REPORT OF C. S. ALVERSON

ON THE

EL CAJON VALLEY WATER INVESTIGATION.

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To the Special Water Committee

of the Common Council of the City of San Diego.

Gentlemen:-

In accordance with the provisions of Ordinance No. 1780 providing for the investigation of the water bearing sands and gravels in a portion of El Cajon Valley, I submit to you the following report:

The purpose of this investigation is to determine where and how the City of San Diego can acquire a reliable and permanent water supply. A proper examination calls for the following data and information:

First: The area and character of the watershed tributary to the proposed place of development.

SECOND: The area, depth, and character of the water bearing sands and gravel from which it is proposed to develop the water supply.

THIRD: A general outline of the proposed methods of development and conveyance of the water to the city of San Diego.

FOURTH: The conclusion deduced and arrived at after the above investigations have been made.

WATERSHED AND SOURCE OF SUPPLY

The source of water supplu will be the runoff and drainage from the watershed of the San Diego River. Personal knowledge, extending over a period of 18 years and data obtained in previous examinations, made it unnecessary for me to make any further investigations above the town of Lakeside.

The area of watershed above Lakeside is estimated to be about 250 square miles. The elevation of the watershed above sea-level is from 400 feet to 6000 feet. The general conformation of the surface is rough, broken and mountainous. In all probability the greater portion of this area will never be cultivated or densely populated. The maximum depth of annual rainfall is in the high maountains and gradually decreases on the lower levels.

The San Diego River has several branches. The rpincipal ones are North Fork (or Colman Creek) which heads to the north of the town of Julian; Cedar Run, which heads to the South of Julian; South Fork, which heads to the West of Cuyamaca mountains; Boulder Creek which heads in the Cuyamaca mountains; Chocolate Creek, which heads near Alpine; San Vicente Creek, which heads to t the South of Ballena Valley and joins the San Diego River near Lakeside. The San Diego River flows in a southerly and westerly direction into False Bay to the North of Old Town.

The geological formation in the main is as follows; The higher mountains are farmed of ancient crystalline chists and massive rocks; the region bordering on the coast consists of unaltered Cretatious, Tertiary and Quatanary deposits of unknown depth. Back of the mesas eruptive rock has been intruded and the frequent foldings and uplifts have formed spurs and knobs of crystalline rocks, these changes in the earth's surface in turn have formed valleys and trough-like depressions into and through which the modern river has cut its way in its flow to the ocean.

The denuding and erosion of the hills and the detritus brought down by the river during floods, have filled these depressions to a greater or less depth with silt, sand, gravel and boulders, and formed underground storage reservoirs. These reservoirs conserve the water in the rainy season and equalize the flow throughout the year.

TESTS AND INVESTIGATIONS.

The present investigation commenced on the 9th day of November 1904, and extended for a point below the McKoon Ranch House on the Fanita, to a point below the town of Lakeside, a distance of about five miles. Twelve test wells were sunk, three pumping plants tested, and other wells that have been dug on the above area were examined, the location of which is shown on the accompanying diagram. Thirty-three feet of six-inch diameter Standard casing pipe, a four inch sand pump, and other necessary appliances, were used in sinking the test wells. A record was kept of the stratas passed through, and samples of the material taken at different depths.

The following is the record of the test wells: At a point 300 feet south and 90 feet East of the N. E. Corner of the J. R. Gillin tract, and designated on the diagrams as O water was found 4½ feet below the surface.

Well No. 1 is 260 ft. south of O.

First 7½ feet of coarse sand. At this depth water is found, then for 17½ ft. a total of 25 ft. pass through coarse quartz and granite, sand full of water, same material in bottom.

Well No. 2 is 150 ft. south of Well No. 1.

First 4 ft. soil and silt, then 4 ft. of sand, water found at 6 ft. below the surface. Then 16 ft. of coarse sand and some fine gravel full of water, a total of 24 ft. the same material in bottom of well.

Well No. 3 is 250 ft. South of Well No. 2.
First 3½ ft. soil and silt, then 5 ft. of coarse sand, water found at 8½ ft. below the surface, then 20 ft, of coarse sand and fine gravel full of water, a total of 28½ feet; same material in bottom of well.

Well No. 4 is 250 ft. South of Well No. 3.
First 4 ft. soil and sand, then 4 ft. coarse sand, water found at 8 ft. below the surface, then 11½ ft. of sand and some coarse gravel, a total of 19½ ft. (Note) A cobble stone got stuck between the casing and sand pump and had to pull the casing out) Good material in bottom of well.

Well No. 5 is 250 ft. South of Well No. 4.
First 3 ft. soil and sand, then 3½ ft. of sand. Water found at 7½ ft. below the surface, then 13½ ft. of coarse sand, a total of 20 ft. At this depth the sand and water run in so fast that it was advisable to put the casing.

From Well No. 5 it is 240 ft. South to a low bench formed by the deposit of former flood waters.

From the above bench it is about 250 ft. South and 330 ft. West to J.R.Gillin's pumping plant, which will be described later.

Well No. 6 bears S 86° E about 2500 ft. distant from No. 5.
First 4½ ft. soil and silt, then 3 ft. of medium coarse sand, water found at 7½ ft. below the surface, then 11 ft. of coarse sand, then 2½ ft. of adobe and silt, then 9 ft. of coarse sand, a total of 30 ft. good material in the bottom of the well.

Well No. 7, is 250 ft. North of Well No. 6.
First 4½ ft. soil, silt, and fine sand, then 3 ft. of coarse

sand, water found at 7½ ft. below the surface, then 21½ ft. of coarse sand and some fine gravel, a total of 29 ft. and good material in bottom of well:

Well No. 8 is 250 ft. North of Well No. 7.
First 6 ft. coarse saand, water found at 6 ft. then 21ft. of coarse sand and some fine gravel, a total of 27 ft. good material in bottom of well.

Well No. 9 is 300 ft. North of Well No. 8.
First 7 ft. coarse sand, water found at 7 ft. then 23 ft. coarse sand and fine gravel, a total of 30 ft. good material in bottom of well.

Well No. 10 is 500 ft. North of Well No. 9.
First foot soil, then 5 ft. of coarse quartz and granite sand, water found at 6 ft. then 11 ft. of very coarse sand and fine gravel, a total of 17 ft; at this depth the pump would not hold the material, which was full of water and free from fine sand and silt.

Well No. 11 bears s. 79½° E about 1175 ft. distant from No. 10.
First 8 ft. in coarse sand, water found at 8 ft., then 20 ft of good water bearing sand, a total of 28 ft. bottom of well good material.

Well No. 12 bears S 20½° E. 900 ft. distant from Well No. 11.
First 9 ft. soil and sand, water found at 9 ft., then 11 ft. of coarse sand, then 5 ft. of silt and some adobe, then 5 ft. of good coarse sand, a total of 30 ft. bottom of well is in good material.

From Well No. 12 the Windmill well near H. D. Williamson's bears S. 20½° E. 1135 ft. distant.

This well is a 10 inch casing drive well. Reported to be 70 ft. in depth and to have passed through silt and sand the entire distance, and the bottom of the well is in sand. At the time I examined it the water stood at 11½ ft below the surface of the ground which is almost the same level as the water in Wells No. 11 and 12.

In 1894 the San Francisco Savings union bored 6-10 inch drive wells in the channel of the San Diego River near the Riverview station on the S.D.C & E Railway. These wells are designated on the accompanying diagram as, A1, A2, A3, A4, A5 and A6.

Wells A-1, 2-3 & 4 were about 200 feet apart and are located in a direct line between the two rocky hills that narrow the valley at this point. The course of the line is approx. N 37° W. The river channel and valley lands are about 1300 ft in width between the base of these hills. Wells A 5 and 6 are located further up stream near the southerly line of the Abbott and the Ferry tracts.

The following data in reference to these wells I obtained from Mr. South and Mr. Woods who were personally familiar with them at the time they were bored. In all six wells the stratas passed through was practically the same. The first 50 ft. sand, gravel etc. water bearing, then 30 ft. of loosely consolidated conglomerates, through which the water would slowly percolate, then 6 ft. of very coarse gravels and cobblestones, free from fine sand or silt, and water bearing; then for some distance through a finer grained material; no bed rock found. After the wells were completed a test was made at Well A-6 with an engine and centrifugal pump; the suction pipe extended down to 18 ft. below the surface.

below the surface. The result after several hours pumping with the water lowered to near the end of the suction pipe, was about 30 miners inches, or 387775 gallons per 24 hours. The floods of 1895 entirely covered up Wells A-2, 3 and 4 and partially filled Wells A-1, 5 and 6, the caps to the wells having not been properly secured.

November 22nd, 1904, I personally made the following measurements; Well A-1 water 3½ ft. below surface and 57 ft. in depth. Well A-5 water 3½ ft. below surface and 72 ft. in depth. Well A-6 water 4 ft. below surface and 68 ft. in depth.

I had previously made examination of the Winchester, Abbott, Kies and Ferry tracts which lay to the Nort, east and south of the above wells. On the Abbott land, which is a part of the Winchester tract, there is quite an area of what should be water bearing lands. On the Ferry tract there are several hundred acres of river channel and bottom lands formed by the junction of the San Vicente and the San Diego River, which has formed lagoons in which the water stands near the general surface. In one well, several hundred feet northerly from the channel of the San Diego River, the water stands at 7½ ft. below the surface; there was no opportunity to test the capacity of the well.

On the Kies tract there is quite a large area of bottom land formed by the junction of the Los Cochas Creek and the San Diego River, which should be water bearing lands.

Returning to the lower end of the area included in this investigation and just West of the Poway wagon road that runs up Sycamore Canyon, Mrs. F. M. McKoon was putting down some wells south of the channel of the San Diego River. The first well was some distance from the river and decomposed granite was struck at a few feet below the surface. A second well nearer the river bottom lands showed the following results from personal examination; First 9 feet soil, sand, gravel and some cobblestones, water found at 9 feet below surface, then 18 ft. of sand, cobblestones and water bearing material, then 8 ft. of compact blue clay a total of 35 ft. The strata of blue clay was not penetrated and is of unknown depth.

Commencing at a point opposite the old McKoon Ranch House and in the channel of the river and extending down the same for some distance are several lagoons of water several feet in depth, from the lower end of which at the present time a small stream of water is running. The largest lagoon, which is just North of the McKoon Ranch House, is reported to have been 70 feet in depth, previous to the floods of 1891 and 1895, which partially filled it.

In connection with these lagoons I will state that on the south side of the river bottom there are several knobs of granite rock that appear above the surface; but in the channel of the river and for some 3 miles north there is no rock visible, the hills to the North being composed of conglomerate or drift deposited in some former geological action and have not been intruded. The contact between this formation and the granite is plainly discernable some three miles northerly from the Santee Station.

TEST OF J. R. GILLIN'S PUMPING PLANT.

The pumping plant is located on the bench of land heretofore referred to. It is an open curbed well, some 24 ft. in depth. The top of the water at rest was 13 ft. below the surface. The motive power is a 10 H.P. West Coast Gasoline engine, and a 4-inch Sterne's centrifugal pump, engine pulley, 22-inch dia.

Pump pulley, 9-inch dia. Suction pipe, 5-inch dia. discharge pipe 4 in. dia. After two hours pumping, in which the surface of the water had been lowered 9½ ft. and at which elevation it remained, the engine revolutions were 255 per minute, the pump revolutions 618 per minute, and the calulated discharge from 60 to 75 miners inches of water, or from 775500 gallons to 969375 gallons per 24 hours.

TEST OF H. D. WILLIAMSON'S NORTH SIDE PUMPING PLANT.

This pumping plant is located at the north side of the river channel proper. It consists of four 8-inch drive wells in which are placed 6-inch Cook well points, length of perforation 8 ft. The first well is at the pump and 30 ft. in depth; the 2nd well is 20 ft. from the 1st well and 40 ft. in depth; the 3rd well is 25 ft. from the 2nd well and 40 ft. in depth; the fourth well is 50 ft. from the 3rd well and 40 ft. depth. Wells are attached directly to a 7-inch suction pipe, motice power a 20 H. P. Model Gasoline Engine and a No. 5 Sampson centrifugal pump. This plant had been pumping for several days about 10½ hours per day. At time test was made it had been running for 9 hours; estimated discharge 65 miners inches, or 840125 gallons per 24 hours.

TEST OF H. D. WILLIAMSON'S SOUTH SIDE PUMPING PLANT.

This pumping plant is located at the south side of the river channel proper. It consists of 4-8 inch drive wells, in which are placed 6-inch Cook well points, length of perforation is 8 ft. The first well is at the pump and 37 ft. in depth; the 2nd well is 25 ft. from the 1st well and 35 feet deeo; the 3rd well is 30 ft. from the 2nd well and 31 feet deep; the fourth well is 50 ft. from the 3rd well and 40 feet deep. The wells are attached direct to a 7" and 8" suction pipe; Motive power a

20 H. P. Lambert Gasoline Engine, and a No. 6 Sampson centrifugal pump. Water raised 8¼ ft. above the center of pump into a 12" by 13" flume, inside measurement. The test was made November 12th, 1904 at 4 P.M. after continuous pumping for 8 hours. Engine revolutions 180 per minute, pump revolutions 465. The flume was running nearly full, and as measured with floats, was 2.8 cubic feet per second, or 140 miners inches, or 1,809,500 gallons per 24 hours.

It will be observed that in the above examination no solid formation or bed rock has been found, and the depth of the water bearing strata is still unknown. The well at the Williamson ranch House is 70 ft. in depth and still in water bearing strata. The wells near Riverview Station where the hills narrow the valley lands to their minimum width and the solid formation should be nearest to the surface, are still at a depth of about 100 ft in the best kind of water bearing material. The test wells show that the water level taken on a line at a right angle to the low water channel of the river is the same elevation across the valley.

The land tested and examined show an area of at least 3 square miles of water bearing lands. On the basis that 24 per cent of the mass is water, then one square mile one foot in depth will contain in round numbers 50 million gallons of water, and 3 square miles one foot in depth, 150,000 gallons. Three square miles 10 ft. in depth, would be 1,500,000,000 gallons, and 20 ft in depth would be 3,000,000,000 gallons and 30 feet in depth would be 4,500,000,000 gallons of water. As this water is taken away to be replaced by the inflowing water from above and underneath. To what depth the water plane will be lowered by pumping out the water depends on the quantity pumped, the volume and pressure of the underground flow, and the seasonal rainfall on the watershed.

DEVELOPMENT AND CONVEYANCE OF THE WATER.

If the city conclude to acquire the lands above described, then in my judgment the best method to develop the water would be along the following lines. At some point near the lower end of the lands that extend across the entire river channel put in a main suction pipe several feet below the surface, and extending the full width of the high water channel, or more. On each side of this main and about twenty-five feet distant from the same and about 100 feet apart and alternating on each side, put down drive wells, to a desirable depth, equip them with six inch dia. Cook points and auxillary suction pipes connected with the main suction pipe. Install a pumping plant on the left bank of the river properly protected from the floods; connect this pumping plant with the main suction pipe and lift the water through a force main to an elevation that the water will flow by gravity through pipes into the University Heights Reservoir. At the end of the force main at the head works, build a reservoir so located and designed that it can be enlarged at some future time. If the drive wells above described will not furnish the required amount of water in the dry summer months, then extend a submerged conduit up stream the necessary distance and put in a second series of drive wells, the submerged conduit to be connected by gravity with the main suction pipe.

CONCLUSIONS.

This examination of the water bearing sands and materials in and bordering on the channel of the San Diego River in a portion of El Cajon Valley has been made at the time when the plane of saturation is lowest, and after an unbroken period of 8 years of light rainfall. Streams that usually flow the entire year have on the surface of their channels become only beds of dry sand. The high mountains have been drained of the greater part of their stored supply of water, and yet for all this the examination shows that within from 12 to 15 miles of the University Heights Reservoir there is still stored a large quantity of water that only requires the proper expenditure of a reasonable amount of capital to make it available for use to the inhabitants of the City of San Diego.

The materials in which this water is stored, and the conditions are similar to those that exist on the Santa Ana and Los Angeles Rivers. The city of Los Angeles during the summer months is using about 35 Million gallons per 24 hours; this water is developed from Ceimegas and the Los Angeles river by means of submerged conduits, shafts and tunnels. From the sands, gravels, and deposits in the Santa Ana River channel and valley lands between the towns of Redlands, San Bernardino, and Colton, private individuals and companies have developed several thousand miners inches of water from Artesian wells, bored wells, pumping plants and submerged conduits; this water irrigates thousands of acres of land and furnishes water to several towns in this section. In what is known as the San Bernardino Valley there are nearly 3000 artesian wells and about 1600 pumping plants whose combined production is estimated to be at least 400 to 500 second feet continuous flow, or from 258 million to 324 million gallons per 24 hours. It is estimated that of the 225,000 acres under irrigation in the principal valleys of Southern California at present, two-thirds are dependent upon developed underground waters, the surface streams and storage reservoirs supply the remaining one-third.

While it is true that in the eight years passed, the plane of saturation has been materially lowered and the quantity produced decreased, it is simply a case of over-development; in other words, they have attempted to develop more than the source of supply will furnish. Even the earth has its limits.

The following figures show the commercial value of water at a given price. Assume that the net profit to the City of San Diego is 4 cents per one thousand gallons; then for 2 million per 24 hours it would be $80 per day, or $29,200 per year. For 4 million gallons per 24 hours it would be $240.00 per day or $87,600 per year. por 8 million gallons per 24 hours it would be $320 per day, or $116,800 per year.

If the total amount required to purchase the land, develope the water, install the head works and furnish the conduits to deliver the water to University Heights Reservoir was $350,000, then an average consumption of 4 million gallons per day and at 4 cents per one thousand gallons would in six years eliminate the entire cost of the works.

All of which is respectfully submitted.

San Diego, Cal. Nov. 28th, 1904.

C. S. Alverson,

Civil & Hydraulic Engineer.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 35 Folder: 26

Business Records - Reports - Alverson, C.S - El Cajon Valley Water Investigation