



WATER

FROM THE
COLORADO
RIVER



HD
1694
C2
M48
1931



WATER

FROM THE
COLORADO
RIVER



Issued by

**THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA**

Headquarters, S. W. Corner, Broadway at Third Street
LOS ANGELES



JULY, 1931

9987430

For the generous co-operation given
by the
LOS ANGELES CHAMBER of COMMERCE
and the
DEPARTMENT of WATER and POWER
of the
CITY of LOS ANGELES

which organizations supplied the population, industrial, port tonnage and agricultural data used in this booklet, The Metropolitan Water District of Southern California desires to express its sincere gratitude.



Artist's picture map of two great Colorado River projects

WATER FROM THE COLORADO RIVER



THE DESERT. Typical of wastelands to be crossed by Metropolitan Aqueduct enroute from Colorado River to cities of Southern California.

Purpose of Book

WATER is the life-blood of Southern California. We are able, with absolute accuracy, to measure our present development in terms of available water supplies. Whether or not this region is to maintain its present state of development and values and, in addition, enjoy continuing growth, depends entirely upon the provision made for the development of additional water supplies.

Southern California is a semi-arid region. Its cities rapidly are exhausting their local water supply sources. The only remaining water source capable of meeting the needs of these cities is the Colorado River.

The fifteen cities now comprising the Metropolitan Water District of Southern California are prepared to finance and build the Aqueduct works required to bring water from the Colorado River to their people. These fifteen cities possess property values totaling more than \$5,000,000,000; they represent a total population of 1,711,000.

Water from the Colorado River is needed to maintain the \$5,000,000,000 of wealth now existing in the cities of the Metropolitan Water District and to meet the requirements of the people now residing in this area—to say nothing of a reasonable provision for future growth. This water is to be made available from the Colorado River.

It is the purpose of this booklet to outline the Boulder Canyon Dam project on the Colorado River and the Metropolitan Aqueduct. Furthermore, it seems pertinent to indicate the extent of the population, industrial and agricultural resources of the Metropolitan area, which stand behind and urgently require Colorado River development.



WATER FROM THE COLORADO RIVER



COLORADO RIVER WATER. The Intake site of the Metropolitan Aqueduct about 150 miles down the River from Boulder Canyon. Here water will be taken from the River and start on its way to the Cities in the Metropolitan Water District.

Why We Need the Water

CITIES of the Coastal Plain of Southern California are today securing water from three sources;

- First. Annual rainfall and the runoff from the mountain snow crops.
- Second. Underground water supplies which accumulated in this area during the countless centuries before man began to develop this region.
- Third. Owens River and the Mono Basin, water supply source for the City of Los Angeles, now in course of development.

All of these three water sources combined are incapable of meeting safely the water needs of these cities beyond the time it will require to make Colorado River water available.

At the present time, Southern California is using all of the available annual rainfall and, in addition, is drawing off its underground water supplies to make up the balance.

Underground water supplies in the Southern California Coastal Plain are contained in three major basins or watersheds—the Los Angeles, San Gabriel and Santa Ana Rivers. Each of these river basins are broken up into a number of sub-basins, there being more than 30 such “water pockets” in all.

Careful studies of each basin and sub-basin have been carried forward for many years. Water levels in every section of Southern California have been systematically charted. The amounts of water coming into these basins have been measured, as have the quantities being extracted.

A few of these sub-basins are holding their own, but in the Coastal Plain, as a whole, the water levels are rapidly and continuously dropping. The theory that a series of wet years will restore the water levels is exploded by the fact that these water levels have been dropping steadily for the past thirty five years despite a number of wet cycles that have occurred in that time.



WATER FROM THE COLORADO RIVER



METROPOLITAN
AQUEDUCT SURVEYORS. Under the
blazing Desert sun for seven years
engineers studied and surveyed a
vast area of 60,000 square miles
searching for the best and most
economical Aqueduct route.

WATER FROM THE COLORADO RIVER

State engineering records reveal that Southern California now actually is using 170,000,000 gallons of water each day MORE than Man or Nature is replacing. This means that, in addition to the annual rainfall, this section is depleting its underground water reserves at the rate of 170 million gallons a day. At this rate, it is obvious, the rapidly diminishing underground reserves soon will be exhausted.

Because it happened to experience a more rapid growth than other sections, Los Angeles reached the limit of its local water sources twenty years ago. This city has maintained uninterrupted growth and industrial expansion, thus far, by importing water from Owens River through an aqueduct 250 miles long. It is now carrying forward additional water development works in Owens Valley and the Mono Basin designed to meet its water needs pending the construction of the Metropolitan Aqueduct from the Colorado River.

It is significant to note that more than 90 per cent of the water being used this year by Southern California, including the Los Angeles-Owens River supply, is being pumped from underground water reserves. These reserves rapidly are dropping.

A few years ago there was an artesian basin in this region totaling 315 square miles in area. Today artesian wells practically have disappeared. In 162 square miles along the Coast, water is now being pumped from depths below sea level. Beneath more than 40 square miles, salt water from the ocean has penetrated and ruined the fresh water basins and caused the abandonment of wells. This encroachment continues and is an ever-present menace wherever water is being withdrawn from depths below sea level.

It is acutely evident that every practicable and feasible form of water conservation must be practiced in Southern California in order to tide over the next eight or ten year period—during which time the Metropolitan Aqueduct from the Colorado River will be under construction.



WATER FROM THE COLORADO RIVER



AQUEDUCT SURVEYOR ON THE RIVER. Six principal points on the Colorado River were studied in search of the best place to divert the Aqueduct water supply and from these points, 65 routes were projected and investigated prior to selection of the Parker line by the District.

Water Rights

UNDER the Metropolitan Water District's contract of April 24, 1930, with the United States, the latter is required to deliver to the District each year 1,050,000 acre-feet of water of the Colorado River, subject to conditions set forth in Article VIII of the Colorado River Compact. Such contract obligates the District to receive the water to be delivered to it by the United States, and, at its own expense, to convey the same to its proposed aqueduct; also to pay monthly for all water so delivered to the District at the rate of 25c per acre-foot. This contract was made by authority of the Boulder Canyon Project Act.

Careful engineering studies show that the Boulder Canyon Reservoir will salvage and impound at least 7,500,000 acre-feet per annum of water over and above that required to satisfy "present perfected rights" in all states concerned. Thus, there will be ample water available for delivery by the United States under this contract.

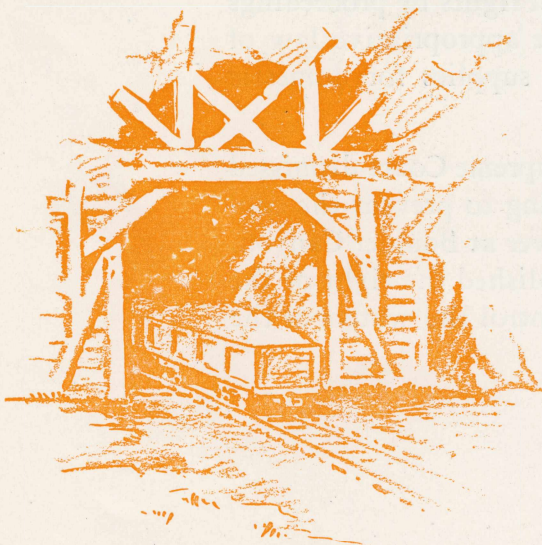
As the result of friendly negotiations, controversy between the District and other claimants of water along the River in California, particularly as to quantities to be diverted, have largely been adjusted. Remaining questions are yielding to like methods of treatment.

The District has reinforced its contract rights by proceedings under the water laws of California. The appropriative law of the State grants a preference to water supplies for domestic and municipal purposes.

On May 17, 1931, the United States Supreme Court dismissed the action by the State of Arizona seeking to prevent the construction of a dam on the Colorado River at Boulder Canyon. Thus the Supreme Court definitely established the right of the Federal Government to regulate and control the waters of the Colorado River.



WATER FROM THE COLORADO RIVER



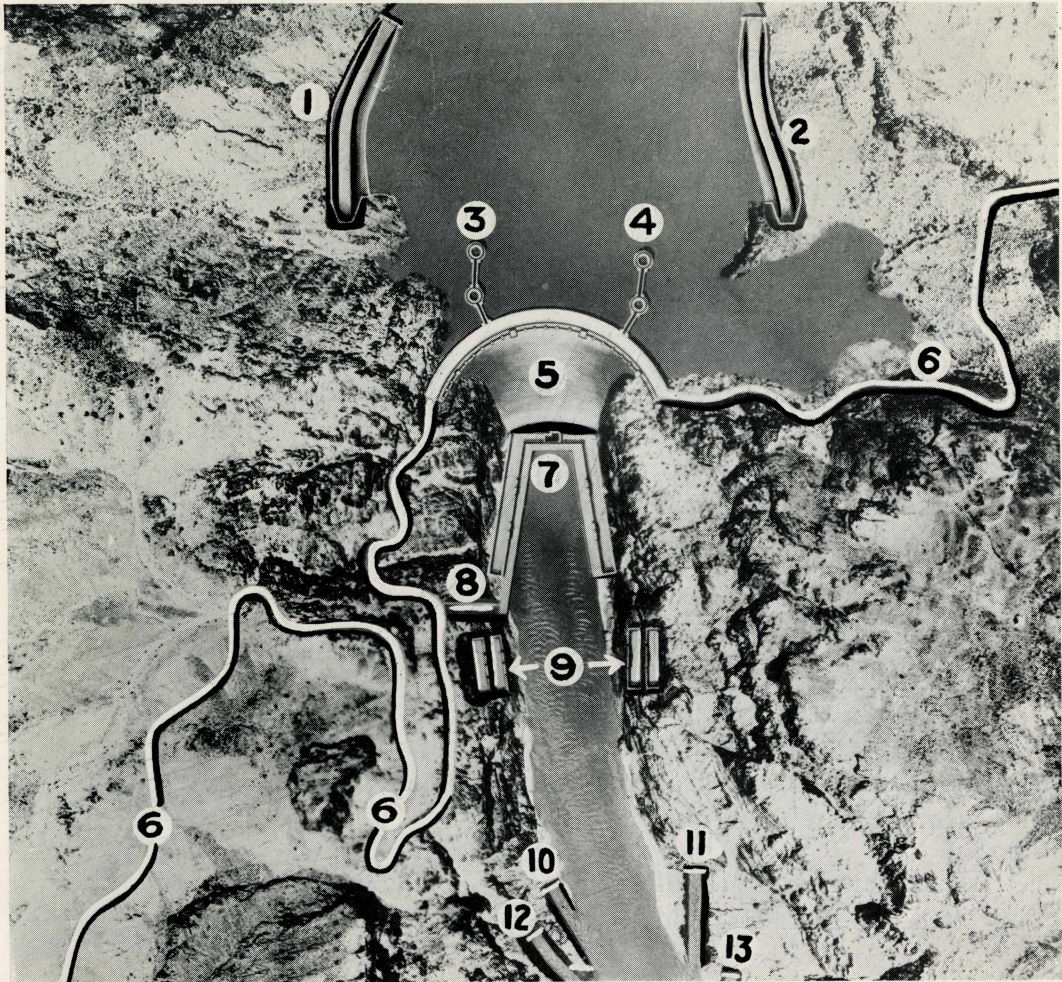
WHERE LONGEST
AQUEDUCT TUNNEL WILL PIERCE
MOUNTAIN. Air view looking over
San Jacinto Peak and San Gorgonio
Pass, with West Portal of 13-mile
Aqueduct tunnel indicated by ar-
row.

Aqueduct History

1923. First survey work launched on Aqueduct project to deliver Colorado River water to cities of Southern California.
1925. \$2,000,000 bond issue voted by Citizens of Los Angeles to carry forward engineering studies on Aqueduct from Colorado River.
1927. California State Legislature adopted Metropolitan Water District Act enabling cities to organize the Metropolitan Water District of Southern California for the purpose of financing, building and operating Aqueduct from Colorado River.
1928. August 3. The Supreme Court of the State of California pronounced the Metropolitan Water District Act to be constitutional.
1928. December 29. Metropolitan Water District of Southern California established at meeting in Pasadena, with eleven original member cities.
1930. December 19. Engineering Board of Review composed of Thaddeus Merriman, A. J. Wiley and Richard R. Lyman filed report with Metropolitan Water District Board of Directors in which Parker Route was recommended as best and most economical route for Aqueduct. Chief Engineer Frank E. Weymouth also had recommended Parker route.
1931. May 8. Metropolitan District Board of Directors unanimously adopted resolution declaring that bond issue to finance construction of Metropolitan Aqueduct from Colorado River should be submitted as soon as practicable.



WATER FROM THE COLORADO RIVER



1 and **2**. Spillways to carry overflow water from reservoir.

3 and **4**. Outlet Towers to connect with Power Plants.

5. Hoover Dam.

6. Highway across the Dam.

7. Power Houses.

8. Inclined elevator for Construction material.

9. Outlet Houses for water not passing through Power Plants.

10-11-12-13. Outlets for Diversion Tunnels.

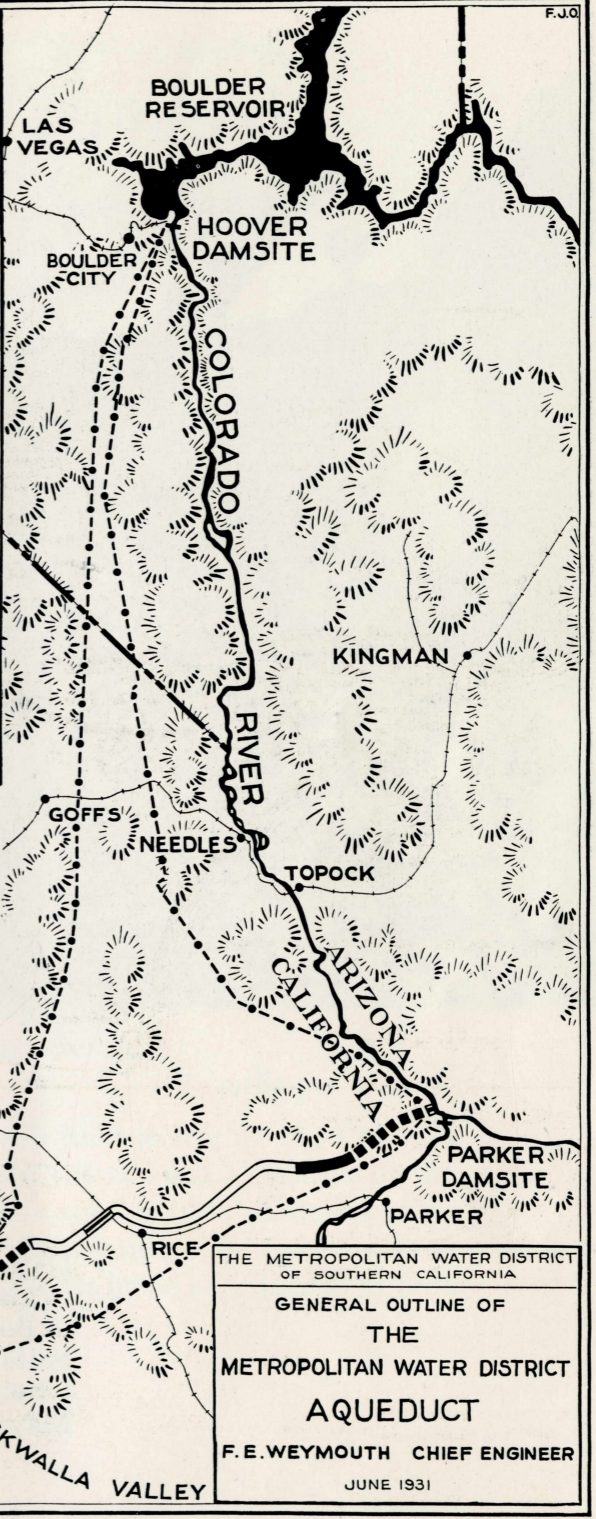
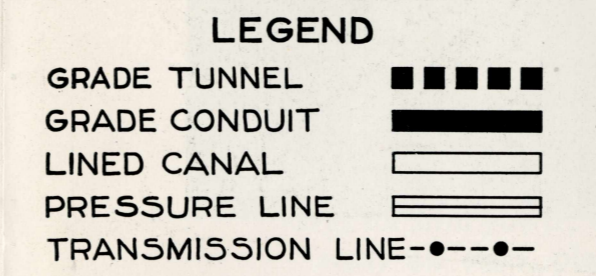
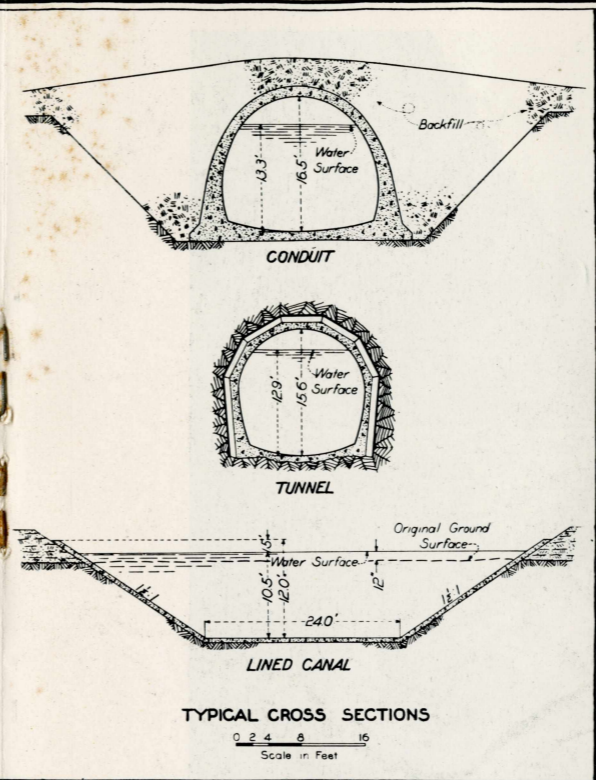
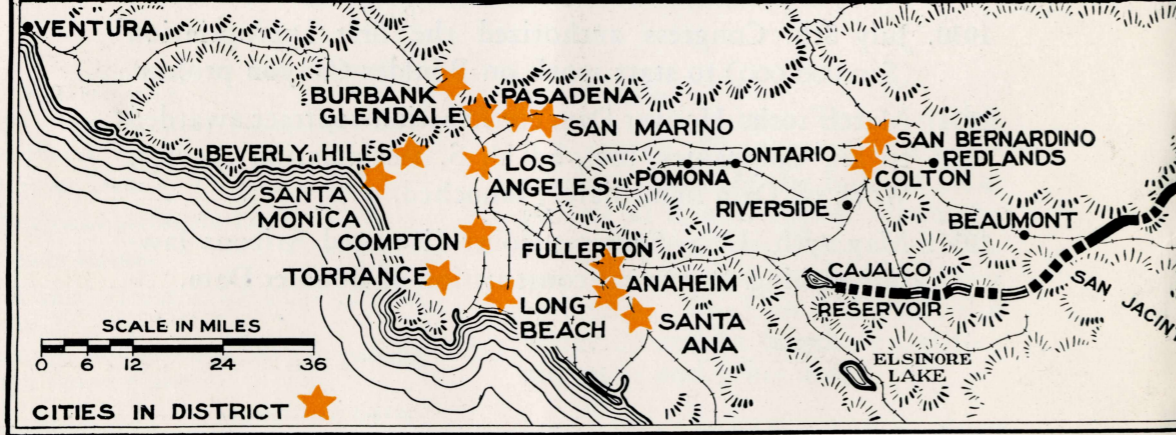
WHEN THE BIG JOB IS FINISHED. Photograph of a Government model of the Boulder Dam project as it will appear when the Dam, Power Plant, Tunnels, Roads and other related works have been completed. The Dam will store the water needed by Southern California cities and other areas.

Colorado River History

AMONG the notable events that mark the history of Colorado River development, thus far, are the following:

- 1906. Colorado River flood in Imperial Valley. Urgent necessity of River flood control revealed.
- 1918. Congress adopted Kincaid Act, authorizing study of lower Colorado River by U. S. Reclamation Service.
- 1922. Department of the Interior submitted to Congress report and recommendation for flood control and development of lower Colorado River. Report recommended construction of Dam at Boulder Canyon.
- 1922. Representatives from seven Colorado River Basin States, following series of public hearings presided over by Herbert Hoover, then Secretary of Commerce, signed Colorado River Compact. This Compact provided for division of waters between Upper and Lower Basin States. Upper Basin includes Colorado, New Mexico, Utah and Wyoming. Lower Basin, Arizona, California and Nevada.
- 1922. Bills for the development of the Lower Colorado River and based upon the recommendations of the Interior Department, were introduced in Congress by Senator Hiram W. Johnson and Representative Phil D. Swing.
- 1928. Congress adopted the Swing-Johnson Bill. Signed by President Coolidge on Dec. 21.
- 1930. July 8th. Congress authorized the first appropriation (\$10,000,000) to start work on Boulder Canyon project.
- 1931. March 10th. Hoover Dam construction contract awarded to Six Companies, Inc., by U. S. Reclamation Service. Work on Dam immediately launched.
- 1931. May 17th. U. S. Supreme Court dismissed Arizona lawsuit seeking to prevent construction of Boulder Dam.





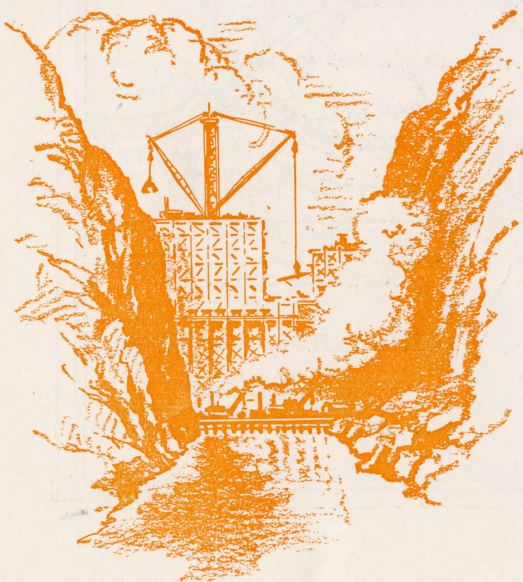
THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

GENERAL OUTLINE OF
THE
METROPOLITAN WATER DISTRICT
AQUEDUCT

F. E. WEYMOUTH CHIEF ENGINEER

JUNE 1931

WATER FROM THE COLORADO RIVER



BUILDING HOOVER DAM. View of one of the battery of giant steam shovels now at work in Boulder Canyon, 24 hours a day, building the largest dam in the world. Scene photographed in May, 1931.

Hoover Dam Facts

HOOVER Dam at Boulder Canyon, now being built by the United States Government is to be, by far, the highest and largest dam ever raised by hand of man.

Table of Facts

Height of Dam, above bedrock	727 feet
Length of crest	960 feet
Width at bottom, up and downstream	650 feet
Volume of concrete masonry	4,500,000 cubic yards
Cement required for Dam	5,500,000 barrels
Steel required for Dam	19,000,000 pounds
Capacity of reservoir	30,500,000 acre feet
Flood control capacity	9,500,000 acre feet
Area of reservoir	145,000 acres
Length of lake	115 miles
Elevation of high water line	1229 feet
Installed capacity of Power Plant, 1,200,000 horsepwr.	
Continuous firm power output	663,000 horsepower
Time for construction	7 years
Contract construction price, including labor and erection only	\$49,000,000
Charge for firm power, which will repay all costs, plus interest, within 50 years	1.63 mills per k. w. h.



Boulder Canyon reservoir will hold in storage the Colorado flood waters now wasting into the sea and a portion of this conserved water will be made available for the Metropolitan Water District of Southern California. This water will be delivered to the cities in the District by an aqueduct to be built by the District.

WATER FROM THE COLORADO RIVER



LITTLE SAN BERNARDINO MOUNTAINS. Along the foothills of this desert range the Metropolitan Aqueduct will push its way via tunnels, inverted siphons and covered conduits, thus holding its elevation above the Coachella Valley which drops below sea level.

Aqueduct Facts

FOLLOWING seven years of exhaustive engineering investigation and a careful study of some 60,000 square miles of Colorado River mountain and desert country, the Metropolitan Water District of Southern California selected the general route for the Metropolitan Aqueduct by action of the Board of Directors on January 16, 1931.

Table of Aqueduct Facts

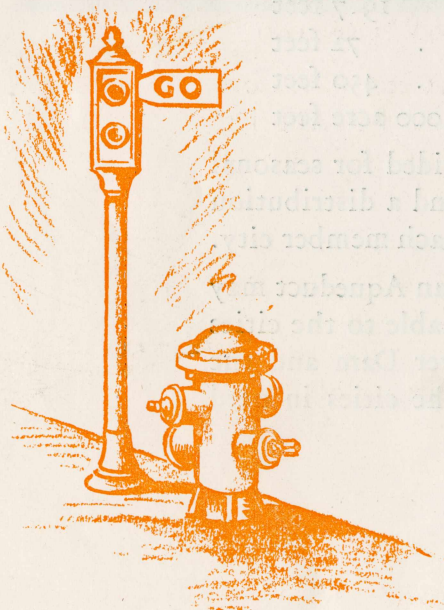
Point where water will be diverted from river	}	Upper Parker Canyon
Location of Parker intake		155 miles below Hoover Dam 57 miles below Needles, Calif.
Length of Aqueduct		266 miles
Number of tunnels		40
Length of longest tunnel		12.95 miles
Total length of tunnels		93.67 miles
Total length of pipe lines		18.86 miles
Length of grade conduit		154.38 miles
Diameter of tunnels		16.1 feet
Height of conduits		16.9 feet
Width of conduits		19.7 feet
Height of diversion dam		72 feet
Initial elevation of water surface		450 feet
Water delivered to cities per year		930,000 acre feet



Ample terminal reservoirs will also be provided for seasonal regulation and emergency storage purposes, and a distribution system constructed to the local reservoirs of each member city.

Only by the construction of the Metropolitan Aqueduct may water from the Colorado River be made available to the cities on Southern California Coastal Plain. Hoover Dam and the Colorado River are almost 300 miles from the cities in need of water.

WATER FROM THE COLORADO RIVER



METROPOLIS. A section of the Metropolitan Area where 2,000,000 persons now live, and use water. Upper Center Right, Los Angeles business district; Above, Pasadena; swinging to the Left along the foothills are Glendale, Burbank, Hollywood and a touch of Beverly Hills.

Population and Water

IN no section of the United States has there occurred such an amazing growth in population and wealth as that which has taken place continuously during the past three decades in the fifteen cities in the Metropolitan Water District of Southern California.

Here are a group of cities that have increased their population more than ten-fold within the past thirty years . . . and have increased the assessed valuation of their properties many, many fold, as well.

These increases have brought with them tremendous demands for water. It is population and this established wealth which make the Metropolitan Aqueduct a feasible project. Furthermore, aside from the question of future growth and industrial expansion in this area, Colorado River water is needed to maintain and safeguard this existing population and wealth.

Population Data

U. S. Census Figures for past Three Decades and Estimated Growth for next Two Decades.

Fifteen cities in Metropolitan Water District.

1900	1910	1920	1930	1940	1950
130,729	408,354	760,486	1,711,328	*2,579,000	*3,566,000

*Projected by Los Angeles Chamber of Commerce on theory that other cities will grow at same rate as does Los Angeles. In past, most of these cities have exceeded central city's rate of growth.

County Assessor records reveal that the total assessed valuation of the fifteen cities in the District, as of 1930, amounted to \$2,431,000,000. In view of the fact that the Counties assess on a basis of a value less than half the actual value, the real valuation of these fifteen cities exceeds five billion dollars.



WATER FROM THE COLORADO RIVER



WORLD COMMERCE.
A section of Los Angeles . . . Long
Beach Harbor . . . 20 years ago,
mud flats . . . today, second seaport
in the world in total commerce and
first in intercoastal trade. Where
Industry is centering and demand-
ing large quantities of fresh water.

Industry and Water

THIRTY years ago the Metropolitan Water District area was a sparsely settled region with no Harbor worth the name and scarcely any industrial activity. Today the Los Angeles-Long Beach Harbor is second in world commerce and first in intercoastal trade.

In the value of its industrial production, Los Angeles has leaped from twenty-third place among American cities, in 1899, to eighth place in 1929.

Among the principal industries of the Metropolitan Area are . . . petroleum refineries, rubber manufacturing plants, fibre board and paper products, furniture manufacturing, ice and cold storage packing plants, steel mills, soap products and laundries.

Industry has found Southern California climatic conditions to be ideally adapted to its requirements. Excellent transportation facilities by rail and water have also encouraged industrial growth in this section.



Value of Manufactured Products in Four Counties

Represented in Metropolitan Water District

1899	1909	1919	1929
\$30,780,000	\$75,153,000	\$479,545,000	\$1,388,700,000

Growth in Los Angeles Harbor Commerce

1915	1920	1925	1930
\$88,000,000	\$153,000,000	\$671,000,000	\$1,055,000,000

More than 13 square miles of wharves, warehouses, ship-yards and petroleum facilities are included in the Los Angeles Harbor. It represents an investment, up to date, of \$100,000,000.

It is this tremendous industrial development that has helped to create such a demand for water . . . and foreshadows far greater demands for the immediate future.

WATER FROM THE COLORADO RIVER



ORANGE GROVES.
In Metropolitan Water District.
Queen of the crops that have
increased from an annual value of
\$15,000,000 in 1900 to \$175,000,000
in 1930 in Metropolitan area. Pro-
duced by Sunshine . . . and WATER.

Irrigation

BY the application of water upon desert spaces, the energetic people of Southern California have transformed this region into one of the richest horticultural and agricultural centers in the world.

Water for this intense crop production has been secured by pumping enormous quantities of water from underground supplies that required centuries for Nature to accumulate. Annual rains are capable of maintaining little more than desert plant life.

The following table reveals the amazing record of agricultural development in Los Angeles, Orange, Riverside and San Bernardino Counties, included in the Metropolitan area:

1900	1910	1920	1930
\$15,470,000	\$32,849,000	\$133,688,000	\$175,128,000

Note: The above crop figures are taken from U. S. Census and County Agricultural Commissioners reports, compiled by the Los Angeles Chamber of Commerce.

Virtually every dollar of this agricultural production is dependent upon an abundant and reliable water supply. Colorado River water is required to maintain the present state of development . . . and to support a reasonable increase in citrus and farm production in the future.

So rapid and intense has been the development of rural areas of Southern California that the demand for water in these sections frequently is as acute as in the cities. The habitable area of the Coastal Plain is largely urban in the making. In this territory the farms of yesterday are the towns of today.

Accordingly, provision of a water supply for domestic and municipal purposes in the Metropolitan District must include a supply for existing cities and for adjacent areas soon to assume urban conditions.



WATER FROM THE COLORADO RIVER



IN BOULDER CANYON. Men at work on one of huge diversion tunnels on Boulder Dam project, where a million horsepower of hydro-electric energy will be generated. A part of this power will pump Aqueduct water over intervening mountains.

Boulder Canyon Power

THAT there is a waiting market for all of the Boulder Canyon hydro-electric power allocated to Southern California is generally conceded.

Use of electric energy for the electrification of all industries, in commercial houses, in homes and for the urban and suburban railways, in the Metropolitan area, is almost universal.

In 1913 this area consumed 160 million kilowatt hours of electric energy. In 1930 that consumption had jumped to 1,185 million kilowatt hours, more than a seven-fold increase.

Allocation of Boulder Canyon Power

(Original allocation by Contract of April 26, 1930, with the United States.)

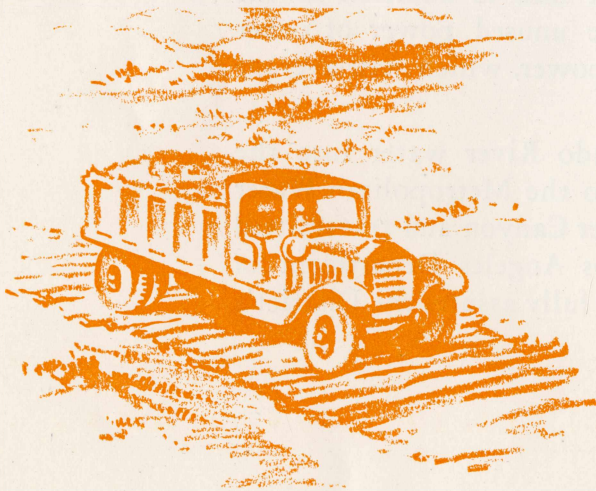
Metropolitan Water District of		
Southern California	36%	234,000 horsepower
City of Los Angeles	13%	84,500 horsepower
Other cities in Southern California	6%	39,000 horsepower
Southern California Edison, and		
other power companies	9%	58,000 horsepower
State of Nevada	18%	117,000 horsepower
State of Arizona	18%	117,000 horsepower
Total, original allocation	100%	650,000 horsepower
Allocation, City of San Diego		13,000 horsepower
Total, continuous firm power		663,000 horsepower

The Metropolitan Water District has, in addition to the above allocation, first right to the unused power of other allottees, and also to all secondary power, which will average more than 200,000 horsepower.

Power which will pump Colorado River water into the Aqueduct and over the mountains to the Metropolitan Water District will be generated at Boulder Canyon and transmitted to the pumping plants by the Los Angeles Department of Water and Power. This arrangement fully assures the District's power supply.



WATER FROM THE COLORADO RIVER



THE LONG TRAIL TO WATER. East of Shaver's Summit we look along the line of an old corduroy road . . . across country to be traversed by the Metropolitan Aqueduct . . . and beyond . . . to the Colorado River . . . and water.

Metropolitan Water District of Southern California

Headquarters, Broadway at Third Street
LOS ANGELES

FRANK E. WEYMOUTH, *Chief Engineer*

Officers of the District

W. P. WHITSETT . . . *Chairman of the Board*
FRANKLIN THOMAS . . . *Vice-Chairman*
S. H. FINLEY . . . *Secretary*
D. W. PONTIUS . . . *Controller*
CHARLES H. TOLL . . . *Treasurer*
W. B. MATHEWS . . . *General Counsel*
A. L. GRAM . . . *Executive Secretary*

Cities in District and Directors

Anaheim	O. E. STEWARD
Beverly Hills	GEORGE R. BARKER
Burbank	HARVEY E. BRUCE
Compton	(To be appointed)
Colton	CHAS. A. HUTCHINSON
Fullerton	WALTER HUMPHREYS
Glendale	W. TURNEY FOX
Long Beach	NOWLAND M. REID
Pasadena	FRANKLIN THOMAS
San Bernardino	R. C. HARBISON
San Marino	HARRY L. HEFFNER
Santa Ana	S. H. FINLEY
Santa Monica	ARTHUR A. WEBER
Torrance	JOHN DENNIS
Los Angeles	JOHN G. BULLOCK
Los Angeles	I. EISNER
Los Angeles	W. L. HONNOLD
Los Angeles	JOHN R. RICHARDS
Los Angeles	W. P. WHITSETT