

CITY OF SAN DIEGO, CALIFORNIA

BOARD OF WATER COMMISSIONERS

SECOND ANNUAL REPORT

FOR THE YEAR 1920.

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February 24, 1921.

Transmitted herewith is the second annual report of the Board of Water Commissioners of the City of San Diego, California. The report sets forth in general, layout of the Impounding and Carrying features, the work undertaken, accomplished and in progress during the calendar year 1920, and in addition contains a brief statement of the City's Municipal Water System, Impounding and Carrying features, in order that the works, their operation and maintenance may be more readily understood by the public.

H. N. Savage
Hydraulic Engineer.

The Board of Water Commissioners.

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FOREWORD.

The Board of Water Commissioners of the City of San Diego was created by vote of the electors of the City at a special election held on April 8, 1919, at which time the Charter of the City of San Diego was amended by the addition of Chapter I, Article 5, creating said Board. This amendment was concurred in by the Senate and the Assembly of the State of California on April 17, 1919 as evidenced by Senate Concurrent Resolution No. 22.

This Charter Amendment provides for a Board of Water Commissioners consisting of three members who are appointed by the Mayor subject to the confirmation of the Common Council. The term of office is for six years (except those first appointed classify themselves by lot to hold two, four and six year terms.) The Board of Water Commissioners is empowered to have exclusive charge and supervision of the conservation and impounding of water by the City of San Diego and of the water, water rights, water works, water impounding system and other properties of the City used in the development of the Water Impounding System.

To carry on the work of the Department there is created a Water Development Fund, which consists of not less than 25% of the gross receipts derived from the sale of water by the City of San Diego and such other moneys that may be transferred into such fund.

The first Board to be appointed under the provisions of the above mentioned Charter Amendment was formally organized June 25, 1919 and took over the control of the Impounding System on July 1, 1919.

BOARD OF WATER COMMISSIONERS
of the
CITY OF SAN DIEGO, CALIFORNIA.

1920.

Chas. E. Sumner, President (Deceased November 7, 1920.)	Term ending May, 1925.
Horace B. Day, Commissioner (Resigned December 27, 1920.)	Term ending May, 1923.
Horace Aughe, Commissioner (Deceased Nov. 28, 1920.)	Term ending May, 1921.
H. N. Savage, Hydraulic Engineer.	
Luril Palmer, Secretary.	

FOR THE YEAR 1921.

Julius Wangenheim, President	Term ending May, 1921.
Charles T. Chandler, Commissioner	Term ending May, 1923.
Frederick M. White, Commissioner	Term ending May, 1925.
H. N. Savage, Hydraulic Engineer.	
Luril Palmer, Secretary.	

General Office, City Hall, Room 18. Corner Fifth & G Streets.
Office Hours: 8:00 A.M. to 5:00 P.M. - Saturday 8:00 A.M. to 12:00 P.M.
Telephone: Main 6400.

ORGANIZATION. 1920.

The Board of Water Commissioners is the administrative head of the Water Development Department.

The City Hall office of the Commission is in charge of a Secretary who is ex-officio Chief Clerk of the Board. The general records and clerical work of the Commission are handled in the main office.

A Supervisor of Operation and Maintenance Impounding and Carrying System, is stationed at Lower Otay Dam and Filter Plant.

Reporting direct to the Commission in part and partly to the Supervisor are three foremen and several detached reservoir keepers and conduit walkers, who carry on the work of operation and maintenance. A foreman of repairs and maintenance is in charge of special jobs and also of minor new construction work. A foreman is in charge of Lower Otay Dam and Reservoir and of the filtration and chlorination plants located at Lower Otay. A foreman of pipe lines, operation and maintenance is stationed at Telegraph Canyon.

WATER SYSTEM.

The principle sources of water supply for the City of San Diego are from the upper reaches of Pine Creek and of the Cottonwood River, both heading in the Laguna Mountains, and Otay River, draining the west slope of Lyons Peak, the south slope of San Miguel Mountain and the north slope of San Ysidro Mountain Range. The drainage basins are known as the Morena, the Barrett, the Upper Otay and the Lower Otay. The above four watersheds have a combined area of 350 sq. mi.

The combined drainage basins, which are all adjacent, have an easterly and westerly average length of about 35 miles and a northerly and southerly average width of about ten miles, extending from Lower Otay, which is about 20 miles southeast of the City of San Diego, in a general northeasterly direction back to the summit of the Coast Range. The carrying system consists of 17½ miles of conduit, made up of canal with sides concrete lined, tunnels unlined, flumes of metal and wood, 10-3/4 miles of open creek channel and about 35 miles of wood-stave and steel pipe lines.

MORENA WATERSHED.

The Morena watershed of the system is the most easterly, and comprises an area of 119 sq. mi. consisting of a rugged, brush covered, mountainous country, ranging in elevation from 3000 ft. above sea level at the Morean Dam up to over 6000 ft. at the crest of the Laguna Mountains and is drained by the Cottonwood River. The Reservoir is located at a point on this watershed near what is known as Morena Butte Mountain, and is formed by the Morena, a rock embankment structure with masonry facing. The Dam has a height of 146 ft. from the original streambed to the crest of the spillway and a total height of 258 feet above lowest foundation. The

capacity of the reservoir gage height 146 ft. is 42,000 acre feet or 13 billion gallons of water. The lowest outlet of the reservoir is at reservoir gage 33.5 or elevation of 2915 ft. above sea level.

BARRETT WATERSHED.

The Barrett watershed comprises a total drainage area of 130 sq. mi. lying west and north of and adjacent to the Morena watershed, and ranges in elevation from 1500 ft. at the Barrett Damsite to over 6000 ft. at the crest of the Laguna Mountains. This area is drained by the Pine Creek and that portion of the Cottonwood River lying below the Morena Dam. At the present time there is under construction at what is known as the Barrett Damsite, a point about one mile south of where the waters of the Cottonwood River are joined by Pine Creek, a gravity, arched, concrete masonry dam. This dam when completed, will have a height of 213 ft. above lowest foundation and a capacity of 43,000 acre feet or over 14 billion gallons. On December 31, 1920 this dam was 41% completed.

LOWER OTAY WATERSHED.

The Lower Otay watershed lying southwest of the Barrett watershed, and adjacent thereto, comprises 86 sq. mi. of territory, ranging in elevation from 500 ft. at the Lower Otay Dam to 3755 ft. at the summit of Lyons Peak. This area is drained by the Dulzura and Jamul Creeks, and while characteristically mountainous, contains many open valleys. The Lower Otay Dam, which impounds the waters of this watershed, is a gravity type, arched concrete cyclopean masonry dam, with a height of 175 ft. above lowest foundation to the over-flow section. The reservoir has a capacity of 57,000 acre feet or 19 billion gallons. The elevation of the lowest outlet of this reservoir is 396 ft. above sea level.

UPPER OTAY WATERSHED.

The Upper Otay watershed comprises an area of 12 sq. mi. and is situated northerly and adjacent to the Lower Otay watershed. The Upper Otay dam, which impounds the waters of this watershed, is an arched concrete masonry dam with a height of 89½ ft. above lowest foundation, to the floor of the spillway. The reservoir has a capacity of one billion gallons of water. Upper Otay drainage area consists of rolling, foot-hill and low mountainside country, ranging in elevation from 550 ft. at the dam up to the summit of San Miguel Mountain elevation 2573 ft. The elevation of the reservoir outlet is 521 ft. above sea level. In addition to conserving the runoff from the Proctor Valley branch of the Otay drainage basin, the Upper Otay Reservoir acts as a balancing reservoir for the pipeline from Harvey Diverting Dam which is serving temporarily as the upper section of the pipeline carrying system to the City distribution system.

CONDUITS.

The open conduit feature of the water carrying system consists of what is known as the Dulzura Conduit Extension and Dulzura Conduit. The Cottonwood Division diverts water from Morena Reservoir at the Hauser Diverting Dam, located on the Cottonwood River 1½ miles below the Morena Dam, and is 6½ miles in length. Continuing 11 miles in length, it passes through the Barrett Reservoir basin to the upper reaches of the Lower Otay Drainage Basin and discharges into Dulzura Creek down which the water flows in open creek channel a distance of 9½ miles to the Harvey Diverting Dam. The present carrying capacity of the Dulzura Conduit is about 35 million gallons of water per day.

Upon the completion of the Barrett Dam, the portion of the Dulzura Conduit Extension through the reservoir basin will be abandoned. Dulzura Conduit will be retained and conduct the waters from both the Morena and Barrett watersheds and reservoirs, into the Otay drainage basin for diversion at Harvey Dam or for storage in Lower Otay Reservoir and also transmission to the City.

SUPPLY MAINS.

The main pipeline system of the City starts at the Lower Otay Reservoir from which point the water is conducted 19 miles to the University Heights distributing reservoir, within the City limits. A low level pipeline takes off from the Otay-San Diego pipe at Bonita Wye and extends 9 miles to the City Distribution System at 30th Street and Broadway. Following the flood of 1916 when the original Lower Otay Dam was destroyed, an emergency pipe line was extended from the Harvey Diverting Dam on Dulzura Creek, a distance of about 8 miles, to and around the Lower Otay Reservoir to a connection with the Otay-San Diego Pipeline. This emergency pipeline was also connected by means of a Tee pipeline with Upper Otay Reservoir, thereby enabling excess water drawn from the Morena watershed, and conducted by Dulzura Conduit and diverted from the Pine Creek, to be run into this reservoir for temporary storage and emergency draft. The present supply mains are made up of the following sizes and lengths of pipe:

15,698 ft.	or about 2.5 miles	of 40" wood-stave pipe
65,185 "	" "	12.0 " " 36" " "
2,843 "	" "	.5 " " 34" " "
30,990 "	" "	5.9 " " 30" " "
18,222 "	" "	3.4 " " 24" " "
5,593 "	" "	.7 " " 32" " "
42,240 "	" "	8.0 " " 28" " "
10,400 "	" "	2.0 " " 24" " "

185,171 ft. or a total of about 35 miles of supply mains.

FILTER PLANT.

All water obtained from the above described drainage basins is passed through the Lower Otay Filtration Plant. This plant consists of a battery of twenty rapid sand filters, each 8 feet in diameter by 20 feet long, with a normal capacity of 10 million gallons per day. After filtration, the water is chlorinated, the average rate of chlorination being $2\frac{1}{2}$ lbs. of liquid chlorine per million gallons of water.

CHOLLAS HEIGHTS RESERVOIR.

The Chollas Heights Reservoir is located along the Otay-San Diego Pipeline at a distance of about four miles from the City limits. This reservoir has a capacity of 90 million gallons and is used as a balancing and emergency storage reservoir.

MISSION VALLEY PUMPING PLANT.

The Mission Valley Pumping Plant, situated in the San Diego River Valley directly north of the City of San Diego, furnishes an auxiliary and emergency supply of water. This plant takes supply from a system of deep wells located along the river channel, it has a capacity upwards of four million gallons per day and is operated during the flood runoff season when water is flowing in the river, and also in emergencies.

ADDITIONAL SOURCES OF SUPPLY.

The Cuyamaca Water Company reports it is in position to supply the City of San Diego on demand from its Murray Reservoir and El Monte Pumping Plant, with a maximum of 7 million gallons of water per day during limited periods. The main pipes of this Company connect with the City mains leading into the University Heights Reservoir.

The San Dieguito Mutual Water Company is under contract to furnish a maximum of 3 million gallons of water per day from the Lake Hodges Reservoir. This contract covers a period of ten years from and after the date at which delivery of water begins, and calls for the purchase of a minimum of one million gallons daily during the first six months of 1921 and a minimum of two million gallons daily thereafter. The maximum daily demand optional to the City under the terms of the contract is three million gallons.

This water enters the City via La Jolla, continuing through the City distribution pipes to supply the lower elevations of the City. Contract for the construction of necessary pipeline connecting the Lake Hodges system with the City mains, was executed Jan. 29, 1920. Completion of this line is expected in February, 1921.

A distributing reservoir "Torrey Pines" with a capacity of 3½ million gallons of water was constructed on the City Pueblo Lands at an elevation of 420 ft. for the purpose of receiving and storing the water from Lake Hodges. Water is delivered by the Lake Hodges distribution system to the North City limits at an elevation of 150 ft. and from there lifted by the City by means of a booster pump into this distributing "Torrey Pines" reservoir.

MORENA DAM AND RESERVOIR.

Morena Reservoir served as the main water supply during the year 1920, supplemented by water diverted from the Pine Creek through Dulzura Conduit and also supplemented by water pumped from the Mission Valley. Routine operation and maintenance of Morena Dam and Reservoir was carried on by the keeper and assistants.

BARRETT DIVERSION SYSTEM.

Routine, operation and maintenance of the Hauser Diverting Dam and Dulzura Conduit Extension and Pine Creek Diverting Dam

and connecting conduit and Dulzura Conduit, were carried on during the year under direction of the Supervisor assisted by Conduit Walkers stationed at Hauser, Barrett and Dulzura Summit, supplemented by an Extra Gang, when required.

During the months of February, March and April, 1920, over two billion gallons of water were picked up and diverted at the Pine Creek and Hauser Diverting Dams into the Dulzura Conduit, and transported to Lower Otay Reservoir and stored. This was accomplished without any serious break occurring on the conduit. The value of the water thus saved, conducted and stored in Lower Otay Reservoir at 10¢ per 1000 gallons, was over \$200,000.00.

A small temporary diversion flume, 1150 feet long, was constructed in the Cottonwood River just above the Conduit Settling Basin and picked up surface water from the river at this point and diverted it into the Dulzura Conduit.

Water amounting to many million gallons, encountered in excavating for the foundation of Barrett Dam, was lifted and discharged into the Dulzura Conduit.

Construction work on the Barrett Dam was prosecuted under the direction of the Hydraulic Engineer and during the year very satisfactory progress was made on this great impounding and storage feature of the City Water System. On Dec. 31, 1920 total excavation accomplished, amounted to 45,748 cubic yards or about 77½ percent of the entire excavation estimated to be removed; 26,631 cubic yards of masonry had been placed in the dam, or about

20½ percent of the entire masonry estimated to be contained in the completed dam. The elevation of the highest masonry in the right or the west section of the dam, stood at reservoir gage 72 which was 14 feet above the floor of the Dulzura Conduit Outlet Tunnel of the reservoir and 106 feet higher than the lowest excavation made for the foundation of the dam. The masonry on the left or east section of the dam stood at reservoir gage 42. Endeavor is being made to advance the construction of the dam at a sufficient rate to provide storage capacity sufficient to impound the average runoff of the watershed during the rainy season of 1920-21.

A force of 268 men, including administrative, technical, clerical, and construction forces, were engaged on this project on Dec. 31, 1920. Ample housing and boarding accommodations are furnished by the City of San Diego on the job, including houses for 26 resident families, the employees being charged for all dormitory accommodation and meals at the actual cost to the City of San Diego. A commissary, post-office, public school, and recreation center are maintained on the grounds for the benefit of the employees and their families.

DULZURA CREEK NATURAL FLOWAGE CHANNEL.

Routine operation and maintenance of the Dulzura Creek natural flowage channel was carried on during the year. During the summer this creek was patrolled by a deputy sheriff to keep campers from polluting the water.

UPPER OTAY RESERVOIR.

The Upper Otay Reservoir served as a balancing and supply reservoir for the City during the year. Excess water drawn from Morena Reservoir was stored in the Upper Otay Reservoir and during

periods of excessive drought this supply was drawn upon for additional supply.

Routine operation and maintenance of this reservoir was carried on by a part time laborer who lives near the dam.

LOWER OTAY RESERVOIR.

Routine operation and maintenance of the Lower Otay Dam and Reservoir was carried on by the foreman in conjunction with other duties at the filter plant. No water was drawn from this reservoir during the year. There is now stored over 5,000,000,000 gallons, all of which is available by pumping with a low head.

October 28, a planting of 90,000 steel head trout was made in the Lower Otay Reservoir, a similar planting having been made the year previous. These fish were obtained from and donated by the State Fish & Game Commission. The only other trout known to have been planted in artificial waters in San Diego County is at Cuyamaca Lake.

Six resident employees are located at Lower Otay Station, and are being housed in buildings owned by the City. Minor repairs and improvements were made to the buildings as required.

MAIN PIPE LINES.

The successful operation and maintenance of the main pipe lines proved a difficult problem. The maximum summer consumption was over 16 million gallons per 24 hours, a duty quite in excess of the quantity the pipelines were originally designed to carry.

A short section of the emergency pipe was lowered 25 feet just above the Lower Otay filtration plant where the line between Upper Otay and the filtration plant approaches the elevation

of the hydraulic gradient. By this change which was made at a cost of \$1827.17, the capacity of the line was increased from 13 to 16 million gallons per day, thereby saving in pumping cost or purchase of water.

PURCHASE OF WATER.

During the year 1920 no water has been purchased by the City of San Diego.

CHOLLAS HEIGHTS RESERVOIR.

The outlet tower of the Chollas Heights Reservoir was fitted with a device intended to cause this reservoir to act as a balancing reservoir on the Otay-San Diego Pipeline.

LOWER OTAY-SAN DIEGO PIPELINE.

The wood-stave pipeline between the Lower Otay filtration plant and the Bonita Wye was known to be in bad order and a series of 72 test pits were dug to determine the condition. A material percent of the bands showed serious area reduction in maximum cases of 100%. The mean of 18 cross section measurements of individual bands worse cases exposed between Lower Otay and Coronado Wye showed an area reduction of 75%. The mean of 40 cross section measurements of individual bands worse cases exposed between the Coronado Wye and Bonita Wye showed an area reduction of 17%. Continual and increasing repairing is required. A single new or second parallel pipeline will soon be a necessity.

A bond issue of \$50,000. was voted by the electors of the City on November 25, 1919 for the purpose of making repairs and improvements to the wood-stave line between Lower Otay and the City. \$10,000.00 worth of these bonds were purchased by the City Treasurer and the funds have been used for the purpose of starting work on this line.

Tunnel No. 4 on the Otay-San Diego Pipeline located near Telegraph Canyon, is subject to frequent caving and the timber lining used heretofore rots rapidly. To overcome this difficulty, concrete tunnel lining shapes are being cast in sections and set in place in the tunnel as required. The work of making these forms and the installation was carried on by City Forces intermittently with the regular operation and maintenance of the line. On Dec. 31, sufficient lining had been cast to line 250 feet of tunnel. Of this amount 100 feet had been installed.

The maintenance of a section of the Otay-San Diego Pipeline, east of the Coronado Wye which has heretofore been the source of much annoyance and expense, was repaired at an expense of \$773.76.

Routine operation and maintenance of the pipelines was carried on by the pipeline foreman and a crew of four to six men, as required. Whenever serious breaks occurred in the line, Chollas Heights reservoir was drawn upon temporarily.

MISSION VALLEY.

The Mission Valley pumping plant was operated intermittently during every month of the year excepting July, August and October, supply^{ing} the City with a total of 357,600,000 gallons of water. The Common Council and the Water Commission co-operated in operating this plant at different times as respective funds permitted.

TELEPHONE LINE.

The City owned telephone line with instruments on practically all stations on the impounding and carrying system, required frequent attention and repair. \$415.48 was expended in routing operation and maintenance and \$215.92 was expended in re-saldering some of the joints. A further and much larger amount of money will have to be expended upon this line to put it in reliable working condition.

FILTRATION PLANT.

The filtration plant at Lower Otay was operated continuously during the year, filtering the entire water supply received from the City's Impounding System. The normal capacity of this filtration plant is 10 million gallons per day, but during summer periods of high daily consumption it was necessary to crowd the plant up to 16 million gallons per day. The plant is operated by three filter operators and one relief operator. Before filtration, the water is treated with Aluminum Sulphate (Al_2SO_4) in the proportion of averaging $1/4$ grain per gallon and after filtration with liquid chlorine.

Considerable difficulty is being experienced from sand getting into the City distributing mains and this has been attributed to the over-crowding of the filter plant.

A filter sand bin was constructed on the hill above and adjacent to the filter plant with a track leading to and over the man holes of each of the filter shells. It is expected that this will materially assist in resanding the filters in a quick and economical manner as compared with the previous method of having to lift the sand from the floor of the filter plant to the top of the shells. Under the new arrangement sand can be dumped into the sand storage bin from trucks or wagons which can drive over it and from the sand storage bin the sand is worked by gravity into a car, from which it is discharged by gravity into the filters. The cost of constructing this bin together with the distributing track was \$1743.37.

Water is lost in washing the filter shells, amounting to about 10 million gallons per month during the period of high consumption. To conserve this water, the Commission authorized the installation of a concrete lined collecting basin just below the filter plant. From this basin the water may be pumped back over the hill

into the Lower Otay Reservoir. The work of constructing the concrete reservoir has been about two-thirds completed and there also remains to be purchased a suitable motor and pump for lifting the water back into the Lower Otay Reservoir. The total cost of this water recovering plant will probably amount to over \$10,000.00.

CHLORINATION.

The Commission installed a two unit Manual Control, Direct Feed Pressure Chlorinator. The units are operated interchangeably monthly, thus permitting over-hauling and cleaning of each unit each month, in addition, in case of the failure of one machine, the other machine may be cut in. The chlorine house, formerly occupied by the gravity type feed plant, previously located on the hill at the rear of the filter plant, has been moved down to the filter plant to house the new dual unit plant.

During the year there has not been reported a single case of B. Coli showing in one c.c. of water, or less, in any sample taken from any of the City mains. Only 39 samples show fermentation in 10 c.c. During the entire year there were only 53 times that the bacteriological count ran above 100, and the highest count recorded was only 875.

TECHNICAL RECORDS.

Hydrographic observations are made and recorded daily at the different stations on the Impounding System and reported weekly to the general office. During periods of storms, observations of rainfall, runoff and other important features are made twice daily, and reported to the City Hall office.

A monthly report summarizing and tabulating the hydrographical data is compiled by the Supervisor and filed with the general office.

INVENTORY.

During the year an inventory of the property and equipment of the system, exclusive of Morena Division was taken. The items comprising this inventory were arranged on 4x6 cards and filed alphabetically according to stations on the Impounding System.

TABLES.

Appended hereto are tables and statistics of prominent interest in connection with the operation and maintenance of the Municipal Water system for the past year.

1920 Drainage Basin Runoff. Monthly. Million Gallons.

Month	Morena	Barrett	Otay	Total
January	101.0 M.G.	119.8	26.3	247.1
February	984.0	1118.0	322.9	2424.9
March	1493.6	2936.0	1124.9	5554.5
April	922.9	1463.2	51.6	2437.7
May	353.1	367.9	00.0	721.0
June	116.2	100.8	1.6	218.6
July	34.8	38.8	5.7	79.3
August	153.3	49.5	0.0	202.8
September	53.1	20.9	5.6	79.6
October	92.9	36.4	17.9	147.2
November	71.3	52.9	15.8	140.0
December	184.8	62.4	17.9	265.1
Total	4561.0	6366.6	1590.2	12,517.8
Mean	380.0	530.6	132.5	1,043.2

1920 Unavoidable Water Losses in Million Gallons.

Month	Evaporation				Conduction Dulzura			Waste	Total
	Morena	Upper Otay	Lower Otay	Chollas	Conduit	Creek	Barrett		
January	51.4	6.1	8.6	0.9	29.1	0.0	29.1	2.0	127.2
February	41.6	5.0	7.4	0.7	23.0	0.0	811.8	1.7	891.2
March	52.5	8.4	16.9	1.0	33.7	0.0	2,278.0	3.0	2,393.5
April	125.4	15.0	36.3	1.8	42.8	0.0	638.8	6.1	866.2
May	149.4	18.3	43.7	2.1	20.3	0.0	9.2	4.9	247.9
June	237.9	24.7	62.1	3.0	18.0	0.0	3.9	5.0	354.6
July	244.7	22.7	62.1	5.1	22.4	56.8	0.6	10.9	425.3
August	224.8	19.2	63.6	5.6	25.7	94.8	0.0	10.8	444.5
September	182.0	16.4	49.6	6.4	20.2	39.6	0.0	6.0	320.2
October	126.3	12.2	31.4	3.0	20.5	38.0	1.5	4.7	237.6
November	73.1	7.4	14.7	0.8	19.8	30.2	0.0	2.9	148.9
December	97.5	8.9	6.6	0.3	12.4	11.8	20.3	2.4	160.2
TOTAL	1,606.6	164.3	403.0	30.7	287.9	271.2	3,793.2	60.4	6,617.3

Note: * Fractional year indicating total loss average of over one million gallons daily.

DIVERSION FROM COTTONWOOD WATERSHED TO OTAY WATERSHED.

Month	Morena	Barrett	Total
January	291.2	90.7	381.9
February	153.9	306.2	460.1
March	16.9	658.0	674.9
April	10.7	824.4	835.1
May	45.2	558.7	603.9
June	262.6	96.9	359.5
July	429.3	38.2	467.5
August	463.8	49.5	513.3
September	582.8	20.9	603.7
October	375.5	34.9	410.4
November	343.5	52.9	396.2
December	206.8	42.1	248.9
Total	2982.0	2573.4	5555.4

Diversion at Barrett - Prior to transmission loss in Dulzura Conduit of 5%.

1920 Annual Turbidity and Coagulation.

Month	Max.	Min.	Turbidity Proport. Mn.	Total lbs.	Coagulation by Al_2SO_4 Dosage gr. per gal.		
					Max.	Min.	Actual Mean
January	50	20	21.25	10970	0.25	0.25	0.33
February	200	20	29.	11248	1.75	0.25	0.41
March	1000	20	80.50	11606	1.00	0.25	0.41
April	1500	20	63.11	13169	1.50	0.25	0.36
May	80	10	20.72	12515	0.50	0.25	0.29
June	50	10	19.21	13625	0.25	0.25	0.27
July	50	20	20.00	16547	0.25	0.25	0.28
August	200	20	23.58	15917	0.25	0.25	0.27
September	20	20	20.	9655	0.25	0.25	0.22
October	20	20	20.	11052	0.25	0.25	0.24
November	20	20	20.	11491	0.25	0.25	0.31
December	100	20	20.76	9388	0.50	0.25	0.33
TOTAL	3290	220	357.93	147,183	7.00	3.00	
MEANS	274.16	18.33	29.82	12,265.25	0.58	0.25	0.29

ACCOUNT OF 1920 WATER RESOURCES.

Item	Million Gallons Dr.	Million Gallons Cr.
Total storage Jan. 1, 1920	7595.9	
Total 1920 Runoff	12517.8	
Boat 1920 Losses		6617.3
Total transmitted to City		3407.9
Total storage Dec. 31, 1920		10081.9
Correction for Chollas Flotation		<u>6.6</u>
	20,115.7	20,115.7

1920

WATER BACTERIOLOGY.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
No samples taken	18	12	23	17	17	19	19	22	17	11	23	18	221
Ave. Bacteria Count per c.c.	41	85	68	40	151	127	31	72	154	166	119	77	
Ave. Bacteria Count per c.c.-1920													94
Highest Count	200	210	207	239	875	455	81	240	400	450	495	425	
Lowest Count	10	18	11	5	4	4	9	7	17	12	14	16	
No. times Bacteria Count exceeded 100 per c.c.													63
Colon Bacillus Present in 0.1 c.c.	0	0	0	0	0	0	0	0	0	0	0	0	0
Colon Bacillus present in 1. c.c.	0	0	0	0	0	0	0	0	0	0	0	0	0
Colon Bacillus present in 10. c.c.	1	3	3	1	1	5	1	6	3	5	5	5	39

The above is for water consumed in the City limits of San Diego, and does not include samples of Camp Kearny Water Supply.

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1920 Annual Sterilization.

Month	Filtrate Less Wash Water Total in Million Gallons.	Introduced Total Lbs.	Sterilization by Liquid Chlorine		
			Max.	Min.	Actual Mean
January	233.8	633	2.5	2.5	2.70
February	192.1	556	2.5	2.5	2.89
March	194.6	543½	2.5	2.5	2.79
April	252.1	632	2.5	2.5	2.50
May	293.2	838½	2.5	2.5	2.86
June	351.1	913	2.5	2.5	2.60
July	410.3	1114	2.5	2.5	2.71
August	409.7	801	2.5	2.5	1.95
September	300.1	731	2.5	2.5	2.43
October	314.1	758½	2.5	2.5	2.41
November	259.3	674	2.5	2.5	2.60
December	197.5	559	2.5	2.5	2.83
TOTAL	3407.9	8753½	30.0	30.0	
MEANS	284.0	729.45	2.5	2.5	2.57

1920 ANNUAL RAINFALL AND TEMPERATURE - CHOLLAS HEIGHTS RESERVOIR.

Month	Inches Rainfall	Mean Air Temperature	Mean Surface Foot Water Temperature.
January	0.69	55.47	53.89
February	3.53	56.96	58.19
March	3.17	57.16	61.50
April	.66	60.80	65.75
May	0.30	64.89	69.28
June	Trace	67.28	75.67
July	Trace	72.89	77.90
August	Trace	74.51	80.00
September	0.07	69.75	74.50
October	0.44	62.15	68.94
November	0.39	58.76	60.00
December	0.87	54.19	55.50
Total	10.12	754.81	801.12
Means	0.84	62.90	66.76

Schedule 1.
CITY OF SAN DIEGO
Municipal Water System.

Statement Showing Receipts and Disbursements,
for Year 1920.

-----Population U.S. Census 1920, 74,683.

Receipts

Total gross receipts \$ 515,610.50

Expenditures

Operating expenses \$ 244,920.83

Taxes 11,889.02

Interest 343,605.20

Bond redemptions 191,825.00

Capital expenditures 14,427.12

TOTAL 806,667.17

DEFICIT \$ 291,056.67

Note: Deficit equivalent to approximately .35¢ of the tax levy.

Schedule 2.

Analysis of Receipts.

Board of Water Commissioners.

Miscellaneous Receipts 1920.

	<u>Hunting & Fishing</u>	<u>Boats</u>	<u>House</u>	<u>Misc.</u>	<u>Total</u>
Office				147.79	147.79
Morena	1774.25	3327.75	244.00	4.25	5350.25
Lower Otay	187.50	339.75	1.00	20.20	548.45
Chollas	66.00	14.50			80.50
	<u>2027.75</u>	<u>3682.00</u>	<u>245.00</u>	<u>172.24</u>	<u>6126.99</u>

Collected by Operating Department.

Water Consumption	476,388.03
Meter installation	13,602.13
Taps and services	12,240.01
Extensions to mains	4,382.20
Shut off and turn on penalties	174.00
Water sales, commercial	1,019.49
Meters, testing and repairs	259.72
Services, moving, repairs	325.41
Pumping cellars and pools	28.64
Hydrants and standpipes	144.75
Meters and service rentals	135.20
Miscellaneous	803.95

TOTAL By Operating Dept.

509,483.51

Total as in Schedule 1.

515,610.50

Schedule 3.

Analysis of Water Consumption Receipts.

Receipts from Water Sales. Calendar Year 1920.

	<u>Consumers</u>	<u>Municipal Bills Cleared.</u>
January	\$ 26,044.84	
February	26,232.12	
March	30,294.51) 1919 portion 57,295.10) 1920 portion
April	34,179.47	
May	36,066.94	
June	42,858.66	6,263.50
July	47,137.60	
August	51,616.88	
September	50,821.36	
October	49,575.91	27,403.58
November	42,344.50	
December	<u>59,215.24</u>	<u>7,772.02</u>
	\$476,388.03	\$98,734.20 *

* Note: Of this amount about \$60,000. represents the value of water furnished during 1920 by the Water Development Department to other City Departments for which it received no credit.

Schedule 4.
Analysis of Operating Expenses.

Impounding System.

General expense	\$ 9,408.40	
Surface source of supply	4,520.19	
Aqueducts, intakes and supply mains	20,384.54	
Buildings and grounds	4,497.24	
Purification expense	16,518.46	
Equipment upkeep	2,213.40	
Miscellaneous	58.85	
Pumping	<u>10,443.63</u>	
TOTAL		\$ 67,844.71

Distributing System.

General expense	11,138.69	
Commercial expense	16,119.59	
Meters	10,891.77	
Services	52,120.07	
Distributing mains	40,679.08	
Distributing reservoirs and stand- pipes	9,652.68	
Miscellaneous equipment	3,140.88	
Supply expense	2,473.61	
Pumping	30,303.37	
Miscellaneous	<u>556.38</u>	
TOTAL		<u>\$177,076.12</u>
GRAND TOTAL AS PER SCHEDULE 1		\$244,920.83

Schedule 5.
Analysis of Taxes.

Taxes paid during 1920 constitute second installment-
State, County and East San Diego taxes for year 1919 and first
installment year 1920. All on property outside territorial limits
of the City of San Diego.

Second installment East San Diego, 1919	\$ 44.50
" " San Diego County and State, 1919	5222.90
First installment East San Diego, 1920	44.50
" " San Diego County and State, 1920	<u>6577.12</u>
	\$11,889.02

Schedule 6.
Analysis of Interest Payments
on Bonds.

Impounding System.

Water 1913	\$ 94,511.25	
Water Development 1914	50,850.00	
Water Conservation 1914	50,578.12	
Water - City of San Diego, 1914	59,130.00	
Dulzura-Otay Conduit, 1916	4,625.00	
Lower Otay Dam, 1917	51,665.00	
Barrett Dam, 1920	8,275.00	
Otay Pipe Line - 1920	462.50	
Total Impounding System		\$ 279,896.87

Distributing System.

Water 1901	16,425.00	
Water Improvement 1905	5,416.85	
50th Street Main 1905	1,467.00	
Water Extension 1903	1,951.13	
Water Enlargement & Extension 1907	7,971.25	
Reservoir 1907	5,025.75	
Water Addition 1911	11,632.50	
Water Extension 1913	12,431.25	
Otay Pipe Line & Distributing 1920	1,387.50	
Total Distributing System		63,708.33
Total as per Schedule 1		\$ 343,605.20

Schedule 7.
Analysis of Bond Redemptions.

Impounding System.

Water 1913	\$ 62,500.00	
Water Development 1914	5,875.00	
Water Conservation 1914	17,625.00	
Water City of San Diego 1914	57,500.00	
Dulzura-Otay Conduit 1916	2,500.00	
Lower Otay Dam 1917	17,500.00	
Barrett Dam 1920	---	
Otay Pipe Line 1920	---	
Total Impounding System		\$ 144,500.00

Distributing System.

Water 1901	12,000.00	
Water Improvement 1903	4,975.00	
30th Street Main 1905	1,350.00	
Water Extension 1903	1,500.00	
Water Enlargement & Extension 1907	6,000.00	
Reservoirs 1907	4,000.00	
Water Addition 1911	9,000.00	
Water Extension 1913	8,500.00	
Otay Pipe Line & Distributing 1920.	---	
Total Distributing System		47,525.00
Total as per Schedule 1		\$ 191,825.00

Schedule 8.
Analysis of Capital Expenditures.

Impounding and Carrying System.

Machinery, Implements, etc.	\$ 3,360.08	
Technical Instruments	364.05	
Improvements to Land & Buildings	1,950.50	
Extensions to Water System	<u>8,772.49</u>	
Total as in Schedule 1.		\$ 14,427.12

Schedule 9.
Statement of Receipts and Disbursements
For Year 1920 Classified into
Impounding and Distributing System.

Receipts

Impounding and Carrying System	\$ 6,126.99	
Distributing System	<u>509,483.51</u>	
Total Receipts		\$ 515,610.50

Expenditures

Impounding and Carrying System.

Operating Expenses	67,844.71	
Taxes	11,889.02	
Interest	279,896.87	
Bond Redemptions	144,500.00	
Capital Expenditures	<u>14,427.12</u>	
Total Impounding System		518,557.72

Distributing System.

Operating Expenses	177,076.12	
Interest	65,708.33	
Bond Redemptions	<u>47,325.00</u>	
Total Distributing System		<u>288,109.45</u>

Grand Total		<u>806,657.17</u>
Deficit		\$ 291,056.67

MISCELLANEOUS.

During the year 1920 there was delivered to the consumer by the Municipal Water System, including Mission Valley pumpage, a total of 5,709.6 million gallons with a total expenditure for operating expenses, taxes, interest, and bond redemptions of \$792,240.05 or an average expenditure of .313¢ per 1000 gallons of water delivered.

A total of 3,352.3 million gallons of water was delivered from the Impounding System during the year at an expenditure for operation, taxes, bond interest and redemption of \$495,542.45 or .1478¢ per 1000 gallons.

A total of 3,559.5 million gallons were distributed through the distributing system mains at a cost for operation, bond interest and redemption of \$273,264.37 or .0767¢ per 1000 gallons.

MISCELLANEOUS.

The total water pumped from Mission Valley was 357.3 million gallons. There was expended by the Water Development Department for operating the plant \$8,588.15, and by the Operating Department \$14,845.08, making a total of \$23,433.23 or .0655¢ per 1000 gallons pumped.

A total of 3,352.3 million gallons of water was filtered at the Lower Otay filtration plant at a cost of \$13,641.65 or .00406¢ per 1000 gallons. Chlorination of this water cost \$2,398.32 or .000715¢ per 1000 gallons, making a total of .00477¢ per 1000 gallons for purification.

Three automobiles were operated by the Department during the year.

Car No. 100 being a Ford Runabout, was used by the Commission and office. This car was driven 5758 miles at a cost, for gas, oil, tires, repairs, etc. of \$287.23 or .05¢ per mile.

Car No. 101, Ford service car, used by Pipeline Foreman, travelled 8910 miles at a cost for gas, oil, tires, repairs, etc. of \$627.84 or .0704¢ per mile. This car required extraordinary repairs during the year, which added to the cost per mile.

Car 102, Ford Truck, used by Extra Gang, travelled 9800 miles at a cost for gas, oil, tires, repairs, etc. of \$646.46 or .0659¢ per mile.

APPENDIX.

COMMISSION ACTIVITIES FOR THE YEAR 1920.

QUESTION OF JURISDICTION.

Shortly after the appointment of the first Board of Water Commissioners, the question arose as to what body had the authority to expend the Barrett Dam Bond Fund and other bond funds voted for the purpose of making improvements to the Municipal Water System. The Common Council claimed the responsibility of directing the funds and the Board of Water Commissioners claimed that the Charter gave them exclusive charge and supervision over the expenditure of these funds. Subsequently, the Common Council and the Board of Water Commissioners agreed to submit the question to the courts. An agreed statement of facts was drawn up and presented to the Superior Court of the County of San Diego. The City Attorney, Shelley J. Higgins, assisted by Deputy City Attorney Arthur F. H. Wright, presented the case for the Common Council, the Board of Water Commissioners being represented by Chas. E. Sumner, President of the Board and Attorney at Law, assisted by the firm of Heskett, Sample & Harden.

The decision of Superior Court Judge Hon. S. M. Marsh, rendered on March 19, 1920, was in part as follows:

"I have concluded to construe said Section 4 as giving to the Board of Water Commissioners the power to construct the dam in question. I cannot understand how it is possible to give to the Board of Water Commissioners exclusive charge and supervision of the conservation and impounding of water without giving them the power to construct dams, dig wells, build pipe lines, and various other things connected with the conservation and impounding of water. I am not reaching this conclusion upon the theory that this power has been given to them by implication, but on the theory that the express language of the section gives them the power. They are given, in fact, the power to do or perform any act in the conservation and impounding of water."

Following this decision the Board of Water Commissioners and Common Council agreed to jointly authorize all expenditures in connection with the construction of Barrett Dam until the case could be appealed to the Supreme Court of the State. A working agreement was adopted and entered into between the Common Council and Board of Water Commissioners whereby the Commission would first approve all appropriations for expenditures of money from the Barrett Dam Bond Fund following which the Council would adopt the necessary ordinances to authorize expenditures initiated by the Hydraulic Engineer and approved by the Commission.

ATTEMPT TO ABOLISH COMMISSION.

An attempt was made to abolish the Board of Water Commissioners, and certain other City Commissions. A special election for the purpose was set down for December 7, 1920. The amendments submitted proposed to also place the Water Impounding and Carrying System, and public parks, harbor, cemeteries, and playgrounds, under a Manager of Operation, subject to the legislative control of the Common Council. Water Commissioners Charles E. Sumner, passed away Nov. 7, and Horace Aughe, Nov. 28.

MUNICIPAL WATER DISTRICT PROJECT.

An attempt was made by the majority of the Board of Water Commissioners during the year to submit to the voters a proposition to establish a Municipal Water District to include the Cities of San Diego, East San Diego, La Mesa, Lemon Grove and the unincorporated territory of Normal Heights and Kensington Park. This movement had at first the endorsement of a number of prominent citizens and of a portion of the Water Committee of the Chamber of Commerce, but such strong opposition was launched against the project, that the Commission abandoned its promotion of the Water District.

TORREY PINES RESERVOIR DISASTER.

Shortly after water was first turned into the reservoir during the night of Dec. 12, 1920, a 2' x 2' portion of the concrete lining gave way permitting the water to escape. Various theories were advanced as to the cause of the failure of the reservoir. Repairs are being made at joint expense of the City and the contractor furnishing the water. It is now expected that the City will be receiving water from the Lake Hodges system through Torrey Pines Reservoir, about Feb. 1, 1921.

The Torrey Pines Reservoir was constructed by contract under designs prepared by the City and under City inspection, the work being paid for by the contractor furnishing the water.

MORENA RESERVOIR RECREATIONAL FEATURES.

Morena Reservoir continued and increased its popularity as a rendezvous for visitors, duck hunters and fishermen. Hunting and fishing was permitted during the entire year and proved a source of considerable revenue to the City. During the year the number of boats on the lake was increased to 23. On holidays and Sundays, the demand for boats was far in excess of the supply. It is estimated that over 75% of the visitors came from Imperial Valley.

A permit fee of only 50¢ per person, and good for two full days, was charged to all persons desiring to fish or hunt on the reservoir. Boats were rented at 50¢ per hour, \$1.00 up to noon, or \$2.00 for all day. Several buildings and tents were rented to camping parties at a charge of about 50¢ per person per day. Camping privileges were discontinued in September in compliance with the wishes of the Board of Health, but hunting and fishing was permitted to continue. Charges for fishing and hunting permits were discontinued. Boat renting was continued. Receipts for permits at Morena for

the year were as follows:

Fishing & hunting fees, to September	\$ 1421.00
Boat rentals, calendar year	3327.75
House rentals " "	244.00
Miscellaneous " "	4.25
Total	\$ 4997.00

DULZURA CREEK PROPOSED CHANGES.

A majority of the Board of Water Commissioners projected the making of a survey for a pipeline to conduct the waters from the end of the Dulzura Conduit to the vicinity of Lower Otay Reservoir, to eliminate the use of Dulzura Creek natural channel, the development of water power was also being considered. The Commissioners were understood to be about to proceed with the preliminary work and plans, when the death of Commissioners Sumner and Aughe stopped the proceedings.

LOWER OTAY RECREATION FEATURES.

Lower Otay Reservoir filled sufficiently during the winter of 1919-20 to again make it a popular resort for visitors and hunters. Being only 20 miles from San Diego, it is about an hours run by automobile. No charges were made for hunting privileges. Nine boats are maintained for the accomodation of visitors and are rented for a fee of \$2.00 per day. Several building are maintained at Lower Otay for the accomodation of visitors over night.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 42 Folder: 2

**Business Records - Reports - Savage, H.N - "Second Annual
Report of San Diego Board of Water Commissioners"**



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