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DEVELOPMENT AND APPLICATION OF WATER NEAR SAN BERNARDINO, COLTON, AND RIVERSIDE CAL., PART II.—Lippincott.

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UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

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PART II.

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EAST RIVERSIDE IRRIGATION DISTRICT.

The lands of the East Riverside Irrigation District are 4 miles south of the city of Colton and 4 miles northeast of the city of Riverside. They are divided into approximately equal parts by the boundary line between San Bernardino and Riverside counties, and vary in elevation from about 900 feet to 1,250 feet, being situated on the mesa and bottom lands on the south side of San Bernardino Valley. These lands are specially adapted to the growth of citrus fruits. The district was organized under the Wright irrigation district act, and has had fewer misfortunes than are usual with similar enterprises. It is, however, endeavoring to disorganize. The total area of lands comprised within its boundaries (3,100 acres), 250 acres of which are hilly and rough, being partially unfit for cultivation, leaving 2,850 acres of first-class agricultural land. The irrigation district and its pipe line are shown in Pl. I (Part I). In order to obtain a water supply, in 1892 the irrigation district purchased from Garner & McKenzie 65 acres of artesian lands in the bottoms of Lytle Creek northeast of San Bernardino. Three wells were sunk in these lands, the deepest being 450 feet and the other two about 250 feet each. A cut was also run in the cienaga upon these lands, for the purpose of developing water. The development during that year (1892) produced 100 miners' inches, or 2 second-feet, at a total cost of $5,997. The output of these artesian wells, which are referred to in the description of the wells of San Bernardino Valley, is given in the table on page 36 (Part I).

In 1891 the East Riverside Irrigation District purchased a 24-inch pipe line from Raynor Springs, about $1\frac{3}{4}$ miles below the artesian land of the district, in sec. 4, T. 1 S., R. 4 W., situated within the district. This pipe line was constructed in the year 1889 by the Vivienda Water Company, for the purpose of serving the greater portion of what is now the East Riverside irrigation district. The pipe is of riveted iron, the gage ranging from No. 10 to No. 14 Birmingham standard. The maximum pressure per square inch sustained by the different sizes as the pipe was constructed was: No. 14, 30 pounds; No. 12, 71 pounds; No. 10, 110 pounds. The valley hydraulic grade line is 7 feet to the mile, and the discharging capacity 9 cubic feet per second.

After the consummation of the purchase by the district the pipe line was extended 8,100 feet, to the wells that had previously been sunk. The upper portion of the pipe is of steel, No. 14 gage. The reservoir was constructed on the lands purchased. It is 40 feet by 70 feet on the bottom, has a depth of 5 feet, and is cement lined. Two kinds of pipe were used in the distribution system—riveted steel and vitrified clay. In 1892 it was estimated that distribution by this means would cost $15 an acre.

The following are the amounts expended in the construction, with the value of the assets, the purchase of the 24-inch pipe line being included in both statements, which are taken from the report by F. C. Finkle, engineer for the district in 1892:

Expenditures.

Purchase price of Vivienda pipe line	$100,000.00
Extension, 8,100 feet to Vivienda pipe line	23,642.87
Two lateral pipe lines	2,292.10
Reservoir No. 2 (when completed)	1,210.00
Cost of sinking three artesian wells	4,497.00
Drainage cuts to McKenzie Spring	500.00
Total	132,141.97

Value of assets.

24-inch conduit as extended	$123,642.87
Two lateral pipes	2,292.10
Reservoir No. 2	1,210.00
100 inches (2 cubic feet) of water, at $1,000 per inch	100,000.00
Total	227,144.97

The owners of the Vivienda Water Company claim that the pipe line, which they value at $100,000, actually cost $120,160, divided as follows:

Pipe-line material and laying	$96,000
Trenching and back filling	8,000
Right to suspend line on motor bridge	1,000
Bridge across Santa Fe Railroad cut on Third street	360
Engineering and superintendence	3,400
Three miles of cement ditch, including pipe across Little Terquisquite Arroyo	11,400

The cement ditch lines referred to were also transferred to the irrigation district.

RIVERSIDE-HIGHLAND WATER COMPANY.

The Riverside-Highland Water Company is a corporation organized February 21, 1898, under the laws of California, to furnish water for domestic purposes and the irrigation of the lands of shareholders situated in that portion of the East Riverside irrigation district in Riverside County which is known as Highgrove. The capital stock was $200,000, divided into 5,000 shares of $40 each. The policy of the company is to furnish an abundance of water to irrigate 2,500 acres of land at the rate of 1 miners' inch of water measured under a 4-inch pressure for each 5 acres of land for the growing of citrus orchards. Recently the company, by a vote of its stockholders, reduced its capital stock to $100,000, divided into 2,500 shares, of which a little more than 2,300 shares are subscribed for and more than 50 per cent is paid in.

The company is the owner of 157 acres of artesian water-bearing lands a few miles north of Colton, in San Bernardino County, from which the water is conducted in a long underground cement and iron pipe line to the lands of its stockholders at Highgrove, a distance of a little more than 7 miles. On these water-bearing lands there are a number of deep artesian wells, from five of which all of the water now used by the company, amounting to a little more than 300 miners' inches, is pumped by means of one 22-horsepower gas engine and two 30-horsepower electric motors, the electric current being furnished at a cost of 1½ cents per horsepower per hour by the Redlands Electric Light and Power Company. The pumps used are of the centrifugal type.

The company does not know how much water its lands will furnish, but it believes that it has an abundant supply. It is now furnishing sufficient water to meet all the demands of 1,800 acres of both old and young orchards, and so far no one has hesitated on account of lack of water to plant orchards in the territory covered by the company. The water is delivered to consumers on demand upon the payment of a toll of 10 cents per miners' inch for a twenty-four hours' run. The lands watered by the company are at a higher elevation than those watered by any other company in the Riverside district, hence its name. The orchards watered are relatively free from frost.

The East Riverside Irrigation District still exists, with its board of officers, but is not operating its system, the Riverside-Highland Water Company supplying water to such portion of the lands as the owners have become stockholders in its company, also to other lands. The landowners within the East Riverside irrigation district, after an effort of eight years, found it impracticable to carry on the system under the act of the legislature popularly known as the Wright act, owing to the fact that the act provided that the revenue should be raised by annual taxation, and also to the extreme difficulty experienced in collecting the taxes thus levied, resulting in numerous tax sales and in suits to restrain the execution of tax deeds by the owner just before the expiration of the redemption period. These suits were expensive to the district, in many instances costing more to defend than the taxes were worth when collected, and resulting in vexatious delays and appeals to the higher court. When no redemption was made from tax sales the tax deeds were executed and delivered to the district, which invariably had to become the purchaser, for no private person would venture to purchase at the sales for fear of expensive litigation to protect the titles procured. In this way a large tract of unimproved land owned by divers and sundry persons, both residents and nonresidents, became conveyed to the district, and while the law authorized the district as owner to sell the lands at their market value, no purchaser could be found who was willing to buy them under the titles held by the district. The lands subject to taxation diminished every year to such an extent that it became manifest that the entire revenue of the district for the payment of its obligations—interest on bonds, operating expenses, etc.—would have to be met by the few landowners who were faithful in paying their taxes; hence the landowners, for self-protection, organized the Riverside-Highland Water Company and ceased to operate as the East Riverside Irrigation District.

LOWER SAN BERNARDINO VALLEY ABOVE RINCON.

Santa Ana River is the most important stream of southern California west of the Coast Range. It includes among its tributaries all of the streams entering San Bernardino Valley, and drains a total area above Rincon of 1,463 square miles, including valley lands, exclusive of the lands tributary to Lake Elsinore; 555 square miles of the basin are mountainous. San Bernardino Valley proper contains 525 square miles.[a] There is a secondary coast range lying along the western edge of the valley, through which Santa Ana River cuts a canyon, beginning at Rincon, which is the railroad station of Crary. These hills are of a shale and sandstone formation of more recent geologic origin than the main range to the east, and constitute a dam or dike which concentrates and throws to the surface most of the underflow or seepage water proceeding through the valley toward the sea. This produces a greater volume of water in the river at Rincon during the irrigation season than at any other place along the stream. During the summer there is a larger body of water flowing at Rincon than at any other place in California south of the Tehachapi Mountains, except in Colorado River.

The streams surrounding San Bernardino Valley have drainage basins which are exceedingly steep and are poorly supplied with forest cover. The basin above Rincon is of granite origin. The storms which occur in southern California are frequently violent, and falling on these drainage basins produce torrential floods which rush onto

[a]For details of these drainage areas see Part I, pages 51 and 52.

the plains, carrying large quantities of granitic detritus. In this way San Bernardino Valley has been built up. These great beds of gravel and bowlders have a high percentage of voids, the porous space being probably one-third of the mass. Consequently the floods which are projected upon the plains are rapidly absorbed, and the great underground reservoir, with a controlling outlet at Rincon, the storage capacity of which is very great, is filled.

If an area of gravel of 500 square miles should be charged to a depth of 300 feet its storage capacity would be 32,000,000 acre-feet of water. These figures are given merely to suggest the enormous capacity of this great underground storage reservoir of San Bernardino Valley. It has been charged with waters through a long cycle of years by the floods described. In addition to the winter floods the summer flow of all the streams from San Antonio Creek to Mill Creek is diverted and used for irrigation purposes, and probably 50 per cent of it sinks into the ground and reenforces the water plane. This large underground reservoir slopes toward Santa Ana River, and its surplus waters are brought to the surface in the canyon at Rincon. The velocity with which the water passes through the gravels is undoubtedly very slow and varies with the density of the soil and the steepness of the slope, causing a very constant delivery of water at the Rincon Narrows.

In June, 1898, a series of measurements was made to determine the relation between the water flowing on the surface of the ground at the mouths of the various mountain basins entering San Bernardino Valley and that returning into the channels of the Santa Ana in the central portions of the valley. The following approximate results were obtained:

Discharge measurements in San Bernardino Valley, 1898.

Stream.	June.	September.[a]
	Second-ft.	*Second-ft.*
Mountain streams above Slover Mountain	80	63
Mountain streams below Slover Mountain	21	17
Total summer streams from mountains	101	80
Return and developed water above Slover Mountain	[b]138	[b]145
Return water between Slover Mountain and Riverside Narrows	75	62
Return water between Riverside Narrows and Rincon	61	53
Total return water above Rincon	274	260

[a] Measurements made between August 27 and September 9.
[b] Riverside Water Company's lower canal not included.
NOTE.—One second-foot equals 50 California miners' inches.

From the foregoing table it will be seen that in June, 1898, there were 173 second-feet, or 8,650 miners' inches, and about September 1 180 second-feet more water seeping into the channels of Santa Ana River in the central portion of the valley than there was entering the valley from the mountain drainage basin.[c] The amount of water rising in the central portion of the valley was about three times the amount

[c] For details see page 47, Part I.

that was being furnished from the mountain streams. During the winter season the mountain streams are much larger in volume. In the case of San Gabriel River, in June, 1898, there was a total of 16 second-feet of water entering from mountain drainage basins above Puente, and 62 second-feet were found flowing in The Narrows, where San Gabriel River cuts through the same secondary coast range that the Santa Ana encounters at Rincon. A similar condition exists opposite Tropico, on Los Angeles River, where in June, 1898, there were 68 second-feet of water flowing and no water entering from the surrounding mountain drainage basins.

The amount of water which returns from irrigation into the channel of the Santa Ana below the lands irrigated is known to be large. According to tables which have been prepared by Prof. L. G. Carpenter, in charge of the Colorado experiment station at Fort Collins, Colo., the velocities of underground water are found to be less than 1 mile a year under ordinary conditions. It will therefore require a number of years for return irrigation water which, for instance, is used in the neighborhood of Rialto or Riverside to reach the channel of Santa Ana River. During the summer of 1899 Mr. Cyrus C. Babb, a hydrographer from the United States Geological Survey, made a determination of the amount of water returning from irrigation in the Solomonsville Valley, on Gila River, Arizona, and found that a volume equaling 64 per cent of the amount which was being used for irrigation at that time was returning to the stream; in the neighborhood of Phoenix the amount returning was found, in a similar manner, to be 40 per cent. In Ogden Valley, Utah, on Ogden River, Prof. Samuel Fortier determined, as the result of thirteen measurements made in the summer of 1894, that while the inflow into the valley was 98.9 second-feet the amount used for irrigation was 76.3 second-feet and the outflow was 115.9 second-feet, showing a greater amount returning than was being used at that time for irrigation. This was doubtless due to the fact that greater quantities of water were used for irrigation in the spring than during the summer months. In Colorado, on Cache la Poudre River, Professor Carpenter, as a result of extensive measurements and experiments, has drawn the following general conclusions:

(1) There is a real increase in the volume of the streams as they pass through the irrigated sections.

(2) The inflow is practically the same throughout the year. It is greater in summer and less in winter, principally because of the effect of the temperature on the soil.

(3) The passage of the seepage water through the soil is very slow, so that it may take years for the seepage from the outlying lands to reach the river.

(4) The seepage water is already an important agricultural factor of the State. The capital value of the water thus received in the valley of the Cache la Poudre alone is not less than $300,000, perhaps $500,000, and for the Platte it is from $2,000,000 to $3,000,000. It is large for the other streams, but of unknown amount.

(5) Ultimately the returns from seepage will make the lower portions of such

valleys as the Platte more certain of water and will probably permit a larger acreage to be grown.

(6) The results here shown may be expected to apply, with limitations, to other valleys similarly situated, where irrigation is as copious, crops the same in character, and the subsoil and rock strata similar and at approximately the same inclination. Where the soil is less porous a greater time must elapse for the water to percolate.

At Rincon there is a flat of approximately 4 square miles area immediately above the canyon, which is believed to contain gravel and sand to depths of at least 50 or 60 feet, below which alternate layers of clay and gravel are believed to exist. Approximately one-third of this area lies on the south or left bank of the river and the remaining two-thirds on the north bank.

Numerous measurements have been made from the Riverside Narrows through to Olive, and the maximum volume of water that occurs at any point in the river is believed to be at the wagon-road crossing of the stream near Rincon.

In the following table is given a series of measurements made by the United States Geological Survey approximately 1 mile below the railroad bridge crossing Santa Ana River below Rincon, the measurements having been made at that point until September 29, 1899, since which date they have been made at the wagon bridge. On September 13, 1899, it was found that when there were 74.38 second-feet of water at the Geological Survey gaging station there were 76.61 second-feet of water at the wagon bridge, or 2.23 feet more water at the wagon bridge than at the Geological Survey station. The wagon bridge being the point of maximum flow, subsequent measurements were made there.

Discharge measurements of Santa Ana River and canal near Rincon, below the mouth of Chino Creek.

Date.	Hydrographer.	Discharge of river.	Discharge of canal.	Total discharge.
1898.		*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
June 21	F. H. Omsted	79.81	3.18	82.99
1899.				
January 3	S. G. Bennett	209.40	2.30	211.70
January 16	F. Rolfe	231.90	0.00	231.90
January 28	do	216.00	6.50	222.50
February 15	do	181.00	1.75	182.75
March 4	do	108.60	0.00	108.60
March 18	do	199.89	0.00	199.89
April 6	do	172.23	0.00	172.23
April 18	do	101.10	2.75	103.85
May 2	do	100.34	2.45	102.79
May 15	do	100.36	3.95	104.31
June 3	do	110.27	3.18	113.45
June 16	S. G. Bennett	87.89	1.65	89.54
July 4	F. Rolfe	68.89	2.42	71.31
July 18	do	64.13	1.54	65.67
August 1	do	57.82	3.44	61.26
August 15	do	64.71	3.16	67.87
August 30	S. G. Bennett	65.90	2.00	67.90
September 13	J. B. Lippincott	72.73	1.65	74.38
September 29	F. Rolfe	83.82	0.00	83.82

Discharge measurements of Santa Ana River at wagon bridge above the mouth of Chino Creek.

Date.	Hydrographer.	River.	Chino Creek.	Springs.	Total discharge.
1899.		*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
October 25	J. B. Lippincott	131.32	14.52	0.50	146.34
October 26	do	146.53	14.52	0.50	161.55

Discharge measurements of Santa Ana River at Riverside Narrows, below all Riverside diversions and north of Arlington Heights.

Date.	Hydrographer.	Discharge.
1898.		*Sec.-ft.*
June 20	F. H. Olmsted	47.63
August 29	do	39.05
1899.		
July 17	F. Rolfe	31.70
September 12	J. B. Lippincott	39.69

For the purpose of comparison four measurements of the amounts of water flowing at Rincon and at the division box of the Santa Ana and Anaheim irrigation companies were made on the same dates, with the results shown in the following table:

Discharge measurements of Santa Ana River.

Date.	Hydrographer.	U. S. G. S. gaging station below Rincon.	Division box of Santa Ana and Anaheim irrigation companies.
1898.		*Sec.-ft.*	*Sec.-ft.*
June 21	F. H. Olmsted	79.81	67.47
1899.			
August 30	S. G. Bennett	65.90	59.62
September 13	J. B. Lippincott	72.73	71.68
October 25	do	[a]146.34	144.72
Total discharge		364.78	343.49

[a] Measured at Rincon wagon bridge.

At the time of the first three measurements there was flowing in a ditch on the left bank of the river opposite the gaging station 3.18, 2, and 1.65 second-feet of water, respectively, which is not included in the totals given in the foregoing table. If included it would show a still greater quantity of water at Rincon. The average of the measurements indicates the presence of 5.32 second-feet (266 miners' inches) more water at Rincon than at the division box. If the greater amount of water found at the Rincon wagon bridge, as compared with that at the original gaging station, is considered, as well as the diversions of the ditch on the left bank opposite the original gaging station, then it is shown by these measurements that there is a loss of fully 8 second-feet between the Rincon wagon bridge and the division box of the Santa Ana and Anaheim water companies. On September 13, 1899, there were at the Rincon bridge 76.61 second-feet of water, while in the two canals of the Santa Ana and Anaheim companies, at a point opposite Esperanza Siding and above all irrigation from either canal, there were only 58.68 second-feet of water, showing a loss of 17.93 second-feet (896 miners' inches) between those points. On October 26, 1899, there were 161.55 second-feet of water at the Rincon bridge and 122.37 second-feet in the canals and river opposite Esperanza, the total amount in the canals being 73.21 second-feet. This shows a loss of 39.18 second-feet (1,959 miners' inches). These measurements are not given as absolute, but they were the best possible determinations under existing conditions. The fact that a loss is shown by each of the observers mentioned is considered evidence that a loss exists and that it is large. Additional measurements are desirable in order to determine more definitely the amount of this loss.

An examination of the wells in the vicinity of Rincon was made in connection with the investigation. As a result it is believed that a bed of gravel, cobble, and sand 40 feet deep exists on the south side of the river, that it is porous and filled with water, and that development works of proper size and form could obtain from it a large supply. From the Auburndale bridge to the Rincon bridge the river gains 12.75 second-feet of water, as indicated by the measurements of September, 1899, Chino Creek not being considered. An examination of the records of wells north of the river indicates that a blanket of clay slopes from the neighborhood of Chino toward the south. Artesian wells occur in the neighborhood of Chino, and flowing water is obtained as far south as the Pioneer schoolhouse, which is approximately 3 miles north of the land referred to. In a well on the property of Mr. Durkee, approximately 1 mile north of this land, a blanket of hard clay 20 feet thick was encountered at a depth of 47.5 feet from the surface of the ground. Beneath this was coarse gravel. The water in this well rose to within a few feet of the surface of the ground. The well furnishes a supply which has never been exhausted by the demands upon it.

Mr. Durkee states that similar conditions were encountered at the schoolhouse well. From the Auburndale bridge to Chino Creek springs are found on both sides of the valley. The evidence obtained from the wells indicates that a blanket of clay may be found in the gravel beds near Rincon. If this layer of clay exists, beneath it will be found large bodies of water, which can be pumped extensively if they do not flow naturally, and the water supply be increased thereby. The only evidence to the contrary that was found was at the pipe works, approximately 3 miles southeast of Rincon, where indefinite information was obtained that two wells have been put down, one 500 and the other 600 feet in depth, through sandstone, bowlders, and gravel, without encountering a layer of clay. The water in these wells, however, rose to within 25 feet of the surface, and the supply has been found sufficient to meet all demands upon it. The elevation of these wells at the surface of the ground is approximately 100 feet above the river at Rincon. At the foot of the small mesa which immediately joins the town on the south shallow wells have been put down to a depth of 25 or more feet, from which flowing water has been obtained.

If development works can be located which will permit the lowering of the water plane 21 feet beneath the surface of the ground, where it now stands, over an area of 1,000 acres, sufficient water could be obtained to furnish 1,000 miners' inches for a period of six months. It has previously been shown that there enters the river naturally from the eastern end of the valley to the Rincon bridge, inclusive of Chino Creek, approximately 700 miners' inches. This increase indicates a supply which is constantly approaching these lands and which should be an addition to the storage capacity of the gravel mentioned. It is believed, therefore, that from 1,500 to 2,000 miners' inches of water could be obtained if development works were constructed which would permit the lowering of this water plane each season 21 feet over an area of 1,000 acres. In a gravel bed west of Burbank the West Los Angeles Water Company has constructed a cut approximately 3,000 feet in length, which varies in depth from nothing to about 25 feet, and which is now delivering, at the end of the drought of 1900, in the neighborhood of 300 miners' inches of water in a locality which is not so favorably situated for the purposes of developing water as are the lands referred to. The works of the West Los Angeles Water Company consist of an open cut in which is placed a wooden flume with sides and top but without bottom. The water enters the flume principally through the bottom. These development works have been in operation since the fall of 1895 and have maintained a continuous discharge of water, although the water plane of San Fernando Valley has been steadily falling.

The Crystal Springs Water Company has laid approximately 2,000 feet of sewer pipe, with open joints, in the sandy bed of Los Angeles River in the narrows west of Verdugo. There are four pipes, laid in two cuts, which are collecting from 400 to 500 miners' inches of water from the river bottoms.

Broadly speaking, the method of procedure should be to divert the entire flow of Santa Ana River near the Auburndale bridge at the beginning of the irrigation season, say the first of May, and carry it in a lined conduit to a point west of Rincon where a drop could be obtained which would produce a substantial water power. The water stored in the gravel beds should then be drawn down by means of pumps operated by this power. At the end of the irrigation season the pumps could be stopped and the water be returned to the natural bed of the river between the Auburndale bridge and Rincon during the season of the year when the supply is large and when the loss to the river in recharging these beds, in addition to the natural inflow of water returning from irrigation, would not be felt. In this manner the storage capacity of the gravel beds would be available the following spring, when the water plane could again be drawn down. Any artesian water that might be found would be in addition to the water obtained from the pumps.

Summarizing, the following conclusions have been reached:

(1) That a large percentage of water used for irrigation returns to the channels of the streams, the amount being greater where the soil is porous and the slopes are steep, both of which conditions exist in San Bernardino Valley.

(2) That the movement of the water through the soil is exceedingly slow, and that while the increase due to irrigation is now felt at Rincon the volume of return water from irrigation will increase in the future and will be a permanent source of supply.

(3) Water of this character is now making its appearance on the lands near Rincon. This is indicated by the fact that although we are now practically at the end of a nine-years' drought the water plane of these lands has steadily risen, until orchards, vineyards, and alfalfa fields which are said to have previously flourished have been drowned. Around Riverside alone 5,000 miners' inches (100 second-feet) of water are now being used for irrigation.

(4) It is impossible to determine accurately the amount of water that could be gathered. It is believed, however, that about 2,000 miners' inches or more could be obtained by pumping. This amount would be independent of any supply which would be obtained from artesian wells.

(5) That the stream measurements show a loss between Rincon and the head of the Santa Ana canal near Esperanza of about 800 miners' inches, which might be saved by a lined conduit extending down the canyon about 7.4 miles.

WELLS IN REDLANDS AND SAN BERNARDINO QUADRANGLES.

All of the wells in the Redlands and San Bernardino quadrangles, irrespective of size or producing capacity, were visited by representatives of the Geological Survey during the summer of 1900. There were 412 wells in the Redlands quadrangle, which were inspected by Mr. Louis Mesmer, of Los Angeles, and 478 wells in the San Bernardino quadrangle, which were inspected by Mr. C. J. Roney, of the same city. The results of the observations were described with considerable detail in the field record books, but have been condensed for publication in this report and are given in the following tables. The numbers of the wells in the tables correspond with those on the map (Pl. I, Part I) and are the same as those given to the detailed descriptions in the field record books. The principal facts are stated in abbreviated form. In the first column is the number of the well as shown on the map. In the next column is the name of the owner, and following that the location, by township, range, and section, the date completed, and the class of well, the latter being indicated by established symbol, *D* meaning dug well, *Dr* driven well, *B* bored well, and *H* horizontal well or tunnel, the accompanying figures giving the size in feet and inches. The elevation of the surface of the well, the elevation of water in the well, and the depth of the well in feet are given in the next columns. The character of the strata is indicated by initials, *C* meaning clay, *G* gravel, *B* bowlders, *L* loam, *S* sand, *R* rock, and *Hp* hardpan. To illustrate: *LSG* is equivalent to loam, sand, and gravel. The next column gives the quality of water, whether hard, soft, alkaline, or sulphurous. The next one gives the method by which the water is obtained, the word *hand* meaning hand pump, *horse* a horsepower machine, *electric* an electric motor, *centrifugal* a centrifugal pump, *gas* a gasoline engine, *wind* a windmill, etc. In the case of the windmill the accompanying figures give the diameter of the windmill in feet. For example: *14 wind* is intended to imply that water is pumped by a 14-foot windmill. In the case of the gasoline engines, electric motors, etc., the accompanying figures indicate the horsepower. The cost of the well and of the machinery (the latter is only roughly approximate) is given in the next two columns, and after that the quantity of water, usually in second-feet, but where otherwise *good* indicates a good supply and *small* a small or deficient supply. In many instances, particularly with capped artesian wells connected directly with pipe systems, it was difficult to determine the volume of water that the well was discharging. In a few instances, which are indicated, the volumes given are for other years than 1900. In the column headed "use of water" the abbreviation *dom* implies domestic use, *st* implies use for watering cattle and horses, and *irr* that water is used for irrigation. Topographic maps were used in determining the elevation of the ground at the well, and the depth to water having been measured with a tape the elevation of the water plane was determined accordingly. The elevations all refer to the summer of 1900, and undoubtedly will vary substantially, either owing to the excessive pumping of water or to subsequent wet years.

Wells in Redlands quadrangle.

No. of well.	Owner	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
1	Dr. Meeker	1 2 16	1900	D, 4 by 6 feet	1,995	1,718	180	CG			$1,100			
2	Ward, Mills & Co	1 2 21	1900	D, 4 by 6 feet	2,005	1,933	125	CG		Gas	750			
3	Crafton Water Co	1 1 7	1900	D, 5 by 6 feet	3,010	2,992	132	BG		Centrifugal; electric	2,000	$2,500	1.38	Irr; power.
4	do	1 1 8	1900	D, 5½ by 6½ feet	3,650	3,648	93	GR		do	[a] 6,000	2,500	2.70	Irr; power.
5	Mrs. M. A. Brown	1 2 22	1879	D, 4 by 4 feet	2,250	2,225	27	Gravel	Hard	Wind		100		Dom.
6	Geo. McIntosh	1 2 22	1899	D, 4 by 4 feet	2,230	2,189	70	Gravel		Centrifugal; electric				Irr.
7	R. P. McIntosh	1 2 20	1900	D, 4½ by 4½ feet	1,910	1,818	103	SGB	Soft	Cylinder pump; gas	700	925	0.14	Irr.
8	L. Lodge	1 2 16	1900	D, 4 by 6 feet	2,060	2,050	70		do	do		1,500	0.30	Irr.
9	L. Lyons	1 2 16	1900	D, 4 by 6 feet	2,075	2,052		GB		do				Irr.
10	T. P. Christian	1 2 17	1900	D, 4 by 6 feet	1,900	1,748	180	CBSG	Soft	do		1,500		Irr.
11	F. Wieder	1 2 29	1900	D, 4 by 5 feet	1,830	1,779	100	GBC	do	do	450	950		Irr.
12	E. J. Roberts	1 2 28	([b])	D, 4 by 6 feet	2,200	2,192				Horse	300			Irr.
13	H. H. Garstin	1 2 29	1900	B, 10 inches	2,000	1,905	241	CG	Soft	Cylinder pump; gas	800	1,430	0.06	Irr.
14	W. J. Tench	1 2 19		D, 4 by 6 feet	1,720	1,560	163	SGB						Irr; dom
15	East Redlands Water Co.	1 3 36	1900	B, 12 inches	1,805	1,621	514			Cylinder pump; gas	2,200		0.32	Irr.
16	E. & D. Conkling	1 2 31	1899	B, 10 inches	1,795	1,545	350		Hard	do		2,200	0.40	Irr.
17	M. S. Crosswell	1 3 24		D, 4 by 6 feet	1,540	1,378	163	Gravel	Soft	do			0.12	Irr.
18		1 2 33		D, 2½ by 4 feet	2,120	2,060	60							
19	Mr. Gregory	1 2 33	1892	D	2,130	2,123	10			Hand	20			Dom.
20	Dunlap estate	2 2 4	1899	B, 10 inches	2,040	2,040				Centrifugal; gas			0.50	Irr.
21	do	2 2 4	1895	B, 7 inches	2,075	2,077	142			Artesian			0.005	Dom.
22	do	2 2 4	1900	B, 10 inches	2,100	2,100	800	CGS	Hard	do	2,950		0.015	Irr.
23	do	2 2 4	1900	B, 10 inches	2,090	2,090		CSG	do	do				Irr.
24	Houghton & McNee	2 2 4	1895	D, 3 by 4 feet	2,278	2,227	43	Gravel		Wind				Dom.
25	Geo. Clyde (tunnel)	1 2 26		H, 4 by 6 feet	2,700	2,700	97	Porphyry		Gravity	[c] 300		0.02	Irr; dom.
26	Mr. Biggin	1 2 34	1899	D, 6 by 6 feet	2,224	2,163	65	SG					0.16	
27	South Mountain Water Co.	1 2 33	1900	B, 10 inches	2,160	2,132	900+			Centrifugal; steam				Irr.
28	Garland estate	1 3 25	1900	B, 10 inches	1,570	1,394		CG		Cylinder pump; gas				Irr.
29	C. D. Fowler	1 3 5	1891	B, 10 inches	1,180	1,125	70	SG	Hard					Irr.
30	West Redlands Water Co.	1 3 35	1899	B, 12 inches	1,600	1,530	226	GCB	do	Cylinder pump; gas	1,250	2,500	0.40	Irr.
31	do	1 3 35	1899	B, 10 inches	1,620	1,529	248	GCB			1,080			Irr.
32	do	1 3 35	1899	B, 12 inches	1,626	1,536	243	GCS		Cylinder pump; gas	1,700	2,500	0.36	Irr.
33	Redlands Heights Water Co.	2 3 1	1900	B, 10 inches	1,880		300	CSG			1,200			Irr.
34	Mr. Painter (?)	2 2 8	1899	D, 4 by 6 feet	1,975	1,932	60	Gravel						
35	do	2 2 8	1899	D, 4 by 6 feet	1,975	1,932	46	Gravel						

[a] Well and tunnel 250 feet long. [b] Not completed. [c] Tunnel 97 feet long.

Wells in Redlands quadrangle—Continued.

No. of well.	Owner.	Location (T. R. S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
36	Mrs. Diaz	2 3 14		B, 7 inches	1,545	1,456	96			Hand	$125	$20		Dom.
37	C. W. Bllue	2 3 14	1898	B, 7 inches	1,523	1,455	110	Gravel	Hard	Wind	200	75		Dom; irr.
38	A. Gregory	1 3 27	1895	B, 7 inches	1,379	1,274	168	CRGS	do	do	250	500	0.016	Dom.
39	W. McConkey	1 3 27	1898	B, 7 inches	1,380					do				Dom.
40	D. Madell	1 3 27	1898	B, 7 inches	1,377	1,277	171		Hard	do	274		0.001	Dom.
41	G. H. Garland	1 3 26	1899	B, 10 inches	1,450	1,261	246	GC		Cylinder pump; gas		3,000	0.40	Irr.
42	C. L. Hayes	1 3 27	1899	B, 10 inches	1,420	1,270	428	CGSB	Soft	do	850	1,400	0.30	Irr.
43	O. W. Harris	1 3 34	1895	B, 7 inches	1,503	1,303	312	CSG	Hard	Cylinder pump; electric.	600	800	0.075	Irr; dom.
44	Horace Evans	1 3 33	1899	B, 10 inches	1,455	1,259	660	CG	Soft	Cylinder pump; gas	1,900	1,400	0.18	Irr; dom.
45	A. C. Fowler	1 3 32	1898	B, 9 inches	1,250	1,140	170	SGC	do	do	250	300	0.10	Irr.
46	L. C. Smith	1 3 32	1898	D, 3 by 3 feet	1,215	1,135	83	Gravel	Hard	Wind	90	65	0.003	Dom.
47	P. B. Fussell	1 3 32	1897	B, 12 inches	1,253	1,195	165	SGC	Soft	do	330	230		Irr; dom.
48	E. Vaché	1 3 32	1885	B, 7 inches	1,260	1,200	140		Hard	do	170	75		Dom.
49		2 3 4	1893	B, 7 inches	1,350	1,290	150			do				St.
50	W. D. Covington	2 3 4	1893	B, 7 inches	1,325	1,290	157		Hard	Hand	350	20	Small.	St.
51	do	2 3 4	1893	B, 10 inches	1,300	1,300	750		do	Artesian	2,000		0.002	Dom; st.
52	D. S. Jordon	2 3 4	1899	B, 7 inches	1,395	1,379	56	LSGC	do	Wind	80	90	0.001	Dom; irr.
53	Redlands Domestic Water Co.	1 3 35	1899	B, 10 inches	1,560	1,503		CSG	do	Centrifugal; electric	1,800		0.80	Dom; irr.
54	Wood, Bill & Davis	1 3 33	1899	B, 10 inches	1,305	1,225	462	CGS	Soft	Cylinder pump; gas	1,200	1,800	0.40	Dom; irr.
55	D. H. Gillan	1 3 32	1899	B, 8 inches	1,245	1,157	438		do	Air compressor; gas		3,000	0.50	Dom; irr.
56	H. Bermudas	1 3 32	1893	B, 7 inches	1,210	1,156	112		Hard	Hand		3		Dom.
57	N. B. Hinckley estate	1 3 32		B, 10 inches	1,177	1,021	700+			Wind				Dom; irr.
58	Wm. Curtis	1 3 30	1885	B, 10 inches	1,144	1,076	76		Hard	do	150	100	0.002	Dom.
59	E. C. Curtis	1 3 29	1895	B, 7 inches	1,120	1,070	96		do	do	160	75	0.002	Dom.
60	R. T. Curtis	1 3 29	1895	B, 7 inches	1,123	1,073	86	GC	do	do	140	100	0.003	Dom.
61	W. M. Curtis	1 3 29	1899	B, 12 inches	1,125	1,079	415	CG	Soft	Cylinder pump; gas	900	1,800	0.70	Irr.
62	N. B. Curtis	1 3 29	1895	B, 7 inches	1,126	1,076	84		Hard	Wind	140	60	0.001	Dom.
63	N. B. Hinckley estate	1 3 30	1899	{B, 36 inches {B, 11 inches	1,150	1,103	{65 {271	Gravel	do	Centrifugal; gas	900	800	0.42	Irr.
64	L. & M. Frink	1 3 30	1889	B, 7 inches	1,140	1,112	62	LSGC	do	Wind	100	163		Dom.
65	Mrs. P. S. Stewart	1 3 30	1898	B, 7 inches	1,144	1,109	76	CG	do	do	150	65	0.001	Dom.
66	Gansnor & Renwick	1 3 30	1898	B, 7 inches	1,140	1,110	200		Soft	do	320	90	0.003	Dom; irr.
67	Redlands Water Co.	1 3 35	1899	B, 10 inches	1,563				Hard	Centrifugal; electric				Irr.
68	Mrs. M. Robison	1 3 30	1870	D, 3 feet	1,110		24		do	Hand			Dry.	
69	Southern Pacific R. R. Co.	1 3 31	1890	B, 7 inches	1,176	1,116	75		do	do	145	20		Dom.
70	W. F. Whittier	1 3 31	1898	{B, 10 inches {B, 7 inches	1,410	1,208	{294 {212	LCG	Soft	Cylinder pump; gas	1,000	935	0.14	Dom; irr

71	do	1	3	31	1898	B, 14 inches B, 10 inches	1,150	1,108	276 84	Gravel	do	Force pump; gas	1,020		0.80	Irr.
72	Owen Buchanan	1	3	31	1898	B, 7 inches	1,265	1,149	237	LSGC	do	Cylinder pump; gas.	379	800	0.14	Irr.
73	W. J. Lawrence	1	3	31	1898	B, 7 inches	1,230	1,148	190	LCG	do	do	304	700	0.12	Irr.
74	Frink Bros	1	3	30	1899	B, 36 inches B, 10 inches	1,147	1,105	335		Hard	Centrifugal; gas	800	700	0.62	Irr.
75	Rhoda Wilson	1	3	30	1899	B, 7 inches	1,138		59	CG	do	Wind	95	65	0.001	Dom.
76	D. Van Leuven	1	3	30	1900	B, 9 inches	1,132	1,098	63		do	Hand	65	14		Dom.
77	E. Hankins	1	3	28	1899	B, 12 inches	1,254	1,200	290	Gravel	do	Cylinder pump; gas.	800	1,300	0.40	Irr; dom.
78	J. A. Osborn	1	3	28	1899	B, 10 inches	1,225	1,173	320	LGC	do	Centrifugal; gas	880		0.50	Irr; dom.
79	do	1	3	28		B, 7 inches	1,224	1,174	190	LGC	do	Wind	300	72	0.001	Dom.
80	Mrs. S. W. Sylvera	1	3	29	1891	B, 7 inches	1,200	1,170	90			do		80	0.001	Dom.
81	A. B. Cook	1	3	29	1897	B, 10 inches	1,206	1,166	110	LSG	Soft	Centrifugal; gas	220	800	0.40	Dom; irr.
82	S. Mansfield	1	3	29	1900	B, 10 inches	1,195	1,163	340	Gravel						
83	do	1	3	29	1890	B, 7 inches	1,193	1,154	109		Hard	Wind	175		Small.	Dom; irr.
84	A. Lenanon	1	3	29	1895	B, 7 inches	1,186	1,156	130		do	Cylinder pump; horse	208	40		Dom.
85	John Furney	1	3	29	1890	B, 7 inches	1,179	1,139	60		do	Wind	100	150	0.003	Dom; irr.
86	Barton Land and Water Co.	1	3	29	1891	B, 7 inches	1,180	1,137	63		do	Hand	100			Dom.
87	M. D. Easton	1	3	29	1890	B, 7 inches	1,121	1,101	45		Soft	Wind	80	70	0.003	Dom.
88	Barton Land and Water Co.	1	3	29	1891	B, 7 inches	1,130	1,100	48		Hard	Hand				Dom.
89	J. R. Campbell	1	3	29	1893	B, 7 inches	1,190	1,155	103		do	do	190	25		Dom.
90	Carl Furst	1	3	29	1891	B, 5½ inches	1,215	1,180	114		do	do	165	35		Dom.
91	S. E. Rockwell	1	3	29	1900	B, 10 inches	1,200	1,170	356	SGR	Soft	Cylinder pump; gas.	1,000	860	0.34	Irr.
92	J. Hickey	1	3	29	1898	B, 9½ inches	1,226	1,190	152	GC	do	do	314	700	0.20	Irr; dom.
93	B. M. James	1	3	29	1899	B, 10 inches	1,230	1,198	220	LSGC	do	do	418	900	0.34	Irr; dom.
94	W. A. Nichols	1	3	28	1891	B, 7 inches	1,246	1,194	122			Hand				Dom.
95	do	1	3	28		B, 10 inches	1,255	1,206	284	GCSR		Cylinder pump; gas.	530	1,000	0.36	Irr.
96	W. D. Tobey	1	3	29		B, 10 inches	1,204		324			do				Irr.
97	S. A. Grover	1	3	28	1899	B, 10 inches	1,253	1,183	231	SC	Hard	do	700	1,100	0.40	Dom; irr.
98	Schee Bros	1	3	28	1899	B, 10 inches	1,280	1,210	425	Gravel	Soft	do	1,400	1,500	0.50	Dom; irr.
99	W. F. Schee	1	3	28	1894	B, 7 inches	1,291				do	do				Irr.
100	Redlands Water Co.	1	3	35	1899	B, 10 inches	1,565				Hard	Centrifugal; steam			1.56	Irr.
101	Barton Land and Water Co.	1	3	28	1900	B, 10 inches	1,315	1,225	250							
102	Willis Miller	1	3	21	1893	B, 7 inches	1,290	1,203	123	SG	Hard	Wind	200	125	0.002	Dom.
103	S. A. Grover	1	3	21	1890	B, 7 inches	1,294				do	do				Dom; irr.
104	C. Cutting	1	3	21	1894	B, 7 inches	1,320	1,220	170		Soft	Cylinder pump; gas.	337	340		Dom; irr.
105	Myron Sherman	1	3	27	1892	B, 8 inches	1,331	1,221	145		do	Cylinder pump; electric.	450	300		Dom; irr.
106	J. S. Hale	1	3	21	1897	B, 11 inches	1,272	1,202	295	Gravel	Hard	Cylinder pump; gas.	600	1,300	0.48	Irr.
107	do	1	3	21	1890	B, 7 inches	1,265	1,201	105		do	Wind	159	200	0.002	Dom; irr.
108	do	1	3	17	1896	B, 10 inches	1,220	1,164	86		do	do	160	75	0.015	Irr.
109	C. A. Shaw	1	3	21	1893	B, 7 inches	1,267	1,217	96		Soft	do	138	87	0.005	Dom; irr.
110	Lewis Deck	1	3	21	1895	B, 7 inches	1,278	1,213	220	GC	do	Cylinder pump; gas.	363	678	0.15	Dom; irr.
110a	do	1	3	21	1895	B, 7 inches	1,278	1,213	150	GC	do				0.15	Dom; irr.
111	I. E. Shaw	1	3	21	1890	B, 7 inches	1,247	1,197	90		do	Hand	150	25		Dom.
112	Alise Van A. Lea	1	3	21	1898	B (2)	1,253		70 130	SLC	Hard	Cylinder pump; gas.	500	700		Not used.
113	A. Gregory	1	3	21	1890	B, 7 inches	1,245	1,194	100		Soft	Wind				Dom.

Wells in Redlands quadrangle—Continued.

No. of well.	Owner.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
114	Gladysta Land and Water Co.	1 3 20	1899	B, 11 inches	1,240					Cylinder pump; gas.				Irr.
115	Frank Hess	1 3 21	1897	B, 11 inches	1,243	1,188	163		Soft	Centrifugal; gas	$326	$800	0.24	Dom; irr.
116	C. S. Lombard	1 3 16	1897	B, 10 inches	1,246	1,182	180		Hard	Cylinder pump; gas.			0.30	Dom; irr.
117	S. Ronzone	1 3 16	1899	B, 9 inches	1,257	1,192	98	LSG	do	Wind	235	200	0.014	Dom; irr.
118	Thos. Blakeley	1 3 16		B	1,254				do	Electric				Irr.
119	Elza Boger	1 3 16	1899	D, 4 by 4 feet B, 9 inches	1,255	1,185	132	([a])						
120	M. R. Gay	1 3 17	1896	B, 11 inches (2)	1,220	1,170	105	SGC	Hard	Air compressor; electric.	200		0.22	Irr.
121	W. W. Story	1 3 16	1900	B, 10 inches	1,262	1,193	163	GC	do	Cylinder pump; gas.	400	1,500	0.50	Dom; irr.
122	John Dostal	1 3 15	1897	B, 10 inches	1,403	1,230	174	HpSG	Soft	Wind	348	140	Small.	Dom.
123	J. F. Boyd	1 3 16	1896	B, 10 inches (2)	1,290	1,180	100 110		do	Cylinder pump; gas.	500	900	0.20	Irr; dom.
124	Wm. Lindenberg	1 3 20	1893	B, 7 inches	1,220	1,180	93		Hard	Wind	140	150	0.009	Irr; dom.
125	H. S. Drew	1 3 19		B, 14 inches B, 10 inches	1,167	1,133	164 291		Soft	Cylinder pump; gas.	1,300	1,500	0.60	Irr; dom.
126	James Smith	1 3 19	1892	B, 7 inches	1,164	1,130	90		Hard	Hand	150	10		Dom.
127	Bryan estate	1 3 20	1900	B, 10 inches B, 8 inches	1,190	1,143	510 118		do	Centrifugal; gas			0.40	Irr.
128	A. M. Ham	1 3 30	1887	B, 7 inches B, 5 inches	1,155	1,120	150 300			Cylinder pump; gas.	1,500	900		Dom; irr.
129	P. H. Covington	2 3 10		B, 7 inches	1,440	1,392	58		Hard	Hand				Dom.
130	Clark & Brotherton	1 3 20	1900	B, 10 inches B, 8¼ inches	1,195	1,162		LCG[a]						
131	J. J. Prendergast	1 3 29	1893	B, 10 inches	1,200	1,166	422		Hard	Cylinder pump; gas.	1,200	800	0.30	Irr; dom.
132	H. H. Cole	1 3 30	1888	B, 7 inches	1,140	1,108	82	LSG		Wind	140	180	Small.	Irr; dom.
133	H. S. Drew	1 3 19	1886	B, 7 inches	1,138		70		Hard	do	140	150	0.001	Dom.
134	C. M. Baxter	1 3 30	1899	B, 10 inches	1,147	1,116	100			Centrifugal; gas			0.60	Irr.
135	do	1 3 30	1892	B, 7 inches	1,147	1,113	80		Hard	Hand				Dom.
136	C. H. Lehmann	1 3 19	1891	B, 10 inches	1,129	1,103	458		Soft	Cylinder pump; gas.	1,300	900	0.40	Irr; dom.
137	A. E. Cole	1 3 30	1892	B, 7 inches	1,125	1,104	100	LSGC	Hard	Wind	160	100	0.005	Irr; dom.
138	A. McCrary	1 3 30	1891	B, 7 inches	1,120	1,093	40	CG	do	Hand	64			Dom.
139	H. R. Scott	1 3 19		B, 7 inches	1,120	1,108	503		do	Centrifugal; gas	1,000	1,000		Irr; dom.
140	do	1 3 19	1879	B, 6 inches	1,127	1,109	500		do					
141	E. H. Durnford	1 4 24	1894	B, 7 inches	1,103	1,093	500		Soft	Centrifugal; gas			0.60	Dom; irr.
142	James Birch	1 4 24	1890	B, 7 inches	1,096	1,087	300		do					Dom.
143	do	1 4 24		B, 7 inches	1,098	1,081	100							
144	D. W. Roach	1 4 24	1899	B, 7 inches	1,102	1,087	85	SG	Hard	Hand	130	24		Dom.
145	E. F. Van Leuven	1 4 25	1890	B, 7 inches	1,103	1,083	48		do	Wind			0.001	Dom.

146	W. H. Van Leuven	1	4	25		B, 7 inches	1,101	1,081	75		do	do				Dom; irr.
147	W. J. Doran	1	3	30	1900	B, 10 inches	1,106	1,086	100		do	do	200			Dom.
148	L. R. Van Leuven	1	3	30	1882	B, 7 inches	1,108	1,093	270		do	do	600	109	0.001	Dom; irr.
149		1	3	30		B, 7 inches	1,120				do	do				Dom; irr.
150	O. Taylor	1	3	32	1897	B, 7 inches	1,210		75		do	do		120	0.003	Dom; irr.
151	H. C. Hamanway	1	3	32		B, 7 inches	1,209				do	Hand				
152	G. J. Grant	1	3	32	1896	B, 7 inches (2)	1,206				do	Gas				Irr; dom.
153	S. L. Gregg	1	3	32		B, 7 inches	1,202				do	Wind				Dom.
154	H. C. Hamanway	1	3	32	1899	B, 10 inches	1,250	1,198	200		do	Cylinder pump; gas			0.32	Irr.
155	T. Morris	1	3	32	1890	B, 7 inches	1,260	1,195	125	LCG	do	Wind			0.002	Irr; dom.
156	S. V. Horton	1	3	32	1891	B, 7 inches	1,270	1,195	125	LCG		do	200	175	0.01	Irr; dom.
157	C. T. Covington	2	3	4	1891	B, 7 inches	1,455	1,415	65	SG	Hard	Hand	100	25		Dom.
158	Mrs. Van Leuven	1	4	25	1896	B, 7 inches	1,105	1,085	78		do	do	150	15		Dom.
159	J. H. Pierson	1	4	24	1884	B, 6 inches	1,104	1,103	605	CG	do	Centrifugal; gas	10,222	1,200	0.60	Dom; irr.
160	F. M. Strang	2	3	10	1897	D, 3 by 3 feet	1,500	1,423	79	SG	do	Hand	77	4		Dom.
161	Railroad School	2	3	10	1891	B, 7 inches	1,527	1,427	118	CG	do	do	180	25		Dom.
162	D. Mulvahill	2	3	10	1891	B, 7 inches	1,470	1,439	61	CG	do	do	115	22		Dom.
163	R. P. Lauretzen	2	3	10		B, 7 inches	1,550	1,474	106		do	do				Dom.
164		2	3	4		B, 7 inches	1,430				do	do				Dom.
165	— DeGarmo	2	3	8		B, 7 inches	1,575	1,485	164		do	Wind				Dom.
166	Smiley Bros	2	3	4		D, 7 by 7 feet	1,347	1,330	23		do	Centrifugal; gas			0.50	Irr.
277	L. F. Cram	1	3	3	1895	B, 12 inches	1,305	1,189	116	SCGR	Soft	Wind	1,000	100	Small.	Dom; irr.
278	C. C. Tyler	1	3	2	1900	D, 4 by 5 feet	1,305			SCGR						
279	John McBride	1	2	6	1900	D, 4 by 4 feet	1,650	1,636	65	SGB		Centrifugal; gas	500	400		Irr; dom.
280	do	1	2	6	1894	H, 4 by 6 feet	1,654	1,654	130	Granite	Hard	Tunnel, 130 ft., flows	250		0.02	Irr.
281	Cram Bros	1	3	2	1899	D, 4 by 4 feet	1,600	1,485	120	CG			300			
		N.	*W.*													
282	E. Highland Orange Co.	1	3	35	1900	B, 12 inches B, 10 inches	1,630	1,610	280 140	SGR		Tunnel, flows	1,680		0.26	Dom; irr.
283	do	1	3	35	1900	D, 4 by 4 feet B, 10 inches	1,680	1,666		SGR						
284	W. M. Bristol	1	3	34	1899	D, 5 by 5 feet	1,650	1,634	50	Gravel	Soft	Cylinder pump; gas		1,250	0.30	Irr.
285	Highland Domestic Water Co.	1	3	27	1899	D, 7 by 9 feet	1,440	1,411	65	GB		2 cylinder pumps; 2 gas engines.		[b]1,500	1.10	Dom.
286	Highland Well Co.	1	3	28	1899	D, 8 by 5 feet	1,431	1,415	46			Cylinder pump; gas			0.68	Irr.
		S.	*W.*													
287	J. C. Weeks	1	3	3	1900	D, 4 by 4 feet B, 12 inches	1,295	1,181	([a])		Hard					
288	H. S. Stroven	1	3	3	1898	B, 10 inches	1,253	1,173	165		Soft	Cylinder pump; gas	400	1,160	0.40	Irr; dom.
289	N. Sutherland	1	3	4	1898	Dug B, 12 inches	1,227	1,160	78		Hard					Not used.
290	Pattee & Nye	1	3	5	1900	D, 6 by 8 feet B, 10 inches	1,200	1,150	50 100			Rotary pump; steam			0.60	Irr.
291	G. J. Fowler	1	3	5	1899	D, 5 feet	1,180	1,127	55	SCG	Soft	Hand	50	17		Dom.
292	R. F. Cunningham	1	3	5	1890	D, 6 feet	1,160	1,120	43	Gravel	do	Centrifugal; steam	150	1,450	0.80	Irr.
293	do	1	3	5	1899	B, 7 inches	1,147	1,103	36		do	Hand	160	15		Dom.
		N.	*W.*													
294	do	1	3	31	1900	D, 5 by 5 feet B, 10 inches	1,260	1,226	135 90	CG		Steam			1.04	Irr.

[a] Unfinished. [b] Two engines.

Wells in Redlands quadrangle—Continued.

No. of well.	Owner.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
295	Redlands Water Co.	1 3 35	1899	B, 10 inches	1,568				Hard					
296	C. K. Matteson	1 3 7	1892	B, 10 inches	1,107	1,083	47	CG	Soft	Centrifugal; steam	$500		0.20	Irr.
297	do	1 3 7	1884	Dug	1,103	1,080	25	SGC	do	Hand	30	$4		Dom.
298	do	1 3 7	1894	B, 10 inches	1,103	1,083	44	SG	do	Centrifugal; gas	175	510	0.60	Irr.
299	Geo. Gustave	1 3 7	1900	D, 4 by 6 feet	1,101	1,082	25	SGR	do	do	50		0.30	Irr; dom.
300	do	1 3 7		D, 3 by 4 feet	1,103	1,085	19	SGB	do					
301	Mrs. H. Taylor	1 3 7		D, 3 feet	1,102	1,080	25	Gravel		Centrifugal; steam				Irr.
302	C. Wiltshire	1 3 6	1895	Dr, 2 inches	1,102	1,080	27		Soft	Hand		25		Dom.
303	Mrs. H. Taylor	1 3 7	1891	B, 3 inches	1,101		235		do	do	300		3.00	Dom; irr.
304	W. F. Somers	1 3 7	1900	B, 10 inches	1,101	1,081	([a])	SGCB						
305	Mrs. Golden	1 4 12	1900	B, 10 inches	1,099	1,099		SGC		Artesian				Irr.
306	do	1 4 12	1898	B, 8 inches	1,102	1,102	744		Soft	do	1,600		[b]1.10	Dom; irr.
307	W. F. Somers	1 3 7	1895	Dug	1,098	1,080	20		do	Hand	20		7.00	Dom.
308	do	1 3 7	1899	D, 3 by 3 feet	1,097	1,079	20		do	do	20		4.00	St.
309	John Kaus	1 3 7	1899	B, 8 inches	1,103	1,085	20			Steam	40			Dom.
310	F. P. Sargent	1 4 13	1894	Dr, 2 inches	1,096	1,084	24	Sand	Hard	Hand	15	10		Dom.
311	S. E. Fitzhugh	1 4 12	1888	B, 3 inches	1,080	1,073	234	SGC	Soft	do	500	6		Dom.
312	do	1 4 12	1885	B, 7 inches	1,081	1,064	20		Hard	do	35	6		Dom.
313	W. Borne	1 3 7		D, 3½ by 3½ feet	1,103					do				Dom.
314	Geo. Covalt	1 3 7	1899	B, 7 inches	1,104	1,079	30		Hard	do		4		Dom.
315	W. F. Somers	1 4 1		B, 3 inches	1,099	1,095	283		Soft	do				Dom.
316	W. K. Bledsoe	1 4 1		D, 4½ feet	1,103	1,086	21	SG	Hard	do	25	3		Dom.
317	T. J. West	1 4 1	1900	D, 5 feet	1,093	1,090	20	SG	Soft	Centrifugal; steam	400	820	1.30	Irr.
318	S. Van Leuven	1 3 6	1883	B, 3 inches	1,104	1,105	309		do	Wind				Irr; dom.
319	Ed. Dailey	1 3 6	1890	B, 3 inches	1,102	1,091	325		do	Hand				Dom.
320	do	1 3 6	1890	B, 3 inches	1,106	1,105	320		do					Not used.
321	do	1 3 6	1885	B, 3 inches	1,103	1,093	350		do	Hand				Dom.
322	W. A. Brouse	1 3 6	1899	Dug	1,104	1,084	22	SG	do	do	25	5		Dom.
323	do	1 3 6	1884	D, 5 feet	1,104	1,084	26	SG	do	Centrifugal; steam	150	630	0.50	Irr.
324	do	1 3 6	1893	D, 5 feet	1,106	1,086	25		do	do	150	620	0.50	Irr.
325	Herman Smith	1 3 6	1899	D, 4 by 4 feet	1,109	1,084	27	SG	do	Hand	100	12		Dom.
326	J. Friedmann	1 3 6	1885	D, 6 feet	1,107	1,090	22	SG	do	Centrifugal; steam	130	485	1.00	Irr; dom.
327	J. Dunlap	1 4 1		B, 3 inches	1,102	1,102	185		Hard	Artesian			0.18	Dom.
328	H. C. Keller	1 4 1	1880	B, 2 inches	1,104	1,104	169		Soft	do			0.02	Dom.
329	A. Roberts	1 3 6	1892	B, 3 inches	1,105	1,105	231		do	do	426		0.005	Dom.
330	Warm Creek School	1 3 6	1885	B, 2 inches	1,106	1,101	150			Hand	175			Dom.
331	W. L. McKenzie	1 4 1	1875	B, 2 inches	1,105	1,105	320		Soft	Artesian			0.01	Irr; dom
		N. W.												
332	Wm. Shay	1 3 31	1890	B, 3 inches	1,103	1,103	150		do	do	300		0.06	Dom.

		S.	*W.*													
333	Wm. Clyde	1	3	6	1889	B, 2 inches	1,106	1,106	146		Soft	Artesian	150		0.03	Irr; dom.
334	Riverside Water Co.	1	4	1	1898	B, 10 inches	1,086		648	CGS	Hard	do				Irr.
335	do	1	4	1	1898	B, 10 inches	1,088		590	SGC	do	do	1,100		1.20	Irr.
336	do	1	4	1	1898	Bored	1,085		384	SCG	do	do				Irr.
337	do	1	4	1		Bored	1,084	1,084	440		do	do				Irr.
338	Redlands Dom. W. Co	1	3	35	1899	B, 10 inches (2)	1,640	1,550	243 400	CSG	do	Centrifugal; electric	650		0.80	Dom.
		N.	*W.*													
339	Thomas Shay	1	3	31	1888	B, 7 inches	1,103	1,089	20	SGC	Soft	Hand	30	5		Dom.
340	do	1	3	31	1895	D, 4 by 4 feet B, 8 inches	1,098		80		Hard	Cylinder pump; gas.	300	1,680	0.50	Irr.
		S.	*W.*													
341	R. T. Clyde	1	3	6	1880	B, 2 inches	1,105	1,105	133		Soft	Artesian	100			Dom; irr.
342	F. L. Talmadge	1	3	6	1880	B, 2 inches	1,106	1,106	135		do	Hand	100	5		Dom.
343	Talmadge & Haws	1	3	6	1897	B, 10 inches	1,140	1,132	425	SCBG	do	Centrifugal; gas	850	986	2.00	Irr.
344	Mrs. Haws	1	3	6	1898	B, 2 inches	1,125	1,125	100		do	Hand	75	3		Dom.
		N.	*W.*													
345	John D. Clark	1	3	31	1899	B, 3 inches	1,130	1,130	125	LCSG	Hard	Artesian	120		0.02	Dom; irr.
346	do	1	3	31	1892	B, 3 inches	1,132	1,132	50	CG	do	do	45			Dom; irr.
347	D. R. Seely	1	3	33	1890	B, 3 inches	1,250	1,176	124		Soft	Wind			0.005	Dom.
348	do	1	3	33	1899	B, 12 inches	1,285	1,110	195			Cylinder pump; gas.				Irr.
		S.	*W.*													
349	W. D. Stevens	1	3	5	1894	D, 8 feet B, 10 inches	1,180	1,130	40 60		Hard	Centrifugal; gas		815	0.60	Irr; dom.
350	Jane C. Goodman	1	3	6	1894	B, 3 inches	1,140	1,128	284		do	Wind	625	108	0.001	Irr; dom.
351	Jas. Roddick	1	3	5	1898	D, 4 inches	1,143	1,114	30		do	Centrifugal; gas		250	0.20	Irr; dom.
352	Saml. Roddick	1	3	6	1899	Dr, 1½ inches	1,139	1,117	27		do	Hand	7	10		Dom.
353	W. F. Talmadge	1	3	6	1885	B, 7 inches	1,148	1,132	30		do	Wind		80	0.001	Dom; irr.
354	do	1	3	6	1891	B, 3 inches	1,146	1,131	41		do	Hand		6		Dom.
355	A. Downey	1	3	6	1899	Dr, 1¼ inches	1,143	1,131	21		Soft	do	4	3		Dom.
356	F. A. Haws	1	3	6	1899	Dr, 1½ inches	1,130	1,120	26		Hard	do	5	5		Dom.
357	E. S. Haws	1	3	6	1899	Dr, 1½ inches	1,130	1,120	20		do	do	5	5		Dom.
358	Mrs. M. C. Haws	1	3	6	1895	B, 3 inches	1,125	1,125	125		Soft	Artesian	250			Dom.
		N.	*W.*													
359	Walter Shay	1	3	31		B, 7 inches	1,110				Hard	Hand				Dom.
360	Kohl Bros	1	3	32	1890	B, 6 inches	1,147	1,129	60		do	Wind			0.001	Dom.
361	H. D. Rabel	1	3	31	1896	B, 2 inches	1,140	1,140	68		Soft	Artesian	40			Dom.
362	do	1	3	31	1898	B, 3 inches	1,142	1,142	86		do	do	70		0.01	Dom.
363	do	1	3	31	1898	B, 3 inches	1,139	1,139	44		do	do	30		0.25	Dom.
364	do	1	3	31		B, 3 inches	1,137	1,137	72		do	do	70		0.005	Dom.
365	Geo. Miller	1	3	32	1898	B, 6¾ inches	1,130	1,043	92		do	Wind	700	100		Dom.
366	D. J. Carpenter	1	4	24	1900	D, 6 by 9 feet	1,470	1,447	25	CS	Alk					
367	D. J. Carpenter & Co.	1	4	24		B, 7 inches	1,475	1,475	71	SG	do				0.06	Irr.
368	do	1	4	24		B, 7 inches	1,474	1,474	123	SG	do				0.10	Irr.
369	do	1	4	24		B, 7 inches	1,474	1,474	193	SG	do				0.08	Irr.
370	do	1	4	24		B, 7 inches	1,476	1,476	184	SG	do	Centrifugal; gas		1,100	0.14	Irr.
371	do	1	4	24		B, 7 inches	1,473	1,473		SG	do				0.10	Irr.
372	do	1	4	24		B, 7 inches	1,473	1,473	127	SG	do				0.10	Irr.
373	do	1	4	24		B, 7 inches	1,473	1,473	167	SG	do				0.06	Irr.
374	W. J. Linville	1	3	30	1899	B, 10 inches	1,270	1,140	368		Hard	Cylinder pump; gas.		3,000	0.36	Irr.

[a] Not completed.

[b] December, 1898.

Wells in Redlands quadrangle—Continued.

No. of well.	Owner.	Location (T. R. S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
375	Mrs. R. L. Burcham	1 3 31	1899	B, 12 inches	1,224	1,154	460		Soft	Cylinder pump; gas.	$1,200	$2,250	0.70	Irr.
376	E. K. Henderson	1 3 30	1899	B, 3 inches	1,233	1,133	134		do	Wind	150			Dom.
377	Jas. McCafferty	1 3 31	1896	B, 7 inches	1,225		80–100		do	Cylinder pump; gas.		2,500	0.40	Irr; dom.
378	J. D. Clark	1 3 31	1897	B, 11 inches	1,170		106	LCB	do	do			0.40	Irr.
379	P. W. Gray	1 3 31	1893	B, 7 inches	1,170	1,120	139		Hard	Wind			0.03	Dom; irr.
380		1 3 30	1900	B, 7 inches	1,310		320	SCGB						
381	John Lin Foster	1 3 32	1894	B, 10 inches	1,220		95		Soft	Wind	} 600	(a)	{ 0.003	Dom; irr.
382	P. H. Gleason	1 3 32	1900	D, 4 by 4 feet	1,250	1,175	78		do	do			{ 0.002	Dom; irr.
383	E. L. Cumbl	1 3 32	1897	D, 4 by 4 feet	1,128	1,091	38	CSB	Hard	Hand	50			Dom.
384	A. C. Pierce	1 3 32	1898	D, 4 by 4 feet	1,210	1,150	62	LSGB	Soft	Wind	120	140	0.005	Dom; irr.
385	Kohl Bros	1 3 32	1898	B, 10 inches	1,148	1,136	300	SGB	do	Centrifugal; gas	600	700	1.60	Dom; irr.
386	State of California Hospital for Insane.	*S. W.* 1 3 5		B, 10 inches	1,110	1,078	85		Hard	Centrifugal; steam			1.60	Irr.
387	Geo. Fowler	*N. W.* 1 3 32	1888	D, 3 by 3 feet	1,165	1,137	29	CG	Soft	Hand				Dom.
388	C. D. Fowler	*S. W.* 1 3 5	1895	D, 4 feet	1,168	1,135	34	CSGB	Hard	do				Dom.
389	J. Bagwell	*N. W.* 1 3 32	1900	{D, 4 by 4 feet {B, 12 inches	1,230	1,117	153		do	Cylinder pump; gas.			0.20	Irr.
390	A. A. Boyd	1 3 32	1895	{Dug {B, 7 inches	1,290	1,138	202		do	do			0.22	Irr; dom.
391	Gage Canal Co	1 4 13	1891	B, 10 inches	1,058	1,058	168		do	Artesian			[b] 4.306	Irr.
392	do	1 4 13	1891	B, 10 inches	1,059	1,059	166		do	do			[b] 1.521	Irr.
393	do	1 4 13	1891	B, 10 inches	1,061	1,061	152		do	do			[b] 1.521	Irr.
394	do	1 4 13	1891	B, 10 inches	1,063	1,063	123		do	do			[b] 1.712	Irr.
395	do	1 4 13	1891	B, 10 inches	1,066	1,066	125		do	do			[b] 0.594	Irr.
396	do	1 3 18	1887	B, 10 inches	1,062	1,062	144		do	do			[b] 2.131	Irr.
397	do	1 3 18	1887	B, 10½ inches	1,064	1,064	140		do	do			[b] 1.011	Irr.
398	do	1 3 18	1888	B, 10 inches	1,075	1,075	138		do	do			[b] 0.605	Irr.
399	do	1 3 18	1888	B, 10 inches	1,075	1,075	106		do	do			[b] 0.188	Irr.
400	do	1 3 18	1888	B, 10 inches	1,074	1,074	130		do	do			[b] 0.563	Irr.
401	do	1 3 18	1888	B, 10 inches	1,071	1,071	146		do	do			[b] 2.212	Irr.
402	do	1 3 18	1888	B, 10 inches	1,065	1,065	116		do	do			[b] 3.176	Irr.
403	do	1 3 18	1888	B, 10 inches	1,064	1,064	134		do	do			[b] 1.424	Irr.
404	do	1 3 18	1888	B, 10 inches	1,061	1,061	116		do	do			[b] 0.594	Irr.
405	do	1 4 13	1887	B, 10 inches	1,057	1,057	147		do	do			[b] 2.254	Irr.
406	do	1 4 13	1887	B, 10 inches	1,058	1,058	122		do	do			[b] 1.026	Irr.
407	do	1 4 13	1892	B, 10 inches	1,059	1,059	115		do	do			[b] 0.484	Irr.

408	....do	1 4 13	1892	B, 10½ inches	1,053	1,053	169		..do	....do			[c]8.105	Irr.
409	....do	1 3 18	1886	B, 7 inches	1,077		127		..do	([d])			[c]0.286	Irr.
410	....do	1 3 18	1886	B, 7 inches	1,076		127		..do	([d])			[c]0.302	Irr.
411	....do	1 3 18	1886	B, 7 inches	1,077		125		..do	([d])			[c]0.270	Irr.
412	....do	1 3 18	1886	B, 7 inches	1,077		125		..do	([d])			[c]0.416	Irr.

[a] Included in cost of well.
[b] Flow of wells Nos. 391 to 412 is given for October, 1892.
[c] December, 1898.
[d] Wells 409 to 412 are pumped by 15-horsepower gas engine and centrifugal pump, raising 2 second-feet of water. These were artesian wells when sunk.

Wells in San Bernardino quadrangle.

No. of well.	Owner of well.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
1	Riverside Water Co.	1 4 27	1887	11-inch pipe	1,014	1,014	115		Hard	Artesian			[a]0.329	Dom.
2	....do	1 4 27		11-inch pipe	1,015	1,015	118		..do	....do			[b]0.284	Dom.
3	....do	1 4 27		11-inch pipe	1,015	1,015	113		..do	....do			[b]0.117	Dom.
4	....do	1 4 27		11-inch pipe	1,016	1,016	111		..do	....do			[b]0.153	Dom.
5	....do	1 4 27		11-inch pipe	1,014	1,014	112		..do	....do			[b]0.117	Dom.
6	....do	1 4 27		11-inch pipe	1,016	1,016	120		..do	....do			[b]0.150	Dom.
7	....do	1 4 27	1888	7-inch pipe	1,013	1,013	128	BCS	..do	....do	$400		[b]0.150	Dom.
8	....do	1 4 27	1888	9-inch pipe	1,016	1,016	125	BCS	..do	....do	525		[b]0.096	Dom.
9	....do	1 4 27	1888	9.5-inch pipe	1,018	1,018	123	BCS	..do	....do	500			Dom.
10	....do	1 4 27	1888	9-inch pipe	1,017	1,017	127	BCS	..do	....do	550			Dom.
11	....do	1 4 27	1888	9-inch pipe	1,021	1,021	201	BCS	..do	....do	800		[b]0.125	Dom.
12	....do	1 4 27		9-inch pipe	1,020	1,020	141	BCSG	..do	....do	650			Dom.
13	....do	1 4 27	1889	9-inch pipe	1,015	1,015	127	CSGB	..do	....do	525			Dom.
14	....do	1 4 27	1889	9-inch pipe	1,014	1,014	125	CSGB	..do	....do	550		[b]0.068	Dom.
15	....do	1 4 22	1889	11-inch pipe	964	964	86	CSGB	..do	....do	480		[c]0.442	Irr.
16	....do	1 4 22	1889	9-inch pipe	981	981	123	CSBG	..do	....do			[c]0.083	Irr.
17	....do	1 4 22	1889	9-inch pipe	955	955	81	SCB	..do	....do			[c]0.900	Irr.
18	....do	1 4 22	1889	9-inch pipe	955	955	92	SGCB	..do	....do			[c]0.361	Irr.
19	....do	1 4 16	1889	9-inch pipe	972	972	225	SCGB	..do	....do			[b]0.158	Irr.
20	....do	1 4 16	1889	7-inch pipe	978	978	75	CSB	([d])	([d])			([d])	
21	....do	1 4 16	1891	7-inch pipe	971	971	175	SCB	([d])	([d])			([d])	
22	....do	1 4 16	1889	9-inch pipe	973	973	55	CSB	Hard	Artesian			0.173	Irr.
23	....do	1 4 16	1889	9-inch pipe	974	974	121	SBCS	..do	....do			0.355	Irr.
24	....do	1 4 22	1889	7-inch pipe	989	989	192	CSGB	..do	....do			[c]0.175	Irr.
25	....do	1 4 22	1889	9-inch pipe	968	968	81	SCGB	..do	....do			[c]0.207	Irr.
26	....do	1 4 22	1889	9-inch pipe	967	967	83	SCB	..do	....do			[c]0.361	Irr.
27	....do	1 4 22	1889	9-inch pipe	981	981	103	SCGB	..do	....do			[c]0.952	Irr.

[a] 1890. [b] 1891. [c] 1896. [d] Well filled and covered with sand from flood and lost.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T.R.S.).			Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S.	*W.*				*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
28	Riverside Water Co	1	4	22	1889	9-inch pipe	970	970	83	SCB	Hard.	Artesian			[a]0.273	Irr.
29	do	1	4	22	1889	9-inch pipe	979	979	101	SCGB	do	do			[a]0.640	Irr.
30	do	1	4	22	1890	9-inch pipe	978	978	97	SCGB	do	do			[a]1.417	Irr.
31	do	1	4	22	1890	9-inch pipe	980	980	165	SCGB	do	do			[a]0.569	Irr.
32	do	1	4	22	1890	9-inch pipe	979	979	165	SCBG	do	do			[a]0.616	Irr.
33	do	1	4	27	1891	9.5-inch pipe	1,012	1,012	330	SGCR	do	do			[b]3.28	Dom.
34	do	1	4	27	1891	9.5-inch pipe	1,012	1,012	326	CSGR	do	do				Dom.
35	do	1	4	22		9.5-inch pipe	977	977	82	CSGB	do	do	$255		[c]0.860	Irr.
37	do	1	4	27		9.5-inch pipe	1,012	1,012	249	CSGR	do	do				Dom.
38	do	1	4	1	1892	7-inch pipe	1,083	1,083	187	SGC	do	do	662		[d]0.027	Irr.
39	do	1	4	1	1893	9.5-inch pipe	1,083	1,083	396	SBCRG	do	do			[d]0.714	Irr.
42	do	1	4	27	1893	9.5-inch pipe	1,011	1,011	344	CSB	do	do				Dom.
43	do	1	4	1	1894	9.5-inch pipe	1,086	1,086	420	SGC	do	do	630		[e]1.452	Irr.
44	do	1	4	22	1896	9-inch pipe	979	979	133		do	do	250		[a]0.971	Irr.
45	do	1	4	22	1896	9-inch pipe	979	979	173	SB	do	do	420			Irr.
47	do	1	4	3	1898	9-inch pipe	1,025	1,025	168	SB	do	do	500			Irr.
51	do	1	4	22		8-inch pipe	954	954	78		do	do				Irr.
52	do	1	4	22		8-inch pipe	955	955	94	SCG	do	do				Irr.
53	do	1	4	22	1898	8-inch pipe	956	956	68	SCG	do	do				Irr.
54	do	1	4	22	1898	8-inch pipe	957	957	68		do	do				Irr.
55	do	1	4	22	1898	7-inch pipe	958	958	92		do	do				Irr.
56	do	1	4	22	1898	7-inch pipe	959	959	75		do	do				Irr.
57	do	1	4	22	1898	8-inch pipe	960	960	92	CS	do	do	128			Irr.
58	do	1	4	22	1898	7-inch pipe	960	960	87	CBGS	do	do	157		[f]0.456	Irr.
59	do	1	4	22	1898	8-inch pipe	961	961	85	SCB	do	do	138		[f]0.622	Irr.
60	do	1	4	22	1898	7-inch pipe	961	961	93	SCB	do	do	173		[f]0.456	Irr.
61	do	1	4	22		8-inch pipe	952	952			do	do				Irr.
62	do	1	4	15	1898	8-inch pipe	985	985	183	SCG	do	do			[f]0.34	Irr.
65	do	1	4	2	1900	10-inch pipe	1,040	1,040	540	GCS	Soft	do			2.89	Irr.
66	do	1	4	2	1900	10-inch pipe	1,035	1,035	580	GCSR	Hard.	do			2.606	Irr.
67	Wm. Roach	2	4	6	1889	7-inch pipe	904	852	130		Soft	10 wind	200	$160	0.015	Irr; dom.
68	do	2	4	6	1875	7-inch pipe	905	852	70		do	12 wind	105	130	0.006	Irr.
69	Mrs. Douglas	2	4	6	1893	7-inch pipe	895	835	112		do	Wind			0.015	Irr; dom.
70	Louise Peña	2	5	12	1888	D, 3 by 4 feet	835	815	22		Hard.	do		110	Small.	Dom.
71	P. Evans	2	5	12	1900	10-inch pipe	840	840	400			Artesian			1.000	Irr.
72	P. Baca	2	5	12	1899	D, 3 by 3 feet	852	832	22		Hard.	Hand	20		Small.	Dom.
73	W. L. Zader	1	4	29	1894	D, 3 feet dia	980	930	52		do	8 wind	40	35	do	Dom.
74	D. Jones	1	4	29	1888	D, 3 feet dia	980		70			Wind	100	200		
75	T. J. Smith	1	4	30	1890	D, 3 feet dia	974		38			do				
76	Mrs. B. R. Atkins	1	4	30	1897	D, 3 feet dia	980	938	59		Hard.	9 wind		500	Small.	Dom.

77		1	4	30		D, 3 by 3 feet	886	871	17			Hand				Dom.
78		1	4	30		D, 3 by 3 feet	875	871	6			do				Dom.
79	Thos. McGraw	1	5	35	1895	D, 4 by 4 feet	875	837	39	SCG	Soft	do	70	14	Small.	Dom.
80	Henry Carson	2	5	10	1900	D, 3 feet dia.	831	784	49	SGR	do		40			Dom.
81	Dan. Baker	2	5	10	1885	6-inch pipe	826	786	60		do	Hand		20		Dom.
82	Mrs. Burgess	1	5	34		D, 4 by 4 feet	988	[illegible]	150			Wind				Not used.
83	T. Pulley	2	5	10	(g)	B, 20 inches	881	808	89							
84	Mrs. L. M. Henry	2	5	10	1898	6-inch pipe	895	787	128		Hard	Wind				Irr; dom.
85	T. Pulley	2	5	10	1896	D, 3 feet dia	850	780	72		do	do	50	120		Irr; dom.
86	John Miller	2	5	10	1900	D, 3 feet dia	866	800	69		Soft	do	40			Dom.
87	Ed. Bridson	2	5	15	1898	7-inch pipe	840	780	100	GS	Hard	10 wind	150	150		Dom; st.
88	J. Rogerson	2	5	15		D, 4 by 4 feet	830	794	37			Hand				Dom.
89	Mrs. A. Parks	2	5	15		7-inch pipe	810	793	28		Hard	Wind				Dom; st.
90	H. C. Parks	2	5	9	1887	D, 3 feet dia	850	784	75		do	do	325	180		Dom; st.
91	Scott La Rue	2	5	9	1900	D, 3 feet dia	845	742	107	SG		do	100	285		Dom; st.
92	Emuel Spooner	2	5	8	1896	D, 4 by 4 feet	850	750	105	SG	Hard	do	115			Dom; st.
93	do	2	5	8	1900	D, 4 by 4 feet	850	750	107	SG			125			
94	W. J. Thomas	2	5	7	1900	D, 4½ by 4 feet	847	817	35	SGB	Soft		70			Dom.
95	E. Thomas	2	5	7	1899	D, 3 by 3 feet	850	814	41	SG	do	Wind	75	150		Irr.
96	do	2	5	7	1894	D, 3 by 3 feet	841	817	26		do	Hand	40			Dom.
97	Mrs. H. M. Thurber	2	6	12	1896	D, 5 feet dia	800	782	28		do	Wind				Irr; dom.
98	F. D. Lewis	2	6	13		D, 4 by 4 feet	795	775	40		do	10 wind				Dom.
99		2	6	12		D, 4 by 4 feet	789	770	31			do				Dom.
100	John Parkhurst	2	6	12	1898	D, 6 feet dia	818	807	13.5	SR	Soft	12 wind	100	135		Dom.
101	J. R. Johnston	2	5	6		Pipe line										Dom.; st.
102	I. McBride	2	6	12	1892	D, 3.5 by 3.5 feet	813	787	55	SR	Soft	8 wind	80	100	Small.	Dom.
103	Milo Gilbert	1	4	24	1900	7-inch pipe	1,004	864	220			12 wind				
104	Riverside Trust Co	1	4	24	1898	10-inch pipe	1,077	1,077	506	CSGR	Hard	Artesian			1.600	Irr.
105	do	1	4	24	1898	10-inch pipe	1,071	1,071	531	CSG	do	do			1.200	Irr.
106	do	1	4	24	1898	10-inch pipe	1,065	1,065	517	CSGR	do	do			1.400	Irr.
107	do	1	4	23	1899	10-inch pipe	1,045	1,045	675	CSGR	do	do			1.500	Irr.
108	do	1	4	24	1899	10-inch pipe	1,076	1,076	568	CSGR	do	do			2.040	Irr.
109	do	1	4	26	1899	10-inch pipe	1,019	1,019	554	CSGR	do	do			0.400	Irr.
110	do	1	4	13	1899	10-inch pipe	1,052	1,052	580		do	do				Irr.
111	do	1	4	13	1899	10-inch pipe	1,061	1,061	537	CSGR	do	do			2.600	Irr.
112	do	1	4	13	1899	10-inch pipe	1,066	1,066	577	CSGR	do	do			1.200	Irr.
113	do	1	4	13	1899	10-inch pipe	1,069	1,069	505	CSGR	do	do			1.040	Irr.
114	do	1	4	13	1900	10-inch pipe	1,079	1,079	478	CSGR	do	do			3.000	Irr.
115	Gage Canal Co	1	4	26	1891	10-inch pipe	1,033	1,033	656		do	do			0.089	Irr.
116	do	1	4	26	1891	10-inch pipe	1,034	1,034	534		do	do			0.956	Irr.
117	do	1	4	26	1891	10-inch pipe	1,034	1,034	582		do	do			0.770	Irr.
118	do	1	4	26	1891	10-inch pipe	1,034	1,034	482		do	do			1.026	Irr.
119	do	1	4	26	1891	10¼-inch pipe	1,034	1,034	320		do	do			0.064	Irr.
120	do	1	4	26	1891	10-inch pipe	1,034	1,034	784		do	do			1.089	Irr.
121	do	1	4	23	1888	10¼-inch pipe	1,036	1,036	196		do	do			0.550	Irr.
122	do	1	4	23	1888	10¼-inch pipe	1,036	1,036	190		do	do			0.979	Irr.
123	do	1	4	23	1889	10-inch pipe	1,036	1,036	142		do	do			0.188	Irr.
124	do	1	4	23	1889	10¼-inch pipe	1,036	1,036	148		do	do			0.121	Irr.

[a] 1896. [b] 1891. [c] 1892. [d] 1900. [e] 1894. [f] 1898. [g] Not finished.

NOTE.—No. 48 is No. 335 of Redlands quadrangle; no record for Nos. 36, 40, 41, and 49; Nos. 50, 63, and 64 are Nos. 334, 336, and 337, respectively, of Redlands quadrangle; No. 46 is also in Redlands quadrangle.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
125	Gage Canal Co	1 4 24	1886	7-inch pipe	1,037	1,037	141		Hard	Artesian			2.330	Irr.
126	do	1 4 13	1886	7-inch pipe	1,037	1,037	181		do	do			1.928	Irr.
127	do	1 4 13	1891	10-inch pipe	1,037	1,037	426		do	do			5.901	Irr.
128	do	1 4 13	1891	10-inch pipe	1,037	1,037	472		do	do			1.874	Irr.
129	do	1 4 13	1891	10-inch pipe	1,048	1,048	518		do	do			1.874	Irr.
130	do	1 4 13	1891	10-inch pipe	1,049	1,049	338		do	do			1.264	Irr.
131	do	1 4 13	1891	10-inch pipe	1,049	1,049	380		do	do			0.770	Irr.
132	do	1 4 13	1891	10-inch pipe	1,049	1,049	386		do	do			1.424	Irr.
133	do	1 4 13	1891	10-inch pipe	1,052	1,052	198		do	do			5.314	Irr.
134	do	1 4 13	1891	10-inch pipe	1,057	1,057	124		do	do			1.299	Irr.
135	do	1 4 13	1891	10-inch pipe	1,055	1,055	116		do	do			2.746	Irr.
136	do	1 4 13	1891	10-inch pipe	1,057	1,057	134		do	do			5.663	Irr.
155	do	1 4 13	1892	10-inch pipe	1,051	1,051	193		do	do			8.239	Irr.
156	do	1 4 13	1892	10-inch pipe	1,046	1,046	192		do	do			8.315	Irr.
157	do	1 4 13	1892	10¼-inch pipe	1,044	1,044	390		do	do			4.835	Irr.
158	do	1 4 13	1892	10-inch pipe	1,042	1,042	224		do	do			5.697	Irr.
159	do	1 4 13	1885	7-inch pipe	1,045		123		([a])	([a])			1.923	Irr.
160	do	1 4 13	1885	7-inch pipe	1,045		133		([a])	([a])			0.473	Irr.
161	do	1 4 13	1885	7-inch pipe	1,045		133		([a])	([a])			3.015	Irr.
162	do	1 4 13	1885	5-inch pipe	1,048		139		([a])	([a])			8.217	Irr.
163	do	1 4 13	1885	7-inch pipe	1,048		211		([a])	([a])			4.641	Irr.
164	do	1 4 13	1885	7-inch pipe	1,046		100		([a])	([a])			0.579	Irr.
169	do	1 4 13	1890	10-inch pipe	1,037	1,037	300			Artesian			5.901	Irr.
170	Riverside Trust Co	1 4 23	1900	10-inch pipe	1,011	1,011	582			do			6.131	Irr.
171	Bloomington Land Co.	1 5 22	1900	12-inch pipe	1,100	858	454	SGCR		do	$1,200			Not used.
172	D. Johnson	1 4 8		8-inch pipe	1,095	1,081	283		Soft		600			Not used.
173	Fox, Archibald & Lantz.	1 4 8			1,089					Centrifugal; 10 gas			0.414	Irr.
174	Jas. Lamb	1 4 8	1894	8-inch pipe	1,097	1,083	102		Soft	do	200	$1,800	0.400	Irr.
175	Jas. Barnhill	1 4 8		8-inch pipe	1,097					Centrifugal; 15 electric.			0.800	Irr.
176	City of Colton	1 4 8	1899	10-inch pipe	1,087	1,070	490		Soft	Centrifugal; electric			0.834	Irr; dom.
177	do	1 4 8	1899	8-inch pipe	1,084	1,068	90		do	do			0.200	Irr; dom.
178	G. W. Curtis	1 4 24	1895	7-inch pipe	1,088	1,063	85	SCG	Hard	8-wind	130	70	0.002	Irr; dom.
179	J. J. Curtis	1 4 24	1892	7-inch pipe	1,088	1,063	90		do	do	150	120	0.003	Irr; dom.
180	A. C. Harvey	1 4 24	1898	7-inch pipe	1,088	1,088	600	GC	do	Centrifugal; 12 gas	400	1,200	2.250	Irr.
181	W. A. Thomas	1 4 24			1,078	1,076				Artesian				
182	L. S. Dart	1 4 25	1890	7-inch pipe	1,075	1,055	80		Hard	12 wind	150		0.002	Dom.

183	Anderson estate	1	4	25		8-inch pipe 4.5-inch pipe	1,093		450 150		Soft	Centrifugal; 25 gas		2,275	0.250	Irr.
184	A. Hunt	1	4	27	1889	7-inch pipe	1,005	1,005	127		Hard	Artesian	200		0.100	Irr; dom.
185	do	1	4	27	1889	7-inch pipe	1,001	1,001	57			do	90		0.800	Irr.
186	do	1	4	27	1895	9½-inch pipe	1,004	1,004	280	SCG		do	1,100		0.400	Irr.
187	do	1	4	27	1894	7-inch pipe	1,007	1,007	200			do	500			Irr.
188	No record															
189	E. M. Cooley	1	4	27	1889	7-inch pipe	1,019	959	86		Hard	12 wind	150	100		Irr; dom.
190	H. L. Drew	1	4	21		3-inch pipe	980	980	200		do	Artesian			0.010	Dom.
191	C. C. Cooley	1	4	27	1885	7-inch pipe	993	928	85		do	12 wind	150	100		Dom.
192	P. Filance	1	4	27	1887	10-inch pipe	983	983	250		Soft	Artesian	1,000		1.200	Irr.
193	Filance estate	1	4	27	1880	3-inch pipe (3)	984	984	75 85 90		do	do			0.900	Irr; dom.
194	O. A. Byrne	1	4	21		2-inch pipe	984	980				Hand		5		Dom.
195	Harry Whaley	1	4	34	1890	7-inch pipe	1,150	1,115	100		Hard	8 wind			0.001	Dom.
196	Thomas N. Hunt	1	4	34	1890	D, 3 feet dia	1,117	1,000	123			16 wind	750	100		Dom.
197	Mr. Blair	1	4	34	1899	D, 5 by 5 feet	1,115	1,109	16			Never used				
198	Ignacio Reyes	1	4	34	1895	Dug	1,182	1,172	13		Soft		15	3		Dom.
199	Washington School	1	4	27		7-inch pipe	1,043	966	129			8 wind		90		Dom.
200	S. A. Pooles	1	4	33	1890	7-inch pipe	1,015	955	75		Hard	12 wind		500	0.005	
201	Fred Pooles	1	4	33	1884	7-inch pipe	955	907	52			8 wind				Dom.
202	Mrs. C. A. Peake	1	4	33	1880	2-inch pipe	950	936	18		Hard	Hand	10			Dom.
203	Chas. Green	1	4	33		3-inch pipe	944		3		do	Wind				Dom.
204	J. D. Warner	1	4	28	1884	1½-inch pipe	938	927	13		do	Hand	10			Dom.
205	do	1	4	28	1898	1¾-inch pipe	926	916	13		do	do	8			Dom.
206	do	1	4	28	1894	10-inch pipe	941	935	515	GCR	do		2,455			
207	Geo. Cooley, sr	1	4	27	1894	7-inch pipe	978	952	72	G		12 wind		125	0.005	Irr; dom.
208	C. A. Poole	1	4	27	1900	7-inch pipe	1,002	984	50	SG	Hard	Hand	110			Dom.
209	A. A. Warren	1	4	33	1885	2-inch pipe	936	929	25		do	12 wind	15	150	0.002	Irr; dom.
210	W. Riverside Water Co.	1	4	32			950	944	112	GR	do	30 compressor		1,275		Irr.
211	J. M. Snodgrass	1	4	28	1898	D, 10 feet dia	931	927	13	GS	do	Bucket pump; eng	50	600	0.500	Irr.
212	do	1	4	28	1898	D, 2 feet dia	923	920	7.5	GS	do	12 wind	10	50	0.003	Irr.
213	A. A. Warren	1	4	33	1897	2-inch pipe	943	936	15		do	Hand	15	5		Dom.
214	S. P. R. R. Co	1	4	21	1882	7-inch pipe	958	915	45		do	12 wind			0.005	Dom.
215	Frank Parody	1	4	28	1900	Dug	955	934	33	S	do	Hand		12		Dom.
216	Martin Gahm	1	4	21	1888	D, 3 by 3 feet	964	927	41		do	8 wind	50	75	0.005	Dom.
217	W. H. Wells	1	4	21	1893	D, 2.5 by 2.5 feet	966	928	44	SG	do	Hand	6			Dom.
218	C. G. Turner	1	4	21	1895	7-inch pipe	966		70		do	12 wind				
219	G. B. Kinyon	1	4	21	1888	D, 3 by 3 feet	948	934	25		Soft	Wind	25	500		Irr; dom.
220	J. F. Stuchberry	1	4	21	1886	D, 3.5 by 3.5 feet	952	933	22	CSG	do	8 wind	30	90	0.007	Irr; dom.
221	J. H. Vaughan	1	4	21	1886	D, 4 feet dia	955	934	27		Hard	12 wind	48	75	0.009	Irr; dom.
222	Alfred Vaughan	1	4	21	1900	D, 4 feet dia	959	928	34			do	62	155		Irr.
223	W. L. Vaughan	1	4	21	1884	D, 4 feet dia	965				Hard	do			0.009	Irr; dom.
224	H. D. Young	1	4	21	1890	D, 2 feet dia	963	931	40		Soft	Hand	40			Dom.

[a] Wells 159 to 164 are connected. From this group a 40-horsepower gasoline engine and centrifugal pump raise 2.66 second-feet of water. These wells were artesian until 1900.

NOTE.—Flow of wells Nos. 104 to 114 and 170 was measured on completion of wells. Flow of wells Nos. 115 to 136 and 155 to 164 is given for October, 1892. No other records of flow of these wells. Wells Nos. 137 to 154 and 165 to 168 are in Redlands quadrangle, as are Nos. 391 to 412. Flow of these wells is given for October, 1892.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T. R. S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
225	J. H. Dodson	1 4 21	1885	D, 4 feet dia	969	926	50		Soft	8 wind		$105	0.003	Irr; dom.
226	Henry Kaiser	1 4 21	1892	D, 4 feet dia	964	922	43		do	12 wind	$84		0.006	Irr; dom.
227	H. C. Dodson	1 4 21	1892	D, 2 feet dia	968	928	55		do	8 wind		212		Irr; dom.
228	John Benner	1 4 21	1880	D, 4 feet dia	970	916	62			12 wind			0.002	Irr; dom.
229	Tom Moran	1 4 21		D, 4 feet dia	974	921	54		Hard	Hand			Small.	Dom.
230	T. Allen	1 4 21	1880	D, 4 feet dia	978	924	68		Soft	14 wind		155	0.001	Dom.
231	S. A. Woodard	1 4 21	1882	D, 4.5 feet dia	984	928	69		Hard	12 wind			0.009	Irr; dom.
232	Los Angeles Bdg. Co.	1 4 21		D, 4 by 4 feet	1,000	Dry.	70			10 wind				
233	J. A. Coburn	1 4 16	1890	D, 4 by 4 feet	1,000	934	80		Hard	12 wind			0.005	Irr; dom.
234	Miss B. Top	1 4 16			1,038	1,038	3			8 wind	5	65	0.002	Irr; dom.
235	Byron Waters	1 4 16	1893	D, 9.5 by 9.5 feet and 5 by 5 feet.	1,019	991	28			Centrifugal; 3 electric.	300	376	0.6	Irr; dom.
235a	do	1 4 16	1889	3-inch pipe	1,019		220			Artesian	700		0.005	Irr; dom.
236	Dr. Rowl			Pipe						do				
237	do			Pipe					Sulph.	do				
238	Homer Jones	1 4 16	1895	3-inch pipe	1,023	1,010	300		do	8 wind			0.002	Irr; dom.
239	Mrs. M. G. Hammel	1 4 16			1,008	1,000	83		Hard	do		75	0.002	Irr; dom.
240	Riverside Trust Co	1 4 23		7-inch pipe	1,000				do	Hand				Dom.
241	F. S. West	1 4 23	1897	2-inch pipe	998									Irr; dom.
242	Mrs. E. A. Paine	1 4 22	1896	3-inch pipe	1,000	1,000	109	SCG	Hard	Artesian		75	0.04	Irr; dom.
243	M. B. Warren	1 4 22	1885	4-inch pipe	996	996	125		do	do			0.01	Irr; dom.
243a	do	50′ SE. from 243	1899	3-inch pipe	997	997	130	SCG		do			0.25	Irr.
244	do	1 4 22	1880	2-inch pipe	998	998	125		Hard	do			0.041	Irr; dom.
244a	do	20′ SW. from 244	1899	3-inch pipe	997	·997			do	do			0.178	Irr; dom.
245	C. E. Bishop	1 4 23	1882	3-inch pipe	1,001	1,001	94		do	do	125		0.02	Irr; dom.
245a	do	1 4 23	1888	7-inch pipe	1,004	1,004	94	SC	do	do			0.02	Irr; dom.
246	Wm. E. Everett	1 4 22	1898	3-inch pipe	1,001	1,001	96		do	do	100		0.25	Irr; dom.
247	Bob Gomer	1 4 15	1890	3-inch pipe	984				do					
248	John Welsh	1 4 23		3-inch pipe	1,007	1,007	100		Hard	Artesian			0.083	Irr; dom.
249	S. B. Parish	1 4 14	1892	10-inch pipe	1,019	1,019	540		Soft	do	2,500		0.40	Irr.
250	do	1 4 14	1885	6-inch pipe	1,017	1,015	104		Hard		300			
251	do	1 4 14	1889	2-inch pipe	1,016		100		do		150			
252	do	1 4 14	1870	1½-inch pipe	1,014	1,014	83		do	Artesian			0.004	
253	Mrs. Elizabeth Case	1 4 14	1898	3-inch pipe	1,007	1,007	91		do	do	85		0.115	Irr; dom.
254	do	1 4 14	1892	7-inch pipe	1,009	1,009	260		do	do	500		0.2	Irr.
254a	W. G. Merrilees	1 4 14	1893	7-inch pipe	1,009	1,009	211		do	do			0.14	Irr.
254b	do	1 4 14	1897	3-inch pipe	1,009	1,009	86		do	do			Small.	Irr.
255	Wm. Stewart	1 4 15	1898	8-inch pipe	1,004	1,004	315		do	do			[a] 1.14	Irr.
256	do	1 4 15	1898	9-inch pipe	1,005	1,005	85		do	do			[b] 0.2	Irr.

257	do	1	4	15		1½-inch pipe	1,004	1,004			do	do			Small.	Dom.
259	do	1	4	15		7-inch pipe	1,002				do					Irr.
260	John Sullivan	1	4	14	1874	2-inch pipe	1,021		82				100		(c)	Irr; dom.
261	do	1	4	14	1893	3-inch pipe	1,024	1,024	210		Hard	Artesian	325		0.062	
263	do	1	4	14	1884	7-inch pipe	1,025	1,023	84				80		(d)	
264	do	1	4	14	1871	2-inch pipe	1,037		90						(d)	
265		1	4	14	1892	2-inch pipe	1,022		92			Artesian			0.002	Dom.
266	Wm. Baker	1	4	14	1870	1.5-inch pipe	1,022	1,022	96		Hard	do	130		Small.	Dom.
267	do	1	4	14	1899	3-inch pipe	1,024	1,024	271	SGC	do	do	435		0.178	Dom; irr.
268	P. J. Clevenger	1	4	14		2-inch pipe	1,030					10 electric; centrifugal.			(c)	
269	do	1	4	14	1897	10-inch pipe	1,043		150						0.5	Irr.
270	Henry Warren	1	4	14	1883	2-inch pipe	1,033	1,023	106				150		(d)	Dom; irr.
271	do	1	4	14	1890	3-inch pipe	1,033	1,023	100			12 wind	100	160	(d)	Dom; irr.
272	John Sullivan	1	4	14	1898	3-inch pipe	1,024	1,024	214		Hard	Artesian	300		0.178	Irr.
273	Henry Warren	1	4	14	1880	7-inch pipe	1,036	1,026	106				200		(e)	Not used.
274	do	1	4	14	1880	7-inch pipe	1,038	1,028	220				500		(f)	Not used.
275	do	1	4	14	1893	10-inch pipe	1,039	1,039	640			Artesian	3,000		0.386	Irr.
276	Frank Feri	1	4	14		2-inch pipe	1,034					Hand			(g)	Dom.
277	G. Renwick	1	4	8		6-inch pipe	1,090	1,055	186		Soft	8 wind			Small.	Dom.
278	Orange Land and Water Co.	1	4	8		7-inch pipe	1,089	1,069	225		do	Centrifugal; 20 compressor; 3 wells in group together.			1.64	Dom; irr.
279	Callahan estate	1	4	20	1886	D, 4 by 4 feet	1,009	933	84			12 wind				
280	E. Memory	1	4	20	1886	D, 4 by 4 feet	982	927	60		Hard	do			Small.	Dom.
281	F. A. Cleveland	1	4	8	1898	2-inch pipe	1,072		90			8 wind	47	40	Small.	Dom.
282	C. H. Westmyer	1	4	8	1897	3-inch pipe	1,069	1,062	94	GSC	Soft	do	74	100	Small.	Dom; irr.
283	W. W. Brison	1	4	9	1899	2-inch pipe	1,062	1,052	99	SG	do	10 wind	100	200	Small.	Dom.
284	G. F. Woods	1	4	9	1900	8-inch pipe	1,059	1,049	140		do	do	300	350	0.008	Dom; irr.
285	do	1	4	9	1887	7-inch pipe	1,060	1,060	300						None.	
286	City of Colton	1	4	8		10-inch pipe (2) 7-inch pipe (2)	1,065		200– 640			Centrifugal; 20 electric.		2,000	2.500	Dom; irr.
287	Isaac Jameson	1	4	8	1898	8-inch pipe	1,070	1,050	90		Hard	12 wind	126	275	0.015	Dom; irr.
288	J. Collins	1	4	8	1887	3-inch pipe	1,054		75			10 wind			Small.	Irr; dom.
289	J. C. Ralphs	1	4	9	1899	10-inch pipe	1,047	1,016	202		Soft	12 wind	500	200	Small.	Irr; dom.
290	Los Angeles Bdg. Co.	1	4	9	1893	10-inch pipe	1,052		160		do	8 gas; centrifugal			0.8	Irr.
291	V. Herkelrath	1	4	15	1882	2-inch pipe	979	979			do	Artesian	70		0.072	Dom.
292	do	1	4	15	1880	2-inch pipe	980	980			do	do	175		0.119	Irr.
293	Mrs. Nowland	1	4	15	1875	2-inch pipe	980	980	160			do	275			Irr.
294	M. H. Hurd	1	4	15	1887	2-inch pipe	983				Hard	do				Dom.
295	Mrs. N. H. Ball	1	4	15	1894	7-inch pipe	996	996	253		Soft	do	500		0.262	Irr.
296	Los Angeles Bdg. Co.	1	4	9		10-inch pipe	1,051	1,049	446			do			0.4	Irr.
297	do	1	4	9		10-inch pipe	1,050	1,048	451			do			0.4	Irr.
298	Mrs. N. H. Ball	1	4	15	1886	3-inch pipe	992	992	107		Soft	do	250			Dom.
299	W. Beck	1	4	15	1892	3-inch pipe	998	998	204		do	do				Irr.
300	H. Klueter	1	4	10	1885	3-inch pipe	1,006	1,006	200		do	do	300		0.074	Dom; irr.
301	do	1	4	10	1887	3-inch pipe	1,005	1,005	206		Soft	do	328			Irr.
302	do	1	4	10	1887	3-inch pipe	1,005	1,005	132		do	do	159		0.518	Irr.
303	do	1	4	10	1897	3-inch pipe	1,003	1,003	135		do	do	125		0.006	Irr.

[a] 1899.
[b] 1898.
[c] Stopped flowing in 1895.
[d] Stopped flowing in 1898.
[e] Stopped flowing in 1889.
[f] Stopped flowing in 1890.
[g] Stopped flowing in May, 1900.

NOTE.—No record for Nos. 258 and 262.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
304	Stephen Wood	1 4 11	1894	3-inch pipe	1,010	1,010	160		Soft	Artesian			Small.	Dom.
305	W. B. Barton	1 4 14	1883	2-inch pipe	1,041		100		do	12 wind		$216	Small.	Dom.
306	Stephen Wood	1 4 11	1880	3-inch pipe	1,022		164			8 wind			Small.	Stock.
307	F. M. Keller	1 4 11	1882	3-inch pipe	1,024	1,024	267		Soft	Artesian	$500		0.02	Dom.
308	W. B. Barton	1 4 13	1892	10-inch pipe	1,045	1,033	115		do	9 gas; centrifugal			0.209	Irr.
309	A. J. Downer	1 4 13	1889	3-inch pipe	1,045		190		do	12 wind	125	50	Small.	Dom.
310	Edwin Martin	1 4 13		3-inch pipe	1,045	1,033	215		do	Hand			Small.	Dom.
311	Lucas Hoagland	1 4 13	1876	2-inch pipe	1,049	1,039	80		do	do	75		Small.	Dom.
312	do	1 4 13	1884	3-inch pipe	1,050	1,040	250		do	8 wind	250	75	Small.	Stock.
313	do	1 4 12	1884	2-inch pipe	1,047		100		do		100			Not used.
314	R. F. Garner	1 4 10	1888		1,019		200			Artesian			Small.	Dom.
315		1 4 12		10-inch pipe	1,059	1,059	682+			do			0.123	Stock.
		N. W.												
316	Geo. M. Cooley	1 4 36	1892	7-inch pipe	1,150	1,108	66		Soft	12 wind		500		Irr; dom.
317	do	1 4 36	1895	11-inch pipe	1,150	1,108	80			9 gas		1,500	0.6	Irr.
317a	do	1 4 36	1895	10-inch pipe	1,150	1,108	80			9½ cylinder pumps				Irr.
318	E. J. Stiles	1 4 35	1898	7-inch pipe	1,196	1,157	48		Soft	10 wind	40	160	Small.	Dom; st.
319	Jas. Dickson	1 4 35	1888	10-inch pipe	1,179	1,145	44		do	12 wind		135	Small.	Dom.
320	J. G. Wood	1 4 35	1884	7-inch pipe	1,124	1,090	44		do	do		200	Small.	Dom.
321	do	1 4 36	1885	11-inch pipe	1,140	1,092	64		do	Cylinder pump; 5 gas	240	600	0.125	Irr.
322	M. E. Myers	1 4 35	1890	2-inch pipe	1,111	1,089	310		Hard	12 wind				Dom; irr
		S. W.												
323	J. S. Bean	1 4 3	1889	3-inch pipe	1,108	1,108	210			Artesian	200		0.1	Irr.
324	do	1 4 3	1898	10-inch pipe	1,108	1,108	524		Hard	do	1,100		0.9	Irr.
		N. W.												
325	J. F. Johnson	1 4 34	1890	7-inch pipe	1,098	1,076	39		do	Hand				Not used.
326	Oscar Perris	1 4 26			1,177		96			Steam; power				Irr.
327	S. G. Ramsey	1 4 25	1896	10-inch pipe	1,190	1,125	90	SC		Power; 10 gas	160	1,200	0.3	Irr.
328	Saml. S. Ford	1 4 26	1898	D, 3 feet dia	1,185	No water.	58			Wind		225	None.	
329	Mescupiabe L. & W. Co.	1 4 23	1899	7-inch pipe	1,288	1,143	402		Hard	Power; 15 gas	1,200	2,000	0.5	Dom; st; irr.
330	do	1 4 26	1892	7-inch pipe	1,222	No water.	102			Wind	300	250	None.	
331	Mrs. Anne C. Severance.	1 4 26	1895	7-inch pipe	1,227	No water.	106			12 wind	300	900	None.	
332	Mrs. S. A. Smith	1 4 27	1894	7-inch pipe	1,224	1,124	140		Soft	16 wind		800	0.010	Irr; dom.
333	F. M. Johnson	1 4 34	1899	10-inch pipe	1,117	1,095	600			10 gas; cylinder pump.	1,160	800	0.230	Irr.
334	do	1 4 34	1880	12-inch pipe	1,112	1,084	40			Wind			Small.	St; dom.

335	H. H. Fitting	1	4	35	1885	7-inch pipe	1,124		44		Soft	do			Small.	St; dom
336	do	1	4	35	1888	D, 6 by 6 feet	1,135	No water.	47			4½ gas; cylinder pump.	100	500	None.	
337	do	1	4	35	1886	3-inch pipe	1,131		325				1,000		Dry.	
338	C. Hansen	1	4	35	1895	7-inch pipe	1,127	1,090	39		Soft	8 wind		200	Small.	St; dom.
339	N. Hoien	1	4	35	1895	7-inch pipe	1,127	1,090	47		do				Small.	St; dom.
340	John Anderson	1	4	34	1885	7-inch pipe	1,130		90		do	8 wind	114	100	Small.	St; dom.
341	H. N. Stones	1	4	34	1884	7-inch pipe	1,141	1,087	85		do	do		125	Small.	St; dom.
342	M. F. Swing	1	4	34	1891	7-inch pipe	1,151		93		do	12 wind		220		St; dom.
343	do	1	4	34	1894	7-inch pipe	1,152		87		do	do			Small.	Irr.
344	A. R. Togg	1	4	34	1891	7-inch pipe	1,160		100		do	do				Irr; dom.
345	F. L. Smith	1	4	34	1897	7-inch pipe	1,163		106		do	10 wind	105	135	0.002	Irr; dom.
346	John W. Anderson	1	4	34	1880	7-inch pipe	1,165	1,103	70		do	do	75	175	0.002	Irr.
347	do	1	4	34	1900	7-inch pipe	1,166	1,103	113		do	16 wind	125	225	0.004	Irr.
348	S. E. Pearson	1	4	27	1899	7-inch pipe	1,182	1,107	104		do	12 wind	135	60	Small.	Irr; dom.
349	R. Meacham	1	4	27	1900	7-inch pipe	1,183		110		do	do			Small.	Irr; dom.
350	do	1	4	27	1890	7-inch pipe	1,172	No water.	64			do			None.	
351	J. H. Taylor	1	4	27	1896	7-inch pipe	1,188	No water.	62		Soft	8 wind	50	100	None.	
352	W. G. Warner	1	4	27	1899	7-inch pipe	1,189	1,119	80			10 steam				Not used.
353	F. D. Olmstead	1	4	27	1895	7-inch pipe	1,190		101		Soft	12 wind		100	Small.	Irr; dom.
354	S. F. Kelley	1	4	28	1897	7-inch pipe	1,170	1,121	115		Hard	8 wind			Small.	Irr; dom.
355	S. F. Kelley et al	1	4	28	1900	12-inch pipe	1,185	1,127	208			20 electric; centrifugal.	1,700	1,171	0.9	Irr.
355a	do	1	4	28	1899	10-inch pipe	1,185	1,127	460							
356	H. C. Ward	1	4	28		7-inch pipe	1,177	1,118	120			12 wind			Small.	Irr.
357	S. H. Johnson	1	4	28	1885	7-inch pipe	1,182	1,122	84		Soft	10 wind		250	Small.	Dom.
358	H. Giddings	1	4	28	1898	7-inch pipe	1,205	1,148	73		do	15 wind		125		Dom.
359	W. G. Rowland	1	4	28	1893	7-inch pipe	1,224	1,156	112		Hard	Geared pump; 3 gas	125	625	0.1	Irr.
360	Fred. Heilemann	1	4	32	1889	7-inch pipe	1,227	1,147	146		do	16 wind	200	750	0.008	Irr; dom.
361	do	1	4	32	1894	7-inch pipe	1,228	1,148	129		do	18 wind			0.012	Irr; dom.
362	do	1	4	29	1890	10-inch pipe 8-inch pipe 6⅝-inch pipe	1,245	1,155	1,025				7,000		(a)	
363	B. E. Wheeler	1	4	29	1898	10-inch pipe	1,258	1,152	125		Hard	Plunger pump; 5 gas	300	800		Irr; dom.
364	F. Alvarado	1	4	32	1900	7-inch pipe	1,188	1,135	93							Not used.
		S. W.														
365	A. B. Hancock	1	4	5	1896	7-inch pipe	1,170		56		Hard	12 wind	125	100	Small.	Dom; etc.
366	do	1	4	5	1882	7-inch pipe	1,169		56		do	do				Dom; etc.
367	D. W. White	1	4	4	1871	7-inch pipe	1,109	1,089	195			Gas; centrifugal; 8 wind.	1,200	200	0.400	Irr; dom.
		N. W.														
368	W. F. Holcomb	1	4	33		7-inch pipe	1,115	1,089	37		Soft				Small.	Dom.
		S. W.														
369	Alex. Wixom	1	4	4	1899	8-inch pipe	1,117		45		Hard	12 wind	50	148	Small.	Dom.
		N. W.														
370	F. L. Holcomb	1	4	33	1885	7-inch pipe	1,128	1,100	47		do	do	100	150	Small.	Dom.
371	do	1	4	33	1885	7-inch pipe	1,133	1,103	47		do	do	100	150	Small.	St.
		S. W.														
372	J. J. Whitney	1	4	4	1884	Pipe	1,129	1,101	112		do	Wind		400	Small.	Dom; st.
373	P. B. Hockaday	1	4	4	1887	7-inch pipe	1,133		110		Soft	12 wind		500	Small.	Dom; irr.
374	J. J. Morris, sr	1	4	5	1890	8-inch pipe	1,137	1,109	53		do	10 wind		75	Small.	Dom; irr

[a] Tools left in well.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T.R.S.).	Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S. W.			*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
375	Dexter Field	1 4 5	1870	6-inch pipe	1,147	1,112	45		Hard	10 wind			Small.	Dom.
		N. W.												
376	C. A. Muscott	1 4 32	1886	8-inch pipe	1,158	1,115	78		Soft	12 wind	$100	$250		Dom; irr.
377	J. W. Roberts	1 4 27	1899	10-inch pipe	1,210	1,155	160	GC	do	Plunger pump; 5 electric.	400	900	0.24	Dom; irr.
378	T C. Parker	1 4 32	1886	Pipe	1,205		98		Hard	12 wind; 3 gas		550		Dom; irr.
379	P. Oldecker	1 4 33	1893	7-inch pipe	1,195		133		do	Geared pump; 2 gas.		400	0.10	Dom; irr.
380	A Peterson	1 4 33	1890	7-inch pipe	1,192	1,134	76	SG	Soft	12 wind	50	100	Small.	Dom; irr.
381	C. A Bruckman	1 4 32	1894	10-inch pipe	1,221	1,151	146		do	Geared pump; 16 gas.	325	775	0.36	Irr.
382	do	1 4 32	1892	7-inch pipe	1,215	1,145	84	SCG	do	12 wind	115	300		Irr.
383	do	1 4 32	1892	7-inch pipe.	1,214	1,144	85		do	Geared pump; 5 gas.	115	625	0.042	Irr.
384	do	1 4 32	1890	7-inch pipe	1,192	1,134	85		do	12 wind	115	250	Small.	Dom.
385	Wilson & Wheat	1 4 32	1890	7-inch pipe	1,188	1,128	82		do	16 wind				Dom; irr.
386	E. D. Palmer	1 4 33	1894	7-inch pipe	1,184		80		Hard	14 wind			Small.	Dom; irr.
387	C. G. Leonhardt	1 4 32	1890	7-inch pipe	1,182		85		Soft	12 wind	115	192	Small.	Dom; irr.
388	do	1 4 32	1899	8-inch pipe	1,197	1,133	90			do	125	297	0.006	Irr.
389	S. E. A. Palmer	1 4 33	1887	7-inch pipe	1,176	1,124	92		Hard	14 wind	150	350	0.003	Dom; irr.
390	Fred F. Palmer	1 4 33	1899	{D, 4 by 6 feet {7-inch pipe }	1,189	1,134	85		do	Duplex; steam	300	500	0.036	Irr.
391	W. D. Wilson	1 4 32	1893	8-inch pipe	1,203	1,138	94		do	12 wind				Irr.
392	S. H. Harmon	1 4 32	1893	10-inch pipe	1,194	1,132	133		do	Geared pump; 5 gas.	1,300	(a)	0.020	Irr.
393	S. W. Harmon	1 4 32	1882	7-inch pipe	1,181	1,128	75		do	12 wind	50	220		Dom; irr.
394	J. O. Slatter	1 4 33	1890	7-inch pipe	1,155		100		Soft	do		150	Small.	Dom.
395	C. N. Damron	1 4 33		7-inch pipe	1,120	1,093	47		Hard	8 wind			Small.	Dom.
396	Mrs. Amy McCrary	1 4 33	1899		1,138	1,112	91		Soft	Hand			Small.	Dom.
397	Thos. Webster	1 4 33	1898	7-inch pipe	1,134					12 wind				Dom.
398	N. M. Swarthout	1 4 33	1885	7-inch pipe	1,142	1,115	75		Hard	8 wind	150	100	Small.	Dom.
399	do	1 4 33	1895	10-inch pipe	1,169		80			Horse	100	35	Small.	Irr.
400	J. H. Lytle	1 4 33	1885	7-inch pipe	1,166	1,135	79		Hard	12 wind	75	50	Small.	Dom; irr.
401	H. S. Davidson	1 4 33	1880	7-inch pipe	1,158		56		Hard	do		500		Dom; irr.
402	N. Swarthout	1 4 33	1885	7-inch pipe	1,142	1,108	55		do	8 wind			Small.	Dom.
403	G. W. Evans	1 4 33	1887	6-inch pipe	1,128	1,096	75		do	do			Small.	Dom.
404	R. M. Bradley	1 4 33	1884	7-inch pipe	1,101	1,082	90			12 wind			Small.	Dom.
405	Mrs. Sarah Abel	1 4 33	1880	D, 3 feet dia.	1,109	1,088	22		Soft	Bucket			Small.	Dom.
406	R. Poppett	1 4 34	1885	7-inch pipe	1,109	1,085	45			12 wind	50	140	Small.	Dom; irr.
407	G. Johnson	1 4 34	1890	7-inch pipe	1,114	1,087	47		Hard	8 wind	60	60	Small.	Dom; irr.
408	E. G. Fish	1 4 34	1889	2-inch pipe	1,133		425		do	do	1,000		Small.	Dom; irr.
409	C. Cohn	1 4 34		7-inch pipe	1,118	1,089			Soft	10 wind			Small.	Dom.
410	O. B. Peck	1 4 34	1888	7-inch pipe	1,147		115		do	14 wind			Small.	Dom; irr.
411	K. P. Stephens	1 4 34	1883	7-inch pipe	1,164	1,114	65		do	do			0.003	Dom; irr.

412	Jno. Y. Anderson	1	4	34	1900	8-inch pipe; 12-inch pipe	1,165	1,109	150; 460				2,000			Not used.
413	Jno. Lawrence	1	4	34	1897	7-inch pipe	1,091	1,076	42		Soft	8 wind		160	Small.	Dom.
414	J. C. Wees	1	4	34	1898	7-inch pipe	1,097	1,073	46		do	do				Dom.
415	Thos. J. Rennous	1	4	34	1900	7-inch pipe	1,133	1,101	72		do	10 wind	72	150	Small.	Dom; irr.
416	H. H. Ham	1	4	34	1888	7-inch pipe	1,121	1,090	52		Hard	8 wind	75	100	Small.	Dom; irr.
417	W. M. Jenkins	1	4	34	1884	7-inch pipe	1,118	1,088	52			12 wind			Small.	Dom; irr.
418	Oscar Wees	1	4	34	1885	7-inch pipe	1,108		48		Soft	8 wind			Small.	Dom.
419	M. W. Davis	1	4	34	1898	7-inch pipe	1,100		42		do	do	40	90		Dom.
420	P. W. Heap, jr.	1	4	34	1894	7-inch pipe	1,128	1,088	58		do	12 wind	60	125	0.002	Dom; irr.
421	B. M. Wall	1	4	34	1897	3-inch pipe	1,100		137		Hard	8 wind			Small.	Dom; irr.
		S.	*W.*													
422	E. Case	1	4	3	1899	8-inch pipe	1,086	1,073	50		Soft	Hand			Small.	Dom.
423	Jno. E. Garner	1	4	2	1900	8-inch pipe	1,087	1,073	334			Centrifugal; 8 gas	750	750	0.800	Irr; etc.
		N.	*W.*													
424	do	1	4	35	1888	10-inch pipe; 7-inch pipe	1,164	1,108	420		Hard	Centrifugal; 20 electric.	1,500	3,000	1.200	Irr.
425	Colton City Water Co.	1	4	31	1900	10-inch pipe	1,202		208			Centrifugal; 25 gas			1.480	Irr; dom.
426	San Bernardino City Waterworks:	1	5	36	1895; 1900	2 11-inch pipes; 12-inch pipe	1,239	1,207	320; 550; 800		Soft	Centrifugal; 25 gas			1.400	City supply.
427	Riverside-Highland Water Co.	1	4	31	1900	10-inch pipe	1,218	1,204	320							Not used.
428	do	1	5	36	1892	10-inch pipe	1,246	1,211	650			Centrifugal; 22 gas	5,000	1,100	1.600	Irr; dom.
429	do	1	4	31	1893	2 10-inch pipes	1,250	1,201	350; 300			Centrifugal; 30 electric.	3,000	2,500	2.000	Irr; dom.
430	do	1	4	31		2 10-inch pipes	1,258	1,203	500–600			do	3,000	2,500	2.800	Irr; dom.
431	Rialto Irrig. Dist.; Citizens' Water Co.	1	5	36	1891	2 10-inch pipes	1,255	1,204	450		Hard	Centrifugal; turbine	1,500		1.300[a]	Irr; dom.
432	do	1	5	36	1894	10-inch pipe	1,260	1,207	460			Centrifugal; 20 gas	1,800	6,000	0.720	Irr; dom.
433	F. E. Watkins	1	5	36	1888	10-inch pipe	1,266	1,210	621		Soft	2 25 compressors			0.890	Irr.
434	Lytle Creek Water and Imp. Co.	1	5	36	1900	3 12-inch pipes	1,290	1,215	226	Gravel	do	Duplex steam	3,661	3,500	[b]2.200	Irr.
435	Rialto Irrig. Dist.	1	5	25	1897	10-inch pipe	1,333	1,303	520			Centrifugal; 30 electric.	1,500	2,000	1.800	Irr; dom.
436	do	1	5	25	1894	10-inch pipe	1,342	1,306	432		Hard	do	1,500	2,000	1.500	Irr; dom.
437	Anglo-American Canaigre Co.	1	5	25	1899	D, 7 by 9 feet (2).	1,337	1,307	45							Not used.
438	F. E. Watkins	1	5	25	1898	10-inch pipe	1,390	1,251	381				2,000			Not used.
439	Riverside-Highland Water Co.	1	4	31		20 wells	1,200–1,225								(c)	Irr.
		S.	*W.*													
440		1	4	4		D, 4 by 4 feet	1,089	1,083	7			Hand				Stock.
441	M. E. Brooks	1	4	5	1886	3-inch pipe	1,102		132		Hard	8 wind				Dom; st; irr.
442	do	1	4	5		3-inch pipe	1,105		140			12 wind			Small.	Irr.
443	Mrs. Mary Bemis	1	4	5	1888	Pipe	1,113		132		Hard	Hand			Small.	Dom.
444	A. W. Bemis	1	4	5	1890	8-inch pipe	1,118	1,101	48		Soft	12 wind			Small.	Dom.
445	do	1	4	5	1894	10-inch pipe	1,114	1,104	50			Centrifugal; 3 gas		250	0.014	Irr.
446	D. F. Probst	1	4	4	1886	7-inch pipe	1,085	1,070	36		Soft	10 wind			Small.	Dom.
447	Mrs. A. Tompkins	1	4	5	1882	7-inch pipe	1,115		212		do	Wind	1,000	175	Small.	Dom; irr.

[a] Included in cost of well. [b] Two wells. [c] These 20 wells have nearly all ceased flowing.

Wells in San Bernardino quadrangle—Continued.

No. of well.	Owner of well.	Location (T. R. S.).			Year completed.	Class of well.	Elevation of surface.	Elevation of water.	Depth of well.	Strata.	Quality of water.	Method of lift.	Cost of well.	Cost of machinery.	Quantity of water.	Use of water.
		S.	*W.*				*Feet.*	*Feet.*	*Feet.*						*Sec.-ft.*	
448	J. Hancock	1	4	5	1875	7-inch pipe	1,138	1,092	128		Hard	Wind			Small.	Dom; irr.
449	M. D. Reynolds	1	4	5	1900	10-inch pipe	1,136	1,106	146		Soft	Centrifugal; 25 gas	$300	$1,400	0.027	Irr.
450	do	1	4	5	1898	7-inch pipe	1,116	1,094	40		do	8 wind	60	150	Small.	Dom.
451	Mrs. M. Lord	1	4	4	1888	3-inch pipe	1,125		150		Hard	10 wind			Small.	Dom.
452	John Marshall	1	4	5	1888	7-inch pipe	1,128	1,103	42		Soft	do			Small.	Dom.
453	I. W. Hazlett	1	4	4	1900	7-inch pipe	1,101	1,082	142		Hard	12 wind	233		0.002	Dom.
454	Mrs. Alice Wixom	1	4	4		7-inch pipe	1,067	1,055	22		Soft	do			Small.	Dom.
455	Mrs. Irving	1	4	4		7-inch pipe	1,099	1,078	100			8 wind			Small.	Dom.
456	J. B. Kitring and R. H. Hacker.	1	4	4	1895	2-inch pipe	1,085	1,070 in 1899.	152		Hard	do		260	Small.	Dom.
457	J. F. Cadd	1	4	4	1888	7-inch pipe	1,068	1,057	40		do	Hand	40		Small.	Dom.
458	H. E. Gardner	1	4	5		3-inch pipe	1,089	1,075			Soft	8 wind			Small.	Dom.
459	Mrs. Marilla Smith	1	4	5	1889	2-inch pipe	1,094	1,079	122		do	Wind	122	150	Small.	Dom.
460	San Bernardino County Hospital.	1	4	8	1898 1899	3-inch pipe 7-inch pipe 10-inch pipe	1,089	1,071	125 125 330		do	Centrifugal; 6 gas			0.300	Irr.
461		1	4	8		2 wells	1,057					Electric				Irr.
462	Riverside Trust Co	1	4	26		9 wells	1,019	1,019				Artesian				Irr.
463	Riverside Water Co	1	4	2			1,036	1,036				do			1.976	Irr.
464	do	1	4	2			1,037	1,037				do			1.930	Irr.
465	do	1	4	2	1900	10-inch pipe	1,040	1,040	544			do			2.896	Irr.
466	do	1	4	2	1900	10-inch pipe	1,041	1,041	582	CSG		do			3.096	Irr.
467	E. D. Meissner	1	4	26	1899	10-inch pipe 8-inch pipe	1,200	1,120	500	GC		Plunger pump; 20 gas	2,600	1,350	0.200	Irr.
468	G. G. Lathrop	1	4	26	1897	7-inch pipe	1,063	1,017	70	GC	Hard	10 wind	105	130	0.003	Dom; irr.
469	R. L. Dewitt	1	4	26	1897	Dug	1,047	1,028	26	LC	do	Hand				Dom.
470	Charles Morris	1	4	26	1892	D, 12 by 12 feet, 10-inch pipe.	1,078	1,063	80	SGC	do	12 wind	400	140	0.007	Irr.
471	do	1	4	26	1899	10-inch pipe 8-inch pipe 7-inch pipe	1,077		640	SGC	do	Artesian	1,500		0.005	
472	No record															
473	F. S. Waters	1	4	23	1877	2-inch pipe	1,054	1,044	196		Hard	8 wind	200	145	0.002	Dom; irr.
474	J. H. Hatherley	1	4	23	1888	3-inch pipe	1,555		450			Artesian	1,700		0.140	Irr.
475	J. H. Kelly	1	4	23	1890	8-inch pipe	1,089		382		Hard	do	2,000		0.400	Dom; irr.
476	do	1	4	23	1891	7-inch pipe	1,074	1,066	500		do	Hand		5		Dom.
477	Mr. Myers	1	4	25	1890	7-inch pipe	1,060		400		do				(a)	
478	W. E. Pedley	1	4	2	1899	10-inch pipe	1,042		510	GR	Soft	Artesian	1,284		2.700	Irr.

[a] Stopped flowing in 1899.

MANUFACTURE OF PORTLAND CEMENT IN SOUTHERN CALIFORNIA.

An important element in the development of an irrigation community is the cost and use of hydraulic cement. Prior to 1893 all of the cement used in southern California came from Europe. This meant a serious financial drain on this section, and the building of a cement-manufacturing plant near Colton which reduced the cost of Portland cement 25 per cent and also kept the remaining 75 per cent at home was therefore an important event in irrigation development as well as building.

The plant of the California Portland Cement Company is three-fourths of a mile from the town of Colton. The company manufactures Portland cement, lime, marble dust, and crushed rock. It employs 70 men, and the capacity of the plant is 300 barrels of cement or 500 barrels of lime daily and an unlimited output of crushed rock. This Portland cement has been extensively used in the various irrigation and hydraulic-power systems of southern California, and has been pronounced by engineers to be equal to imported cement, while it is sold at a much lower price than the foreign article. C. W. Smith, of Pasadena, is now the president of the company and E. Duryee is the chemist.

Probably few, even in the engineering profession, would be inclined to credit the statement, which nevertheless can be corroborated by United States Government reports, that 75 per cent of the Portland cement consumed in the United States during 1900 was manufactured in this country. The only Portland-cement plant on the Pacific coast, however, is the one at Colton, where rotary kilns are in operation. At the outset the Colton company employed an expert to investigate the cement works in the East, of which there are many, and they adopted, as the result of his investigations, what they believe to be the best process. The plant is continuous and largely automatic in operation, machinery being employed to such an extent that 3 barrels of cement per day are obtained for each man employed, as contrasted with 1 barrel per day per man, the ordinary output in European works. The process is protected by letters patent and is American in every respect. The works are very favorably located, being in the center of the semitropical fruit belt of southern California and contiguous to most of the extensive irrigation and hydraulic-power plants of that section, thus insuring an increasing market for the product in the future. In the rear of the mill towers Slover Mountain, with its inexhaustible deposit of pure calcspar and two clay deposits at short distances, which provide abundant crude materials. The company is fortunate in having available limestone almost chemically pure and a clay peculiarly adapted to the manufacture of the cement, while the Los Angeles petroleum provides a cheap and excellent fuel. These advantages enable the company to manufacture its product at a minimum cost and to place it on the market for about three-fourths the price of foreign cements. The mixing, grinding, and burning of the crude materials is carried on under the constant direction and analysis of a chemist whose laboratory is at the works. The crude materials are first crushed and mixed by weight, then ground to an impalpably fine powder, then fed continuously at the rate of 3 tons hourly into a rotary kiln 75 feet long, in which they remain one and three-fourths hours. The low heat of the upper end of the kiln drives off the moisture from the raw mixture; the low red heat of the middle part decarbonizes the limestone; and the high heat of the lower end causes the caustic lime alumina and silica to unite and form Portland cement clinker—little nodules the size of beans and walnuts. After leaving the kiln the clinker is cooled and ground into the finished product. The materials enter the kiln as a mechanical mixture of limestone and clay and come from it a chemical compound of definite formulæ.

The character of the Colton cement is the same as that of all Portland cements. Analyzed it approximates some of the leading foreign brands, while the physical tests have generally shown it to be superior to the foreign brands in the local market both in the fineness of the powder and in its tensile strength.

Analyses of Portland cements.

Constituent.	Colton, American (E. Duryee, analyst).	White Bros., English (E. Duryee, analyst).	Alsens, German (W. MacClay, analyst).
	Per cent.	*Per cent.*	*Per cent.*
Silica (SiO_2)	22.060	23.567	24.90
Alumina (Al_2O_3)	9.310	10.020	11.22 (Alumina and ferric oxide)
Ferric oxide (Fe_2O_3)	3.090	3.080	
Magnesia (MgO)	0.900	1.067	0.38
Lime (CaO)	61.512	59.000	59.98
Sulphuric acid (SO_3)	1.200	1.400	0.86
Alkalies	1.761	2.100	0.50
Moisture and carbonic acid			2.16
Total	99.833	100.234	100.00

The following table comprises data from the report of Mr. J. W. Robinette, C. E., the cement tester, who sampled and tested 4,000 barrels of the product purchased by the San Gabriel Electric Company:

Results of tests of Colton Portland cement.

Length of time.	Number of tests.	Average tensile strength.	Fineness passed.	Average of 4,000 barrels.
		Pounds.	*Mesh.*	*Per cent.*
1 day	255	129	2,500	99.64
7 days	510	510	8,100	95.33
28 days	481	607	144,000	93.22

The extreme care taken to insure a good and uniform cement may be inferred from the fact that the raw mixture is every half hour subjected to chemical tests for the determination of the percentage of lime, which element is not permitted to vary either way more than 1 per cent from the standard. The mixture is ground so fine that only one-third of 1 per cent remains on a 50-mesh screen, 5 per cent on a 90-mesh screen, and 7 per cent on a 120-mesh screen. After it has been burned the clinker is spread in layers on a cooling and mixing floor, and the accumulated burn of several days is thoroughly mixed before it is ground. After the cement has been ground and again mixed in conveyers and elevators it is put into sacks holding 95 pounds each. A sample is taken from every tenth sack and numbered. These samples are tested, a record of the tests being kept and embodied in the reports which are mailed to the purchasers.

ACKNOWLEDGMENTS.

In the preparation of this report on the water systems of San Bernardino Valley, involving as it does numerous historical references, many authorities were consulted. The writer is particularly indebted to Mr. Kingsbury Sanborn, chief engineer of the Riverside Water Company, who rendered valuable assistance in the determination of the total output from the gravel beds above Colton and who assisted in many other ways, and to Mr. William Irving, who furnished nearly all of the data concerning the Gage canal and who assisted generally. Acknowledgments are also due to many other engineers familiar with local conditions.

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