

NOTES ON
LOS ANGELES WATER SUPPLY



by
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INTRODUCTION

The water works system of Los Angeles is unique in several respects. The fact that the original pueblo was granted perpetual rights to the waters of the entire water shed of the Los Angeles River above the pueblo has often been repeated, and it is hardly necessary to call it to attention here. But it is perhaps not so well known that throughout the century and a half since the formal founding of the pueblo in 1781, the control of the river was never once relinquished. Part of this flow was leased to the Canal and Reservoir Company for irrigation from 1868 to 1877, and a portion was leased to the Los Angeles City Water Works Company for domestic distribution from 1868 to 1898, but the Zanja Madre and its branches were always controlled by the municipality.

Another point worthy of note is the perpetual inadequacy of the water works system prior to construction of the aqueduct. Most large cities put on construction programs that periodically bring them to the point where the engineers can lean back and feel that things are fixed for a while. It is true that the water works engineers of Los Angeles were striving to that end, and almost annually predicted that their program for the following year would be adequate for a considerable time. But just as regularly the remarkable expansion of the city exceeded all expectations and the capacity of reservoirs and pumps and trunk lines was exceeded almost before they could be built.

Remarkable also were the men who fought perennially to serve the city with water, for there are many who spent a full working life at this job. William Mulholland started about 1878 under Fred Eaton in the construction of mains. Later he was appointed zanjero on the main ditch, and then worked intermittently on the water works until he was appointed Superintendent of the Los Angeles City Water Works Company in the latter part of 1886. He was hailed as the Chief until his death in 1935. Thos. Brooks has worked at all phases of water supply from 1883, was appointed Assistant Superintendent to Mr. Mulholland in 1887, and is still on the job. L. M. Anderson, Auditor, 1888 to the present; George Read, Meter and Service Superintendent, 1892 on; Fred Fischer, Chief Mechanical Engineer, 1889 and still active, and a number of others in the ranks of foremen and skilled pipe men have known almost no other job.

Those still living can all remember 'way back when', but Thos. Brooks has a few years on all of them, and was in such contact with all phases of the work that his recollections are worth recording, lest they be lost. Mr. Brooks has been one of the finest superiors that one could wish for. His strict discipline has always been tempered by exceptional patience, and fairness to all from the humblest laborer up has won him a respect and affection to be coveted by any one. Always of moderate stature and slight build, Mr. Brooks does not expect things of others that he himself is unwilling to undertake. His self-discipline and sense of duty still brings him out in the middle of the night to see that a special job is going right. The obligation of the water-works man to respect and consider the convenience of the consumer and the public in general is constantly kept before his men.

The object of this compilation of "Notes on Los Angeles Water Supply" is to record many of the things that have been obscure and more or less mixed as to date and sequence. Notes from authentic sources have been added to make this a short history of the development of the most valuable natural resource of this region. The sincerity of purpose, honesty and unstinting labor of those responsible for this conservation and development will have to be read between the lines.

Practically every date mentioned has been obtained from a contemporary source. Many years of old original City Council minutes have been read, literally thousands of pages of old payroll books, pipe record books, and sketch maps have been turned in order to glean clues to the sequence and date of various construction projects. And no one without Mr. Brooks' knowledge of men's names and old descriptions of streets and places could have sorted them out. Reference numbers used in the text

refer to the following sources.

1. Minutes of the Los Angeles Common Council.
2. Photograph in Security Trust and Savings Bank Collection.
3. Thomas Brooks.
4. Los Angeles City Water Works Co's. sketch maps and record books.
5. Los Angeles City Water Works Co's. payroll book.
6. A History of California and an Extended History of Los Angeles - Jas. M. Guinn.
7. History of Los Angeles City and County - Spalding.
8. Centennial History - J. J. Warner.
9. Annual Reports, Board of Public Service Commissioners and Board of Water & Power Commissioners.

Laurance E. Goit
September, 1938.



Thomas Brooks inspects set up for
special gate valve test.

NOTES ON THE LOS ANGELES WATER SUPPLY
By THOMAS BROOKS
Assisted by Laurance E. Goit
September, 1938

I - THE PUEBLO

El Pueblo de Nuestra Senora la Reina de Los Angeles de Porciuncula was established on September 4, 1781, with eleven families totaling forty-four persons. The basis of choice of the site was water, the pueblo being located on comparatively high level ground near the stream of the Porciuncula River. The charter from the King of Spain demanded as one of the first duties of the settlers the building of a dam and water ditch to the common Plaza.

The "toma" or dam was built of brush across the river close to the site of the present Broadway Bridge, and the Zanja Madre dug to pass close to the Plaza and then on to irrigated fields. As the pueblo slowly grew water was carried to the homes farther from the spreading ditches, until distribution by means of a barrel wagon was introduced.

This method of water distribution continued until 1850, when the town of one thousand was incorporated under American laws, and until William G. Dryden was granted a permit in 1857 to distribute water in pipes from Abila Springs located on low ground near the present intersection of Alameda and College Streets.

II - EARLY DISTRIBUTION ORGANIZATIONS

Dryden's permit included the construction of a reservoir, and in October 1860, the Common Council directed that this be built in the center of the Plaza. (1) This first reservoir of Los Angeles was built of brick, and judging from old photographs (2) was about 30 feet square with the bottom of the tank about 10 feet from the ground. Water raised to a ditch by a water wheel flowed to the Plaza where it was pumped into the reservoir to elevation about 310 feet. Distribution to the nearby houses was through bored log pipes.

On June 24, 1861 (1) a special committee reported on the proposed introduction of water into the city for domestic purposes. They recommended "a flume, water wheel, etc., raising the present dam, and a new water ditch." A fund of \$4,000 was raised by private subscription and the work completed that summer by Perry & Woodworth. On August 5th, 1861, (1) an ordinance establishing rates for water for domestic use was passed, inaugurating municipal distribution of water for domestic use in Los Angeles.

The winter immediately following was marked by a flood that washed out the new city dam and Dryden's water wheel. The city had the dam rebuilt; and Dryden installed a new water wheel for his system.

Part of the contract for rebuilding the city dam was the installation of 15,000 feet of wooden pipes of 3 inch and 4 inch bore. Sainsevain, the contractor asked permission (1) to join these logs with "iron tubes" to produce the best possible job.

The "Public Water Works of Los Angeles" consisting of the water wheel, flume, special domestic water ditch and considerable footage of log pipe were leased on February 8, 1865 (1) to David W. Alexander for a period of four years. On August 7, 1865 (1) the council made a new lease, at the request of Alexander, with Jean L. Sainsevain. The dam and water wheel went out again in the winter 1866-7. Again the dam was rebuilt by the City and a new wheel was located opposite the present Solano Street.

Some time soon after this Sainsevain completed a small reservoir to receive water from the wheel. This reservoir was located just north of Bishops Road and Buena Vista Street with an elevation of about 360 feet.

The reproduction of "Official Map No. 4" shows the location of the toma, the

OFFICIAL MAP NO. 4

of Los Angeles City.

We hereby certify that by ordinance of the Mayor and Common Council of the City of Los Angeles approved November 17th 1868 this map was adopted and declared to be an official map of said City to be designated as Number 4 (Five)

Witness our hands and the seal of said City

Christoval Aguilar Mayor
John King First of the Common Council



Recorded Nov 23, 1868 at request
of A. J. King.

City's first water wheel and the wheel at Solano Street. The reservoir constructed by Sainsevain was located north of the Roman Catholic Cemetery.

The City dam that had been rebuilt in 1867 was washed out the following winter after being in use only a few months. The population of Los Angeles had reached 4,500 and was increasing fast, and considerable activity started in the water works field.

Early in 1868 the Los Angeles Canal and Reservoir Company was organized, and gained a permit to build a dam on the river above Crystal Springs and to furnish water and power for what became known as the Woolen Mill Tract at 6th and Pearl Streets (Figueroa Street). The council also granted them a large area of land in the neighborhood of the present Echo Park. This Company dammed the canyon creating a reservoir that is now the lake in Echo Park.

Dryden assigned his franchise to distribute water to Bernardo and McFadden in 1868.

Sainsevain operated under lease the city owned distribution works through several bad winters, and following the washout of 1867 sold his rights to Griffin, Beaudry and Lazard, who formed the Los Angeles City Water Works Company. They obtained a 30 year franchise to operate the works consisting of the water wheel, Plaza and Bishops Road reservoirs, ditches and 3 miles of pipes. The inclusion of the Plaza reservoir in this lease left Bernardo and McFadden, successors to Dryden, without a reservoir so they soon sold the remains of Dryden's works to the new company.

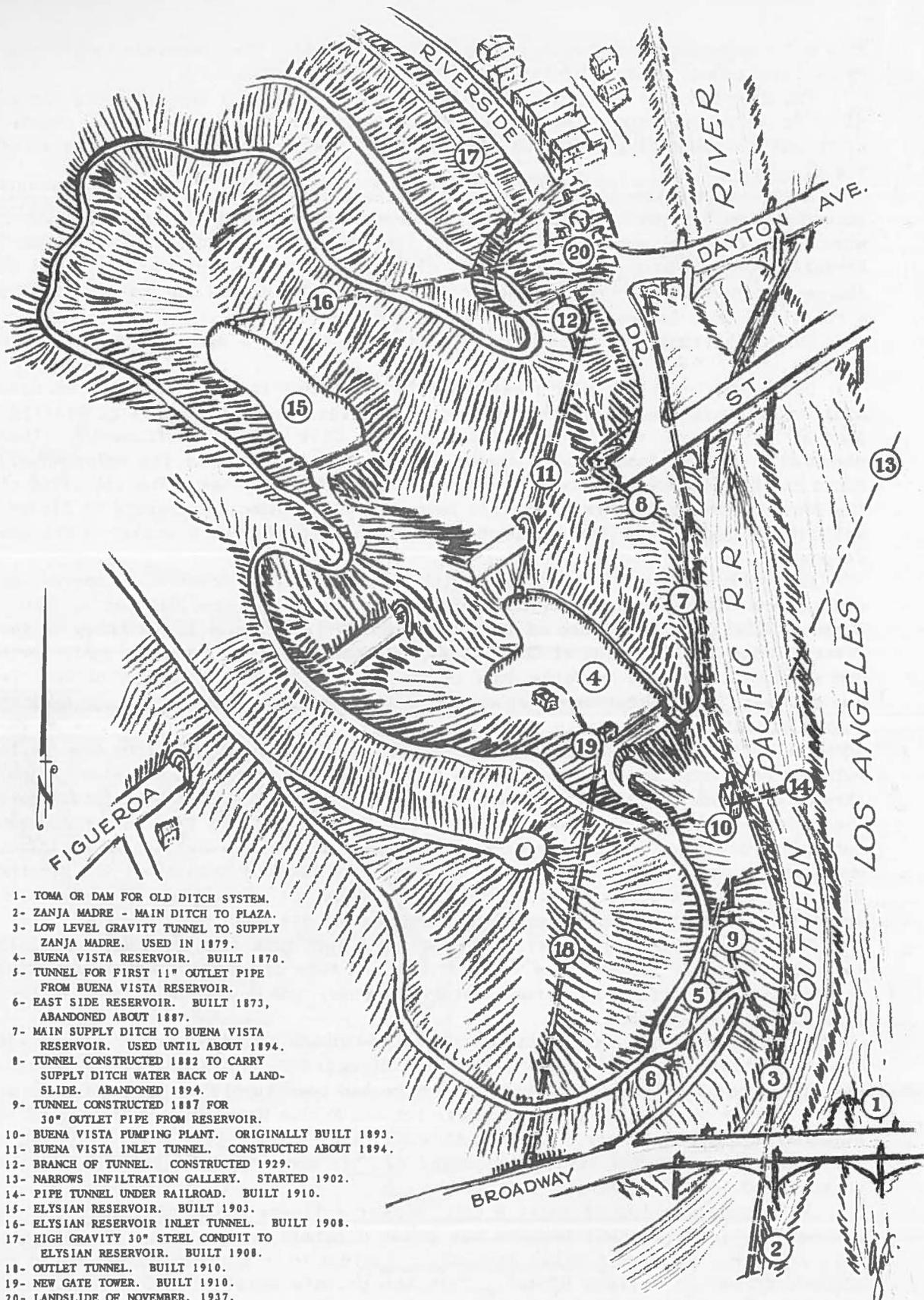
On November 10, 1870, the Council (4) ordered the Plaza reservoir removed, an arrangement having previously been made with the Los Angeles City Water Works Company, giving them the use of City land in the hills above the Narrows on the river. Under the direction of Chas. Miles, engineer for the company, a small earth dam was built across a suitable draw in the hills forming the nucleus of what is now the Buena Vista Reservoir. Water was brought to this reservoir through a ditch that followed the bluff of the west bank of the river from a diversion dam at the location of the present Crystal Springs galleries. The outlet pipe from the reservoir was of riveted sheet iron 11 inches in diameter and went through a short tunnel through a shoulder south of the reservoir coming out near the west end of the Buena Vista Street (Broadway) bridge and on Buena Vista Street to Bishops Road, then reduced to 8 inches, the pipe ran down Buena Vista Street to First and Main Streets where it connected to the system then existing. It seems probable that the Bishops Road reservoir was abandoned at this time as it is not likely that the elevation would fit in with the new Buena Vista elevation of 378 feet.

Some time prior to 1871 (4), 7730 feet of 8 inch cast iron main had been laid in Eternity Street (later Buena Vista Street and then Broadway) from Bishops Road to First and Main, via Short Street (Bellevue Avenue). This was the first cast iron pipe laid in Los Angeles.

Service No. 1 (4) was installed at the residence of J. Bernardo, located on Eternity Street 192 feet south of Bernard Street.

The Canal and Reservoir Company meantime had been supplying irrigation water in the western part of the City and power for the Woolen Mills that were originally built by Barnard Brothers. After much wrangling, the City on August 20, 1877, arranged a contract for buying the works of this company, but the deal was not consummated until August 15, 1878 (4).

With a population of about 6,000, Bunker Hill was being occupied, and on October 31, 1872, Prudent Beaudry was given a permit to lay pipes through the City streets. He pumped water from Abila Springs with a steam pump located on Alameda Street at College Street. This was private water, the City zealously guarding its right to the river. Beaudry's two reservoirs (6) (7) were located on Pearl Street (Figueroa Terrace) north of College Street with an elevation of



- 1- TOMA OR DAM FOR OLD DITCH SYSTEM.
- 2- ZANJA MADRE - MAIN DITCH TO PLAZA.
- 3- LOW LEVEL GRAVITY TUNNEL TO SUPPLY ZANJA MADRE. USED IN 1879.
- 4- BUENA VISTA RESERVOIR. BUILT 1870.
- 5- TUNNEL FOR FIRST 11" OUTLET PIPE FROM BUENA VISTA RESERVOIR.
- 6- EAST SIDE RESERVOIR. BUILT 1873, ABANDONED ABOUT 1887.
- 7- MAIN SUPPLY DITCH TO BUENA VISTA RESERVOIR. USED UNTIL ABOUT 1894.
- 8- TUNNEL CONSTRUCTED 1882 TO CARRY SUPPLY DITCH WATER BACK OF A LANDSLIDE. ABANDONED 1894.
- 9- TUNNEL CONSTRUCTED 1887 FOR 30" OUTLET PIPE FROM RESERVOIR.
- 10- BUENA VISTA PUMPING PLANT. ORIGINALLY BUILT 1893.
- 11- BUENA VISTA INLET TUNNEL. CONSTRUCTED ABOUT 1894.
- 12- BRANCH OF TUNNEL. CONSTRUCTED 1929.
- 13- NARROWS INFILTRATION GALLERY. STARTED 1902.
- 14- PIPE TUNNEL UNDER RAILROAD. BUILT 1910.
- 15- ELYSIAN RESERVOIR. BUILT 1903.
- 16- ELYSIAN RESERVOIR INLET TUNNEL. BUILT 1908.
- 17- HIGH GRAVITY 30" STEEL CONDUIT TO ELYSIAN RESERVOIR. BUILT 1908.
- 18- OUTLET TUNNEL. BUILT 1910.
- 19- NEW GATE TOWER. BUILT 1910.
- 20- LANDSLIDE OF NOVEMBER, 1937.

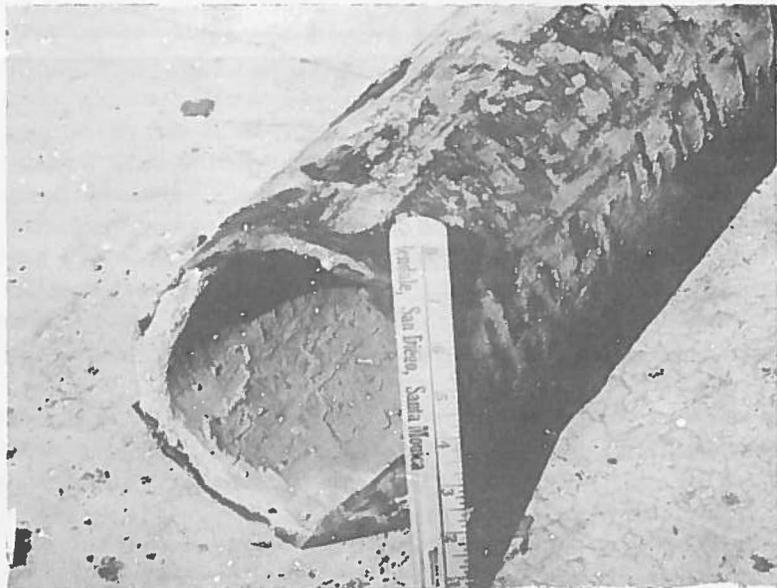
ELYSIAN PARK AREA
 SHOWING WATER WORKS STRUCTURES

about 466 feet.

The installation of services was an entirely different kind of a job then than the way they are put in at the present time. In the tapping of a cast iron main for one inch or smaller services a rather crude affair known as a "crow" or the "old man" was chained on the pipe to be tapped and a special fluted combination drill and reamer was used to give the hole the right taper. After the hole had been drilled to the proper diameter the drill was withdrawn under full main pressure and the corporation cock driven home. If the service man who was doing the drilling became nervous and missed the taper drilled hole on the first trial he would as a rule miss it twice more, and by that time he would be so thoroughly wet that he would forget to be nervous and insert the corporation cock properly. There was no going home for a change of clothes as water works men did not pay any attention to wet clothes in those days. Later on the service man became a little wiser and put on a rubber coat, and that was the end of wet clothes.

Just before the man doing the tapping pulled the drill from the hole just completed he would have the storekeepers and roomers or occupants of rooms in line with water from the tap close all doors and windows and warn pedestrians not to get in the line of the water that was about to be turned loose, but on rare occasions ladies and sometimes men would assume they knew what they were doing and walk in line with the water when the drill was withdrawn. The result would be some very wet clothes, but every one took the inconvenience good naturedly and there were no complaints made at the office. The ladies of the present writing would not stand for anything like that and there would be a complaint go to the office at once for a financial adjustment.

The territory East of the river meanwhile had been developing, and in 1873 a 6 inch sheet iron cement lined pipe was laid across the river under the Downey Avenue (Spring Street) bridge. A small reservoir of about a million gallons capacity was constructed by Hancock for Griffin and Downey on the hillside just above the west end of the Buena Vista Street bridge at the same elevation as the Buena Vista Reservoir. It is probably at this time that a 15 inch 12 gauge sheet iron outlet pipe was installed from Buena Vista Reservoir, and the old 11 inch outlet pipe was used to supply water to the new East Side Reservoir. The 15 inch pipe was through the same tunnel as the 11 inch.



Piece of original 6" cement lined sheet steel pipe. Made in Los Angeles in the 1870's and recovered in 1938.

In the tapping of the sheet iron cement lined pipe a carpenter's brace and a special made bit was used. The cement was drilled out about one half way through the cement lining, then a long threaded nipple with a stop cock on the end was screwed through the clamp. This pushed out the uncut cement core and the job was finished without the loss of any water.

In 1875 (3) the Los Angeles City Water Works Company laid a 22 inch sheet iron pipe from south of the Buena Vista Street bridge parallel to the Southern Pacific Railroad mainline track and San Fernando Street (Spring Street) to Main and First Streets. This work was under the personal supervision of Fred Eaton working under the company's engineer Chas. E. Miles. Later the 22" was extended north parallel to the west bank of the river to the toe of the Buena Vista dam. In 1887 the reservoir outlet pipe was enlarged to 30 inches, this pipe going through a new tunnel lower down in the hill about 500 feet south of the present Buena Vista pumping station, and connecting to the 45 inch and 22 inch mains at Buena Vista Street. The tunnel was constructed under the supervision of Thos. Brooks and the pipe laid by the Lacy Manufacturing Company.

The Angeleno Heights Reservoir was built for Beaudry on the hill above the north end of Beaudry Avenue, on the present White Knoll Drive, in 1877. (4) It consisted of a basin excavated in the rock with a high water elevation of 596 feet. A steam pump installed by P. Beaudry at College Street and Figueroa Terrace raised water from the nearby Beaudry reservoir to this new high reservoir through a 42 inch pipe.

The piped distribution system for domestic water was owned and operated by the Los Angeles City Water Works Company, while the City operated the Zanja System of gravity water for irrigation. In 1878 the Common Council (4) had a tunnel built at a low level starting at the location of the west abutment of the present Dayton Avenue bridge and emerging near the Buena Vista Street bridge to supply the Zanja Madre. This tunnel was crooked and on a very poor grade and was used for a few years only.

In 1882 (3) a landslide carried away a short flume used in conjunction with the supply ditch from Crystal Springs to Buena Vista Reservoir at the north end of the north tunnel of the present Figueroa Street. A tunnel was excavated under the supervision of Fred Eaton into the hill and back out again going around the slide. About two years later the capacity of Buena Vista Reservoir was greatly enlarged by excavating the sides to bed rock. The dam was not changed in elevation but was made considerably wider.

In 1883 and for quite a period before and after that date, the entire personnel of the Los Angeles City Water Works Company were S. B. Caswell, collector and book-keeper, Fred Eaton, Superintendent and Engineer, Tom Burns, his assistant, Thos. Brooks, assistant to Tom Burns, and a permanent crew of four laborers and two ditch and reservoir keepers. The Water Company directors at this time were W. H. Perry, President of the Board, S. H. Mott, Secretary and Treasurer, Wm. Ferguson, S. Lazard, Chas. Duccumun, and W. J. Brodrick. These Board members took a great interest in the operation of the Company, and were very good men to work for, but they insisted that every dollar spent must show a return of 100 cents. Fred Eaton and Tom Burns each were paid a salary of \$100.00 per month, but Mr. Eaton had permission from the Board to do outside engineering on his own account; about one-half of his time was devoted to the Los Angeles City Water Works Company's interests.

The equipment owned by the Company at this time consisted of two light one horse spring wagons, two horses, two crude wet tapping "crows", water buckets and what were known as "San Jose" hand operated pumps. If a leak was very bad these pumps could deliver plenty of torture to the men operating them. After Tom Burns quit the Water Company's employment which was about September, 1883, the service foreman did all his own pipe fitting, tapped the main, made and posted all service records, kept the time and was paymaster. At the present date this would be some job, but at that time he had only three laborers and himself to take care of. The service foreman received \$75.00 per month and laborers \$2.00 for a ten-hour day, and worked six days per week.

The first telephone was installed (5) in the water company headquarters on Marchessault Street in October, 1884.

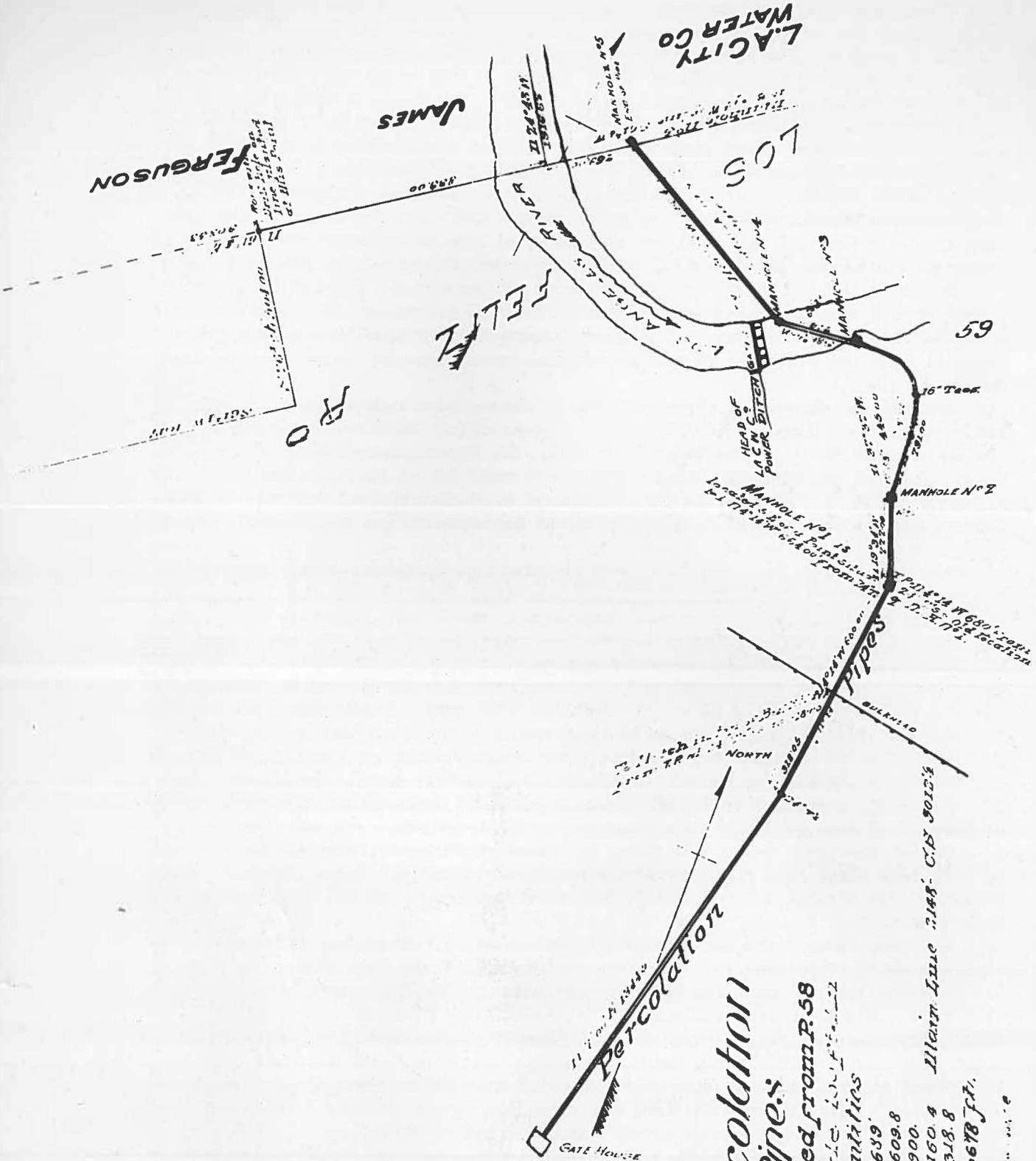
The Crystal Springs development was started in August of 1886 (5). Percolation pipes were installed at a depth of 10 to 14 feet in the river bed starting from a brick gate house at elevation 395 founded on bed rock at the most easterly point of Griffith Park. Extending north from the gate house a distance of 3656 feet was a double line of open joint pipes starting with 24" and stepping down to 12" (4). The yield of these pipes was a little over five million gallons daily, but the intrusion of roots reduced the flow a little. From the gatehouse a tunnel about 1,100 feet long was excavated through the point of the hills discharging into the ditch leading to the City. This tunnel was started by William Mulholland under a contract, but later the Company took over the job retaining Mr. Mulholland as general foreman.

Prior to this (January, 1886) (5) the Water Company had started constructing a redwood box conduit in the supply ditch. This conduit under the supervision of W. J. Kelley, Superintendent of the Water Company at that time, followed the ditch location from the south end of the new Crystal Springs tunnel to about the present Dayton Avenue.

About three weeks after the completion of the butt-cut redwood box that replaced the original open domestic water supply or power ditch which delivered water from the Los Angeles River to the Buena Vista Reservoir Superintendent W. J. Kelley died (about the last of November, 1886) while on a vacation at Santa Monica. Shortly after the death of Superintendent W. J. Kelley, W. H. Perry, President of the Water Company board, suggested that Superintendent Kelley's duties be assumed by S. B. Caswell and Thos. Brooks, Mr. Caswell to handle all finances, including collection of water bills, while the field department including services, street main construction and all maintenance was to be under the supervision of Mr. Brooks. But on account of his age and lack of the necessary experience, Mr. Brooks respectfully declined the promotion. Shortly after this offer was made, Mr. Brooks, during a visit to Mr. Perry's office, had the sincere pleasure of highly recommending William Mulholland for the late W. J. Kelley's position. Having known William Mulholland for several years, he was sure he would more than make good. A few days later he was notified that Bill Mulholland was to be his boss, Mr. Mulholland having been appointed Superintendent for the Los Angeles City Water Works Company at a salary of \$500.00 per month. Mr. Brooks was delighted when he received this order. In January, 1890, Mr. Brooks was appointed assistant superintendent of Los Angeles City Water Works Company.

One of the first large jobs under the new superintendent was the installation of a 22 inch sheet iron pipe in Buena Vista Street from just below the Buena Vista Street Bridge to High Street (Ord Street), and continuing south as 18 inch on New High Street.

In June, 1883, there were about 1900 services in the system, and one 22 inch 12 gauge sheet iron trunk line starting at the Buena Vista Reservoir and ending at the intersection of First and Main Streets; also an 11 inch sheet iron line from the Buena Vista Reservoir to Buena Vista Street (now North Broadway) and Bishops Road. East Los Angeles was supplied with domestic water through one 6 inch cement lined sheet iron main. Boyle Heights was also served through a 6 inch pipe line by the way of Aliso Street. The Washington and Main Street districts were supplied with domestic water through a 4 inch cast iron main which was laid from Seventh and Main Streets to the south line of Washington Street on Main Street. This gave an ample domestic water supply at that time (1883), as that part of the City from Seventh Street south, east, and west was mostly all fruit orchards and vineyards, and was well supplied with water by way of open zanjias which delivered water from the Los Angeles River to most of this district. With the exception of the 22 inch on Main Street from First Street north and the 8 inch on Buena Vista Street, the entire City



Percolation Pipes

Continued from P. 58

Scale 1" = 100'

Diameter	Quantity	Total Length
24"	2639'	
20"	609.8'	
18"	900'	
16"	5160.4'	
12"	1318.8'	
		Total 10678 ft.

Sheet 39

was supplied with domestic water through 2, 3, 4, and 6 inch mains from elevation 374 which gave an average pressure of about 30 pounds.

In laying mains of 12 inch diameter or under up to the year 1887, ropes and men were the only means we had for lowering the pipe into the trench. During this period of the growth of the domestic water works, cranes, tripods, power pumps, cutting or welding torches, dry tapping machines and other modern conveniences were unheard of as a part of the water works equipment. What was known as "San Jose" hand operated pumps were used on leaks and in making connections when water buckets were too slow.

III - WATER DISTRIBUTION BECOMES A MONOPOLY

The Citizens Water Company bought the properties of Prudent Beaudry's system in 1886, and operated them until about 1890, when the Los Angeles City Water Works Company bought the system.

About 1889 the "Garvanza" system which had been built by Rogers and later operated by Winans was purchased by the Los Angeles City Water Works Company. This system included the "Highland" Reservoir at Latrobe Avenue (Avenue 63) and Crescent Street, with a water elevation of 619 feet, partly supplied by pump from wells in Pasadena located (3) near where the Raymond Hotel later stood. The "Hazard" system including the Hazard Reservoir which was built prior to 1889 and the pump on Richmond Street were acquired by the Los Angeles City Water Works Company in 1891 (4).

The first meter (3) used in Los Angeles domestic water system was a 2 inch Worthington piston type. It was installed by Thos. Brooks on August 16, 1889 (4) on Macy Street west of Mission Road for Chas. Stern's Winery.

In 1893 a Pelton water wheel was installed by the water company and belted to a piston pump. Water for driving the wheel was taken through a 30 inch riveted pipe from the end of the main supply ditch at the Buena Vista Reservoir and discharged to the river through a culvert. An 18 inch riveted force main was installed in Buena Vista Street to College Street and up to the Beaudry Reservoir, replacing the supply from the old Canal and Reservoir Company ditch which was frequently muddy.

Between 1883 and 1894 for a shutoff of not over three-quarters of an hour the consumers were not notified that the water was going to be shut off. During this period on two separate occasions the domestic water supply for the entire City (or rather town) was shut off to make necessary connections at and near the Buena Vista Reservoir from 9 P.M. until 3 A.M. No one was notified that the water was to be off, and during this time the City had absolutely no fire protection except from the zanjias, several of which passed through the town.

The enlarging of the Southern Pacific railroad yards along the foot of the hills about 1894 or 1895 endangered the lower end of the power ditch, so a tunnel was put through the hill from a point opposite the present Dayton Avenue bridge to the north end of the Buena Vista Reservoir. The tunnel is 4 feet wide by about 5-1/2 feet high through the sandstone, about half of its length of 1336 feet being lined with brick.

With the City growing rapidly and the demand for water increasing even faster, a reservoir was built in 1895, (4) in a ravine in the western edge of the City at what is now Lucille and Bellevue Avenues with a high water elevation of 386 feet, and was called the Bellevue Reservoir. A tunnel 4,785 feet long was dug through the Ivanhoe hills and a brick conduit completed the inlet. This tunnel starts from the Crystal Springs conduit at a point just north of Riverside Drive and Hyperion Avenue. The outlet pipe was 30 inch cast iron pipe down Hoover Street to Seventh Street where 24 inch cast iron pipe was laid to Figueroa Street, (4) and 20 inch from that point to Seventh and Broadway, the line being completed on March 24th, 1895.

About this time the tunnel from the Crystal Springs gate house to the supply conduit was abandoned, and the ditch around the point of the hill re-established. Sand had accumulated on the floor of the tunnel, and Thos. Brooks had a gang of men

in the tunnel removing this, when suddenly a portion of the roof started caving in. As the men ran to get out, the water from the headworks ditch poured into the tunnel from overhead, but everyone escaped.

The redwood box enclosing the "power ditch" from Crystal Springs was in bad condition, and in 1897 (3 and 4) was replaced with a 44 inch sheet iron pipe.

The Hazard Reservoir was small and covered with a wooden roof. In 1896 the water company improved this reservoir with concrete lining and a new substantial wooden roof.

The contract between the City and the water company expired in 1898, and negotiations were started for purchase by the City. Several years were spent in appraising and wrangling, the purchase being consummated in December, 1901, for a price of two million dollars.



Installing 24" cast iron trunk line on 7th Street at Westlake Park in 1895.

IV - UNDER MUNICIPAL OWNERSHIP

The system for water distribution acquired by the City consisted (9) of Buena Vista and Bellevue Reservoirs, supplying the low gravity area, Beaudry and Hazard Reservoirs supplying the high gravity area, Angeleno Heights and Highland Reservoirs supplying pumped water to still higher elevations, infiltration galleries at Crystal Springs (low gravity), Buena Vista pump and Highland pump, 676 fire hydrants, and 337 miles of pipe supplying a population of about 120,000 through 23,180 services, less than a thousand of which were metered.

A Board of Water Commissioners consisting of seven members was organized February 13, 1902, (9) under authority of the City Council. William Mulholland was appointed Superintendent, Thos. Brooks, Assistant Superintendent, and L. M. Anderson, Auditor. Upon recommendation of the Superintendent, water rates were reduced, a 10% cut being made on previous flat rates and a cut of 50% on meter rates.

The new municipal organization immediately took steps to increase the storage facilities and the yield of water from the river. In 1903, (9) Elysian Reservoir was completed with a capacity of ten million gallons at high water elevation of 443 feet. Buena Vista pumping plant was enlarged and a 7 mgd pump installed in October, 1903, (9) to lift water from a new infiltration gallery being driven through the rock under the river bed from the Buena Vista pump in a north-easterly direction. Started in 1902, and used in the summer of 1903, this gallery was completed in 1904. This water was pumped to the new Elysian Reservoir, or to Buena Vista Reservoir as required.

Solano Reservoir was built in 1904 on a hill near Elysian Park, the high water elevation being 617 feet. Angeleno Heights Reservoir which was in bad repair was abandoned. In June, 1904, (9) another 7 mgd pump was erected at the Buena Vista pumping plant to pump to the new Solano Reservoir, so the Beaudry pump and reservoir were abandoned, and the Pelton wheel and pump at Buena Vista removed.

A new main supply conduit from the Pomeroy and Hooker lands was constructed

following in general the route of the old Canal and Reservoir ditch, and was completed in (9) 1904 to the site of the Ivanhoe Reservoir. A 24 inch main was laid from here to Bellevue and Lakeshore Avenues (Glendale Boulevard) where it reduced to 20 inches. This brought "high gravity" water into the downtown district, resulting in much damage to old plumbing but benefiting greatly otherwise.

To conserve the water of the river for domestic use the zanja system of furnishing irrigation water was discontinued in the spring of 1904. In the fall of that year Mr. Mulholland and Fred Eaton visited the Owens Valley to appraise that distant water shed as a possible source of water.



Los Angeles River in 1897 just above Power Ditch
Intake at Crystal Springs.

During the summer of 1903, the works of the West Los Angeles Water Company were purchased adding 26.65 miles of mains to the system. This district lying west of Hoover Street was supplied from wells on Jefferson Street, so added only slightly to the difficulty of maintaining an adequate supply of water.

Wells were drilled and pumps installed at Slauson and Compton Avenues, and put in use late in the summer of 1905, the yield being 4 mgd.

In November, 1905 work was started on the fifty million gallon Ivanhoe Reservoir which occupied the upper end of the site set aside for the larger Silver Lake Reservoir. This job was completed in May, 1906. Infiltration galleries were started at the Head works in 1905, and extensions made at Crystal Springs in 1906. Further water capacity also was gained by the drilling of wells on the Pollock Place, and water was discharged into the low gravity conduit from these wells in April, 1906.

Conservation of water by metering was a policy established by William Mulholland



"Tourist" car being demonstrated by Mr. Watt
Moreland in 1904.

and the first Board in 1902, and several years were spent in installing meters on the services of those observed to be wasters of water. By 1906 the per capita consumption of water was reduced by the installation of meters from 300 gallons daily to 125 gallons daily (9). From this time on the systematic metering of all services was carried out block after block, starting with the business area.

In June, 1906, a small tank was constructed on Le Moyne Avenue supplied from a

pumping plant at the East side of Silver Lake. This is the first steel tank used by the modern water works of Los Angeles.

The larger Silver Lake Reservoir with a capacity of 727 million gallons at an elevation of 454 feet was started in August, 1906.

The growing city seemed to have an insatiable thirst, and in 1907, in spite of the development of the Head works and Crystal Springs galleries it was necessary to drill wells and install pumping equipment at Figueroa and Slauson Avenues.

The following year high gravity water from the Head works was brought directly into the Elysian Reservoir by constructing a 30 inch pipe from the Ivanhoe conduit along Locksley Place and Riverside Drive to enter the reservoir through a tunnel under Elysian Peak.

The meter repair and service installation divisions had been increasing in size and importance in proportion to the influx of people to the City, and in March, 1909, these functions were consolidated into the Meter and Service Division with George Read as Superintendent.

In the latter part of 1909 a tunnel was excavated from the Buena Vista Reservoir to Broadway, near Solano Street. Early in 1910, a 40 inch outlet pipe from the new tower at the Buena Vista Dam was laid through the tunnel. Also a 30 inch pipe for Elysian Reservoir high gravity water was laid from the pump house through the same tunnel.

The small Wicks Reservoir, now called Rowena, located on the line of the High Gravity conduit had been abandoned in 1906 when the Ivanhoe Reservoir was completed. In 1910 this reservoir was enlarged and completely rebuilt under the supervision of Thos. Brooks, raising the high water level 8 feet to 454 feet elevation.

An outstanding event of 1911 was the organization of the Bureau of Water Works and Supply and the Bureau of Power and Light. On March 25th, William Mulholland was appointed Chief Engineer of the Water Bureau and E. F. Scattergood, Chief Electrical Engineer.

The Owens River Aqueduct had been under construction for several years, and in preparation for the reception of water from this far away source work was started on the San Fernando Reservoirs in 1911. To receive and store the aqueduct water south of the Santa Monica mountains two reservoirs were started in 1913 in Franklin

Canyon. A tunnel through the mountains to Franklin Canyon was holed through on June 2, 1913.

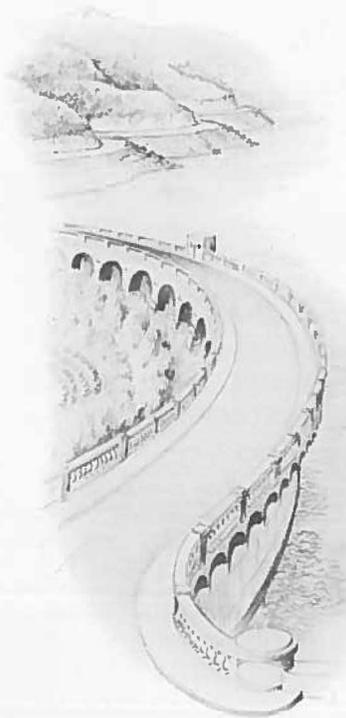
On November 5th, 1913, water was released to flow down the Cascade above San Fernando, celebrating the completion of that great monument to Wm. Mulholland, the Owens River Aqueduct.

The domestic water system both before and after it was taken over by the City of Los Angeles was most fortunate in having at the head such men as Chas. Miles, known as Prince Charley, who was an outstanding hydraulic engineer and a friend to everyone and was well liked by all. He was succeeded about 1876 by Mr. Fred Eaton known by everyone as just "Fred", a man above the average as a civil and hydraulic engineer and a splendid man to work for and with. The third was W. J. Kelley who was more of an office man than an engineer. He died in 1886 after about three and one half years as Superintendent of the Los Angeles City Water Works Company.

Next came Wm. Mulholland, a true friend to all including all animals and trees. If any employee wilfully destroyed a fine large tree he would get a lecture from Mr. Mulholland that he would not forget. During the time he was superintendent for the water company he was known by all as just Bill Mulholland, a true friend to all employees under his supervision. He was far beyond the average man in good hard practicable common sense, had a wonderful memory and a most pleasing personality, and was a most wonderful man to work for and with. His library at the time of his start in water works was little more than Fanning's Treatise on Hydraulics, Trautwine's Engineer's Pocket Book, Kent's Mechanical Engineers Pocket Book, a Geometry, a Trigonometry, and Shakespeare's Works. He was also very fond of Grand Opera. Mr. Mulholland retired from the activities of Chief Engineer on December 1, 1928, but continued his connection with the Water Bureau as Consultant until his death in 1935.

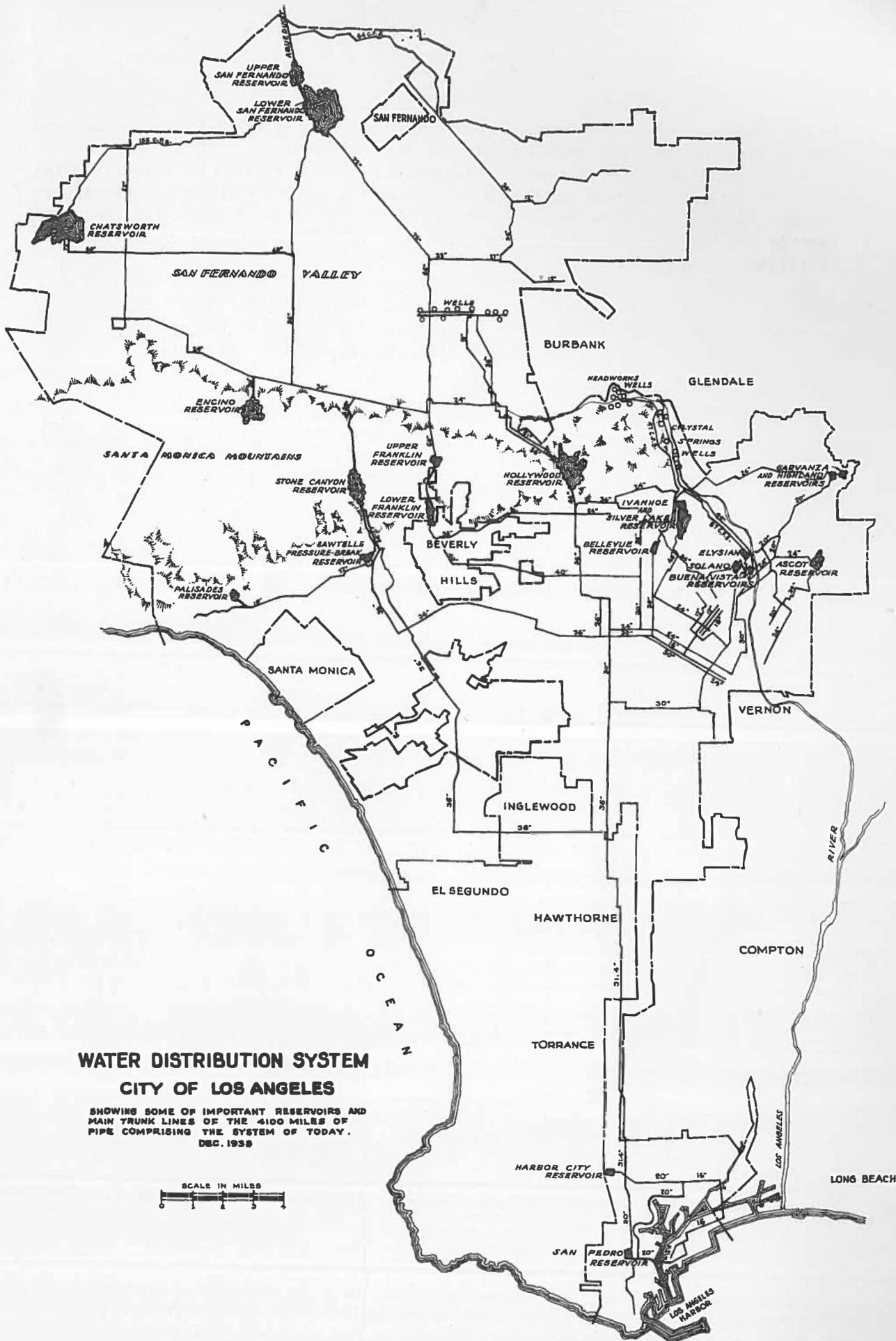
Mr. Mulholland was followed as Chief Engineer by Harvey A. Van Norman, known by his hundreds of friends as just Van. Highly respected and well liked by all the employees under his supervision, he has a most pleasing and attractive personality and is an able engineer, and it would be impossible to find a more just and understanding engineer to have as a superior.

Mr. Van Norman's chief assistant is Wm. W. Hurlbut, who has been with the Department continuously since 1907. He is an able hydraulic engineer, and is the best informed employee concerning the entire water system from Mono to San Pedro, and represents the Chief Engineer and General Manager



in his absence. He keeps in close contact with the activities of all divisions, and insists that all employees receive fair and just treatment.

In the latter part of these notes dealing with operations by the City after 1902, no attempt has been made at completeness, since very thorough reports and records are available covering this period. It is in the two preceding decades that records are missing, and it is hoped that this work fills in some of the gaps and clarifies that period.



**WATER DISTRIBUTION SYSTEM
CITY OF LOS ANGELES**

SHOWING SOME OF IMPORTANT RESERVOIRS AND
MAIN TRUNK LINES OF THE 4100 MILES OF
PIPE COMPRISING THE SYSTEM OF TODAY.
DEC. 1938

