water for a total of 80 of the larger cities of California, Oregon, and Washington. The data for each city are essentially the same as will appear in the complete report for the whole country.

Data for the supplies in California, Oregon, and Washington were compiled mainly by R. T. Kiser, chemist, Salt Lake City, assisted by I. W. Walling, district chemist, Sacramento, for the supplies in California. The work was done under the general supervision of C. S. Howard, regional chemist, Salt Lake City. Review and final assembly of the data were made by E. W. Lohr in the Washington office under the direction of S. K. Love, Chief, Quality of Water Branch.

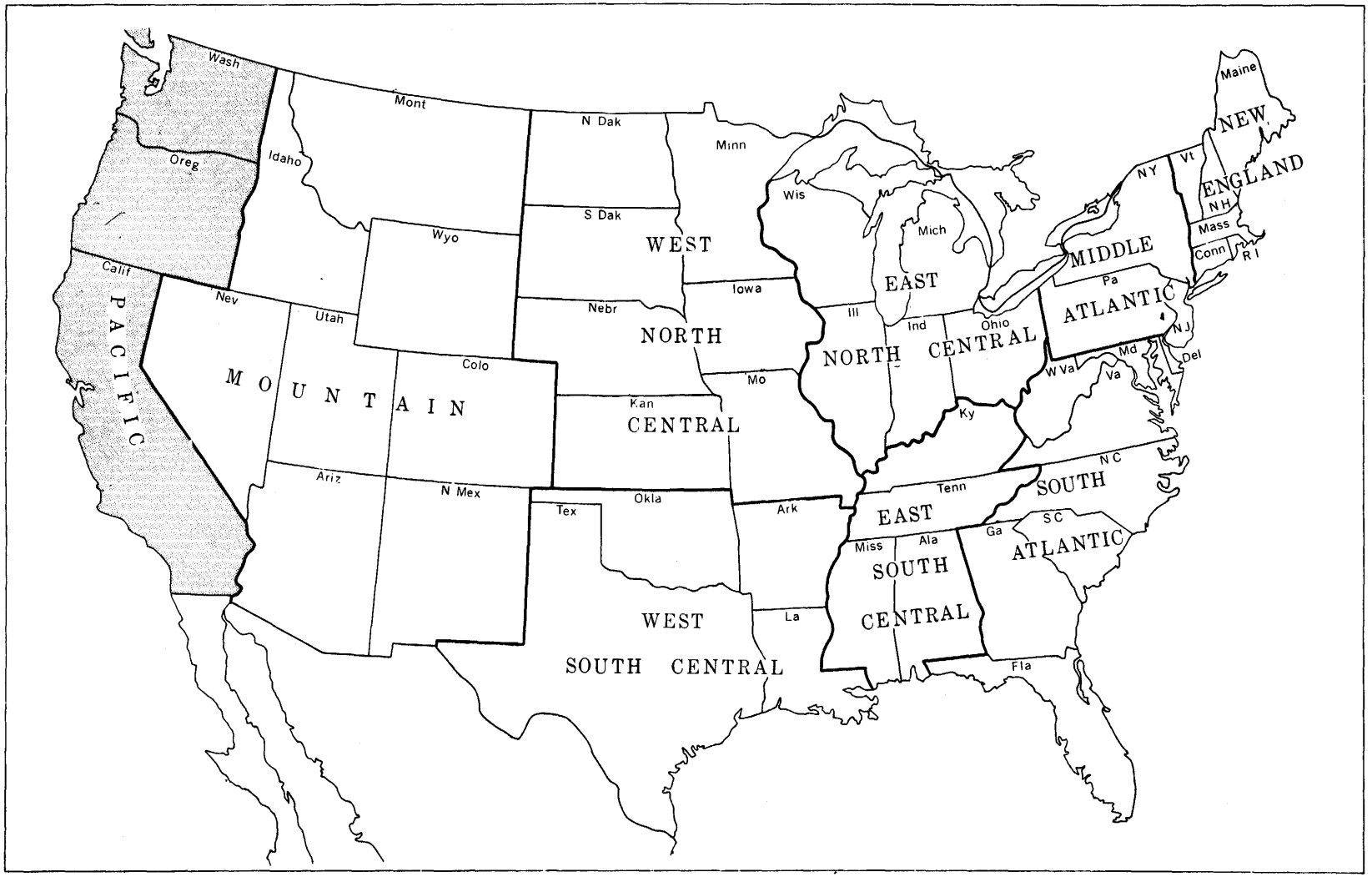

Figure 1. -Map of the United States showing sections covered by the nine circulars on the Industrial Utility of Public Water Supplies of the United States, 1952. The shaded portion represents the section of the country covered by this circular.

CALIFORNIA

ALAMEDA
(Population, 64,430)

Ownership: East Bay Municipal Utility District. (See Oakland.)

ALHAMBRA
(Population, 51,359)

Ownership: Municipal.
Source: 9 wells ranging in depth from 300 to 872 ft. The yield of the wells is reported to be from 900 to 3,150 gpm. Emergency supply from wells owned by California Water and Telephone Co., South Pasadena.
Treatment: None.
Storage: Reservoirs and tanks, 27,675,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 2	Well 8	Well 12	Longden Well	Garfield Reservoir [a]
Silica (SiO_2)	--	--	--	--	--
Iron (Fe)	.04	.02	.02	.0	.00
Manganese (Mn)	.00	.00	.00	.00	.00
Calcium (Ca)	35	40	42	36	53
Magnesium (Mg)	7.0	10	11	7.8	15
Sodium (Na)	19	25	23	28	27
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	--	0	--
Bicarbonate (HCO_3)	129	154	146	132	151
Sulfate (SO_4)	21	17	24	26	40
Chloride (Cl)	13	26	27	17	46
Fluoride (F)	.8	.5	.4	.8	.5
Nitrate (NO_3)	11	20	19	21	36
Dissolved solids	221	261	262	238	326
Hardness as $CaCO_3$:					
Total	115	143	149	123	196
Noncarbonate	9	17	29	15	72
Color	--	--	--	--	--
pH	7.4	7.3	7.3	7.3	7.8
Specific conductance (micromhos at 25 C.)	317	389	400	371	535
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	Feb. 9, 1951	Feb. 9, 1951	Feb. 9, 1951	Feb. 9, 1951	Feb. 9, 1951
Depth (feet)	734	764	862	778	
Diameter (inches)	30-18-16	30-20-16	20	26-20	
Date drilled	1931	1935	1948	1926	
Percent of supply	--	--	--	--	

[a] Receives water from Wells 8, Longden, and Garfield.

ARCADIA
(Population, 23,066)

Ownership: Municipal.
Source: 11 wells ranging in depth from 462 to 862 ft. The yield of the wells ranges from 500 to 3,600 gpm. Emergency supply from wells owned by Southern California Water Co.
Treatment: None.
Storage: Reservoirs, 10,500,000 gal.

Analyses indicate that there is considerable variation in the character of the water from the individual wells of approximately same depth and at different depths. The analyses selected show the range in dissolved solids and hardness in the water from the different wells.

ANALYSES

(Analyses, in parts per million, by Pomeroy & Assoc., Pasadena, Calif.)

	Orange Grove Well 1A	Orange Grove Well 4A	Longden Well 1[a]	Camino Real Well 1	Rancho Well 8
Silica (SiO_2)	11	12	18	14	14
Iron (Fe)	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	26	44	48	39	79
Magnesium (Mg)	5.2	14	11	11	24
Sodium (Na)	50	33	13	19	18
Potassium (K)	1.7	1.8	3.0	1.5	2.1
Carbonate (CO_3)	--	--	--	--	--
Bicarbonate (HCO_3)	156	187	201	182	204
Sulfate (SO_4)	48	60	11	21	121
Chloride (Cl)	13	15	7.0	9.3	14
Fluoride (F)	1.0	.8	.4	.9	.8
Nitrate (NO_3)	5.6	7.4	13	2.5	28
Dissolved solids	[b]238	[b]80	234	[b]208	[b]401
Hardness as $CaCO_3$:					
Total	86	167	164	143	296
Noncarbonate	0	14	0	0	128
Color	--	--	--	--	--
pH	7.5	7.5	7.6	7.8	7.4
Specific conductance (micromhos at 25 C.)	--	--	355	--	--
Turbidity	--	--	1.1	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	Feb. 7, 1951	Feb. 7, 1951	May 8, 1951	Feb. 7, 1951	Feb. 7, 1951
Depth (feet)	462	466	550	714	--
Diameter (inches)	22	16	26	20	--
Date drilled	1921	1921	1927	1949	--
Percent of supply	--	--	--	--	--

[a] Analyzed by California State Dept. of Public Health.
[b] Sum of determined constituents.

BAKERSFIELD
(Population, 34,784)

Ownership: California Water Service Co.; supplies East Bakersfield and other consumers outside the city limits. Total population supplied, about 75,000.
Source: About 80 wells ranging in depth from 60 to 682 ft. The yield of the wells (data on 44 wells) is reported to range from 160 to 1,250 gpm, and to average 716 gal.
Treatment: None.
Storage: Reservoirs, 10,300,000 gal.

ANALYSES

(Analyses, in parts per million, by California Water Service Co., San Jose, Calif.)

	Well 79-01	Well 70-01	Well 7-06	Well 11-03	Range of constituents [a]
Silica (SiO_2)	14	20	24	21	9 - 33
Iron (Fe)	.08	.01	.04	.00	.00- .63
Manganese (Mn)	.04	.06	.01	.01	.00- 1.7
Calcium (Ca)	5.2	23	34	62	5.2 -128
Magnesium (Mg)	1.2	3.9	7.8	14	1.0 - 75
Sodium (Na)	34	25	24	37	10 -171
Potassium (K)	--	--	--	--	-- --
Carbonate (CO_3)	--	--	--	--	-- --
Bicarbonate (HCO_3)	85	115	142	205	59 -250
Sulfate (SO_4)	11	16	24	59	6.2 -384
Chloride (Cl)	7	10	19	38	5 -411
Fluoride (F)	--	--	--	---	-- --
Nitrate (NO_3)	.6	3.1	1.8	16	.0 - 35
Dissolved solids	[b] 115	[b] 157	[b] 205	[b] 348	108 -1,010
Hardness as $CaCO_3$:					
Total	18	73	118	214	18 -628
Noncarbonate	0	0	1	44	-- --
Color	--	--	--	--	-- --
pH	7.0	7.0	7.0	7.0	6.6 8.3
Specific conductance (micromhos at 25 C.)	180	253	339	572	180 1,620
Turbidity	--	--	--	--	-- --
Temperature (F.)	--	--	--	--	-- --
Date of collection	Oct. 27, 1950	Sept. 11, 1950	Apr. 23, 1951	Apr. 23, 1951	1948 - 1951
Depth (feet)	615	300	250	240	60 - 682
Diameter (inches)	16	16	16	16	-- --
Date drilled	1949	1948	1946	1939	-- --
Percent of supply	--	--	--	--	-- --

[a] Based on 80 analyses (1 analysis from each well) made between 1948-1951.
[b] Sum of determined constituents.

BERKELEY
(Population, 113,805)

Ownership: East Bay Municipal Utility District. (See Oakland.)

CALIFORNIA

BEVERLY HILLS
(Population, 29,032)

Ownership: Municipal; supplies also West Hollywood. Total population supplied, about 41,000.

Source: 17 wells ranging in depth from 90 to 702 ft (83 percent of supply); Colorado River (17 percent of supply), furnished by the Metropolitan Water District of Southern California (see Los Angeles). The yield of the wells is reported to range from 100 to 900 gpm, and to average 540 gal.

Treatment: Aeration, softening with excess lime, recarbonation, rapid sand filtration, chlorination, and ammoniation.

Rated capacity of treatment plant: 7,500,000 gpd.

Raw-water storage: 1,171,000 gal.

Finished-water storage: 18,780,000 gal.

ANALYSES

(Analyses, in parts per million, by City of Beverly Hills)

	Franklin Well 9	Tatum Well 1-A	City Well 1-A	Melrose M Well
Silica (SiO_2)	10	27	35	23
Iron (Fe)	0	.15	0	0
Manganese (Mn)	--	--	--	--
Calcium (Ca)	61	50	76	31
Magnesium (Mg)	27	30	39	9
Sodium (Na) / Potassium (K)	47	158	195	186
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	281	415	517	371
Sulfate (SO_4)	72	106	79	43
Chloride (Cl)	30	100	190	120
Fluoride (F)	1.2	.4	.3	.5
Nitrate (NO_3)	18	--	--	--
Dissolved solids	[a] 405	[a] 676	[a] 868	[a] 594
Hardness as $CaCO_3$:				
Total	263	248	350	114
Noncarbonate	32	0	0	0
Color	--	--	--	--
pH	--	7.5	7.2	8.0
Specific conductance (micromhos at 25 C.)	600	1,050	1,380	1,000
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of analysis	Spring, 1951	Spring, 1951	Spring, 1951	Spring, 1951
Depth (feet)	90	400	411	600
Diameter (inches)	16	16	16	16
Date drilled	1921	1930	1948	1948
Percent of supply	--	--	--	--

[a] Sum of determined constituents.

ANALYSES

(Analyses, in parts per million, by City of Beverly Hills)

	Plant 1 (raw water)	Plant 1 (finished water)	Plant 2 (raw water)	Plant 2 (finished water)
Silica (SiO_2)	20	20	12	12
Iron (Fe)	.20	.10	.20	.20
Manganese (Mn)	--	--	--	--
Calcium (Ca)	75	25	42	22
Magnesium (Mg)	30	26	16	12
Sodium (Na) / Potassium (K)	148	148	160	159
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	398	207	403	303
Sulfate (SO_4)	108	110	68	70
Chloride (Cl)	138	148	84	90
Fluoride (F)	.4	.4	.6	.6
Nitrate (NO_3)	--	--	--	--
Dissolved solids	[a] 716	[a] 580	[a] 581	[a] 515
Hardness as $CaCO_3$:				
Total	310	170	170	102
Noncarbonate	0	0	0	0
Color	--	--	--	--
pH	7.5	8.2	8.0	8.1
Specific conductance (micromhos at 25 C.)	1,100	920	920	840
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Oct. 1951	Oct. 1951	Oct. 1951	Oct. 1951

Regular determinations at treatment plant, 1951

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water[b]	--	330	300	--	--	7.6	--	320	300	--	--	--
Finished water[b]	--	176	150	--	--	8.1	--	168	160	--	--	--
Raw water[c]	--	330	304	--	--	8.0	--	172	164	--	--	--
Finished water[c]	--	250	230	--	--	8.1	--	106	98	--	--	--

[a] Sum of determined constituents.
[b] Plant 1.
[c] Plant 2.

BURBANK
(Population, 78,577)

Ownership: Municipal.
Source: 11 wells (3, 4, 6, 7, and 9 to 15) ranging in depth from 180 to 790 ft, 98 percent of supply; Colorado River distributed by the Metropolitan Water District of Southern California, 2 percent of supply. (See Los Angeles.) The yield of the wells is reported to range from 500 to 2,860 gpm.
Treatment: The well water is not treated. Colorado River water is softened and filtered by the Metropolitan Water District of Southern California.
Raw-water storage: Approximately 35,000,000 gal.
Finished-water storage: --

ANALYSES

(Analyses, in parts per million, by Carl Wilson, Los Angeles)

	Well 4	Well 7	Well 10	Well 11	Well 14
Silica (SiO_2)	20	19	25	24	19
Iron (Fe)	0	0	0	0	0
Manganese (Mn)	0	0	0	0	0
Calcium (Ca)	67	66	52	51	50
Magnesium (Mg)	18	17	14	15	14
Sodium (Na)	33	39	35	19	31
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	275	275	242	189	222
Sulfate (SO_4)	43	49	47	46	41
Chloride (Cl)	24	25	12	16	16
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	13	12	.5	5	4
Dissolved solids	[a]354	[a]362	[a]305	[a]269	[a]284
Hardness as $CaCO_3$:					
Total	241	235	187	189	182
Noncarbonate	16	10	0	34	0
Color	--	--	--	--	--
pH	7.5	7.4	7.9	7.9	7.8
Specific conductance (micromhos at 25 C.)	--	--	--	--	--
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	Sept. 1951	Sept. 1951	Sept. 1951	Sept. 1951	Sept. 1951
Depth (feet)	227	630	588	653	730
Diameter (inches)	16	20	20	20	20
Date drilled	1924	1939	--	--	1950
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

COMPTON
(Population, 47,991)

Ownership: Municipal; supplies also about 1,000 people outside the city limits. Total population supplied, about 49,000.
Source: 9 wells (1, 2, 6, and 8 to 13), 256, 282, 280, 717, 642, 466, 640, 410, and 738 ft deep. The yield of the wells is reported to be 630, 790, 360, 740, 1,200, 1,080, 2,000, 450, and 1,350 gpm. Emergency supply from the Colorado River distributed by the Metropolitan Water District of Southern California. (See Los Angeles.)
Treatment: None.
Storage: 3,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 1	Well 6	Well 9	Well 10	Well 11
Silica (SiO_2)	---	--	--	---	--
Iron (Fe)	.03	.17	.08	.03	.04
Manganese (Mn)	.0	.0	.0	.0	.0
Calcium (Ca)	57	87	51	68	58
Magnesium (Mg)	12	18	6.7	12	10
Sodium (Na)	40	48	44	27	43
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	5
Bicarbonate (HCO_3)	212	256	173	210	205
Sulfate (SO_4)	71	126	88	65	71
Chloride (Cl)	22	40	15	26	21
Fluoride (F)	.4	.4	.3	.4	.3
Nitrate (NO_3)	.0	.0	.0	.1	.0
Dissolved solids	336	505	315	387	400
Hardness as $CaCO_3$:					
Total	191	294	154	219	187
Noncarbonate	18	81	12	47	10
Color	--	--	--	--	--
pH	7.9	7.6	8.2	7.8	8.3
Specific conductance (micromhos at 25 C.)	--	--	--	--	--
Turbidity	0	0	0	0	0
Temperature (F.)	--	--	--	--	--
Date of collection	Mar. 21, 1951	Mar. 21, 1951	Mar. 21, 1951	Mar. 21, 1951	Mar. 21, 1951
Depth (feet)	256	280	642	466	640
Diameter (inches)	12	8	28, 16	16	16
Date drilled	1920	1880	1947	1947	1948
Percent of supply	--	--	--	--	--

CONTRA COSTA DISTRICT
(Population, 43,000)

Ownership: California Water Service Co.; supplies Concord, Crockett, Mountain View, Port Chicago, and San Ramon Valley. Total population supplied, about 43,000.

Source: San Joaquin River through the Contra Costa Canal (47 percent of supply), Sacramento River (45 percent of supply), Port Chicago wells (5 percent of supply), and other wells (3 percent of supply). There is an emergency connection with the East Bay Municipal Utility District. (See Oakland.)

Treatment: Surface waters: prechlorination, coagulation with alum, sedimentation, activated carbon, rapid sand filtration, postchlorination, and adjustment of pH with soda ash or lime. Water from the Galindo wells is softened with zeolite.

Rated capacity of treatment plant: 6,000,000 gpd.

Raw-water storage: 1,000,000,000 gal.

Finished-water storage: 5,200,000 gal.

ANALYSES

(Analyses, in parts per million, by California Water Service Co., San Jose, Calif.)

	Galindo wells (raw water)	Government Ranch wells	Mallard Reservoir (raw water)[a]	Finished water[b]
Silica (SiO_2)	25	21	8	8
Iron (Fe)	.06	.15	.93	.10
Manganese (Mn)	.10	.18	.13	.11
Calcium (Ca)	46	41	26	30
Magnesium (Mg)	36	31	22	19
Sodium (Na)	41	119	65	56
Potassium (K)	--	--	--	--
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	279	288	107	112
Sulfate (SO_4)	56	79	60	77
Chloride (Cl)	38	113	103	70
Fluoride (F)	.1	.1	0	.0
Nitrate (NO_3)	11	11	.6	3.7
Dissolved solids	[c] 391	[c] 557	[c] 338	[c] 319
Hardness as $CaCO_3$:				
Total	262	230	155	152
Noncarbonate	34	0	68	61
Color	--	--	0	--
pH	7.9	7.5	7.2	8.0
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Feb. 8, 1950	Jan. 23, 1950	Jan. 3, 1950	1949

[a] Surface waters.
[b] Composite sample, distribution system.
[c] Sum of determined constituents.

CONTRA COSTA DISTRICT--Continued

	Galindo wells (raw water)	Government Ranch wells	Mallard Reservoir (raw water)	Finished water
Depth (feet)	193-498	114-610		
Diameter (inches)	10-12	12		
Date drilled	1910-1929	1925-1928		
Percent of supply	--	--		

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	238	88	7.5	7.9	7.2	155	262	152	--	--	--
Finished water	92	--	--	8.0	--	--	152	--	--	--	--	--

CULVER CITY
(Population, 19,720)

Ownership: Southern California Water Co.; supplies also about 4,100 people outside the city limits. Total population supplied, about 23,800.
Source: 10 wells. Sentney Plant: wells (5 to 8, 10, and 12), 266, 810, 287, 320, 290, and 650 ft deep; Pacific Plant: well (4), 335 ft deep; Sepulveda Plant: well (3), 300 ft deep; Manning Plant: wells (4 and 5), 304 and 855 ft deep. The yield of the wells is reported to range from 135 to 1,150 gpm.
Treatment: Aeration, coagulation with ferrous chloride, activated carbon, sedimentation, rapid sand filtration, and chlorination.
Rated capacity of treatment plant: 2,500,000 gpd.
Raw-water storage: None.
Finished-water storage: 1,350,000 gal.

ANALYSES

(Analyses, in parts per million, by Smith-Emery Co., Los Angeles, Calif.)

	Sentney Wells	Pacific Well	Sepulveda Well	Manning Wells
Silica (SiO_2)	12	14	12	12
Iron (Fe)	.06	.1	.25	.04
Manganese (Mn)	.03	.03	.12	.00
Calcium (Ca)	87	115	106	87
Magnesium (Mg)	42	46	49	30
Sodium (Na)	87	44	95	46
Potassium (K)	--	--	--	--
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	360	299	366	337
Sulfate (SO_4)	151	209	188	97
Chloride (Cl)	90	89	125	43
Fluoride (F)	--	--	--	--
Nitrate (NO_3)	--	--	--	--
Dissolved solids	[a]646	[a]665	[a]756	[a]481
Hardness as $CaCO_3$:				
Total	389	474	467	340
Noncarbonate	94	231	166	64
Color	--	--	--	--
pH	8.0	7.8	8.0	7.6
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Mar. 27, 1950	Apr. 7, 1950	Apr. 7, 1950	June 2, 1950
Depth (feet)	266-810	335	300	304-855
Diameter (inches)	14-18	16	16	10-14
Date drilled	1931-1946	1932	1938	1938-1944
Percent of supply	--	--	--	--

[a] Sum of determined constituents.

EAST BAKERSFIELD
(Population, 38,177)

Ownership: California Water Service Co. (See Bakersfield.)

EAST LOS ANGELES
(Population, 85,900)

Ownership: California Water Service Co.
Source: 43 wells ranging in depth from 276 to 815 ft. The depth of most of the wells is around 500 ft.
Treatment: Chlorination.
Raw-water storage: None.
Finished-water storage: 8,140,000 gal.

ANALYSIS

(Analysis, in parts per million, by California Water Service Co., San Jose, Calif.)

	Typical composite of wells		Typical composite of wells
Silica (SiO_2)	28	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	212
Manganese (Mn)	.0	Noncarbonate	43
Calcium (Ca)	57		
Magnesium (Mg)	17	Color	--
Sodium (Na)	37	pH	7.9
Potassium (K)	--	Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	206		--
Sulfate (SO_4)	55	Turbidity	--
Chloride (Cl)	46	Temperature (F.)	--
Fluoride (F)	.0	Date of collection	1950
Nitrate (NO_3)	.0		
Dissolved solids	[a]342		
Depth (feet)			--
Diameter (inches)			--
Date drilled			--
Percent of supply			100

[a] Sum of determined constituents.

EUREKA
(Population, 23,058)

Ownership: Municipal; supplies also about 8,000 people outside the city limits. Total population supplied, about 31,000.
Source: Mad River (impounded); emergency supply from 3 deep wells.
Treatment: Prechlorination; coagulation with alum, sodium aluminate, and lime; rapid sand filtration; activated carbon for odor and taste control; post-chlorination and ammoniation in the transmission main.
Rated capacity of treatment plant: 2,500,000 gpd.
Raw-water storage: Approximately 750,000,000 gal impounded behind Mad River Dam.
Finished-water storage: 2,125,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Mad River [a]	Wells [b]		Mad River [a]	Wells [b]
Silica (SiO_2)	--	--	Hardness as $CaCO_3$:		
Iron (Fe)	0.4	0.2	Total	66	92
Manganese (Mn)	.0	.0	Noncarbonate	6	5
Calcium (Ca)	20	14			
Magnesium (Mg)	3.9	14	Color	--	--
Sodium (Na)	2.8	20	pH	8.0	7.9
Potassium (K)	--	--	Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	73	107	Turbidity	--	0
Sulfate (SO_4)	4.3	.0	Temperature (F.)	--	--
Chloride (Cl)	5.4	30	Date of collection	June 15, 1950	June 14, 1950
Fluoride (F)	.0	.0			
Nitrate (NO_3)	.0	3.5			
Dissolved solids	[c] 73	[c] 134			

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	50	100	20	7.2	7.5	6.5	50	100	30		71,500	5
Finished water	40	90	8	7.0	7.3	6.8	60	100	35		50	5

[a] Finished water except for final chlorination.
[b] Hawthorne Street wells.
[c] Sum of determined constituents.

FRESNO
(Population, 91,669)

Ownership: Municipal; supplies also about 16,000 people outside the city limits. Total population supplied, about 108,000.
Source: 45 wells ranging in depth from 80 to 319 ft. The depths of most of the wells are between 100 and 200 ft. The yield of the wells is reported to range from 1,000 to 2,425 gpm, and to average 1,489.
Treatment: None.
Storage: 1,880,000 gal.

ANALYSES

(Analyses, in parts per million, by U. S. Geological Survey)

	Well 2	Well 3	Well 24	Well 27	Well 32[a]
Silica (SiO_2)	73	80	71	73	58
Iron (Fe)	.02	.01	.0	.0	.01
Manganese (Mn)	--	--	--	--	.00
Calcium (Ca)	34	28	15	18	25
Magnesium (Mg)	19	17	8.3	13	14
Sodium (Na)	29	23	18	16	22
Potassium (K)	5.9	5.2	3.4	4.4	4.3
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	202	172	101	130	174
Sulfate (SO_4)	13	9.3	9.6	8.4	3.3
Chloride (Cl)	20	18	6.8	8.0	18
Fluoride (F)	.0	.0	.0	.0	.1
Nitrate (NO_3)	27	22	14	14	5.4
Dissolved solids	330	286	202	217	236
Hardness as $CaCO_3$:					
Total	163	140	72	98	120
Noncarbonate	0	0	0	0	0
Color	7	5	10	3	---
pH	7.8	7.6	7.7	7.6	7.6
Specific conductance (micromhos at 25 C.)	451	378	231	269	--
Turbidity	0	1	3	0	--
Temperature (F.)	--	--	--	--	--
Date of collection	Oct. 17, 1951	Oct. 17, 1951	Oct. 17, 1951	Oct. 17, 1951	May 2, 1947
Depth (feet)	142	123	162	130	182
Diameter (inches)	20	18	18	18	20
Date drilled	1922	1923	1925	--	1941
Percent of supply	--	--	--	--	--

[a] Analyzed by Twining Laboratories, Fresno, Calif.

GLENDALE
(Population, 95,702)

Ownership: Municipal; supplies also about 400 people outside the city limits. Total population supplied, about 96,100.

Source: 11 wells (Grandview 1 to 4, 6, 9 to 12, and Glorietta 3 and 4) ranging in depth from 180 to 640 ft and Verdugo Stream, about 99 percent of supply. The yield of the wells is reported to range from 835 to 3,190 gpm, and averages 2,117 gpm. Most of the supply is from the wells. Auxiliary supply (about 1 percent of the total), Colorado River distributed by the Metropolitan Water District of Southern California. (See Los Angeles.)

Treatment: None (Colorado River water is softened and filtered by Metropolitan Water District of Southern California). (See Los Angeles.)

Storage: 170,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Grandview Well 6	Grandview Well 11	Grandview Wells[a]	Glorietta Well 3	Verdugo Stream
Silica (SiO_2)	--	--	19	--	--
Iron (Fe)	.60	1.3	--	3.8	.68
Manganese (Mn)	.00	.00	0	.00	.00
Calcium (Ca)	54	52	56	36	54
Magnesium (Mg)	14	13	12	14	21
Sodium (Na)	57	32	71	20	26
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	223	214	243	149	188
Sulfate (SO_4)	73	55	67	23	80
Chloride (Cl)	39	14	51	14	23
Fluoride (F)	.4	.4	--	.4	.5
Nitrate (NO_3)	5.7	1.4	3.5	26	10
Dissolved solids	[b]354	[b]274	[b]399	[b]211	[b]308
Hardness as $CaCO_3$:					
Total	193	183	189	150	223
Noncarbonate	10	7	0	28	67
Color	--	--	--	--	--
pH	7.7	7.9	7.7	7.1	6.8
Specific conductance (micromhos at 25 C.)	628	491	--	389	545
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	Oct. 19, 1951	Oct. 19, 1951	Nov. 29, 1949	Oct. 19, 1951	Oct. 19, 1951
Depth (feet)	476	640	--	180	
Diameter (inches)	18	18	--	16	
Date drilled	1923	1929	--	1928	
Percent of supply	--	--	--	--	

[a]Analyzed by Carl Wilson, Los Angeles, Calif.
[b]Sum of determined constituents.

HUNTINGTON PARK
(Population, 29,450)

Ownership: Municipal.
Source: 11 wells ranging in depth from 510 to 1,550 ft. The yield of the wells is reported to range from 200 to 1,440 gpm. Emergency supply from wells owned by Southern California Water Co. in Bell and Maywood.
Treatment: None.
Storage: 7,442,000 gal.

The weighted average hardness and dissolved solids of the water served are 228 ppm and 365 ppm, respectively.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 2	Well 6	Well 7	Well 10	Well 12
Silica (SiO_2)	15	20	23	14	17
Iron (Fe)	.03	.00	.00	.00	.04
Manganese (Mn)	.00	.00	.05	.00	.00
Calcium (Ca)	72	85	48	47	46
Magnesium (Mg)	26	47	15	20	13
Sodium (Na)	54	60	42	44	45
Potassium (K)	1.9	1.4	3.0	2.4	2.3
Carbonate (CO_3)	--	--	--	--	--
Bicarbonate (HCO_3)	216	248	193	201	204
Sulfate (SO_4)	121	205	76	82	69
Chloride (Cl)	75	89	22	24	23
Fluoride (F)	.4	.4	.3	.4	.4
Nitrate (NO_3)	7.1	.4	.8	3.5	.0
Dissolved solids	[a]479	747	349	373	345
Hardness as $CaCO_3$:					
Total	287	408	181	201	170
Noncarbonate	110	205	23	35	3
Color	--	--	--	--	--
pH	7.4	7.5	7.7	7.7	7.8
Specific conductance (micromhos at 25 C.)	824	1,000	518	548	521
Turbidity	< 1	< 1	< 1	< 1	< 1
Temperature (F.)	--	--	--	--	--
Date of collection	Sept. 25, 1951	Sept. 25, 1951	Sept. 26, 1951	Sept. 25, 1951	Sept. 25, 1951
Depth (feet)	533	756	984	1,200	1,504
Diameter (inches)	12	12	12	18	14
Date drilled	1920	1908	1909	1937	1945
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

INGLEWOOD
(Population, 46,185)

Ownership: Municipal; supplies also about 100 people outside the city limits. Total population supplied, about 46,300.
Source: About 25 wells ranging in depth from 282 to 798 ft. Most of the wells are under 500 ft in depth.
Treatment: Chlorination.
Storage: 4,800,000 gal.

ANALYSES

(Analyses, in parts per million, by Montgomery and Pomeroy, Los Angeles, Calif.)

	Wells 9, 11, 19, 24[a]	Well 22	Well 29	Well 33
Silica (SiO_2)	19	19	19	44
Iron (Fe)	.0	.0	.08	.15
Manganese (Mn)	.0	.0	.0	.10
Calcium (Ca)	71	84	77	73
Magnesium (Mg)	14	24	21	25
Sodium (Na)	52	67	79	104
Potassium (K)	--	--	--	--
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	249	261	281	386
Sulfate (SO_4)	94	70	79	74
Chloride (Cl)	32	115	87	108
Fluoride (F)	.0	--	--	.0
Nitrate (NO_3)	1.8	7	18	.0
Dissolved solids	[b]406	[b]515	[b]518	[b]618
Hardness as $CaCO_3$:				
Total	235	308	279	285
Noncarbonate	31	94	49	0
Color	0	0	0	0
pH	7.7	7.3	7.5	7.5
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	0	0	0	0
Temperature (F.)	--	--	--	--
Date of collection	Oct. 26, 1949	Oct. 26, 1949	Oct. 26, 1949	July 14, 1949
Depth (feet)	--	403	532	495
Diameter (inches)	--	18	18	18
Date drilled	--	1938	1945	1949
Percent of supply	--	--	--	--

[a] Composite sample.
[b] Sum of determined constituents.

CALIFORNIA

LONG BEACH
(Population, 250,767)

Ownership: Municipal; supplies also about 20,000 people outside the city limits. Total population supplied, about 271,000.

Source: 27 wells (Alamitos wells 8, 9, and 13; Citizens wells 5 to 7; Development wells 3 to 8; Wilson well; Wise wells 1 and 2; Commission wells 1 to 6; and North Long Beach wells 1, and 3 to 7), 58 percent of supply; Colorado River distributed by the Metropolitan Water District of Southern California, 42 percent of supply. (See Los Angeles.) The depth of the wells is reported to range from 193 to 1,700 ft, and the yield, from 190 to 1,925 gpm.

Treatment: Well water: prechlorination, coagulation with ferric chloride, diatomaceous earth, activated carbon, caustic soda, Calgon, sedimentation, rapid sand filtration, and postchlorination. Water from the Colorado River is softened and filtered by the Metropolitan Water District of Southern California.

Rated capacity of treatment plant: 25,000,000 gpd.

Raw-water storage: 12,000,000 gal.

Finished-water storage: 86,500,000 gal.

ANALYSES

(Analyses, in parts per million, by City of Long Beach)

	Wells (composite, raw water)	Wells (composite, finished water)	Finished water [a]
Silica (SiO_2)	11	22	18
Iron (Fe)	.06	.08	.28
Manganese (Mn)	.0	.01	.06
Calcium (Ca)	13	12	18
Magnesium (Mg)	.9	.9	4.4
Sodium (Na)	71	80	109
Potassium (K)	--	--	--
Carbonate (CO_3)	3	2	0
Bicarbonate (HCO_3)	176	172	150
Sulfate (SO_4)	8.4	8.7	88
Chloride (Cl)	22	39	63
Fluoride (F)	.0	.0	.0
Nitrate (NO_3)	.0	.0	.0
Dissolved solids	[b] 216	[b] 249	[b] 375
Hardness as $CaCO_3$:			
Total	36	36	63
Noncarbonate	0	0	0
Color	80	8	17
pH	8.4	8.4	8.1
Specific conductance (micromhos at 25 C.)	--	--	--
Turbidity	77	7.9	--
Temperature (F.)	--	--	--
Date of collection	Oct. 2, 1951	Oct. 2, 1951	Sept. 4, 1951

[a] Composite, wells and Colorado River, from distribution system.
[b] Sum of determined constituents.

CALIFORNIA

LOS ANGELES
(Population, 1,970,358)

Ownership: Municipal; supplies also about 25,000 people outside the city limits. Total population supplied, about 2,000,000.

Source: Owens Valley Aqueduct (76 percent of supply); Los Angeles River sources (10 percent of supply); Vanowen wells (8 percent of supply); miscellaneous local wells (5 percent of supply); Colorado River distributed by Metropolitan Water District of Southern California (1 percent of supply); emergency supply from about 20 wells.

Treatment: Chlorination (except for a part of the supply from the emergency wells, which is not treated). All major reservoirs are chlorinated at the outlets; occasional chlorine residuals are carried from one reservoir to another.

Raw-water storage: Crowley Lake, 60,000,000,000 gal; Haiwee Reservoir, 19,500,000,000 gal; Bouquet Canyon Reservoir, 11,750,000,000 gal; Lower San Fernando Reservoir, 6,540,000,000 gal; Chatsworth Reservoir, 3,260,000,000 gal; other smaller reservoirs.

Finished-water storage: Many minor reservoirs and tanks for pressure regulation. Total storage of both raw and treated water, 131,000,000,000 gal.

The Owens Valley Aqueduct sources include 5 streams in Mono Basin, Owens River, and at times about 100 deep wells in Owens Valley. The Mono Basin streams are diverted through an 11 mile tunnel into Owens River, which is impounded in Crowley Lake, with a capacity of 60,000,000,000 gal. These sources are combined in the aqueduct to supply the San Fernando Valley, the southwest part of Los Angeles proper, and is mixed with other sources in the remaining parts of the city. The total length of the Owens Valley Aqueduct (including the tunnel) is 244 miles.

The Los Angeles River sources include spreading grounds, infiltration gallery, and 3 groups of wells: Verdugo, Headworks, and Crystal Springs wells.

ANALYSES

(Analyses, in parts per million, by City of Los Angeles)

	Owens Valley Aqueduct[a]	Los Angeles River Conduit[ab]	Vanowen Wells[a]
Silica (SiO_2)	18	23	24
Iron (Fe)	.04	.02	.00
Manganese (Mn)	.02	.00	--
Calcium (Ca)	25	77	58
Magnesium (Mg)	5	20	16
Sodium (Na)	34	52	33
Potassium (K)	4	4	3
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	142	231	192
Sulfate (SO_4)	23	139	96
Chloride (Cl)	17	36	18
Fluoride (F)	.6	.4	.4
Nitrate (NO_3)	.1	12	4.9
Dissolved solids	[c] 200	[c] 478	[c] 350
Hardness as $CaCO_3$:			
Total	84	274	210
Noncarbonate	0	84	53
Color	--	--	--
pH	8.3	7.6	7.7
Specific conductance (micromhos at 25 C.)	320	720	540
Turbidity	--	--	--
Temperature (F.)	58	65	63
Date of collection	--	--	--
Depth (feet)			257-595
Diameter (inches)			--
Date drilled			--
Percent of supply			8

[a] Average for 1950-51 fiscal year.

[b] This analysis was calculated according to the percentage derived from each of the sources. During the year the conduit may be supplied from Los Angeles River sources, Owens Valley Aqueduct, and Vanowen wells.

[c] Sum of determined constituents.

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Ownership: Metropolitan Water District of Southern California; supplies 16 constituent areas in 5 counties (Los Angeles, Orange, Riverside, San Bernardino, and San Diego) in amounts from 0 to 98 percent of supply; 22 percent of the total water production for these areas. Total population supplied, about 3,563,000 (estimated as of July 1949).

Source: Colorado River impounded in Lake Havasu. Emergency supply from San Gabriel River impounded in Morris Reservoir.

Treatment: La Verne plant (all Colorado River water except that through San Diego Aqueduct): treatment varies somewhat, but in general is as follows: prechlorination, activated carbon, coagulation with chlorine-activated silica sol (sodium silicate), intermittent partial lime softening, rapid sand filtration, zeolite or polystyrene resin softening of part of the water so that the total effluent has a hardness of about 125 ppm, postchlorination, final adjustment of pH with lime. San Diego Aqueduct: chlorination.

Rated capacity of treatment plant: 200,000,000 gpd (designed to be increased to 400,000,000 gpd).

Raw-water storage: Lake Havasu, 233,600,000,000 gal; Copper Basin Reservoir, 7,886,000,000 gal; Lake Mathews, 34,870,000,000 gal; Morris Reservoir, 12,810,000,000 gal; Gene Reservoir, 2,050,000,000 gal; San Jacinto Reservoir, 554,000,000 gal.

Finished-water storage: Palos Verdes Reservoir, 326,000,000 gal; Orange County Reservoir, 65,000,000 gal; Corona Del Mar Reservoir, 4,900,000 gal.

Constituent areas of Metropolitan Water District of Southern California: Anaheim, Beverly Hills, Burbank, Coastal Municipal Water District, Compton, Fullerton, Glendale, Long Beach, Los Angeles, Pasadena, San Diego County Water Authority, San Marino, Santa Ana, Santa Monica, Torrance, and West Basin Municipal Water District (new area in M. W. D. June 1949). The West Basin Municipal Water District comprises the cities of El Segundo, Gardena, Hermosa Beach, Manhattan Beach, Redondo Beach, Palos Verdes Estates, and industrially important unincorporated areas.

Water is delivered from Lake Havasu by main aqueduct to San Diego Aqueduct and to Lake Mathews. San Diego Aqueduct connects with the main aqueduct and extends to San Vicente Reservoir of the San Diego system, a distance of 71.1 miles. The main aqueduct is 242 miles long; the total distribution system is 215 miles long, making a total aqueduct length of 457 miles.

ANALYSES

(Analyses, in parts per millions, by Metropolitan Water District of Southern Calif.)

	Raw water [a]	Finished water [a]		Raw water [a]	Finished water [a]
Silica (SiO_2)	8.0	12	Hardness as $CaCO_3$:		
Iron (Fe)	--	--	Total	315	125
Manganese (Mn)	--	--	Noncarbonate	197	6
Calcium (Ca)	79	31			
Magnesium (Mg)	28	12	Color	--	--
Sodium (Na)	99	189	pH	8.4	8.8
Potassium (K)	4	3	Specific conductance (micromhos at 25 C.)	1,040	1,100
Carbonate (CO_3)	4	12	Turbidity	--	--
Bicarbonate (HCO_3)	137	121	Temperature (F.)	--	--
Sulfate (SO_4)	290	290	Date of collection	--	--
Chloride (Cl)	79	83			
Fluoride (F)	.4	.4			
Nitrate (NO_3)	.2	.2			
Dissolved solids	[b] 661	[b] 692			

Regular determinations at treatment plant, 1948-49

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	119	127	108	8.3	8.6	8.0	334	343	319	--	--	--
Finished water	111	151	63	8.8	9.3	8.4	133	196	116	--	--	--

[a] Colorado River. Average for 1950-51 fiscal year.
[b] Sum of determined constituents.

LYNWOOD
(Population, 25,823)

Ownership: Municipal; supplies also about 500 people outside the city limits. Total population supplied, about 26,300.
Source: 11 wells (2 to 12) ranging in depth from 352 to 956 ft. The yield of the wells is reported to range from 550 to 1,700 gpm, and to average 1,158.
Treatment: None.
Storage: Elevated tanks, 300,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 2	Well 3	Well 4	Well 7	Well 8
Silica (SiO_2)	18	22	20	23	20
Iron (Fe)	.05	--	.05	--	--
Manganese (Mn)	--	--	.1	--	--
Calcium (Ca)	112	77	62	58	54
Magnesium (Mg)	23	16	10	12	8.6
Sodium (Na)	52	49	39	31	37
Potassium (K)	4.4	4.1	3.2	2.4	4.0
Carbonate (CO_3)	--	--	7	2	2
Bicarbonate (HCO_3)	287	268	210	248	237
Sulfate (SO_4)	159	99	72	37	42
Chloride (Cl)	81	36	22	17	15
Fluoride (F)	.4	.3	.3	.3	.3
Nitrate (NO_3)	--	--	--	1.1	.3
Dissolved solids	660	448	352	310	306
Hardness as $CaCO_3$:					
Total	375	259	197	192	171
Noncarbonate	139	39	13	0	0
Color	0	0	0	0	0
pH	8.2	8.3	8.9	8.5	8.6
Specific conductance (micromhos at 25 C.)	910	656	517	471	454
Turbidity	.6	.5	.5	.05	.3
Temperature (F.)	--	--	--	--	--
Date of collection	Apr. 27, 1951	Apr. 27, 1951	Apr. 27, 1951	Apr. 27, 1951	Apr. 27, 1951
Depth (feet)	352	436	790	610	864
Diameter (inches)	16	16	16	16	16
Date drilled	1930	1924	1946	1907	1948
Percent of supply	--	--	--	--	--

MANHATTAN BEACH
(Population, 17,330)

Ownership: Municipal; supplies also about 7,200 people outside the city limits. Total population supplied, about 24,500.
Source: 6 wells (9 to 14), 70 percent of supply; Colorado River distributed by the Metropolitan Water District of Southern California, 30 percent of supply. (See Los Angeles.) Well 9 is reported to be 390 ft deep, and wells 10 to 14 are reported to be 550 ft deep. The yield of each well is reported to be 800 gpm.
Treatment: The well water is not treated. The Colorado River water is softened and filtered by the Metropolitan Water District of Southern California.
Raw-water storage: None.
Finished-water storage: 2,850,000 gal.

ANALYSES

(Analyses, in parts per million, by Carl Wilson, Los Angeles)

	Well 9	Well 10	Well 11	Well 12	Well 13
Silica (SiO_2)	19	25	25	26	22
Iron (Fe)	--	.02	--	.05	.02
Manganese (Mn)	0	--	0	0	0
Calcium (Ca)	65	52	42	59	67
Magnesium (Mg)	18	17	17	21	17
Sodium (Na)	76	94	86	104	80
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	287	417	378	314	298
Sulfate (SO_4)	28	3	1	16	35
Chloride (Cl)	98	43	37	132	93
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	0	0	--	0	0
Dissolved solids	[a]445	[a]439	[a]394	[a]513	[a]461
Hardness as $CaCO_3$:					
Total	236	200	175	234	237
Noncarbonate	0	0	0	0	0
Color	--	--	--	--	--
pH	7.8	7.8	7.7	7.5	7.7
Specific conductance (micromhos at 25 C.)	--	--	--	--	--
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	June 4, 1951	June 4, 1951	June 4, 1951	June 4, 1951	June 4, 1951
Depth (feet)	390	550	550	550	550
Diameter (inches)	16	16	16	16	16
Date drilled	1940	1943	1943	1948	1949
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

MONROVIA
(Population, 20,186)

Ownership: Municipal.
Source: 6 wells (San Gabriel 1 to 4, Chapman 5 and 6), 476, 420, 500, 530, 387, and 424 ft deep, 94 percent of supply; 2 springs, 6 percent of supply. Auxiliary supply, surface water runoff from mountains when flow is adequate.
Treatment: Mountain and spring supplies are chlorinated. Well water is not treated.
Storage: 8,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	San Gabriel Well 2	Chapman Well 6	Surface water run-off
Silica (SiO_2)	18	20	18
Iron (Fe)	--	.01	--
Manganese (Mn)	--	--	--
Calcium (Ca)	49	42	52
Magnesium (Mg)	15	11	15
Sodium (Na)	14	20	17
Potassium (K)	1.0	3.5	3.0
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	193	204	244
Sulfate (SO_4)	14	10	20
Chloride (Cl)	12	9.5	8.5
Fluoride (F)	.4	1.0	.4
Nitrate (NO_3)	16	8.0	.4
Dissolved solids	[a]235	228	270
Hardness as $CaCO_3$:			
Total	185	151	190
Noncarbonate	26	0	0
Color	--	--	--
pH	7.5	7.7	8.2
Specific conductance (micromhos at 25 C.)	395	362	408
Turbidity	1.3	1.2	.9
Temperature (F.)	--	--	--
Date of collection	May 4, 1951	May 4, 1951	May 4, 1951
Depth (feet)	420	424	--
Diameter (inches)	20	20	--
Date drilled	1924	1928	--
Percent of supply	--	--	--

[a]Sum of determined constituents

MONTEREY
(Population, 16,205)

Ownership: California Water and Telephone Co.; supplies also Pacific Grove, Carmel, and about 30,000 people in other communities. Total population supplied, about 60,000.
Source: Carmel River (99 percent of supply) and 2 wells, 80 and 60 ft deep (1 percent of supply).
Treatment: Alum, lime, and activated carbon as needed, pressure filtration, and chlorination.
Rated capacity of treatment plant: 8,000,000 gpd.
Raw-water storage: 1,532,000,000 gal.
Finished-water storage: 170,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Raw water [a]	Finished water [a]		Raw water [a]	Finished water [a]
Silica (SiO_2)	--	--	Hardness as $CaCO_3$:		
Iron (Fe)	0.10	0.04	Total	77	76
Manganese (Mn)	.0	.0	Noncarbonate	17	14
Calcium (Ca)	16	13			
Magnesium (Mg)	8.9	10	Color	--	--
Sodium (Na)	13	12	pH	7.8	7.8
Potassium (K)	--	--	Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	73	73			
Sulfate (SO_4)	18	15	Turbidity	--	--
Chloride (Cl)	9.5	9.0	Temperature (F.)	--	--
Fluoride (F)	.3	.2	Date of collection	May 8, 1951	May 8, 1951
Nitrate (NO_3)	.0	.0			
Dissolved solids	154	148			

[a] Carmel River.

MONTEREY PARK
(Population, 20,395)

Ownership: Municipal.
Source: 4 wells (1 to 4), 410, 450, 1,110, and 480 ft deep. The yield of the wells is reported to be 900, 1,300, 2,000, and 900 gpm. Emergency supply from Southern California Water Co.
Treatment: None.
Storage: Reservoirs, 4,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 1	Well 2	Well 3	Well 4
Silica (SiO_2)	22	19	20	12
Iron (Fe)	--	.02	--	.03
Manganese (Mn)	--	--	--	--
Calcium (Ca)	35	39	30	38
Magnesium (Mg)	11	10	5.3	12
Sodium (Na)	28	28	45	30
Potassium (K)	2.0	2.0	2.0	2.6
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	[a] 173	[a] 176	[a] 160	[a] 185
Sulfate (SO_4)	22	14	22	14
Chloride (Cl)	21	20	23	24
Fluoride (F)	.6	.6	.5	.5
Nitrate (NO_3)	7.5	12	4.9	14
Dissolved solids	272	262	280	284
Hardness as $CaCO_3$:				
Total	133	140	96	143
Noncarbonate	0	0	0	0
Color	0	0	0	0
pH	8.2	8.4	8.6	8.4
Specific conductance (micromhos at 25 C.)	361	367	364	374
Turbidity	1.0	.8	.8	.9
Temperature (F.)	--	--	--	--
Date of collection	Apr. 18, 1951	Apr. 18, 1951	Apr. 18, 1951	Apr. 18, 1951
Depth (feet)	410	450	1,110	480
Diameter (inches)	12	16	30-16	12
Date drilled	1875	1924	1946	1945
Percent of supply	--	--	--	--

[a] Includes the equivalent of any carbonate (CO_3) present.

NATIONAL CITY
(Population, 21,199)

Ownership: California Water and Telephone Co.; supplies Chula Vista and also about 11,000 people outside the city limits. Total population supplied, about 48,000.

Source: Colorado River distributed by the Metropolitan Water District of Southern California (92 percent of supply). (See Los Angeles.) National City well 1 (8 percent of supply). The well is 74 ft deep and is reported to yield 450 gpm. Emergency supply from shallow wells in bed of Sweetwater River.

Treatment: Chlorination.

Raw-water storage: Sweetwater Reservoir, 9,500,000,000 gal.

Finished-water storage: 790,000 gal.

ANALYSIS

(Analysis, in parts per million, by California State Dept. of Public Health)

	Well 1		Well 1
Silica (SiO_2)	7.2	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	180
Manganese (Mn)	--	Noncarbonate	6
Calcium (Ca)	40		
Magnesium (Mg)	20	Color	--
Sodium (Na)	132	pH	8.2
Potassium (K)	13	Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	214	Turbidity	--
Sulfate (SO_4)	61	Temperature (F.)	--
Chloride (Cl)	172	Date of collection	Feb. 8, 1951
Fluoride (F)	.3		
Nitrate (NO_3)	--		
Dissolved solids	[a] 551		

Depth (feet)	74
Diameter (inches)	12
Date drilled	1931
Percent of supply	8

[a] Sum of determined constituents.

OAKLAND
(Population, 384,575)

Ownership: East Bay Municipal Utility District; supplies also Alameda, Albany, Berkeley, El Cerrito, Richmond, San Leandro, Vallejo (part of supply), other smaller cities, and numerous unincorporated areas in Alameda and Contra Costa Counties. Total population supplied, about 900,000.

Source: Mokelumne River impounded in Pardee Reservoir (93 percent of supply); local runoff into San Pablo, Upper San Leandro, Chabot, and Lafayette Reservoirs (7 percent of supply).

Treatment: Orinda Plant (Mokelumne River): coagulation with alum, rapid sand filtration, chlorination, and lime for pH adjustment. San Pablo and Upper San Leandro Plants: aeration, coagulation with alum, sedimentation, rapid sand filtration, chlorination, and lime for pH adjustment. Chabot and Grant Miller (Lafayette Reservoir) Plants: coagulation with alum, sedimentation, pressure filtration, chlorination, lime for pH adjustment.

Rated capacity of treatment plants: 196,000,000 gpd.

Raw-water storage: Reservoirs: Pardee, San Pablo, Upper San Leandro, Chabot, and Lafayette, 102,759,000,000 gal.

Finished-water storage: About 100 distribution reservoirs, 387,900,000 gal.

Pardee Reservoir, with a storage capacity of 68,400,000,000 gal, is about 94 miles northeast of the East Bay area. Water is released through an outlet tower into the twin Mokelumne Aqueducts, together capable of delivering almost 100,000,000 gpd by gravity flow. By operating pumping plants the daily flow can be increased to more than 210,000,000 gpd. Most of this water is treated at the Orinda Filter Plant and transmitted into distribution mains; the remaining amounts are stored in the four terminal reservoirs.

The storage capacity of the terminal reservoirs is as follows: San Pablo, 14,000,000,000 gal; Upper San Leandro, 13,500,000,000 gal; Chabot, 4,100,000,000 gal; Lafayette, 1,700,000,000 gal.

Although much of the water is served by gravity, the district requires 67 pumping plants and over 100 distribution reservoirs to serve those at the higher elevations.

ANALYSES

(Analyses, in parts per million, by East Bay Municipal Utility District)

	Finished water [a]	Finished water [b]	Finished water [c]	Finished water [d]
Silica (SiO_2)	7.2	1.3	5.6	.4
Iron (Fe)	[e] .4	[e] 2.6	[e] .6	[e] .9
Manganese (Mn)	.0	.0	.0	.0
Calcium (Ca)	6.0	23	36	48
Magnesium (Mg)	.7	5.6	13	22
Sodium (Na)	4.7	13	20	34
Potassium (K)	--	--	--	--
Carbonate (CO_3)	[f] 24	--	--	--
Bicarbonate (HCO_3)		81	142	199
Sulfate (SO_4)	1.1	24	45	71
Chloride (Cl)	5.0	13	18	32
Fluoride (F)	.1	.1	.2	.2
Nitrate (NO_3)	--	--	--	--
Dissolved solids	[g] 37	[g] 122	220	316
Hardness as $CaCO_3$:				
Total	18	81	144	208
Noncarbonate	0	15	28	45
Color	--	--	--	--
pH	9.1	8.0	7.9	7.9
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	June 1950	June 1950	June 1950	June 1950

[a] Mokelumne River.
[b] San Pablo Reservoir.
[c] Upper San Leandro Reservoir.
[d] Chabot Reservoir.
[e] Iron and aluminum oxides.
[f] Includes the equivalent of any carbonate (CO_3) as bicarbonate (HCO_3).
[g] Sum of determined constituents.

ONTARIO
(Population, 22,872)

Ownership: Municipal; supplies about 300 people outside the city limits. Total population supplied, about 23,200.
Source: 8 wells (1 to 8), 600, 600, 604, 507, 551, 496, and 536 ft deep. The yield of the wells is reported to be 945, 1,650, 1,500, 1,600, 2,400, 2,400, 1,420 and 450 gpm. Emergency supply from well and surface water of San Antonio Water Co.
Treatment: None.
Storage: 14,750,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 1	Well 6	Well 7
Silica (SiO_2)	27	29	34
Iron (Fe)	--	.02	--
Manganese (Mn)	--	--	--
Calcium (Ca)	53	47	46
Magnesium (Mg)	6.3	6.4	7.6
Sodium (Na)	15	16	18
Potassium (K)	3.0	2.0	--
Carbonate (CO_3)	0	0	0
Bicarbonate (HCO_3)	200	187	172
Sulfate (SO_4)	9.5	8.0	14
Chloride (Cl)	7.0	6.0	9
Fluoride (F)	.4	.2	.4
Nitrate (NO_3)	1.9	2.5	2.6
Dissolved solids	236	208	238
Hardness as $CaCO_3$:			
Total	158	144	145
Noncarbonate	0	0	4
Color	0	0	0
pH	8.5	--	8.5
Specific conductance (micromhos at 25 C.)	352	327	343
Turbidity	1.6	2.2	1.7
Temperature (F.)	--	--	--
Date of collection	Apr. 12, 1951	Apr. 13, 1951	Apr. 13, 1951
Depth (feet)	600	551	496
Diameter (inches)	16	26	16
Date drilled	1910	1930	--
Percent of supply	--	--	--

OXNARD
(Population, 21,567)

Ownership: Municipal; supplies also about 2,000 people outside the city limits. Total population supplied, about 23,600.
Source: 5 wells (1 to 5), 234, 234, 232, 250 ft deep (depth not reported for well 5). The yield of the wells is reported to be 800, 800, 800, 800, and 1,000 gpm.
Treatment: None.
Storage: 1,000,000 gal.

ANALYSES

(Analyses, in parts per million, by Smith-Emery Co., Los Angeles, Calif.)

	Wells (composite sample)	Well 1	Well 5
Silica (SiO_2)	7.5	--	--
Iron (Fe)	--	.25	0
Manganese (Mn)	--	--	.8
Calcium (Ca)	155	153	197
Magnesium (Mg)	42	51	61
Sodium (Na)	105	86	93
Potassium (K)	--	--	--
Carbonate (CO_3)	3	0	0
Bicarbonate (HCO_3)	262	230	248
Sulfate (SO_4)	471	501	625
Chloride (Cl)	55	58	61
Fluoride (F)	--	.6	.7
Nitrate (NO_3)	--	6.0	2.4
Dissolved solids	[a]968	[a]969	[a]1,160
Hardness as $CaCO_3$:			
Total	561	594	745
Noncarbonate	340	402	540
Color	--	--	--
pH	8.2	7.4	7.4
Specific conductance (micromhos at 25 C.)	1,500	--	--
Turbidity	--	--	--
Temperature (F.)	--	--	--
Date of collection	Nov. 24, 1950	Dec. 8, 1950	Dec. 8, 1950
Depth (feet)	--	234	--
Diameter (inches)	--	14	14
Date drilled	--	1912	--
Percent of supply	--	--	--

[a] Sum of determined constituents.

PALO ALTO
(Population, 25,475)

Ownership: Municipal; supplies also about 9,750 people outside the city limits. Total population supplied, about 35,200.
Source: San Francisco city supply (see San Francisco) 60 percent of supply; 9 wells, 250 to 600 ft deep, 40 percent of supply.
Treatment: Chlorination.
Raw-water storage: --
Finished-water storage: 4,980,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Main Station Well	Mayfield Well [a]	Middlefield Well	Oregon Well
Silica (SiO_2)	--	--	--	--
Iron (Fe)	.04	.6	0	.26
Manganese (Mn)	.0	0	0	.1
Calcium (Ca)	61	41	39	82
Magnesium (Mg)	14	12	11	22
Sodium (Na)	86	65	110	102
Potassium (K)	--	--	--	--
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	283	244	271	254
Sulfate (SO_4)	44	40	33	33
Chloride (Cl)	83	35	90	170
Fluoride (F)	.0	0	0	.1
Nitrate (NO_3)	.4	1.1	0	1.8
Dissolved solids	575	438	552	668
Hardness as $CaCO_3$:				
Total	211	151	142	291
Noncarbonate	0	0	0	87
Color	--	--	--	--
pH	7.7	7.9	7.9	8.1
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Feb. 6, 1951	Feb. 6, 1951	Feb. 6, 1951	Feb. 6, 1951
Depth (feet)	446	526	600	512
Diameter (inches)	14	14	14	14
Date drilled	1926	1931	1932	1930
Percent of supply	--	--	--	--

[a] Also known as Park Boulevard Well.

CALIFORNIA

PASADENA
(Population, 104,577)

Ownership: Municipal.
Source: Colorado River distributed by Metropolitan Water District of Southern California, 62 percent of supply (see Los Angeles); 14 wells ranging in depth from 642 to 1,220 ft, 35 percent of supply; Arroyo Seco, Eaton Canyon, and Millard Streams, 3 percent of supply.
Treatment: Colorado River: softened and filtered by Metropolitan District of Southern California (see Los Angeles). Local supplies: chlorination and ammoniation.
Rated capacity of treatment plant: --
Raw-water storage: --
Finished-water storage: 103,000,000 gal.

ANALYSES

(Analyses, in parts per million, by City Of Pasadena)

	Jourdan Well [a]	Garfield Well [a]	Woodbury Well [a]	Sunset Well [a]	Copelin Well [a]
Silica (SiO_2)	30	30	26	30	30
Iron (Fe)	.03	.03	.06	.03	.03
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	42	20	24	37	47
Magnesium (Mg)	11	4.0	3.7	11	15
Sodium (Na)	17	25	33	23	26
Potassium (K)					
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	178	99	123	159	216
Sulfate (SO_4)	13	13	21	18	28
Chloride (Cl)	10	10	12	14	13
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	8.7	9.9	6.7	14	6.4
Dissolved solids	[b] 219	[b] 161	[b] 187	[b] 225	[b] 272
Hardness as $CaCO_3$:					
Total	151	65	74	139	179
Noncarbonate	5	0	0	9	2
Color	--	--	--	--	--
pH	7.4	7.7	7.8	7.4	7.3
Specific conductance (micromhos at 25 C.)	--	--	--	--	--
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	--	--	--	--	--
Depth (feet)	729	720	1220	751	700
Diameter (inches)	26	26	26	26	26
Date drilled	1926	1921	1930	1924	1921
Percent of supply	11	7	6	6	3

[a] Average for year 1950-51.
[b] Sum of determined constituents.

ANALYSES

(Analyses, in parts per million, by City of Pasadena)

	Eaton Canyon Stream[a]	Arroyo Seco Stream[a]		Eaton Canyon Stream[a]	Arroyo Seco Stream[a]
Silica (SiO_2)	19	24	Hardness as $CaCO_3$:		
Iron (Fe)	.04	.07	Total	175	213
Manganese (Mn)	--	--	Noncarbonate	4	5
Calcium (Ca)	45	56			
Magnesium (Mg)	15	18	Color	--	--
Sodium (Na)	14	26	pH	8.2	7.9
Potassium (K)			Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	208	254	Turbidity	--	--
Sulfate (SO_4)	21	36	Temperature (F.)	--	--
Chloride (Cl)	7.2	13	Date of collection	--	--
Fluoride (F)	--	--			
Nitrate (NO_3)	.4	.4			
Dissolved solids	[b] 224	[b] 299			

[a] Average for year 1950-51
[b] Sum of determined constituents

POMONA
(Population, 35,405)

Ownership: Municipal.
Source: 12 wells (1 to 12) ranging in depth from 495 to 1,104 ft, and 2 tunnels (1 and 3). The yield of the wells is reported to range from 400 to 1,500 gpm, and to average 843 gal.
Treatment: None.
Storage: Reservoirs, 15,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 4	Well 5	Well 6	Well 11	Tunnel 3
Silica (SiO_2)	20	19	18	23	16
Iron (Fe)	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	72	52	68	52	37
Magnesium (Mg)	12	8.5	7.6	9.3	4.0
Sodium (Na)	12	20	32	12	31
Potassium (K)	11	4.6	4.4	3.8	3.0
Carbonate (CO_3)	--	--	--	--	--
Bicarbonate (HCO_3)	214	184	170	189	172
Sulfate (SO_4)	29	27	64	20	21
Chloride (Cl)	11	9	13	7.0	10
Fluoride (F)	.3	.4	.2	.3	.8
Nitrate (NO_3)	48	32	80	17	13
Dissolved solids	321	270	386	256	218
Hardness as $CaCO_3$:					
Total	231	166	202	169	108
Noncarbonate	56	15	62	14	0
Color	0	0	0	0	0
pH	7.0	7.3	7.1	7.3	7.3
Specific conductance (micromhos at 25 C.)	495	403	540	382	330
Turbidity	1.2	.8	.7	.6	.9
Temperature (F.)	--	--	--	--	--
Date of collection	May 9, 1951	May 9, 1951	May 9, 1951	May 9, 1951	May 9, 1951
Depth (feet)	537	575	560	566	
Diameter (inches)	20	20	20	20	
Date drilled	1940	1930	1933	1947	
Percent of supply	--	--	--	--	

REDONDO BEACH
(Population, 25,226)

Ownership: California Water Service Co.; supplies also Hermosa Beach and about 3,000 people outside the city limits. Total population supplied, about 40,000.
Source: 13 wells ranging in depth from 286 to 600 ft (95 percent of supply); auxiliary supply from Colorado River distributed by the Metropolitan Water District of Southern California (5 percent of supply). (See Los Angeles.) The yield of the wells is reported to range from 180 to 1,052 gpm, and to average 557 gal.
Treatment: Chlorination of well water. Colorado River water is softened and filtered by the Metropolitan Water District of Southern California.
Storage: 3,450,000 gal.

ANALYSES

(Analyses, in parts per million, by California Water Service Co., San Jose, Calif.)

	Well 5-04	Well 21-01	Well 22-01	Well 25-01	Well 5-02
Silica (SiO_2)	21	28	18	33	21
Iron (Fe)	.01	.22	.01	.08	.22
Manganese (Mn)	.03	.10	.07	.0	.07
Calcium (Ca)	52	38	48	27	54
Magnesium (Mg)	15	24	15	12	16
Sodium (Na)	56	79	54	99	62
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--
Bicarbonate (HCO_3)	252	305	263	305	254
Sulfate (SO_4)	44	5.3	23	12	43
Chloride (Cl)	44	77	44	50	56
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	2.5	.6	.0	.0	1.8
Dissolved solids	[a]359	[a]403	[a]332	[a]384	[a]379
Hardness as $CaCO_3$:					
Total	191	194	182	117	200
Noncarbonate	0	0	0	0	0
Color	--	--	--	--	--
pH	7.9	7.7	7.8	7.9	8.0
Specific conductance (micromhos at 25 C.)	612	715	590	653	644
Turbidity	0	0	0	0	0
Temperature (F.)	74	74	72	75	72
Date of collection	Apr. 13, 1950	Feb. 19, 1951	Apr. 25, 1950	May 10, 1950	Apr. 11, 1950
Depth (feet)	520	450	600	504	340
Diameter (inches)	16	16	16	16	16
Date drilled	1949	1944	1948	1950	1908
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

REDWOOD CITY
(Population, 25,544)

Ownership: Municipal; supplies also about 4,900 people outside the city limits. Total population supplied, about 30,400.
Source: Hetch Hetchy aqueduct of the San Francisco supply. (See San Francisco.) Emergency supply from local wells.
Treatment: Chlorination by City of San Francisco.
Storage: 6,420,000 gal.

ANALYSIS

(Analysis, in parts per million, by City of San Francisco)

	Finished water [a]		Finished water [a]
Silica (SiO_2)	7	Hardness as $CaCO_3$:	
Iron (Fe)	.03	Total	56
Manganese (Mn)	0	Noncarbonate	8
Calcium (Ca)	15		
Magnesium (Mg)	4.6	Color	--
Sodium (Na)	11	pH	7.5
Potassium (K)	--	Specific conductance (micromhos at 25 C.)	163
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	59	Temperature (F.)	--
Sulfate (SO_4)	19	Date of collection	Mar. 1, 1950
Chloride (Cl)	9		
Fluoride (F)	.1		
Nitrate (NO_3)	.1		
Dissolved solids	95		

[a] Composite sample.

RICHMOND
(Population, 99,545)

Ownership: East Bay Municipal Utility District. (See Oakland.)

CALIFORNIA

RIVERSIDE
(Population, 46,764)

Ownership: Municipal; supplies also about 1,600 people outside the city limits. Total population supplied, about 48,400.
Source: 26 wells in the San Bernardino artesian basin. Well depths range from 300 to 1,192 ft. Most of these wells are flowing. Auxiliary supply from 5 wells in Riverside.
Treatment: None.
Storage: Reservoirs, 22,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Composite sample [a]	Warren Well 2	Raub Well 2	Hunt Wells (5 wells)	Cooley Wells (9 wells)
Silica (SiO_2)	16	17	15	18	18
Iron (Fe)	--	--	.01	--	--
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	27	33	28	26	35
Magnesium (Mg)	4	4.4	2.7	4.9	7.0
Sodium (Na)	50	16	57	51	31
Potassium (K)	--	3.2	5.6	3.6	4.4
Carbonate (CO_3)	0	--	--	--	--
Bicarbonate (HCO_3)	162	144	151	162	175
Sulfate (SO_4)	34	16	44	31	28
Chloride (Cl)	18	5.5	27	24	8.0
Fluoride (F)	.4	.5	.8	.4	.2
Nitrate (NO_3)	--	1.1	1.4	1.9	1.3
Dissolved solids	[b]229	170	246	262	216
Hardness as $CaCO_3$:					
Total	84	102	80	85	116
Noncarbonate	0	0	0	0	0
Color	--	0	0	0	0
pH	--	7.2	7.4	7.7	7.4
Specific conductance (micromhos at 25 C.)	350	266	208	374	355
Turbidity	--	1.2	.9	.9	.5
Temperature (F.)	--	--	--	--	--
Date of collection	Nov. 17, 1950	May 8, 1951	May 8, 1951	May 8, 1951	May 8, 1951
Depth (feet)		1,137	1,192	409-868	520-1,138
Diameter (inches)		20	20	10-20	10-20
Date drilled		1930	1931	1912-46	1899-1947
Percent of supply		--	--	--	--

[a] City tap.
[b] Sum of determined constituents.

SACRAMENTO
(Population, 137,572)

Ownership: Municipal; supplies also about 13,500 people outside the city limits. Total population supplied, about 151,100. Southern California Water Co. supplies about 4 percent of the population.
Source: Sacramento River (96 percent of supply); 20 wells (owned by Southern California Water Co.), 4 percent of the supply.
Treatment: Sacramento River: coagulation with alum, sedimentation, rapid sand filtration, and chlorination. Wells: none.
Rated capacity of treatment plant: 64,000,000 gpd.
Raw-water storage: None.
Finished-water storage: 14,000,000 gal.

The intake in the Sacramento River is just below the mouth of the American River. Analytical data indicate that at times the water withdrawn represents chiefly American River water.

ANALYSES

(Analyses, in parts per million, by U. S. Geological Survey)

	Raw water [a]	Finished water [a]		Raw water [a]	Finished water [a]
Silica (SiO_2)	9.2	9.1	Hardness as $CaCO_3$:		
Iron (Fe)	.0	.0	Total	20	21
Manganese (Mn)	--	--	Noncarbonate	0	6
Calcium (Ca)	4.6	5.0			
Magnesium (Mg)	2.0	2.0	Color	15	0
Sodium (Na)	1.5	1.5	pH	7.2	6.7
Potassium (K)	.6	.9	Specific conductance (micromhos at 25 C.)	46.8	54.6
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	23	18			
Sulfate (SO_4)	1.7	7.6	Turbidity	--	--
Chloride (Cl)	.9	1.4	Temperature (F.)	54	58
Fluoride (F)	.0	.0	Date of collection	June 6, 1952	June 6, 1952
Nitrate (NO_3)	.6	.4			
Dissolved solids	36	37			

[a] Sacramento River.

SAN BERNARDINO
(Population, 63,058)

Ownership: Municipal.
Source: 28 wells ranging in depth from 40 to 1,408 ft (82 percent of supply), and Lytle Creek (18 percent of supply). The yield of the wells is reported to range from 125 to 2,900 gpm, and to average 1,298 gal (data on 21 wells).
Treatment: Chlorination of creek water; well water not treated.
Storage: Reservoirs, 37,690,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Antil Well 5	17th St. & Sierra Way Well	Hanford Well 1	Perris Hill Well 3	Lytle Creek [a]
Silica (SiO_2)	--	14	9	15	--
Iron (Fe)	--	.03	--	--	0
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	24	52	47	31	52
Magnesium (Mg)	1.8	9.5	7.7	6.1	6
Sodium (Na)	44	12	17	32	41
Potassium (K)	2.2	4.0	4.0	.3	--
Carbonate (CO_3)	--	--	--	--	--
Bicarbonate (HCO_3)	127	210	188	129	244
Sulfate (SO_4)	42	13	30	27	27
Chloride (Cl)	7.4	4.8	10	18	12
Fluoride (F)	.4	.4	.4	.8	--
Nitrate (NO_3)	1.3	5.3	3.7	3.5	--
Dissolved solids	232	244	240	[b] 197	[b] 258
Hardness as $CaCO_3$:					
Total	67	169	149	102	154
Noncarbonate	0	0	0	0	0
Color	0	0	0	0	--
pH	8.8	8.5	8.4	8.0	8.0
Specific conductance (micromhos at 25 C.)	319	339	325	352	--
Turbidity	1.1	1.1	1.0	3.5	--
Temperature (F.)	--	--	--	--	--
Date of collection	Apr. 18, 1951	Apr. 18, 1951	Apr. 18, 1951	Apr. 18, 1951	1940
Depth (feet)	1,408	700	752	265	
Diameter (inches)	--	20	16	20	
Date drilled	1929	1948	1920	1930	
Percent of supply	--	--	--	--	

[a] Special Bulletin No. 63, California Water Supply Statistics, California State Dept. of Health.
[b] Sum of determined constituents.

SAN DIEGO
(Population, 334,387)

Ownership: Municipal; supplies San Dieguito Irrigation District, Santa Fe Irrigation District, La Jolla, Del Mar, and part of Coronado. Total population supplied, about 342,000.

Source: San Diego River system (62 percent of supply), Cottonwood-Otay system (32 percent of supply), and San Dieguito system (6 percent of supply). Emergency supplies from Lake Henshaw, Sweetwater River water furnished by California Water and Telephone Co., and Colorado River through the San Diego aqueduct of the Metropolitan Water District of Southern California. (See Los Angeles.)

Treatment: Alvarado plant: prechlorination, coagulation with ferric sulfate, partial softening with lime, settling, recarbonation, rapid sand filtration, postchlorination, and adjustment of pH with lime. Lower Otay plant: pressure filtration and chlorination. Torrey Pines plant: pressure filtration and chlorination. There are several stations for chlorination only. Fluoridation is scheduled to begin at the Alvarado plant within the first few months of 1952.

Rated capacity of treatment plant: Alvarado plant: 66,000,000 gpd. Lower Otay plant: 16,000,000 gpd. Torrey Pines plant: 3,000,000 gpd.

Raw-water storage: 130,076,000,000 gal.

Finished-water storage: 136,000,000 gal.

The percentages of supply shown above are the "normal" percentages. Considerable quantities of Colorado River water have been used for the past few dry years, due to extremely low production of local supplies. For the year ending June 30, 1951, almost 90 percent of the supply came from the Colorado River, distributed through the San Dieguito system and San Vicente Reservoir.

The San Diego River system includes water from the San Diego River and tributaries, and is stored in El Capitan and San Vicente Reservoirs. However, most of the water received at present in San Vicente Reservoir is Colorado River water through the San Diego Aqueduct. Water from the San Diego River system is treated at the Alvarado Plant.

The Cottonwood-Otay system includes water from Buchman and La Posta Creeks (tributaries of Cottonwood Creek) stored in Morena Reservoir, Cottonwood and Pine Valley Creeks stored in Barrett Reservoir, and Dulzura Creek stored in Lower Otay Reservoir. All Cottonwood-Otay sources eventually reach Lower Otay Reservoir.

The San Dieguito River system stores water from the San Dieguito River in Lake Hodges and San Dieguito Reservoir. Water in this system is treated at Torrey Pines plant.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	El Capitan Reservoir	San Vicente Reservoir	Lower Otay Reservoir	San Dieguito Reservoir
Silica (SiO_2)	(a)	(a)	(a)	(a)
Iron (Fe)	--	.03	--	.03
Manganese (Mn)	--	--	--	--
Calcium (Ca)	44	76	36	84
Magnesium (Mg)	22	34	32	38
Sodium (Na)	36	88	86	91
Potassium (K)	4.0	4.8	3.8	4.3
Carbonate (CO_3)	7	5	7	4
Bicarbonate (HCO_3)	179	148	265	186
Sulfate (SO_4)	51	268	44	271
Chloride (Cl)	41	80	91	96
Fluoride (F)	.4	.4	.6	.4
Nitrate (NO_3)	2.4	1.3	1.8	1.7
Dissolved solids	290	646	450	678
Hardness as $CaCO_3$:				
Total	198	329	222	366
Noncarbonate	39	200	0	208
Color	--	--	--	--
pH	8.5	7.8	8.2	8.0
Specific conductance (micromhos at 25 C.)	501	990	759	1,000
Turbidity	1.1	.8	.6	.6
Temperature (F.)	--	--	--	--
Date of collection	May 21, 1951	May 24, 1951	May 1951	May 9, 1951

[a] Mean silica values obtained from quarterly analyses for the fiscal year 1950-51 by Carl Wilson, Los Angeles, are as follows: El Capitan Reservoir, 21 ppm; San Vicente Reservoir, 9 ppm; Lower Otay Reservoir, 10 ppm; San Dieguito Reservoir, 17 ppm.

CALIFORNIA

SAN FRANCISCO
(Population, 775,357)

Ownership: Municipal; furnishes the entire supply for Belmont, Belmont Water District, Burlingame, Moffett Field, Redwood City, San Carlos, San Mateo, and Sunol; furnishes part of the supply for Alameda County Water District, Atherton, Daly City, Menlo Park, Millbrae, Palo Alto, and South San Francisco. Total population supplied, about 975,000.

Source: Hetch Hetchy system (60 percent of supply), Alameda system (approximately 30 percent of supply), Peninsula system (approximately 10 percent of supply). Emergency supplies from Sunset wells system and from Lake Merced, within San Francisco.

Treatment: Chlorination, copper sulfate for algae control in open reservoirs. Aeration of water from Calaveras Reservoir. Fluoridation authorized in November 1951.

Raw-water storage: Storage reservoirs, total capacity 187,630,000,000 gal.

Finished-water storage: Distribution reservoirs, total capacity 315,600,000 gal; elevated tanks, total capacity 2,780,000 gal.

The Hetch Hetchy system includes the Tuolumne River impounded in Hetch Hetchy Reservoir, Eleanor Creek impounded in Lake Eleanor, and Cherry River. These waters are combined at Early Intake, 155 miles east of San Francisco, where they enter the aqueduct leading to San Francisco.

Hetch Hetchy Reservoir has a storage capacity of 117,300,000,000 gal, Lake Eleanor a storage capacity of 9,000,000,000 gal, while the present capacity of the aqueduct is about 92,000,000 gpd. Under construction (1951) is a dam on Cherry River which will create a new reservoir with a capacity of 86,000,000,000 gal. Also under construction is a second section of aqueduct across San Joaquin Valley which will increase the capacity of the aqueduct to 140,000,000 gpd.

The Alameda sources lie on the east side of San Francisco Bay within the drainage area of Alameda Creek. The chief source is Calaveras Reservoir, which impounds Calaveras Creek and Arroyo Hondo, and water diverted from upper Alameda Creek through a tunnel. Calaveras Reservoir has a storage capacity of 31,550,000,000 gal, and its water flows by gravity to enter the Hetch Hetchy aqueduct. During dry years water is also obtained from two underground sources: Sunol filter galleries on Alameda Creek and wells in the vicinity of Pleasanton. When these sources are used, the water is pumped into the Hetch Hetchy aqueduct near the Bay Crossing Division.

The Peninsula system includes chiefly three reservoirs: Crystal Springs, Pilarcitos, and San Andres. These reservoirs catch and store the local runoff; also Crystal Springs is the terminal reservoir for the Hetch Hetchy aqueduct, which includes all of the Hetch Hetchy and Alameda sources. The storage capacity of each reservoir is as follows: Crystal Springs, 22,580,000,000 gal; San Andres, 6,190,000,000 gal; Pilarcitos, 1,010,000,000 gal. Water from Pilarcitos Reservoir is released to San Andres Reservoir. Water from Crystal Springs and San Andres Reservoirs is supplied to a number of distribution reservoirs throughout the city. Crystal Spring lines supply downtown, commercial, waterfront areas of the city, and peninsula communities as far south as San Carlos. San Andres lines furnish water to residential areas of San Francisco. Bay Crossing lines (Hetch Hetchy aqueduct) supply peninsula communities south of San Carlos and some communities in Alameda County.

ANALYSES

(Analyses, in parts per million, by City of San Francisco)

	Hetch Hetchy Reservoir	Calaveras Reservoir	Pilarcitos Reservoir	Sunol Galleries	Pleasanton Wells
Silica (SiO_2)	3.8	5.0	3.7	14	11
Iron (Fe)	.02	.02	.02	.03	.02
Manganese (Mn)	0	0	0	0	0
Calcium (Ca)	1.1	25	15	52	63
Magnesium (Mg)	1.4	8.8	5.1	14	29
Sodium (Na)	.1	8.8	14	26	28
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	7	105	70	193	283
Sulfate (SO_4)	1.6	17	6.5	63	47
Chloride (Cl)	1	7	20	21	30
Fluoride (F)	.1	.1	.0	.1	.1
Nitrate (NO_3)	.1	.2	.1	.0	1.0
Dissolved solids	[a]13	[a]124	[a]99	[a]286	[a]348
Hardness as $CaCO_3$:					
Total	9	99	59	187	275
Noncarbonate	3	13	1	29	44
Color	--	--	--	--	--
pH	6.4	7.7	7.5	7.9	8.0
Specific conductance (micromhos at 25 C.)	19.7	225	175	466	606
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	June 1949	June 1949	June 1949	1948	January 1949

[a] Sum of determined constituents.

ANALYSES

(Analyses, in parts per million, by City of San Francisco)

	Crystal Springs lines	San Andres lines	Bay Crossing lines
Silica (SiO_2)	7.5	7.0	3.0
Iron (Fe)	.02	.01	.05
Manganese (Mn)	0	0	0
Calcium (Ca)	13	14	7.5
Magnesium (Mg)	5.6	6.2	3.4
Sodium (Na)	11	12	5.3
Potassium (K)	--	--	--
Carbonate (CO_3)	0	0	0
Bicarbonate (HCO_3)	66	71	34
Sulfate (SO_4)	13	12	8.7
Chloride (Cl)	10	15	5
Fluoride (F)	.1	.0	.0
Nitrate (NO_3)	.0	.1	.0
Dissolved solids	[a] 93	[a] 102	[a] 50
Hardness as $CaCO_3$:			
Total	54	58	33
Noncarbonate	1	2	5
Color	--	--	--
pH	7.9	7.8	7.3
Specific conductance (micromhos at 25 C.)	152	170	85
Turbidity	--	--	--
Temperature (F.)	--	--	--
Date of collection	Apr. 17, 1951	Apr. 17, 1951	Aug. 18, 1950

[a] Sum of determined constituents.

SAN JOSE
(Population, 95,280)

Ownership: San Jose Water Works (private); supplies also Los Gatos and about 65,300 people outside the city limits. Total population supplied, about 165,500.
Source: 41 wells ranging in depth from 185 to 1,535 ft (60 percent of supply); Los Gatos and Saratoga Creeks (40 percent of supply).
Treatment: Wells: chlorination for some, others untreated. Creeks: chlorination, occasional use of chlorine dioxide and ammonia.
Rated capacity of treatment plant: --
Raw-water storage: Impounding reservoirs for streams, 2,485,000,000 gal.
Finished-water storage: Distribution reservoirs, 42,800,000 gal.

ANALYSIS

(Analysis, in parts per million, by California Water Service Co.)

	Composite water [a]		Composite water [a]
Silica (SiO_2)	21	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	194
Manganese (Mn)	.00	Noncarbonate	8
Calcium (Ca)	42		
Magnesium (Mg)	21	Color	--
Sodium (Na)	29	pH	8.2
Potassium (K)	1	Specific conductance (micromhos at 25 C.)	475
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	222	Temperature (F.)	--
Sulfate (SO_4)	41	Date of collection	1950
Chloride (Cl)	16		
Fluoride (F)	.1		
Nitrate (NO_3)	6.8		
Dissolved solids	[b] 288		
Depth (feet)			--
Diameter (inches)			--
Date drilled			--
Percent of supply			100

[a] Mean for 1950.
[b] Sum of determined constituents.

SAN LEANDRO
(Population, 27,542)

Ownership: East Bay Municipal Utility District. (See Oakland.)

SAN MATEO
(Population, 41,782)

Ownership: California Water Service Co.
Source: Crystal Springs Reservoir (see San Francisco). Emergency supply from 10 wells, ranging in depth from 237 to 445 ft.
Treatment: Chlorination of water from Crystal Springs Reservoir by City of San Francisco; softening by lime-soda process, and chlorination of well water, when used.
Finished-water storage: 5,540,000 gal.

SANTA ANA
(Population, 45,533)

Ownership: Municipal.
Source: Colorado River distributed by the Metropolitan Water District of Southern California , 83 percent of supply. (See Los Angeles.) Six wells (7, 12 to 16), 960, 466, 960, 978, 1,140, and 1,050 ft deep, 17 percent of supply.
Treatment: Chlorination of well water; Colorado River water treated by Metropolitan Water District of Southern California. (See Los Angeles.)
Raw-water storage: --
Finished-water storage: 2,060,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 13	Well 14	Well 15	Well 16
Silica (SiO_2)	18	16	18	15
Iron (Fe)	.05	.07	.00	.00
Manganese (Mn)	.00	.00	.00	.00
Calcium (Ca)	51	63	50	67
Magnesium (Mg)	18	16	19	20
Sodium (Na)	45	43	43	43
Potassium (K)	1.9	2.3	1.7	1.3
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	204	230	207	208
Sulfate (SO_4)	93	74	90	83
Chloride (Cl)	39	54	35	53
Fluoride (F)	.3	.5	.3	.4
Nitrate (NO_3)	16	12	4.4	21
Dissolved solids	[a]383	[a]394	[a]364	[a]406
Hardness as $CaCO_3$:				
Total	203	225	205	250
Noncarbonate	36	36	35	79
Color	--	--	--	--
pH	7.5	7.4	7.5	7.5
Specific conductance (micromhos at 25 C.)	645	708	625	685
Turbidity	< 1	< 1	< 1	< 1
Temperature (F.)	--	--	--	--
Date of collection	Sept. 25, 1951	Sept. 25, 1951	Sept. 26, 1951	Sept. 25, 1951
Depth (feet)	960	978	1,140	1,050
Diameter (inches)	18-16	20-16	26-16	20-12
Date drilled	1925	1932	1929	1927
Percent of supply	--	--	--	--

[a]Sum of determined constituents.

SANTA BARBARA
(Population, 44,913)

Ownership: Municipal; supplies also about 400 people outside the city limits. Total population supplied, about 45,300.
Source: Santa Inez River impounded in Gibraltar Reservoir, 60 percent of supply; 9 wells ranging in depth from 473 to 946 ft, 40 percent of supply. The yield of the wells is reported to range from 250 to 800 gpm. Auxiliary supply, 5 wells. There is an emergency connection with a private water company.
Treatment: Santa Inez River water: prechlorination, lime-soda softening, recarbonation, coagulation with alum, rapid sand filtration, and postchlorination. Well water: chlorination.
Rated capacity of treatment plant: 6,000,000 gpd.
Raw-water storage: Gibraltar Reservoir, approximately 4,700,000,000 gal.
Finished-water storage: Reservoirs, 64,000,000 gal.

Santa Inez River is supplemented when available by water from Tecolote Tunnel. When water from this source is used no softening is done. Sheffield Reservoir serves to distribute both Santa Inez River and Tecolote Tunnel water.

ANALYSES

(Analyses, in parts per million, by Pomeroy & Associates, Pasadena, Calif.)

	Yanonali Well 1	Soledad Well 1	De La Guerra Well 1	De La Guerra Well 3
Silica (SiO_2)	32	32	38	28
Iron (Fe)	.1	.0	.0	.0
Manganese (Mn)	--	--	--	--
Calcium (Ca)	70	88	103	81
Magnesium (Mg)	23	24	36	23
Sodium (Na)	53	75	54	42
Potassium (K)	1.7	2	2.0	1.4
Carbonate (CO_3)	--	--	--	--
Bicarbonate (HCO_3)	251	301	249	252
Sulfate (SO_4)	134	135	106	125
Chloride (Cl)	27	65	131	30
Fluoride (F)	.4	.3	.4	.3
Nitrate (NO_3)	.6	2	40	4
Dissolved solids	[a]465	[a]572	[a]633	[a]459
Hardness as $CaCO_3$:				
Total	268	319	408	295
Noncarbonate	64	72	201	90
Color	--	--	--	--
pH	6.9	7.2	6.7	7.0
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Aug. 29, 1951	Aug. 29, 1951	Aug. 29, 1951	Aug. 29, 1951

[a] Sum of determined constituents.

	Yanonali Well 1	Soledad Well 1	De La Guerra Well 1	De La Guerra Well 3
Depth (feet)	946	635	529	698
Diameter (inches)	14	14	14	14
Date drilled	1950	1948	1948	1948
Percent of supply	--	--	--	--

ANALYSES

(Analyses, in parts per million, by Pomeroy & Associates, Pasadena, California)

	Finished water [a]	Tecolote Tunnel		Finished water [a]	Tecolote Tunnel
Silica (SiO_2)	24	28	Hardness as $CaCO_3$:		
Iron (Fe)	--	--	Total	220	52
Manganese (Mn)	--	--	Noncarbonate	42	0
Calcium (Ca)	46	14			
Magnesium (Mg)	25	4.0	Color	--	--
Sodium (Na)	99	117	pH	7.6	8.2
Potassium (K)	2.4	6.7	Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	--	--	Turbidity	--	--
Bicarbonate (HCO_3)	214	236	Temperature (F.)	--	--
Sulfate (SO_4)	224	98	Date of collection	Aug. 6, 1951	Aug. 6, 1951
Chloride (Cl)	19	11			
Fluoride (F)	.7	.8			
Nitrate (NO_3)	1.2	1.2			
Dissolved solids	[b] 547	[b] 397			

[a] Sheffield Reservoir.
[b] Sum of determined constituents.

CALIFORNIA

SANTA CRUZ
(Population, 21,970)

Ownership: Municipal; supplies also about 11,000 people outside the city limits. Total population supplied, about 33,000.
Source: Coastal streams: Laguna Creek, Majors Creek, and Liddell Creek (57 percent of supply); San Lorenzo River (39 percent of supply); 3 wells each 100 ft deep (4 percent of supply).
Treatment: San Lorenzo River: prechlorination, activated carbon, pressure filtration, and postchlorination. Coastal streams: chlorination. Wells: chlorination, and addition of Calgon for stabilization.
Rated capacity of treatment plant: 6,750,000 gpd.
Raw-water storage: None.
Finished-water storage: Reservoirs and tanks, 45,800,000 gal.

Water from the coastal streams flows by gravity to Santa Cruz. San Lorenzo River water is first treated, then pumped to the system.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	San Lorenzo River (raw water)	San Lorenzo River (finished water)	Bay Street Reservoir [a]
Silica (SiO_2)	--	--	--
Iron (Fe)	.1	--	--
Manganese (Mn)	.0	--	--
Calcium (Ca)	33	37	55
Magnesium (Mg)	11	6.8	5.1
Sodium (Na)	22	20	12
Potassium (K)	--	--	--
Carbonate (CO_3)	0	0	0
Bicarbonate (HCO_3)	110	126	177
Sulfate (SO_4)	56	26	24
Chloride (Cl)	20	24	12
Fluoride (F)	.0	.2	.0
Nitrate (NO_3)	1.5	.0	.9
Dissolved solids	[b] 198	202	220
Hardness as $CaCO_3$:			
Total	128	123	160
Noncarbonate	37	20	15
Color	--	--	--
pH	7.6	7.9	7.6
Specific conductance (micromhos at 25 C.)	--	347	370
Turbidity	--	< 1.0	< 1.0
Temperature (F.)	--	--	--
Date of collection	Jan. 30, 1951	Oct. 16, 1951	Oct. 16, 1951

[a] Coastal streams (finished water).
[b] Sum of determined constituents.

SANTA MONICA
(Population, 71,595)

Ownership: Municipal.
Source: Colorado River distributed by the Metropolitan Water District of Southern California, 91 percent of supply (See Los Angeles); 8 wells ranging in depth from 250 to 468 ft, 9 percent of supply. The reported yield of the wells is from 500 to 1,750 gpm. Emergency supply from Southern California Water Co.
Treatment: Colorado River water is softened and filtered by the Metropolitan Water District of Southern California. The well water is not treated.
Raw-water storage: --
Finished-water storage: 20,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California State Dept. of Public Health)

	Well 1	Well 2		Well 1	Well 2
Silica (SiO_2)	14	--	Hardness as $CaCO_3$:		
Iron (Fe)	.00	.0	Total	291	295
Manganese (Mn)	.00	.0	Noncarbonate	109	136
Calcium (Ca)	64	66			
Magnesium (Mg)	32	33	Color	--	--
Sodium (Na)	49	44	pH	7.0	7.1
Potassium (K)	1.3	--	Specific conductance (micromhos at 25 C.)	725	--
Carbonate (CO_3)	--	0			
Bicarbonate (HCO_3)	222	201			
Sulfate (SO_4)	119	138	Turbidity	< 1	--
Chloride (Cl)	53	42	Temperature (F.)	--	--
Fluoride (F)	.3	.4	Date of collection	Sept. 25, 1951	Sept. 25, 1951
Nitrate (NO_3)	20	.6			
Dissolved solids	485	493			

Depth (feet)	250	250
Diameter (inches)	16	16
Date drilled	1920	1940
Percent of supply	--	--

SANTA ROSA
(Population, 17,902)

Ownership: Municipal; supplies also about 12,000 people outside the city limits. Total population supplied, about 30,000.

Source: 7 wells (2 to 6, Peters Springs well, and Ralphine well) 900, 300, 1,000, 290, 915, 139, and 846 ft deep, 67 percent of supply; Santa Rosa Creek and MacRae Springs, 33 percent of supply. MacRae Springs furnishes less than 1 percent of supply. The yield of the wells is reported to be 380, 325, 950, 250, 1,500, 575, and 450 gpm. Water from Santa Rosa Creek and MacRae Springs is stored in Lake Ralphine. Water from Peters Springs and Ralphine wells is pumped into Lake Ralphine during the summer months.

Treatment: Wells 2 to 6: aeration and polyphosphate (Calgon) for iron and manganese control, chlorination, and dechlorination by sulfur dioxide. Lake Ralphine: chlorination after long storage.

Rated capacity of treatment plant: 6,500,000 gpd.

Raw-water storage: Lake Ralphine, 135,000,000 gal.

Finished-water storage: Reservoirs, 2,800,000 gal.

ANALYSES

(Analyses, in parts per million, by Brown and Caldwell, San Francisco)

	Well 4[a]	Well 6	Peters Springs Well[a]	Lake Ralphine	Finished water (city tap)
Silica (SiO_2)	93	89	95	38	84
Iron (Fe)	.33	.27	.33	.52	.27
Manganese (Mn)	.09	.07	.10	.03	.18
Calcium (Ca)	28	29	34	22	30
Magnesium (Mg)	18	18	21	19	18
Sodium (Na)	} 59	67	64	25	58
Potassium (K)					
Carbonate (CO_3)	0	0	0	14	0
Bicarbonate (HCO_3)	285	290	346	168	280
Sulfate (SO_4)	.9	9.9	2.9	7.0	8.8
Chloride (Cl)	27	28	16	11	25
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	.0	7.0	1.0	3.1	1.5
Dissolved solids	366	391	405	222	364
Hardness as $CaCO_3$:					
Total	144	147	171	133	149
Noncarbonate	0	0	0	0	0
Color	0	--	0	5	--
pH	8.0	7.4	8.1	8.4	7.5
Specific conductance (micromhos at 25 C.)	550	479	610	334	486
Turbidity	2	--	0	7	--
Temperature (F.)	--	--	--	--	--
Date of collection	Jan. 19, 1948	Aug. 31, 1950	Jan. 22, 1948	Feb. 10, 1949	Sept. 19, 1950
Depth (feet)	1,000	915	139		
Diameter (inches)	16-10	16	8		
Date drilled	1940	1950	1923		
Percent of supply	--	--	--		

SOUTH GATE
(Population, 51,116)

Ownership: Municipal.
Source: 17 wells ranging in depth from 551 to 1,600 ft. The reported yield of the individual wells is from 400 to 1,900 gpm. There are emergency cross-connections with the Huntington Park and Walnut Park systems.
Treatment: None.
Storage: 1,300,000 gal.

ANALYSES

(Analyses, in parts per million, by Smith Emery Co., Los Angeles, Calif.)

	Well 5	Well 15	Well 17	Well 18	Well 20
Silica (SiO_2)	16	14	13	12	14
Iron (Fe)	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	55	68	60	63	62
Magnesium (Mg)	8.9	18	18	12	14
Sodium (Na)	47	46	46	29	34
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	213	238	244	238	219
Sulfate (SO_4)	59	103	64	37	73
Chloride (Cl)	28	32	41	26	23
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	--	--	--	--	--
Dissolved solids	[a]319	[a]398	[a]362	[a]296	[a]328
Hardness as $CaCO_3$:					
Total	174	246	225	208	214
Noncarbonate	0	48	24	12	32
Color	--	--	--	--	--
pH	7.4	7.6	7.8	7.5	7.8
Specific conductance (micromhos at 25 C.)	500	600	570	450	520
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	Nov. 2, 1950	Nov. 2, 1950	Nov. 2, 1950	Nov. 2, 1950	Nov. 2, 1950
Depth (feet)	1000	700	551	792	1,400
Diameter (inches)	12	12	16	18	18
Date drilled	1923	--	1931	1945	1949
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

CALIFORNIA

STOCKTON
(Population, 70,853)

Ownership: California Water Service Co.; supplies also about 29,000 people outside the city limits. Total population supplied, about 100,000.
Source: 37 wells ranging in depth from 198 to 1,050 ft.
Treatment: 7 wells at Station 1: aeration, chlorination, and Calgon. Water from all but 5 wells is chlorinated.
Rated capacity of treatment plant: --
Raw-water storage: None.
Finished-water storage: Reservoirs and tanks, 3,000,000 gal.

ANALYSES

(Analyses, in parts per million, by California Water Service Co., San Jose, Calif.)

	Well 1-09	Well 18-01	Well 22-01	Range of Constituents [a]	Mean [a]
Silica (SiO_2)	54	43	47	40 - 64	49
Iron (Fe)	.08	.04	.07	.00 - .34	.08
Manganese (Mn)	.14	.08	.14	.00 - .72	.09
Calcium (Ca)	38	10	22	4.0 - 93	20
Magnesium (Mg)	20	4.9	5.9	2.9 - 52	10
Sodium (Na)	71	31	71	15 - 227	65
Potassium (K)	--	--	--	-- --	--
Carbonate (CO_3)	--	--	--	-- --	--
Bicarbonate (HCO_3)	160	118	163	115 - 219	164
Sulfate (SO_4)	3.8	3.4	2.4	.5 - 12	4.0
Chloride (Cl)	134	6	67	6 - 410	63
Fluoride (F)	--	--	--	-- --	--
Nitrate (NO_3)	6.8	.1	.6	.0 - 14	2.6
Dissolved solids	[b] 408	[b] 158	[b] 298	158 - 828	296
Hardness as $CaCO_3$:					
Total	176	44	78	22 - 446	91
Noncarbonate	46	0	0	-- --	0
Color	--	--	--	-- --	--
pH	7.8	7.9	8.0	7.5 - 8.6	8.0
Specific conductance (micromhos at 25 C.)	715	211	475	211 - 1595	471
Turbidity	--	--	--	-- --	--
Temperature (F.)	--	--	--	-- --	--
Date of collection	Apr. 19, 1951	July 21, 1951	July 21, 1951	1951	1951
Depth (feet)	--	408	420		
Diameter (inches)	30	30-16	30-16		
Date drilled	--	1947	1949		
Percent of supply	--	--	--		

[a] Based on 37 analyses (1 analysis from each well) 1951.
[b] Sum of determined constituents.

TORRANCE
(Population, 22,241)

Ownership: Municipal; supplies also about 4,200 people outside the city limits. Total population supplied, about 26,400.

Source: 3 wells, 570, 540, and 492 ft deep (60 percent of supply); Colorado River distributed by the Metropolitan Water District of Southern California, 40 percent of supply. (See Los Angeles.) The yield of the wells is reported to be 1,350, 1,350, and 950 gpm.

Treatment: Well water is chlorinated. Colorado River water is softened and filtered by the Metropolitan Water District of Southern California.

Storage: 2,320,000 gal.

ANALYSES

(Analyses, in parts per million, by Montgomery & Pomeroy, Los Angeles, Calif.)

	Well 1	Well 2	Torrance District Well 1
Silica (SiO_2)	--	--	24
Iron (Fe)	.30	.25	.25
Manganese (Mn)	--	--	0
Calcium (Ca)	36	33	39
Magnesium (Mg)	15	14	14
Sodium (Na)	73	75	69
Potassium (K)	7.1	7.9	6.3
Carbonate (CO_3)	0	--	0
Bicarbonate (HCO_3)	267	272	242
Sulfate (SO_4)	.0	.0	7.3
Chloride (Cl)	68	63	78
Fluoride (F)	--	--	.0
Nitrate (NO_3)	.0	--	--
Dissolved solids	[a]331	[a]327	[a]357
Hardness as $CaCO_3$:			
Total	150	143	154
Noncarbonate	0	0	0
Color	--	--	--
pH	--	--	7.7
Specific conductance (micromhos at 25 C.)	--	--	--
Turbidity	0	0	0
Temperature (F.)	--	--	--
Date of collection	Feb. 15, 1947	Feb. 15, 1947	Nov. 12, 1948
Depth (feet)	570	540	492
Diameter (inches)	16	16	14
Date drilled	1935	1935	1936
Percent of supply	--	--	--

[a] Sum of determined constituents.

CALIFORNIA

VALLEJO
(Population, 26,038)

Ownership: Municipal; supplies also about 44,350 people outside the city limits. Total population supplied, about 70,400.
Source: 61 percent of the supply is obtained from East Bay Municipal Utility District (see Oakland). Surface waters impounded in reservoirs: Gordon Valley Creek (26 percent of supply), Green Valley Creek (13 percent of supply).
Treatment: Water from East Bay Municipal Utility District treated by the District (see Oakland). Local supply: prechlorination, coagulation with alum, sedimentation, activated carbon, postchlorination, and lime for pH control.
Rated capacity of treatment plant: 5,000,000 gpd.
Raw-water storage: Reservoirs, 6,053,600,000 gal.
Finished-water storage: 49,000,000 gal.

ANALYSES

(Analyses, in parts per million, by City of Vallejo, Calif.)

	Green Valley Creek[a]	Gordon Valley Creek[a]		Green Valley Creek[a]	Gordon Valley Creek[a]
Silica (SiO_2)	28	5.0	Hardness as $CaCO_3$:		
Iron (Fe)	.0	.0	Total	29	170
Manganese (Mn)	.0	.0	Noncarbonate	0	22
Calcium (Ca)	6.0	41			
Magnesium (Mg)	3.0	17	Color	10	5
Sodium (Na)	10	27	pH	7.7	7.9
Potassium (K)			Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	0	Turbidity	10	25
Bicarbonate (HCO_3)	37	183	Temperature (F.)	--	--
Sulfate (SO_4)	10	65	Date of collection	June 1950	June 1950
Chloride (Cl)	8	11			
Fluoride (F)	.0	.0			
Nitrate (NO_3)	1.0	.0			
Dissolved solids	90	263			

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	7.0	8.2	5.6	80	110	60	20	400	10
Finished water	--	--	--	7.4	7.4	7.4	80	110	60	2	5	0

[a] Raw water.

WHITTIER
(Population, 23,820)

Ownership: Municipal.
Source: 6 wells (1, 5, 7 to 9, and 11), 434, 680, 1,000, 302, 664, and 837 ft deep. The yield of the wells is reported to be 800, 1,800, 2,200, 4,300, 3,750, and 4,200 gpm.
Treatment: None.
Storage: Reservoirs, 18,400,000 gal.

ANALYSES

(Analyses, in parts per million, by Truesdail Laboratories Inc., Los Angeles)

	Well 5	Well 7	Well 8	Well 9	Well 11
Silica (SiO_2)	25	14	18	16	20
Iron (Fe)	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--
Calcium (Ca)	83	61	63	44	33
Magnesium (Mg)	16	13	9.5	6.0	3.8
Sodium (Na)	34	20	13	12	22
Potassium (K)	--	--	--	--	--
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	257	219	206	159	144
Sulfate (SO_4)	101	40	24	1.9	.0
Chloride (Cl)	18	17	18	20	15
Fluoride (F)	--	--	--	--	--
Nitrate (NO_3)	1.4	4.5	8.2	.0	2.2
Dissolved solids	[a] 405	[a] 277	[a] 255	[a] 178	[a] 167
Hardness as $CaCO_3$:					
Total	275	205	196	134	97
Noncarbonate	62	26	27	4	0
Color	--	--	--	--	--
pH	7.2	7.2	8.0	7.9	8.1
Specific conductance (micromhos at 25 C.)	672	453	406	291	297
Turbidity	--	--	--	--	--
Temperature (F.)	--	--	--	--	--
Date of collection	May 21, 1951	Jan. 18, 1951	Jan. 18, 1951	Jan. 18, 1951	Jan. 18, 1951
Depth (feet)	680	1,000	302	664	837
Diameter (inches)	26-18	18-14	24	24	20
Date drilled	1922	1930	1931	1933	1948
Percent of supply	--	--	--	--	--

[a] Sum of determined constituents.

OREGON

ALBANY
(Population, 10,115)

Ownership: Mountain States Power Co.; supplies also about 330 people outside the city limits. Total population supplied, about 10,450.
Source: South Santiam River (through power canal).
Treatment: Coagulation with alum and lime, rapid sand filtration, and chlorination.
Rated capacity of treatment plant: 3,000,000 gpd.
Raw-water storage: None.
Finished-water storage: 890,000 gal.

ANALYSIS

(Analysis, in parts per million, by Elgin Water Softener Corp., Elgin, Ill.)

	Finished water		Finished water
Silica (SiO_2)	17	Hardness as $CaCO_3$:	
Iron (Fe)	--	Total	42
Manganese (Mn)	--	Noncarbonate	15
Calcium (Ca)	15		
Magnesium (Mg)	1.2	Color	--
Sodium (Na)	4.3	pH	--
Potassium (K)	--	Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	33	Temperature (F.)	--
Sulfate (SO_4)	19	Date of collection	Apr. 12, 1945
Chloride (Cl)	3.6		
Fluoride (F)	[a].2		
Nitrate (NO_3)	--		
Dissolved solids	[b]76		

Regular determinations at treatment plant,

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	--	--	--	--	--	--	--	--	--
Finished water	27	--	--	7.0	--	--	43	--	--	--	--	--

[a]Determination by Oregon State Board of Health, November 1950.
[b]Sum of determined constituents.

ASTORIA
(Population, 12,331)

Ownership: Municipal; supplies also Tongue Point Naval Station and some other consumers outside the city limits. Total population supplied, about 14,800.
Source: Bear Creek and tributaries impounded in 3 artificial lakes. Intake located about 11 miles east of Astoria.
Treatment: Chlorination and occasional use of copper sulfate for algae control.
Rated capacity of treatment plant: 5,200,000 gpd.
Raw water storage: 200,000,000 gal.
Finished water storage: 24,000,000 gal.

The color and turbidity of the water are variable, being highest from September through November.

ANALYSIS

(Analysis, in parts per million, by 13th Naval Dist. Sanitation Engineering Lab.)

	Finished water		Finished water
Silica (SiO_2)	28	Hardness as $CaCO_3$:	
Iron (Fe)	.18	Total	27
Manganese (Mn)	0	Noncarbonate	0
Calcium (Ca)	6.1		
Magnesium (Mg)	2.8	Color	10
Sodium (Na)	7.6	pH	7.0
Potassium (K)		Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0	Turbidity	2
Bicarbonate (HCO_3)	37	Temperature (F.)	--
Sulfate (SO_4)	3.2	Date of collection	June 7, 1950
Chloride (Cl)	6.8		
Fluoride (F)	[a].1		
Nitrate (NO_3)	--		
Dissolved solids	73		

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Temperature		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	7.0	7.6	6.8	--	--	--	50	67	37
Finished water	--	--	--	6.9	7.0	6.8	--	--	--	49	62	35

[a] From other analyses.

OREGON

BEND
(Population 11,409)

Ownership: Municipal; supplies also about 300 people outside the city limits. Total population supplied, about 11,700.
Source: Tumalo Creek.
Treatment: Chlorination.
Raw water storage: None.
Finished water storage: 1,635,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	19	Hardness as $CaCO_3$:	
Iron (Fe)	.03	Total	11
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	3.5		
Magnesium (Mg)	.6	Color	7
Sodium (Na)	2.0	pH	6.7
Potassium (K)	.8	Specific conductance (micromhos at 25 C.)	31
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	18	Turbidity	--
Sulfate (SO_4)	.8	Temperature (F.)	46
Chloride (Cl)	.9	Date of collection	June 18, 1951
Fluoride (F)	.0		
Nitrate (NO_3)	.1		
Dissolved solids	37		

COOS BAY
(Population, 6,223)

Ownership: Municipal; supplies also North Bend, Eastside, and about 1,500 consumers outside the city limits. Total population supplied, about 15,200.
Source: Pony Creek.
Treatment: Prechlorination, color removal by coagulation with alum and lime, rapid sand filtration, and aeration (spray).
Rated capacity of treatment plant: 4,000,000 gpd.
Raw-water storage: 658,000,000 gal.
Finished-water storage: 5,500,000 gal. Present construction program will provide an additional 4,500,000 gal.

ANALYSES

(Analyses, in parts per million, by U. S. Geological Survey)

	Raw water[a]	Finished water		Raw water[a]	Finished water
Silica (SiO_2)	7.1	6.6	Hardness as $CaCO_3$:		
Iron (Fe)	.08	.04	Total	9	37
Manganese (Mn)	--	--	Noncarbonate	0	18
Calcium (Ca)	1.8	12			
Magnesium (Mg)	1.0	1.8	Color	100	6
Sodium (Na)	5.9	8.3	pH	6.1	7.1
Potassium (K)	--	1.4	Specific conductance (micromhos at 25 C.)	--	116
Carbonate (CO_3)	0	0	Turbidity	5	--
Bicarbonate (HCO_3)	16	23	Temperature (F.)	58	66
Sulfate (SO_4)	2.1	13	Date of collection	May 7, 1947	June 15, 1951
Chloride (Cl)	10	15			
Fluoride (F)	.2	.0			
Nitrate (NO_3)	.4	.2			
Dissolved solids	57	73			

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Temperature		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	12	14	8	6.6	6.9	5.2	8	10	8	54	68	36
Finished water	18	24	16	8.4	9.0	8.0	24	30	22	--	--	--

[a]Analyzed by the Charlton Laboratories, Portland, Oreg.

CORVALLIS
(Population, 16,207)

Ownership: Municipal; supplies also Philomath and about 800 consumers outside the city limits. Total population supplied, about 18,300.
Source: Rock Creek.
Treatment: Pressure filtration, chlorination and ammoniation.
Rated capacity of treatment plant: 5,000,000 gpd.
Raw-water storage: --
Finished-water storage: 7,000,000 gal.

A water treatment plant has been constructed to utilize water from the Willamette River although this source has not been used to date (June 1951). This plant has a rated capacity of 4,000,000 gpd. The treatment of the water will include coagulation, sedimentation, gravity filtration, and chlorination.

ANALYSES

(Analyses, in parts per million, by U. S. Geological Survey)

	Finished water[a]	Raw water[b]		Finished water	Raw water
Silica (SiO_2)	24	19	Hardness as $CaCO_3$:		
Iron (Fe)	.02	--	Total	37	20
Manganese (Mn)	--	--	Noncarbonate	0	0
Calcium (Ca)	8.5	4.2			
Magnesium (Mg)	3.9	2.4	Color	5	--
Sodium (Na)	5.1	5.8	pH	7.5	--
Potassium (K)	2.2		Specific conductance (micromhos at 25 C.)	94	47.9
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	51	28			
Sulfate (SO_4)	1.8	4.9	Turbidity	--	--
Chloride (Cl)	4.8	3.0	Temperature (F.)	64	--
Fluoride (F)	.2	--	Date of collection	June 14, 1951	Nov. 27, 1950
Nitrate (NO_3)	.2	.8			
Dissolved solids	76	[c]54			

[a]Rock Creek.
[b]Willamette River.
[c]Sum of determined constituents.

EUGENE
(Population, 35,879)

Ownership: Municipal; supplies also about 14,000 people outside the city limits. Total population supplied, approximately 50,000.
Source: McKenzie River. The intake is located near Hayden Bridge, 7 miles east of the city.
Treatment: Prechlorination, coagulation with alum and lime at times of high turbidity of water, and rapid sand filtration.
Rated capacity of treatment plant: 25,000,000 gpd.
Raw-water storage: None.
Finished-water storage: 5 reservoirs, 21,100,000 gal; elevated tank, 100,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	20	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	17
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	3.6		
Magnesium (Mg)	2.0	Color	7
Sodium (Na)	3.6	pH	7.5
Potassium (K)	1.6	Specific conductance (micromhos at 25 C.)	51
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	27	Temperature (F.)	59
Sulfate (SO_4)	1.6	Date of collection	June 14, 1951
Chloride (Cl)	2.2		
Fluoride (F)	.0		
Nitrate (NO_3)	.1		
Dissolved solids	48		

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	--	7.4	7.0	17	18	16	--	--	--
Finished water	--	--	--	--	7.4	6.6	17	18	16	--	--	--

KLAMATH FALLS
(Population, 15,875)

Ownership: Oregon Water Corporation (subsidiary of Boise Water Corporation, Boise, Idaho); supplies suburban Altamont District and also consumers outside the corporate limits of the city. Total population supplied, about 26,000.
Source: 4 flowing wells (3, 6, 7, and 8), 145, 147, 370, and 850 ft deep.
Treatment: Chlorination.
Raw-water storage: None.
Finished-water storage: 3,700,000 gal.

ANALYSIS

(Analysis, in parts per million, by the University of California, Berkeley, Calif.)

	Wells (composite sample)		Wells (composite sample)
Silica (SiO_2)	24	Hardness as $CaCO_3$:	
Iron (Fe)	.15	Total	52
Manganese (Mn)	0	Noncarbonate	0
Calcium (Ca)	10		
Magnesium (Mg)	6.3	Color	--
Sodium (Na)		pH	8.2
Potassium (K)	30	Specific conductance (micromhos at 25 C.)	212
Carbonate (CO_3)	--	Turbidity	--
Bicarbonate (HCO_3)	108	Temperature (F.)	67
Sulfate (SO_4)	1.3	Date of collection	Mar. 22, 1949
Chloride (Cl)	19		
Fluoride (F)	.3		
Nitrate (NO_3)	--		
Dissolved solids	141		

MEDFORD
(Population, 17,305)

Ownership: Municipal; supplies also Central Point, Eagle Point, and about 3,500 people outside the city limits. Total population supplied, about 23,100.
Source: Big Butte Spring.
Treatment: None.
Storage: 12,400,000 gal.

ANALYSIS

(Analysis, in parts per million, by Charlton Laboratories, Portland, Oreg.)

	Big Butte Springs		Big Butte Springs
Silica (SiO_2)	35	Hardness as $CaCO_3$:	
Iron (Fe)	.0	Total	35
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	7.3		
Magnesium (Mg)	4.0	Color	--
Sodium (Na)	7.0	pH	6.9
Potassium (K)		Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	56	Temperature (F.)	42
Sulfate (SO_4)	1.3	Date of collection	Apr. 21, 1947
Chloride (Cl)	2.0		
Fluoride (F)	.0		
Nitrate (NO_3)	.3		
Dissolved solids	99		

PENDLETON
(Population 11,774)

Ownership: Municipal; supplies also about 200 people outside the city limits. Total population supplied, about 12,000.
Source: Springs, 80 percent of supply; 2 wells 774 and 761 ft deep, 20 percent of supply. Emergency supply from privately owned well.
Treatment: Chlorination.
Raw-water storage: None.
Finished-water storage: 3,500,000 gal.

ANALYSIS

(Analysis, in parts per million, by Charlton Laboratories, Portland, Oreg.)

	Springs and wells[a]		Springs and wells[a]
Silica (SiO_2)	44	Hardness as $CaCO_3$:	
Iron (Fe)	.2	Total	95
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	25		
Magnesium (Mg)	8.0	Color	--
Sodium (Na)	26	pH	7.2
Potassium (K)		Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0	Turbidity	< 1
Bicarbonate (HCO_3)	146	Temperature (F.)	--
Sulfate (SO_4)	15	Date of collection	January 1949
Chloride (Cl)	12		
Fluoride (F)	.2		
Nitrate (NO_3)	--		
Dissolved solids	[b] 203		
Depth (feet)			--
Diameter (inches)			--
Date drilled			--
Percent of supply			100

[a]Composite sample.
[b]Sum of determined constituents.

PORTLAND
(Population, 373,628)

Ownership: Municipal; supplies also about 107,000 people outside the city limits, including 60 water districts, water companies, and towns in areas adjacent to Portland. Total population supplied, about 480,000.
Source: Bull Run River impounded in Lake Ben Morrow Reservoir which extends $3\frac{1}{2}$ miles along the river, and Bull Run Lake, the source of the main branch of the river close to the summit of the Cascades.
Treatment: Chlorination and ammoniation.
Rated capacity of treatment plant: --
Raw-water storage: Storage reservoir on Bull Run River, 11,000,000,000 gal; Bull Run Lake, 3,000,000,000 gal.
Finished-water storage: 6 reservoirs, 192,000,000 gal.

The water from the river is diverted 5 miles downstream from the storage dam through 3 steel conduits to distribution reservoirs on Mount Tabor, a distance of 24 miles. Four distribution reservoirs are located on Mount Tabor and two in Washington Park. Distribution is mainly by gravity.

ANALYSIS

(Analysis, in parts per million, by Charlton Laboratories, Portland, Oreg.)

	Finished water		Finished water
Silica (SiO_2)	7.2	Hardness as $CaCO_3$:	
Iron (Fe)	.2	Total	9
Manganese (Mn)	.00	Noncarbonate	0
Calcium (Ca)	2.3		
Magnesium (Mg)	.7	Color	15
Sodium (Na)	2.1	pH	7.0
Potassium (K)	.2	Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	--	Turbidity	<1
Bicarbonate (HCO_3)	15	Temperature (F.)	59
Sulfate (SO_4)	.9	Date of collection	Sept. 19, 1947
Chloride (Cl)	2.4		
Fluoride (F)	.0		
Nitrate (NO_3)	.3		
Dissolved solids	30		

SALEM
(Population, 43,140)

Ownership: Municipal; supplies also about 10,000 people outside the city limits. Total population supplied, about 53,100.
Source: Infiltration system from North Santiam River about 17 miles southeast of Salem. Auxiliary or emergency supply from wells. The wells furnished 19 percent of the total supply in 1950.
Treatment: Chlorination and ammoniation.
Rated capacity of treatment plant: --
Raw-water storage: None.
Finished-water storage: 11,500,000 gal. A reservoir under construction will provide 100,000,000 gal of additional storage.

The infiltration system is on Stayton Island in the North Santiam River above Stayton and below the Little North Fork. On Stayton Island 3 wells each 25 ft deep and capable of delivering 2 mgd are used when necessary to augment the infiltration supply. Water from the infiltration system is conducted to Salem by gravity flow through a 36-in. pipe line.
Four wells which are in Salem and connected to the distribution system and are used during peak loads contributed about 7 percent of the supply in 1951. Contribution from all the wells probably exceeded 20 percent in 1951.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water (tap sample)		Finished water (tap sample)
Silica (SiO_2)	17	Hardness as $CaCO_3$:	
Iron (Fe)	.03	Total	17
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	4.9		
Magnesium (Mg)	1.1	Color	5
Sodium (Na)	3.2	pH	7.3
Potassium (K)	2.6	Specific conductance (micromhos at 25 C.)	54
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	31	Turbidity	--
Sulfate (SO_4)	1.7	Temperature (F.)	64
Chloride (Cl)	1.0	Date of collection	June 14, 1951
Fluoride (F)	.0		
Nitrate (NO_3)	.1		
Dissolved solids	45		

SPRINGFIELD
(Population, 10,807)

Ownership: Mountain States Power Company.
Source: Willamette River; Auxiliary supply, 8 contiguous wells (1 to 8) ranging in depth from 28 to 30 ft. The yield of the wells is reported to be 1,000, 400, 1,250, 1,000, 150, 500, 900 and 1,000 gpm respectively. The well water is supplied directly to the transmission line which in turn feeds into the distribution system.
Treatment: Willamette River: rapid sand filtration and chlorination. During peak periods of consumption a pressure filter is operated in parallel with the 2 sand filters. The well water is chlorinated.
Rated capacity of treatment plant: 2,500,000 gpd.
Raw-water storage: None.
Finished-water storage: 1,550,000 gal.

The well system has been developed during 1950 and 1951. Should this source prove entirely satisfactory, it is expected to replace the Willamette River supply.

ANALYSES

(Analyses, in parts per million)

	Raw water[a]	Well 3[b]		Raw water[a]	Well 3[b]
Silica (SiO_2)	17	11	Hardness as $CaCO_3$:		
Iron (Fe)	--	1.3	Total	36	37
Manganese (Mn)	--	--	Noncarbonate	16	5
Calcium (Ca)	11	11			
Magnesium (Mg)	2.1	2.3	Color	--	--
Sodium (Na)	1.4	3.9	pH	--	7.1
Potassium (K)	--	--	Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	--			
Bicarbonate (HCO_3)	25	39	Turbidity	--	--
Sulfate (SO_4)	15	2.5	Temperature (F.)	--	53
Chloride (Cl)	2.4	4.4	Date of collection	Apr. 12, 1951	Sept. 26, 1950
Fluoride (F)	--	--			
Nitrate (NO_3)	--	.9			
Dissolved solids	[c]61	[c]56			

Depth (feet)	29
Diameter (inches)	12
Date drilled	1950
Percent of supply	--

[a]Willamette River. Analyzed by Elgin Softener Corporation, Elgin, Illinois.
[b]Analyzed by Oregon State College, Corvallis, Oreg.
[c]Sum of determined constituents.

WASHINGTON

ABERDEEN
(Population, 19,653)

Ownership: Municipal; supplies also about 1,000 people outside the city limits. Total population supplied, about 20,650.
Source: Wishka River impounded 21.7 miles northeast of Aberdeen. A separate industrial system, municipally owned, utilizes large quantities of raw water from the Wynooche River. Emergency supplies from Wynooche River and Lake Aberdeen.
Treatment: Chlorination and ammoniation.
Rated capacity of treatment plant: 10,000,000 gpd.
Raw-water storage: 120,000,000 gal.
Finished-water storage: 24,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water[a]		Finished water[a]
Silica (SiO_2)	14	Hardness as $CaCO_3$:	
Iron (Fe)	.12	Total	25
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	5.6		
Magnesium (Mg)	2.6	Color	5
Sodium (Na)	3.2	pH	7.3
Potassium (K)	2.1	Specific conductance (micromhos at 25 C.)	60
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	34	Turbidity	--
Sulfate (SO_4)	1.0	Temperature (F.)	61
Chloride (Cl)	3.4	Date of collection	June 12, 1951
Fluoride (F)	.3		
Nitrate (NO_3)	.2		
Dissolved solids	57		

[a] Wishka River.

WASHINGTON

BELLINGHAM
(Population, 34,112)

Ownership: Municipal; supplies also about 1,500 people outside the city limits. Total population supplied, about 35,600.
Source: Lake Whatcom (96 percent of supply) and Lake Padden (4 percent of supply).
Treatment: Chlorination and ammoniation. Lime added to water from Lake Whatcom for corrosion control.
Rated capacity of treatment plant: 100,000,000 gpd.
Raw-water storage: Lake Whatcom and Lake Padden (capacities not computed).
Finished-water storage: 4 reservoirs, 2,000,000 gal; elevated tank, 75,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water [a]		Finished water [a]
Silica (SiO_2)	1.3	Hardness as $CaCO_3$:	
Iron (Fe)	.01	Total	16
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	4.8		
Magnesium (Mg)	.9	Color	5
Sodium (Na)	3.3	pH	7.2
Potassium (K)	1.6	Specific conductance (micromhos at 25 C.)	55
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	21	Turbidity	--
Sulfate (SO_4)	4.0	Temperature (F.)	69
Chloride (Cl)	3.2	Date of collection	Aug. 13, 1951
Fluoride (F)	.2		
Nitrate (NO_3)	.2		
Dissolved solids	35		

[a] Lake Whatcom.

BREMERTON
(Population, 27,678)

Ownership: Municipal; supplies also Puget Sound Naval Shipyard and military personnel, and about 20,000 people outside the city limits. Total population supplied, about 63,000.
Source: Anderson Creek, Gorst Creek, and Union River (82 percent of supply); 7 artesian wells (1 to 7) ranging in depth from 245 to 627 ft (18 percent of supply). The yield of the wells is reported to range from 130 to 1,500 gpm.
Treatment: Anderson and Gorst Creek stations: sedimentation, chlorination, and ammoniation; chlorination of Union River supply and at main distribution reservoir.
Rated capacity of treatment plant: 15,000,000 gpd.
Raw-water storage: None.
Finished-water storage: Reservoirs, 22,000,000 gal.

ANALYSES

(Analyses, in parts per million, by Northwest Laboratories, Seattle, Wash.)

	Anderson Creek	Gorst Creek	Union River
Silica (SiO_2)	39	38	33
Iron (Fe)	.09	.15	.38
Manganese (Mn)	--	--	--
Calcium (Ca)	7.2	9.7	9.0
Magnesium (Mg)	4.2	4.9	2.7
Sodium (Na)	7.5	6.9	12
Potassium (K)	--	--	--
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	50	58	56
Sulfate (SO_4)	.8	.8	2.3
Chloride (Cl)	6.8	7.7	7.4
Fluoride (F)	.0	.0	.0
Nitrate (NO_3)	.0	.0	.0
Dissolved solids	[a] 90	95	[a] 94
Hardness as $CaCO_3$:			
Total	35	44	34
Noncarbonate	0	0	0
Color	2.5	0	6
pH	7.5	7.6	7.4
Specific conductance (micromhos at 25 C.)	--	--	--
Turbidity	--	--	--
Temperature (F.)	--	--	--
Date reported	July 5, 1951	July 5, 1951	July 5, 1951

[a] Sum of determined constituents.

ANALYSES

(Analyses, in parts per million, by Northwest Laboratories, Seattle, Wash.)

	Well 2	Well 6	Well 7
Silica (SiO_2)	31	41	30
Iron (Fe)	.14	.09	.05
Manganese (Mn)	--	--	--
Calcium (Ca)	12	15	19
Magnesium (Mg)	5.1	3.2	4.0
Sodium (Na)	13	9.9	12
Potassium (K)	--	--	--
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	79	76	78
Sulfate (SO_4)	4.4	1.6	.8
Chloride (Cl)	7.1	6.4	17
Fluoride (F)	.0	.0	.0
Nitrate (NO_3)	.0	.0	.0
Dissolved solids	106	108	114
Hardness as $CaCO_3$:			
Total	51	52	64
Noncarbonate	0	0	0
Color	0	0	0
pH	8.2	8.2	8.1
Specific conductance (micromhos at 25 C.)	--	--	--
Turbidity	--	--	--
Temperature (F.)	--	--	--
Date reported	July 5, 1951	July 5, 1951	July 5, 1951
Depth (feet)	245	535	627
Diameter (inches)	22	16	16
Date drilled	1941	1944	1945
Percent of supply	--	--	--

WASHINGTON

EVERETT
(Population, 33,849)

Ownership: Municipal; supplies also about 10,000 people outside the city limits. Total population supplied, about 43,800.
Source: Sultan River stored in Lake Chaplain.
Treatment: Chlorination.
Rated capacity of treatment plant: 110,000,000 gpd.
Raw-water storage: Lake Chaplain, 4,500,000,000 gal.
Finished-water storage: 30,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	6.1	Hardness as $CaCO_3$:	
Iron (Fe)	.08	Total	12
Manganese (Mn)	--	Noncarbonate	1
Calcium (Ca)	3.6		
Magnesium (Mg)	.7	Color	5
Sodium (Na)	1.0	pH	7.2
Potassium (K)	1.0	Specific conductance (micromhos at 25 C.)	29
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	13	Turbidity	--
Sulfate (SO_4)	2.5	Temperature (F.)	60
Chloride (Cl)	1.2	Date of collection	June 9, 1951
Fluoride (F)	.1		
Nitrate (NO_3)	.3		
Dissolved solids	22		

WASHINGTON

LONGVIEW
(Population, 20,339)

Ownership: Municipal; supplies also about 4,000 people outside the city limits. Total population supplied, about 24,300.
Source: Cowlitz River.
Treatment: Coagulation with alum and lime, sedimentation, rapid sand filtration, chlorination, and ammoniation.
Rated capacity of treatment plant: 5,000,000 gpd.
Raw-water storage: 500,000 gal.
Finished-water storage: 7,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	12	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	22
Manganese (Mn)	--	Noncarbonate	5
Calcium (Ca)	7.3		
Magnesium (Mg)	.8	Color	5
Sodium (Na)	2.4	pH	7.8
Potassium (K)	1.9	Specific conductance (micromhos at 25 C.)	63
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	20	Temperature (F.)	--
Sulfate (SO_4)	8.0	Date of collection	June 13, 1951
Chloride (Cl)	1.9		
Fluoride (F)	.3		
Nitrate (NO_3)	.0		
Dissolved solids	45		

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	7.0	7.2	6.8	--	--	--	25	1000	25
Finished water	18	--	--	7.2	7.4	7.0	--	--	--	0	0	0

OLYMPIA
(Population, 15,819)

Ownership: Municipal; supplies also about 300 people outside the city limits. Total population supplied, about 16,100.
Source: McAllister Springs.
Treatment: Chlorination.
Rated capacity of treatment plant: 20,000,000 gpd.
Raw-water storage: 2,000,000 gal.
Finished-water storage: 7,700,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	36	Hardness as $CaCO_3$:	
Iron (Fe)	.03	Total	50
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	10		
Magnesium (Mg)	6.2	Color	3
Sodium (Na)	6.9	pH	7.4
Potassium (K)	2.9	Specific conductance (micromhos at 25 C.)	133
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	72	Turbidity	--
Sulfate (SO_4)	3.6	Temperature (F.)	62
Chloride (Cl)	4.4	Date of collection	June 11, 1951
Fluoride (F)	.0		
Nitrate (NO_3)	.8		
Dissolved solids	107		

RENTON
(Population, 16,039)

Ownership: Municipal; supplies also about 1,000 people outside the city limits. Total population supplied, about 17,000.
Source: Springbrook Springs and 4 wells (1 and 2, and Liberty Park 1 and 2). The yield of the wells is reported to be 105, 260, 1,000 and 1,000 gpm. Emergency supply from City of Seattle.
Treatment: Chlorination (at source only).
Raw-water storage: 1,800,000 gal.
Finished-water storage: 1,000,000 gal.

A private residential development of 150 homes, supplied by a private water company, has been annexed by the city. The source of the supply is springs, with a 25,000 gal storage tank. The City of Renton may purchase this water system.

ANALYSES

(Analyses, in parts per million, by U. S. Geological Survey)

	Finished water [a]	Finished water [b]		Finished water [a]	Finished water [b]
Silica (SiO_2)	29	28	Hardness as $CaCO_3$:		
Iron (Fe)	.02	.01	Total	66	64
Manganese (Mn)	--	--	Noncarbonate	2	5
Calcium (Ca)	13	12			
Magnesium (Mg)	8.2	8.2	Color	5	5
Sodium (Na)	5.3	5.5	pH	7.2	7.3
Potassium (K)	4.0	2.6	Specific conductance (micromhos at 25 C.)	161	161
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	78	72			
Sulfate (SO_4)	9.6	9.8	Turbidity	--	--
Chloride (Cl)	4.2	4.0	Temperature (F.)	50	52
Fluoride (F)	.4	.2	Date of collection	June 8; 1951	June 6, 1951
Nitrate (NO_3)	4.0	4.2			
Dissolved solids	109	109			

[a] Springbrook Springs.
[b] Liberty Park wells.

RICHLAND
(Population, 21,809)

Ownership: U. S. Government. Operated by General Electric Co. Supplies also about 6,000 people outside Richland. Total population supplied, about 27,800.

Source: Domestic supply, 18 wells in four groups: Richland group of 8 wells (2, 4, 5, 12, 13, 14, 15, and 18) ranging in depth from 70 to 140 ft, and reported to yield 6,000 gpm; North Richland group of 6 wells (A, B, C, D, E, and 5) ranging in depth from 100 to 120 ft and reported to yield 7,000 gpm; Columbia group of 3 wells (A, B, and C) 80 to 110 ft deep, and reported to yield 2,200 gpm; and 1 well (1100-8) 120 ft deep, and reported to yield 1,000 gpm. The Columbia group of wells is used only during the summer months.

Treatment: Chlorination of domestic supply.

Raw-water storage: --

Finished-water storage: 5,400,000 gal.

A separate supplementary supply for lawn sprinkling during summer months is obtained from a canal from the Yakima River through a separate distribution system. The river water is used also to flood the percolation basin in the well field area in order to maintain the ground water level during the summer months.

The water delivered to the consumers varies in chemical composition according to the wells pumped and somewhat with the level of the ground water table.

ANALYSES

(Analyses, in parts per million, by General Electric Co., Richland, Wash.)

	8 wells (Richland group)	6 wells (North Richland group)	Well 1100-8
Silica (SiO_2)	55	38	52
Iron (Fe)	.01	.02	.00
Manganese (Mn)	.00	.00	< .01
Calcium (Ca)	50	27	34
Magnesium (Mg)	16	5.8	7.5
Sodium (Na)	21	8.5	16
Potassium (K)	4	1.3	2.7
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	206	100	139
Sulfate (SO_4)	44	12	18
Chloride (Cl)	8.5	4.0	5.5
Fluoride (F)	.2	.2	.2
Nitrate (NO_3)	.9	.8	.3
Dissolved solids	307	148	186
Hardness as $CaCO_3$:			
Total	191	91	116
Noncarbonate	22	9	2
Color	5	0	0
pH	7.7	7.8	7.8
Specific conductance (micromhos at 25 C.)	424	202	283
Turbidity	2	< 1	< .1
Temperature (F.)	--	--	--
Date of collection	Apr. 24, 1951	Apr. 24, 1951	Apr. 24, 1951

	8 wells (Richland group)	6 wells (North Richland group)	Well 1100-8
Depth (feet)	70 to 140	100 to 120	120
Diameter (inches)	16 to 30	20 to 30	10
Date drilled	1943-44	1948	1948
Percent of supply	--	--	--

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	--	--	--	--	--	--	--	--	--	--	--	--
Finished water	120	232	80	7.2	7.8	7.0	140	202	90	2.0	2.0	2.0

SEATTLE
(Population, 467,591)

Ownership: Municipal; supplies also about 110,000 people outside the city limits. Total population supplied, about 580,000.
Source: Cedar River impounded in Lake Youngs.
Treatment: Chlorination and ammoniation.
Rated capacity of treatment plant: Approximately 300,000,000 gpd.
Raw-water storage: Lake Youngs, 3,660,000,000 gal.
Finished-water storage: 365,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by Seattle Water Dept.)

	Cedar River		Cedar River
Silica (SiO_2)	4.0	Hardness as $CaCO_3$:	
Iron (Fe)	.04	Total	18
Manganese (Mn)	.0	Noncarbonate	0
Calcium (Ca)	6.3		
Magnesium (Mg)	.6	Color	0
Sodium (Na)	.4	pH	7.3
Potassium (K)		Specific conductance (micromhos at 25 C.)	--
Carbonate (CO_3)	0	Turbidity	0
Bicarbonate (HCO_3)	22	Temperature (F.)	43
Sulfate (SO_4)	2.1	Date of collection	Jan. 8, 1951
Chloride (Cl)	.6		
Fluoride (F)	.0		
Nitrate (NO_3)	.0		
Dissolved solids	37		

SPOKANE
(Population, 161,721)

Ownership: Municipal; supplies also about 400 people outside the city limits. Total population supplied, about 162,100.
Source: 13 wells in two groups (87 percent of supply) with two pumping stations: Well Pumping Station (5 wells of 45 ft mean depth) and Parkwater Pumping Station (8 wells of 140 ft mean depth). Seven auxiliary wells (13 percent of supply) with four pumping stations: Ray Street (2 wells of 76 ft mean depth); Grace Avenue (1 well); Hoffman Avenue (2 wells of 225 ft mean depth); and Baxter (2 wells of 130 ft mean depth). The auxiliary wells are used during the summer months.
Treatment: Chlorination.
Rated capacity of treatment plant: --
Raw-water storage: --
Finished-water storage: 70,100,000 gal.

ANALYSES

(Analyses, in parts per million, by City of Spokane Health Dept.)

	Well Station [a]	Park-water Station [b]		Well Station [a]	Park-water Station [b]
Silica (SiO_2)	20	11	Hardness as $CaCO_3$:		
Iron (Fe)	.0	.0	Total	153	161
Manganese (Mn)	.0	.0	Noncarbonate	10	17
Calcium (Ca)	35	38			
Magnesium (Mg)	16	16	Color	--	--
Sodium (Na)	4.0	4.9	pH	7.9	7.9
Potassium (K)	--	--	Specific conductance (micromhos at 25 C.)	--	--
Carbonate (CO_3)	0	0			
Bicarbonate (HCO_3)	175	175	Turbidity	--	--
Sulfate (SO_4)	13	13	Temperature (F.)	--	--
Chloride (Cl)	2.0	1.9	Date of collection	June 1951	June 1951
Fluoride (F)	.0	.0			
Nitrate (NO_3)	2.2	2.2			
Dissolved solids	184	186			

Depth (feet)	45	140
Diameter (feet)	28 to 50	6
Date dug	1907-25	1948
Percent of supply	60	27

[a] Five wells.
[b] Eight wells.

ANALYSES

(Analyses, in parts per million, by City of Spokane Health Dept.)

	Ray Street Station (2 wells)	Hoffman Avenue Station (2 wells)	Baxter Station (2 wells)	Grace Avenue Well
Silica (SiO_2)	7.2	7.2	6.4	15
Iron (Fe)	.0	.0	.0	--
Manganese (Mn)	--	--	--	.0
Calcium (Ca)	39	32	37	29
Magnesium (Mg)	12	15	13	11
Sodium (Na)	14	1.0	4.1	3.0
Potassium (K)	--	--	--	--
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	176	146	145	126
Sulfate (SO_4)	22	16	27	12
Chloride (Cl)	7.4	2.5	5.7	3.6
Fluoride (F)	--	--	--	.0
Nitrate (NO_3)	8.9	.9	.4	4.0
Dissolved solids	191	144	195	132
Hardness as $CaCO_3$:				
Total	147	142	146	118
Noncarbonate	2	22	27	14
Color	--	--	--	--
pH	7.6	8.1	8.2	7.9
Specific conductance (micromhos at 25 C.)	--	--	--	--
Turbidity	--	--	--	--
Temperature (F.)	--	--	--	--
Date of collection	Oct. 1945	Sept. 1944	Dec. 1944	July 1951
Depth (feet)	76	225	130	--
Diameter (feet)	20	5	2	--
Date dug	1937	1923	1943	--
Percent of supply	6	3	.3	4

TACOMA
(Population, 143,673)

Ownership: Municipal; supplies also about 12,000 people outside the city limits. Total population supplied, about 155,700.
Source: Green River (94 percent of supply); auxiliary supply from 13 wells ranging in depth from 74 to 788 ft, and an average yield (reported) of 3,490 gpm. The well supply is used when the Green River is turbid, during peak demand for sprinkling, and for emergencies.
Treatment: Chlorination and ammoniation.
Rated capacity of treatment plant: 72,000,000 gpd.
Finished-water storage: Reservoirs, 160,000,000 gal; standpipes, 2,574,000 gal.

The intake on Green River is near Palmer, about 35 miles east of Tacoma. The water is transmitted by pipe line to McMillin Reservoir, located 8 miles southeast of Tacoma. A second pipe line connects McMillin Reservoir and the distribution system in Tacoma.

ANALYSES

(Analyses, in parts per million, by Northwest Laboratories, Seattle, Wash.)

	Green River (raw water)	Finished water	Well 5-A
Silica (SiO_2)	23	26	27
Iron (Fe)	0	0	0
Manganese (Mn)	0	0	0
Calcium (Ca)	5.2	6.4	12
Magnesium (Mg)	1.2	1.3	7.7
Sodium (Na)	6.9	6.7	9.4
Potassium (K)	--	--	--
Carbonate (CO_3)	--	--	--
Bicarbonate (HCO_3)	29	30	56
Sulfate (SO_4)	2.0	2.1	8.9
Chloride (Cl)	6.3	6.3	9.5
Fluoride (F)	0	0	0
Nitrate (NO_3)	0	0	17
Dissolved solids	[a] 59	[a] 64	115
Hardness as $CaCO_3$:			
Total	18	21	61
Noncarbonate	0	0	16
Color	0	0	0
pH	7.4	7.8	7.1
Specific conductance (micromhos at 25 C.)	--	--	--
Turbidity	--	--	--
Temperature (F.)	--	--	--
Date reported	Oct. 4, 1948	Oct. 4, 1948	Oct. 4, 1948
Depth (feet)			378
Diameter (inches)			26
Date drilled			1930
Percent of supply			--

[a] Sum of determined constituents.

TACOMA--Continued

Regular determinations at treatment plant

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water.....	--	--	--	7.8	7.8	7.1	21	61	18	0	150	0
Finished water...	--	--	--	--	--	--	--	--	--	--	--	--

VANCOUVER
(Population, 41,664)

Ownership: Municipal; supplies also about 6,800 people outside the city limits. Total population supplied, about 48,500.

Source: 14 wells (72 percent of supply) and springs (28 percent of supply). The range in depth and reported yield of 5 wells (1, 3, 4, 5, and 6) represent about average conditions for the 14 wells. The depth and the yield of the 5 wells are as follows: well 1, 132 ft and 1,000 gpm; well 3, 128 ft and 1,000 gpm; well 4, 243 ft and 2,000 gpm; well 5, 240 ft and 1,200 gpm; well 6, 278 ft and 2,000 gpm.

Treatment: Chlorination.

Raw-water storage: --

Finished-water storage: 5,728,000 gal.

The analysis given is representative of the water furnished to the consumers.

ANALYSIS

(Analysis, in parts per million, by Charlton Laboratories, Portland, Oreg.)

	Finished water (composite)		Finished water (composite)
Silica (SiO_2)	44	Hardness as $CaCO_3$:	
Iron (Fe)	.3	Total	55
Manganese (Mn)	.0	Noncarbonate	0
Calcium (Ca)	14		
Magnesium (Mg)	4.8	Color	--
Sodium (Na)	4.4	pH	6.9
Potassium (K)		Specific conductance (micromhos at 25 C.).....	--
Carbonate (CO_3)	--	Turbidity	--
Bicarbonate (HCO_3)	73.	Temperature (F.).....	--
Sulfate (SO_4)	5.7	Date of analysis	Apr. 18, 1949
Chloride (Cl)	3.2		
Fluoride (F)	.0		
Nitrate (NO_3)	--		
Dissolved solids	129		

WALLA WALLA
(Population, 24,102)

Ownership: Municipal; supplies also about 1,500 people outside the city limits. Total population supplied, about 25,600.
Source: Mill Creek (84 percent of supply); auxiliary supply from 3 wells (1 to 3), 810, 808, and 1,169 ft deep. The yield of the wells is reported to be 1,500, 1,200, and 2,000 gpm. The wells are pumped only during the summer months and furnish 16 percent of the annual supply.
Treatment: Chlorination of water from Mill Creek; well supply not treated.
Raw-water storage: 15,000,000 gal.
Finished-water storage: --

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water		Finished water
Silica (SiO_2)	39	Hardness as $CaCO_3$:	
Iron (Fe)	.03	Total	38
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	9.4		
Magnesium (Mg)	3.6	Color	5
Sodium (Na)	4.2	pH	7.6
Potassium (K)	2.6	Specific conductance (micromhos at 25 C.)	102
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	60	Turbidity	--
Sulfate (SO_4)	1.8	Temperature (F.)	61
Chloride (Cl)	1.0	Date of collection	June 6, 1951
Fluoride (F)	.2		
Nitrate (NO_3)	.2		
Dissolved solids	89		

WENATCHEE
(Population, 13,072)

Ownership: Municipal; supplies also about 2,000 people outside the city limits. Total population supplied, about 15,100.
Source: Columbia River.
Treatment: Sedimentation, coagulation with alum, rapid sand filtration, and chlorination.
Rated capacity of treatment plant: 14,000,000 gpd.
Raw-water storage: None.
Finished-water storage: 4,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Columbia River (raw water)		Columbia River (raw water)
Silica (SiO_2)	9.6	Hardness as $CaCO_3$:	
Iron (Fe)	--	Total	65
Manganese (Mn)	--	Noncarbonate	6
Calcium (Ca)	20		
Magnesium (Mg)	3.6	Color	--
Sodium (Na)	8.6	pH	--
Potassium (K)		Specific conductance (micromhos at 25 C.)	143
Carbonate (CO_3)	0	Turbidity	--
Bicarbonate (HCO_3)	72	Temperature (F.)	53
Sulfate (SO_4)	21	Date of collection	May 12, 1949
Chloride (Cl)	1		
Fluoride (F)	.2		
Nitrate (NO_3)	.6		
Dissolved solids	[a] 100		

Regular determinations at treatment plant, 1950

	Alkalinity as $CaCO_3$ (ppm)			pH			Hardness as $CaCO_3$ (ppm)			Turbidity		
	Av	Max	Min	Av	Max	Min	Av	Max	Min	Av	Max	Min
Raw water	45	51	39	7.7	8.1	7.3	45	60	30	2.3	3.5	1.0
Finished water	45	50	41	7.5	7.8	7.3	46	60	32	.2	.5	0

[a] Sum of determined constituents.

WASHINGTON

YAKIMA
(Population, 38,486)

Ownership: Municipal; supplies also about 3,800 people outside the city limits. Total population supplied, about 42,300.
Source: Naches River; emergency supply from 2 wells (1 and 2) 250 and 65 ft deep. (No well water was used during 1950.)
Treatment: Plain sedimentation, filtration through natural sand and gravel beds, and chlorination.
Rated capacity of treatment plant: --
Raw-water storage: --
Finished-water storage: 24,000,000 gal.

ANALYSIS

(Analysis, in parts per million, by U. S. Geological Survey)

	Finished water[a]		Finished water[a]
Silica (SiO_2)	17	Hardness as $CaCO_3$:	
Iron (Fe)	.11	Total	.21
Manganese (Mn)	--	Noncarbonate	0
Calcium (Ca)	6.1		
Magnesium (Mg)	1.4	Color	10
Sodium (Na)	3.0	pH	7.1
Potassium (K)	1.0	Specific conductance (micromhos at 25 C.)	57
Carbonate (CO_3)	0		
Bicarbonate (HCO_3)	30	Turbidity	--
Sulfate (SO_4)	2.5	Temperature (F.)	64
Chloride (Cl)	1.7	Date of collection	June 7, 1951
Fluoride (F)	.1		
Nitrate (NO_3)	.1		
Dissolved solids	50		

[a] Naches River.

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