

- a 70

This report was ordered compiled at a meeting held February 5, 1916. Those present were:

John S. Akerman,	Pres. Chamber of Commerce
W. H. A. Johnston,	" Cabrillo Club
O. W. Cotton,	" Realty Board
John S. Gillons,	" Merchants Association
F. M. White,	" Manufacturers Association
Edw. F. Stahle,	Sec. Chamber of Commerce
John F. Forward, Jr.,	
Chas. C. Crouch,	
Rufus Choate,	

CONSIDERATION OF A PLAN TO DEVELOP A
MUTUAL SUPPLY OF WATER FOR THE CITY
OF SAN DIEGO AND ITS CONTIGUOUS TER-
RITORY. By

Rufus Choate.

In accordance with the ideas expressed by the executive heads of the local commercial organizations assembled and the special wish of John F. Forward, Jr., exponent of the present endeavor to co-ordinate the land and water resources of this immediate territory, I am herewith presenting my conclusions.

To permit the development of those sections adjacent to Oceanside elimination is made of the stream flow on the San Luis Rey River west of Warners Ranch and the waters of the Temecula River. These streams could amply supply a population of 150,000.

Fifty thousand additional acres contiguous to the City of San Diego can be irrigated or 450,000 more people supplied if the remaining waters are properly conserved. Estimates are based on reports eliminating enthusiasm and dry periods properly considered. Engineers have based their conclusions on stream flows and rainfalls for the previous twenty years, which included the greatest drought since 1850. They have considered all conditions suggested in making estimates in semi-arid countries as Southern California is termed. The possible safe daily yields from the various systems thus deducted are basis of these statements.

The Mojave River proposition is offered according to the statements in their report. Greater wealth, population and demand may suggest in the future that San Diego should go to the Sierra Nevadas or receive its supply from the proposed

government conservation scheme on the Colorado.

This question of water has become Chautauquized. The time is not far distant when a real plan must be adopted. There should be an elimination of the present policy whereby units of construction are carried on, based on the individual ideas of the ever changing administrations; properly constructed reservoirs are good for a century. The best possible plan should be adopted, so that when the system is completed maximum results will be obtained. By following this method it would discredit false reports concerning San Diego's water supply. It would show the possibilities thereby encouraging the investment of capital. The initial construction desired could be determined and the fear of a water shortage eliminated by adding units in proportion to the demand.

The plan considered presents the possibility of giving the City of San Diego an adequate water supply and at the same time assist the development of the adjacent territory. The districts to be aided are located west of the El Cajon Valley and Otay reservoirs and that portion south of the northern boundary of Linda Vista to the Tia Juana Valley and including the City of San Diego and the bay region. The studies are confined to the vast level areas void of adequate gravity and underground supplies commonly known as the Mesas. It is estimated that these sections contain 65,000 acres of level and rolling land. Valleys and canyons have been eliminated.

The land quantities and maps were furnished by F. A. Rhodes, Civil Engineer of San Diego.

AN ADEQUATE WATER SUPPLY THE
IMPORTANT ISSUE.

Attached to this report is a detailed statement from the engineer of the company having rights on the Mojave River. The drainage area is located on the north side of the San Bernardino mountains.

Your attention is also directed to the fact that an insurance supply might be secured from the Imperial Valley or Colorado River. The maximum supply of any local conserving system is reduced by reason of certain prolonged dry periods. When in use this insurance unit would probably increase the duty on water, but its period of supply would be very limited. It would permit the use of more local waters, reducing reserve supplies and thereby increasing revenues.

At this time special consideration is given to the water resources within a radius of sixty miles. The diversions to be made at Warner's dam, the several dams on the Santa Ysabel, San Diego, Sweetwater, Otay, Cottonwood and Tia Juana Rivers. A number of complete reports have been compiled on the separate systems. Local water conditions have made legal history. Testimony by hydraulic engineers before the courts and railroad commission as to water possibilities are matters of public record. The United States weather bureau has recorded the rainfall since 1850 as to precipitation in the City of San Diego. Since 1905 the Federal government has measured the run off of our streams. The method of measurement in most localities admits of only an approximation. The diverting dam above Lakeside and the Sweetwater structure, each built about 1887, have permitted more accurate statements which are matters of record. The conservation of waters on the Pacific Coast by the construction of dams has

become a science. All these conditions tend to facilitate this undertaking. Only a small percentage of the run off waters are now conserved. Of the many large dams to be constructed by the adoption of a comprehension plan only two have been built. One is so located as to arrest the entire desired drainage of its river, but inadequate in size to conserve the larger floods. The other only stops the waters of a tributary stream. This condition allows the acceptance of a complete study for a plan whereby modern methods of construction and combinations may be adopted.

SUGGESTIONS AS TO PROCEDURE.

Legal community combinations should only be initiated when conservative conclusions have been determined. This city is in no position to lend its credit to any tentative promotion scheme. Estimates--as property values, net supplies, safe construction and costs--must be deducted from careful surveys made by competent unbiased engineers. In general the district, but in particular the city's financial ability to undertake this work, must be carefully considered. Surveys to this date are regarded as preliminary. Much data has been secured to facilitate final and positive conclusions. It must be the work of competent engineers to present a comprehensive plan which can be constructed in units.

MUTUAL DEVELOPMENT.

The reasons for this mutual consideration is based on the theory that private capital has not been active in assisting constructive work, that laws have been specialized to favor municipalities, that the systems under consideration may eventually become one unit, that we look to the same sources for our

future supplies, that separate district water development will breed contentions, minimize results and increase costs, that the sections herein mentioned are only separated from the City of San Diego by legislative lines, that the elimination of these boundaries is not far distant, that an immediate productive territory is a desired unit, that San Diego must increase its water supply, that uncertainties destroy confidence, that larger suburban towns with self-supporting sections will make a greater San Diego, that by co-operative treatment they should finally be merged into one great community, calls to your attention a careful consideration of some conservative plan whereby the city may lend its credit in this mutual undertaking. State laws have recently been passed which might be adopted. A metropolitan water district could wholesale the stored waters to the separate communities which in return would be the responsible distributors. Existing laws might be amended by the legislature in 1917 and made more adaptable to this locality. This community combination must be carefully considered. Such questions as low price acreage receiving water supplies, quantities to be delivered to each section and maintenance are but a few of the factors in this scheme.

THE MANANA WATER QUESTION.

If San Diego desires to attain her just position, she must develop certain units. A hurried panoramic glance at nature's picture suggests a great future city on the harbor of San Diego. The good Lord only started the world, gave fewer problems to this community and surrounded the San Diego constructionist with ample resources to overcome obstacles. The

one paramount issue has been, and it still exists, the water question. Delay in promoting plans to control and to develop our water resources has operated much to our disadvantage. The conditions which now surround this problem produce a positive demand that it be considered from every possible angle. It is still most suggestive of an earnest endeavor.

MUST BE SAFE GUARDED.
BUSINESS MEN'S BUSINESS.

We must admit that the real builders of communities are its men. The successful business executives of this city must be the exponents of this proposition. The successful completion of the Panama-California Exposition proves conclusively San Diego's ability to do big things. It is the product of local business men deducting their conclusions from advice and plans submitted by men possessed of national recognized reputations. Big business properly conducted along lines of honest intention may be sprinkled with errors and still bear the stamp of positive success. The initial moves and successful conclusions in this problem will depend entirely upon the initiative, the efforts, the time and the determination of our most successful business men. To secure the confidence of the public, this step must be adopted. Besides being a costly proposition, enthusiastic water promoters, energetic owners of dry mesa land and the ever ready townsite promotor will be quite in evidence.

The credit of San Diego must be loaned if the project is carried to a successful issue. Therefore, these business men who must stand sponsor for the city's interest must be the im-

partial dictator guided by unselfish personal motive and empowered with full legal authority. They must have the advice of competent engineers. The safety of the community will demand this procedure. A properly directed endeavor means substantial local advancement. It will provide an immediate productive territory, assist the completion of one railroad and attract another road from the north. It will invite the investment of new capital and increase the actual and assessed wealth of the bay region. The indirect personal gains make it the business man's business.

REASONS FOR POPULATED CENTERS.

Communities, like individuals, are best productive of results when confronted with obstacles or problems. The proof of this statement is illustrated by certain American cities arising in locations adverse to the laws governing the reasons for congested communities.

Among the reasons are:

- 1st. The desire, activity and determination of the pioneer.
- 2nd. The discovery and development of material wealth or making possible at a minimized cost an immediate productive territory.
- 3rd. The advantage of location, thereby granting rights in competitive sections.
- 4th. By the development of contiguous territory assisting and strengthening the commercial units preparatory to entering competitive fields.
- 5th. Obtaining goals by possessing industrial, commercial and banking units in proportion to foreign demands.
- 6th. By having competing lines of transportation each

responsible to different executive heads, even though the roads combine for mutual protection,

7th. Possessing the shorter lines of transportation to small towns or larger productive communities. Being favored by lower cost of freight and time of transit with the larger centers. On the Pacific Coast, harbors determine terminal points a most important factor.

8th. The capitalization of climate conditions has become an issue in the southwest accomplished by rapid transit, paved roads, well developed communities interlinked with productive yet attractive orchards, all tending to charm and keep interested the visitor, the one who has made Southern California.

9th. Last, but not least, Men.

CONSERVATIVE CONCLUSIONS DESIRED.
ENTHUSIASM DISCOUNTED.

A careful review of these constructive units determines the importance of this question. The principle obstacle suggests little concern as to reservoir sites. Nature has been generous in favoring this county with ideal basins having storage capacity approximating two hundred billion gallons. The locations are ideal, permitting gravity water to all contiguous sections susceptible to improvement. Rainfall averages are most valuable but somewhat deceiving. The one determining feature is the actual run off of the stream taken at the point of discharge into the reservoir. These statements are injected as a governor to enthusiasm produced by exceptional wet winters. During the season of 1895 having a local rainfall of 11.90 inches increasing materially along the higher elevations caused twenty-three billion gallons to discharge into the Sweetwater reservoir. A local

rainfall of 10.45 inches in 1901, increasing slightly along the upper elevations permitted an encatchment of only 270 million gallons. The rainfall in 1916 to date of March 8th is 12.02 inches and the estimated discharge into that basin is 56 billion gallons of water.

The east regards as a safe supply six months, San Francisco two years, and this section five years storage to promote confidence and safety as insurance against drought. Carrying this surplus water demands an extra investment of capital void of an earning power. The runoff into the Sweetwater Dam totalled for the seven years preceding 1904 only 350 million gallons. The annual evaporation at all times has an average of 55 perpendicular inches. While these adverse conditions must be seriously considered so as to defeat over-confidence, they by no means argue against the development of our water resources.

The reports on the Volcan system issued by Hydraulic Engineer Philip E. Harroun and the one issued by M. M. O'Shaughnessy and J.B. Lippincott state that the estimates of cost seem reasonable; they specifically add that they are based upon preliminary surveys made by the Volcan Company. Along the stream bed of these watersheds and the other local rivers under consideration, the types and heights of dams and actual bedrock conditions have not been fully determined. The location of the reservoirs and their capacities are well understood. The recent disaster suggests the best possible structures as the larger streams must possess at least two dams to arrest the flood waters.

HOW THE STREAMS ARE CONTROLLED
SAN LUIS REY - SANTA YSABEL RIVERS.

The Volcan Land and Water Company claim the right of diversion

at the Warners dam site subject to an agreement. It is said a contract exists granting certain supplies to Escondido during dry periods. Certain rights are held by the Pala and Rincon Indians. Oceanside contests the right of diversion at Warner's. It is stated that several minor holdings contend the same as Oceanside. The Volcan Company claim to have purchased certain river properties, thereby securing the large majority of riparian ownerships. They are the owners of the Warner dam and reservoir site. Their plan is to divert the waters of that reservoir by tunnel to the Santa Ysabel watershed. On this stream they claim ownership to the Southerland dam site and portions of the reservoir, the Pamo dam site and portions of its reservoirs, and the Carroll dam site and portions of that basin, with holdings in a control reservoir called the San Clemente. The riparian lands between Pamo and Carroll dam sites represent an area of 3880 acres. Below Carroll these conditions also exist by claim of Del Mar and the San Dieguito Ranch. Most of these rights are still owned outside of the company. Engineers compensate these claims as in certain cases on the San Luis Rey River by run offs from intervening watersheds. Failure to compromise may mean court proceedings. This company also suggests the construction of two ^{minor} dams in the Ramona Valley. Gravity water will flow from the Warners reservoir into either the Sutherland or Pamo basins. From Sutherland to Pamo to San Clemente to Linda Vista and San Diego the water will flow by gravity. It is stated that some work has been done at Warner's, but the balance of the system remains in an undeveloped condition. The Carroll waters must be pumped if used on the higher elevations.

SAN DIEGO RIVER.

On the San Diego River the City of San Diego makes a claim to prior rights held under certain Pueblo grants. The Cuyamaca Water Company, successors to the San Diego Flume Company, claim certain rights based on the construction of a three and one-half billion mountain dam removed from the main stream, a diversion structure on the main river where the waters have been conveyed through an original flume having a capacity flow of about 1000 miner inches per day. With few minor improvements the original structures built in 1887 still remain. No new development tending to increase the supply has been inaugurated. This flume, approximately thirty-five miles in length, with its pipe lines, furnishes water to several small towns and considerable acreage. The excess waters are discharged into the La Mesa reservoir which has a capacity of about 500 million gallons. The original corporation is said to have sold water rights in excess of the amount of water that had been developed. The present corporation is endeavoring to have the courts reduce the obligation to about 187 miner inches.

This proposition has not been a successful venture. At the time of its construction, facts and figures regarding local water conditions were limited to reports emanating from ranchers who volunteered an approximation. A clay dam holds back the conserved water; the watershed is twelve square miles; the rainfall at the dam averages forty inches. This amount decreases considerably toward the eastern rim of the drainage basin. Conditions make the evaporation quite excessive. Had a dam of average capacity been constructed on the main river

the proposition would have been a pronounced success.

Several years ago the La Mesa-Lemon Grove sections, now supplied by the Cuyamaca Company, organized an irrigation district. They have purchased six hundred acres in a reservoir site above the Old Mission Dam. At a point a fraction of a mile below this old structure they intend to erect a dam 105 feet in height, conserving eleven billion gallons of water. They now assert their claims to certain quantities of water, but would probably co-operate in any reasonable plan tending toward a general development. Under an agreement to purchase, they secured a valuation of \$745,000 placed by the state railroad commission on the Cuyamaca Company's properties. Below the El Capitan dam there are about 3500 acres possessing riparian rights. Below the intended mission structure the same condition prevails, except the acreage is not so large. No conserving dams have been constructed on the San Diego River. Besides the intended structure, another dam should be built above Lakeside, called the El Capitan. The City of San Diego and the Cuyamaca Water Company are now contesting the right to certain Indian lands which would be flooded by the conserved waters in the El Capitan reservoir.

SWEETWATER RIVER.

The Sweetwater Water Company is owned by the San Diego Land Company, now a Morgan corporation. This company is also the owner of about 28,000 acres of local land. The Sweetwater dam was constructed in 1887; its original capacity has been increased to 11,500 million gallons. The conserved waters irrigate about 3900 acres of land, mostly lemons, and furnish the municipal supply to National City. Another dam could be constructed at a higher elevation if diverted water were furnished to supply certain amounts to the original

reservoir. The rights of the Sweetwater Company are well established.

OTAY - COTTONWOOD - CAMPO.

The City conserving system has well defined rights which will permit the construction of the Barrett, Marron and Otay dams. The Morena dam is a completed structure, and also the upper Otay, which is of minor importance.

TIA JUANA.

The diversion of the Tia Juana waters would be subject to Mexican laws. Mr. A. H. Frost of this city has made some investigations regarding this stream and claims ownership to certain portions of land used in conserving its waters.

The proposition is not free from obstacles, yet easy of solution if pursued by proper efforts. Ownership possessed with proper titles can be secured, but the question of price is the determining factor.

The City of San Diego is directly concerned in this project. It will provide for many years to come its water supply. It will permit the development of the contiguous territory. If the asking prices for the desired properties are within reason and the cost of construction properly determined, the City of San Diego can well afford to proceed along constructive lines.

REASON FOR DISTRICT OR COMPLETE DEVELOPMENT.

The development of a part or the entire proposition has its proportion of merit. The Volcan water system is considered as one unit. The systems, including and south of the San Diego River, should represent another unit. Litigation, failure to purchase the desired holdings at proper prices,

or refusal to dispose of the properties, may delay the carrying out of this scheme. The units should be developed along lines of least resistance. The territory in question should be divided by Mission Valley. The volcanic system possesses the natural supply for the Linda Vista Mesa. The San Diego, Sweetwater, Otay, Cottonwood and Tia Juana Rivers should care for all sections south of the Mission Valley.

An increased municipal water supply suggests an unnecessary surplus pending future growth. This excess stored water given an earning power at the same time assisting production development is suggestive of initial consideration. The sections favored should be in the direct path of San Diego's future growth. Pasadena has proven conclusively that citrus orchards becoming residential districts use the same amount of water in either case. The section south of Mission Valley argues for the least resistance in an expanded growth. The developed territory fringing the harbor is an example of conserved waters. These productive and populated sections have been made possible even though confronted with uncertain water supplies. An adequate storage will produce even better results. Therefore, these orchard demonstrating and contiguous suburban districts possessed of transportation lines and other public utilities awaiting extension are given first consideration. A compact development will lessen the construction cost of distributing systems. This territory can be planted to orchards, increasing our resources subject to change to more populated centers if commercial activities and industries warrant the demand and the water supply will remain the same. By this method the water will have a full earning power and

fear of future shortage eliminated. By the adoption of a systematic plan for its development this territory can become one of the choice sections of Southern California. It is ideally located with its average elevation of 300 feet. Ideal climatic conditions practically free from frost with soil properties adapted to minimum water supplies, it possesses an opportunity to expand in proportion to the amount of water developed. East of Chula Vista is a mesa containing 14,000 acres having soil conditions equal to the best in southern California. Adjacent to National City, Encanto, La Mesa, Lemon Grove, La Presa and east of Grantville is a district having 16,000 acres. Inadequate water supplies have made possible self-supporting communities. In this section the soils vary, but a great quantity of acreage can be made most productive.

WATER SUPPLY FOR THIS DISTRICT.

The watersheds of the San Diego, Otay, Sweetwater, Cottonwood, Campo and Tia Juana Rivers, having a total drainage area of about 2000 square miles, represent the water supply district for this territory.

RESERVOIRS CONSIDERED FOR THE
SUPPLY SOUTH OF MISSION VALLEY.

DAM	OUTLET ELEVATION	HEIGHT	MILLION GALLONS CAPACITY	FLOODED AREA	SQ. MI. DRAINAGE
MORENA	2912	150	15,000	1370	135
BARRETT	1550	175	15,000	936	135
MARRON	546	115	12,000	850	250
TIA JUANA	275	140	15,000 (about)		1200
OTAY	397	130	13,000	1000	85
SWEETWATER	145	115	11,500	1055	186
UPPER "	1285	155	8,000	440	195
EL CAPITAN	600	160	23,000	1170	198
MISSION	275	105	11,000	1675	189

The following is the approximate number of gallons to each flooded acre when the dams have been constructed to the above heights and the reservoirs are full - El Capitan 20 million, Upper Sweetwater 18 millions, Barrett 16 millions, Marroun 14 millions, Otay 13 millions, Morena 11 millions, Sweetwater 11 millions and Mission reservoir 6½ million gallons of water.

MORENA - Dam completed 1912 - owner City of San Diego. Elevation watershed 2900 to 5000.

BARRETT - No dam constructed - Reservoir and dam site owned by City of San Diego - also riparian rights - Elevation watershed 1500 to 5000 feet. Bedrock partially determined - north side and stream bed present good conditions - south side considerable exploration work - engineers feel reasonably certain of favorable

conditions but suggest about \$5000 to complete investigations. Dam site in very narrow gorge - cost of dam not to exceed \$500,000.

MARROUN - No dam constructed - Dam site and reservoir cut by boundary line Mexico and United States - City of San Diego owns the American side of dam site and portions of reservoir. Also owns riparian rights watershed 500 to 4000 feet. Bedrock - No explorations made - Appearances good on south side bed of stream and north side investigations must be made. Dam site widens out on north side - Cost of dam about \$750,000.

TIA JUANA - A. H. Frost San Diego claims certain ownership watershed in Mexico. Elevation 225 to 5000 feet. Dam site suggests inexpensive structure - on S.D. & A. railroad gorge quite narrow - Bed rock conditions unexplored but appearance good. Has very good reservoir site.

OTAY (LOWER) - No dam - Reservoir, dams site and riparian rights owned by City of San Diego. Elevation watershed 400 to 3500. Bed rock conditions determined - cost of dam about \$500,000.

SWEETWATER - Dam constructed about 1887 - owned by San Diego Land Co. Elevation watershed 145 to 6500 feet.

UPPER SWEETWATER - The Dehesa dams site owned by San Diego Land Co. - Gorge very good for dam. Bed rock conditions not determined. Elevation watershed 1285 to 6500.

EL CRIPITAN - Cuyamaca Water Co., claim ownership to dams site - reservoir site on private and Indian lands. Riparian rights undecided. No dam constructed - Bed rock conditions - tunnels run on south and north side - not fully determined, cost of dam approximately \$ 1,000,000. - Best large reservoir site in San Diego County. Elevation watershed 600 to 6500.

MISSION - 600 acres and dams site owned by La Mesa-Lemon Grove Irrigation Co. Balance private ownership. Elevation watershed

275 to 6500. Bed rock - Very certain of ideal conditions.

The rainy season extends from October to May. The quantity increases with the elevation. The average precipitation on the coast is 10 inches while approximately 20 inches at 2500 feet and 40 inches at 5000 feet represent the interior annual averages.

Conduits have been constructed to convey by gravity the waters from the Morena and Barrett Dams to Lower Otay. Gravity waters from the Marron Dam can also be delivered to the Otay or the Sweetwater Dam. The Tia Juana dam would be at a low elevation but the stored waters might be conveyed to augment the storage of the Sweetwater Dam or used as the direct supply for Chula Vista and the head of the bay region including Coronado. The Marron and Tia Juana reservoirs being in Mexico, the transfer of their waters with due diligence to the United States is worthy of consideration. These two dams have an immense area of low altitude drainage. While the run off would be small in dry years, they would possess great value during the flood periods which occur about every seven years. If the ratio of evaporation area by an increased capacity given the Otay reservoir is not too great, the new dam should be constructed to hold back a greater quantity of water. If conditions are found favorable, the capacity of the new reservoir should be 18 to 25 billion gallons. The discharge from the Marron would satisfy this increase. Investigation should be made at a point several hundred feet below the old dam for the new structure.

The present Sweetwater reservoir should be filled from the San Diego or Tia Juana Rivers, or Marron Dam. Another reservoir should be considered on the Sweetwater River

with a capacity to control the average flood waters. Its elevation would give a gravity flow to the mesa west of Chula Vista. The El Capitan and Mission Dams would control the flood waters on the San Diego River. A small structure has been considered on the San Vicente creek at a point above Fosters. The large flooded area of the Mission reservoir argues against its adoption, but the bed of the basin contains ideal pumping sands. This underground supply held as a reserve to be pumped during any prolonged dry period will not only add to the safety of a general supply, but permit a great daily draught.

It is reasonable to suppose that this system properly developed would furnish additional water for 25,000 acres of citrus orchard, or 14,000 acres and enough water for an additional population of 100,000. A low estimate has been accorded the Tia Juana River as all estimates are based upon tentative investigations.

LINDA VISTA.

Twenty-five thousand acres represent the level land on the Linda Mesa including the elevated sections east of Rose Canyon and south of Torrey Pines. Another similar section is the Otay mesa containing 10,000 acres. Preference should be accorded the Linda Vista section due to its possible direct supply of water. While Mission Valley is a barrier to adjacent suburban growth, it grants to that territory special qualifications suggestive of separate distinct communities with populated centers self supported by orchards. Certain soils will have to be treated and prepared to provide the necessary drainage. This district contains large quantities of land adapted to orchard growth. Its vast level distances

untouched by property plotters gives it a special opportunity in town and country planning. Brought to a high state of cultivation it has an added value by being the gateway from the north.

ITS SOURCES OF WATER SUPPLY.

The watersheds of the San Luis Rey and Santa Ysabel are specially located to serve this vast territory. Opportunity has been granted the districts in and around Oceanside to conserve the waters originating west of Warner's Ranch. A diversion is therefore made at Warner's Dam. By the construction of a tunnel the waters can be diverted to the Santa Ysabel watershed and stored in either the Pamo or Sutherland dams, which are located on the same stream. Sutherland or Pamo Dams will permit the flow of gravity water to the Linda Vista mesa or San Diego. The small controlling reservoir San Clemente will be a unit in the original construction. The elevation of this district will require any waters to be pumped from the Carroll reservoir.

VOLCAN LAND AND WATER COMPANY RESERVOIRS.

DAM	OUTLET ELEVATION	HEIGHT	GALLONS CAPACITY	FLOODED AREA	SQ. MI. DRAINAGE AREA
WARNER	2640	90 ft.	38,210	4055	210
SUTHERLAND	1940	130	6,000	434	53
PAMO	890	156	15,480	1050	57
CARROLL	215	110	17,950	1700	196
SAN CLEMENTE	600	70	1,500	166	

The following is the approximate number of gallons to each flooded acre when dams have been constructed to the above heights and the reservoirs are full. Pamo 15 millions, Sutherland 14 millions, Carroll 10 millions and Warner 9½ millions.

STATEMENT SECURED FROM ENGINEER POST OF VOLCAN CO.

WARNER'S - No dam constructed - Elevation watershed 2600 to 6100 feet. Bed rock conditions - claims to have secured County rock - varies from soft to hard rock - down at depth of about 27 feet. Cut off wall of concrete constructed up to stream bed.

SUTHERLAND - No dam constructed - claim to have dug 4 foot trench across damsite - bed rock exposed - Volcanic trap rock similar to Sweetwater.

PAMO - No dam constructed - claims to have made complete borings - indications 20 feet to foundation in stream bed about 30 feet on sides. Conditions are believed to be not quite as good as Sutherland but adequate for certain type of dam.

CARROLL - No dam constructed - Bed rock conditions explored by drills and trenches. Believed to be excellent indications.

The report of Philip E. Harroun states that the safe net supply of this system is 23 million gallons per day. The safe net daily yield, according to the O'Shaughnessy-Lippincott report, is about 20 millions. By these reports it is reasonable to suppose that this system fully developed would furnish an adequate supply of water to 22,500 acres. It might be divided to care for a population of 100,000 and 13,000 acres.

From a true agricultural standpoint no section is superior to the Otay mesa. In its soil conditions, its elevated frostless territory, it possesses qualifications which at no distant day will accept a position among the most productive districts of southern California. In relation to the

city it occupies an independent position. If it should be determined that the proposed water supply is adequate so as to include this district, 10,000 acres can be added as a productive territory.

COST OF WATER IN OTHER
SECTIONS OF SOUTHERN CALIFORNIA.

To produce the best results 325,000 gallons for each acre per year has been determined as an ample supply for citrus orchards in the districts herein mentioned. Many sections in southern California use 500,000 to 650,000 gallons each year. The close proximity to the coast, character of soil and less frequent desert winds produce this favored condition. As to cost of irrigation waters in southern California, a government engineer makes the following statement: "In one section of the Pomona Valley the cost of a water right is \$125.00 per share; valued on a 6% basis with an added assessment for pumping of \$10.00 makes the annual cost \$17.50 per acre. Under the Gage canal at Riverside water rights are worth \$300 per acre with an annual assessment of \$8.00 per share. On a 6% basis the annual cost of water would be \$26.00 per acre. Under the California Domestic Company of Whittier an average of 1-1/2 shares are used to the acre. The market value is \$100.00 per share with assessments varying from \$9.00 to \$15.00. Annual cost of water, same basis is \$21.00 per acre. Under the Temecula Water Company of Corona there are two shares for each acre at \$100.00 per share with an assessment of \$12.00 per share or \$36.00 per acre. The San Antonio Water Company has one share for each acre valued at \$100.00. The assessment averages \$8.50 for each share, or \$14.50 for each acre. The Foot Hills Lemon Company's plant at Corona lifts its water 725 feet; the cost has not been ascertained, but

it is reasonable to suppose that the duty is very high."

An investigation showing the average cost of waters for irrigating 12,000 acres has been made by selecting orchards in various sections; having a water duty less than \$15.00 a year there were 7,000 acres; it cost \$15.00 to \$25.00 to irrigate 3396 acres. To irrigate 1420 acres the annual duty varied from \$25.00 to \$35.00 and \$35.00 to \$50.00 to irrigate 184 acres. It is reasonable to suppose that many of the lower rates returned, no consideration was given as to cost of water rights. In an argument presented in forming a water district it was shown that ten mutual water companies paid an average assessment of \$10.20 per year, and on a 6% basis for their invested capital for the necessary water stock an average of \$13.74 or an average annual cost of \$23.90 per acre. These mutual companies furnish water to 55,000 acres located in San Bernardino and Riverside Counties.

The contour of the local lands will demand the piping of conserved waters. While the installation will be more expensive, waste will be decreased over ditches used in other sections. Water under pressure available at all times has its special advantages.

AN EMPIRE OF 65,000 ACRES
ADJACENT TO SAN DIEGO.

In southern California development follows the well filled water pipes. This statement fittingly applies to San Diego's contiguous territory. It is the basic reason for present development. Failure to provide an adequate water supply depicts 75,000 acres of land void of production. The history of its development, past, present and future, could be accurately written today if man and capital continue to refuse

to develop the desired unit. This great territory is within a radius of twenty miles of the business center of San Diego. Its elevation varies from 250 to 500 feet. The land contained in this report represents quantities with gradients most acceptable in orchard planting. It possesses a climate without a superior on this entire globe. With its views of the sea, harbor and mountains, it could befittingly accept the name of Vistaland. It is less attacked by the frost of any southern California section. The soil conditions vary, but it possesses a quantity of land adapted to the culture of citrus fruits to materially increase the groves of California. Thirty-five thousand additional acres of citrus fruits five to San Diego a place among the banner counties leading in that production. It is most adapted to the lemon and the Valencia orange. These fruits possess the greatest commercial value when conditions are conducive to summer ripening. The cool summer climate produces a condition which might be termed the "districts of delayed seasons" which admits a value especially adapted for the lemon.

WINTER VEGETABLES.

The sale value of winter vegetables in Florida is fast approaching that of her orange crop. This bay region should become the greatest of all winter vegetable producers. Its elevated sections are more free from frost than any districts in the United States. The many little canyons operate as a depository for any chilled night air. The surroundings are ideal with all snow mountains located at a distance having no effect on these sections. Claims are being substantiated that the best of all winter vegetables lands are contained on our mesas. The better mesas sections are still unused as they

are void of water supplies. These especially located districts capable of raising the delicate varieties would have little competition in distant markets. A very conservative earning power one crop is \$300.00 per acre F.O.B. Certain varieties with special markets have returned \$1000.00, and even as high as \$4000.00 per acre, has been reported. Taking into consideration the limited territory adapted to this winter production, the markets are unlimited. One broker offered to purchase 400 carloads. Due to frost conditions in other sections sixty carloads^{TOMATOES} at this time could be sent daily to practically non-competitive markets. The consumption in the northwest is extremely good but small in comparison to Chicago, which records daily shipments of 100 carloads. The industry has wonderful possibilities if quantities can be delivered. The production varies as to the acre production according to variety. A conservative estimate would be one to one and one-half cars to each planted acre.

MARKETS.

Our producing sections are located within the boundaries of a nation granting more or less protection against invasion of unreasonable foreign competition. The markets of the United States consume more in percentage of population than those of any nation. With a population in 1910 of 92 millions, and a probable increase in 1920 to 110 millions, and 1930 135 millions, with the principle increase in territories not qualified to compete, argues against an over-production. Experience is determining better methods for distribution. The double tracking of transcontinental railroads and better gradients permitting reduction in time is bringing these consuming territories nearer to our fields of production.

The Panama Canal is acting as a governor in relation to excessive charges made for transportation. The outlook should be viewed with optimism. The markets have so expanded that while demands are made for qualities, quantities must exist if import invitations are extended. Imperial Valley cantaloupes became famous partially for their quality but more so due to the quantity; Hood River for its immense quantity of delicious apples; Riverside for its national supply of navel oranges. The request of the California Vegetable Union demanding of districts the planting of 1000-acre portions of certain vegetables if their co-operation was desired illustrates this condition. The territory contiguous to San Diego will not attain its desired position until it produces in quantities sufficient to meet and continue to satisfy large demands.

To localize in distant markets the products of a district, quality and quantity must be produced.

SUBURBAN AND BOULEVARD DEVELOPMENT.

The conditions are especially adapted for suburban sections. The possibilities for construction of ideal drives is not surpassed in southern California. The Linda Vista mesa with its vast level stretches dotted with orchards and homes and ideal drives pictures a future worthy of an attempt tending to accomplish results. A drive along the bluffs of Mission Valley via the Old Mission, over the Grantville mesa to La Mesa, Lemon Grove, Sweetwater Dam, Chula Vista mesa, Otay Reservoirs, Otay mesa and Tia Juana, all lined with productive groves suggesting wealth, and then returning by the harbor possessed with activities would place this community in a distinctive class. Export freight in quantities attractive to transportation companies and in value adequate to offset the import shipments has deferred the commercial growth of San Diego.

RESULTS FROM 5000 ACRE PARCELS SUPPLIED WITH WATER AND PLANTED TO ORCHARDS.

On the Linda Vista, National City and Chula Vista mesas the present assessed value per acre for level land is \$5.00, while improved orchards are assessed for \$125.00 for each acre. These figures were secured from the county assessor.

A tentative table is given to show the value between an improved and unimproved 5000 acre tract; it being presumed that it would possess a townsite. The valuation of the improved section is estimated at a period five years hence.

<u>Without Water</u>	<u>With Water</u>
Present assessed value.	Assessed value.
5000 acres @ \$5.00- - \$25,000.	1000 acres townsite \$400,000
void of all improvements	4000 " orchards 400,000

Chula Vista is assessed for \$693869.00. The same quantity of land, level but without water, west of Chula Vista is assessed for only approximately 2% of that amount.

SALE VALUES.

<u>Without Water</u>	<u>With Water</u>
Sale value 5000 acres \$125,000	4000 acres @ \$350. per acre \$1,400,000.
	1000 " Townsite 1,200,000.
	Real value orchards 4,000,000.
	Townsite & Imp. 2,000,000.

Added to these figures would be cost of installation of gas, electricity and railroad extensions, preparing the land, planting, home building, townsite improvements and construction of roads.

According to reliable orchard statistics the average expenditure for materials including water, fertilizer, fumigation and taxes, the cost per acre is \$83.24. The average cost for labor is \$52.82, or a total annual cost of \$136.06 per

acre. The actual shipments from the orchards will be 200 boxes to the acre, or 800,000 boxes for 4000 acres. This represents about 2250 cars of freight. A low estimate as the value of a carload of lemons F. O. B. San Diego would be \$750.00 per car, or a return of \$1,686,500. Twenty thousand acres would return \$8,432,500. The amount paid to the transportation lines would be about \$3,250,000. representing freight on 11,250 cars.

IN CONCLUSION.

The best results will be obtained when all the waters are conserved suggests that the flood runoffs must not reach the ocean. The adoption of a plan pursued along constructive lines whereby this is accomplished will produce the proper solution of our many years discussed water question. The greatest possible amounts must be conserved. The excessive floods occur at least every seven years. The runoff records indicate that at times during the intervening periods the annual discharge of the streams will be in excess of the annual future draughts and evaporation, but there will be years probably successive when encatchments will be surprisingly small.

Therefore dry years supplies will be the product of excessive floods which are produced by heavy rains rather exceptional precipitating rapidly and high dams well constructed must be built to retain any discharge of the streams. The desired capacity of the reservoir can be determined by available stream flow records. With funds not available to immediately build such structures all plans and construction should permit extensions to the proper heights.

Otay reservoir holding ten billion gallons having a surface area of 900 acres would have an average evaporation of

one billion gallons. The Mission dam same storage but surface area of 1600 acres would have an annual evaporation approximately one billion seven hundred and fifty millions of gallons. The reason is due to the difference in the surface area. The amount would supply this city for three months; its value at 10¢ per 1000 gallons would be \$75,000, which represents the interest at 4-1/2 per cent on an amount exceeding \$1,650,000. This suggests the selection of reservoirs with large storage capacities and small surface areas even though the dams are more expensive. Gravity flow enters into this consideration. To arrest all the flood waters will require the construction of the dams herein mentioned with careful consideration regarding evaporation conditions.

The amount of water to be ultimately developed, the quantity of land to be improved, qualifying in quality for some certain products varied as to districts, the invitation which will be extended to capital, the amount of wealth to be returned, the freight and commerce to be produced, the added real and assessed wealth, the redinment of adjacent territory and most of all the guarantee to capital invested and to be invested that the water problem will be solved, makes it worthy of the best effort ever put forth by the people of San Diego.

There is no intent to boost or assist the sale of any developed or undeveloped water system. It is an endeavor to solve a most important problem. The facts presented which surrounded the issue are conservative. The interests of the city can be protected by placing the problem in the hands of those to be most injured by extravagant and ill-advised procedures. To secure an additional city supply, some of these units must be constructed, therefore no attempt is made to state probable costs as all estimates are based on preliminary surveys.

Rufus Choate

ESTIMATED LEVEL LAND

- UNIMPROVED -

By F. H. RHODES, Civil Engineer,
San Diego, California.

This report is submitted in pursuance of your request of February 7th to investigate and determine the number of acres of available irrigable land on the mesas, valleys and low rolling hills lying within a radius of twenty miles of the center of the City of San Diego.

All the lands were visited with a view to determining what portion might be included in an irrigation project by reason of its topography and what portion should be excluded on account of a lack of soil.

The total amount of land thus gone over is divided into the following districts:

1. The Pueblo Lands of San Diego.
2. The Linda Vista Mesa.
3. The La Mesa, Lemon Grove, Encanto and La Presa District.
4. The Sweetwater Valley to Otay Valley District.
5. The Otay Mesa.

PUEBLO LANDS OF SAN DIEGO.

1. The Pueblo Lands of San Diego include all the flat land north of Mission Valley to Torrey Pines, and East of Soledad Mountains to the Pueblo Lands' boundary. These mesas lie at an elevation ranging from two hundred to four hundred and fifty feet above sea level. They are cut by deep canyons, some of which have very steep side slopes and others have slopes that could be utilized for various trees or vine planting. In making this estimate, however, only the flat table land was excluded. North of the Railroad or Rose Canyon to Torrey Pines there is estimated to be 2600 acres of mesa land; between Railroad or Rose Canyon and San Clemente Canyon, 600 acres; between San Clemente Canyon and the Mission Valley 5800 acres; making a total of 9000 acres of irrigable mesa land in the Pueblo Lands of San Diego. The soil on this land is about two feet deep and is underlaid with a soft sand stone which does not absorb the moisture. The land which has not been cleared is covered with a fairly thick growth of sage brush and a scattering of sumac, all of which attains a height of about four feet.

LINDA VISTA MESA.

2. The Linda Vista district includes all the mesa land east of the Pueblo lands and south of Los Penasquitos Valley

to Mission Valley. This land varies in elevation from three hundred feet to six hundred feet above sea level. Several large canyons cut into this mesa, but its available land is in larger tracts than the mesas on the Pueblo Lands. There are 16,000 acres of table land in this district. The quality of the soil does not appear to be as good as that of the Pueblo Lands. Borings taken showed an average depth of eighteen inches of soil, deposited on a reddish hardpan. This mesa shows a rather spotted accumulation of soil from twelve inches to two and a half feet deep. The height and thickness of the brush readily shows where this difference occurs.

LA MESA, LEMON GROVE ENCANTO AND LA PRESA DISTRICT

3. All the land lying south of the Mission Valley and the El Cajon valley and North of the Sweetwater Valley as far East as the Jamacha Bridge over the Sweetwater comprises the above named district. It is comprised of mesas, rolling hills and valleys, all without an adequate water supply. Within this district occurs the change from a light soil overlying a hard stratum to the deeper adobe soil. The area computed includes all land below six hundred foot level, with the exception of steep hillside and canyon slopes and the valley land under the Sweetwater Irrigation System, and contains 16,000 acres.

SWEETWATER VALLEY TO OTAY VALLEY.

4. This district contains all the irrigable high lands between the Sweetwater Valley and the Otay Valley from Chula Vista to the Otay Reservoirs. It is mostly rolling hills and small valleys, all of which are overlaid with a thick layer of adobe. All of the land lies below an elevation of six hundred feet and there are 14,000 acres of good irrigable land in the district.

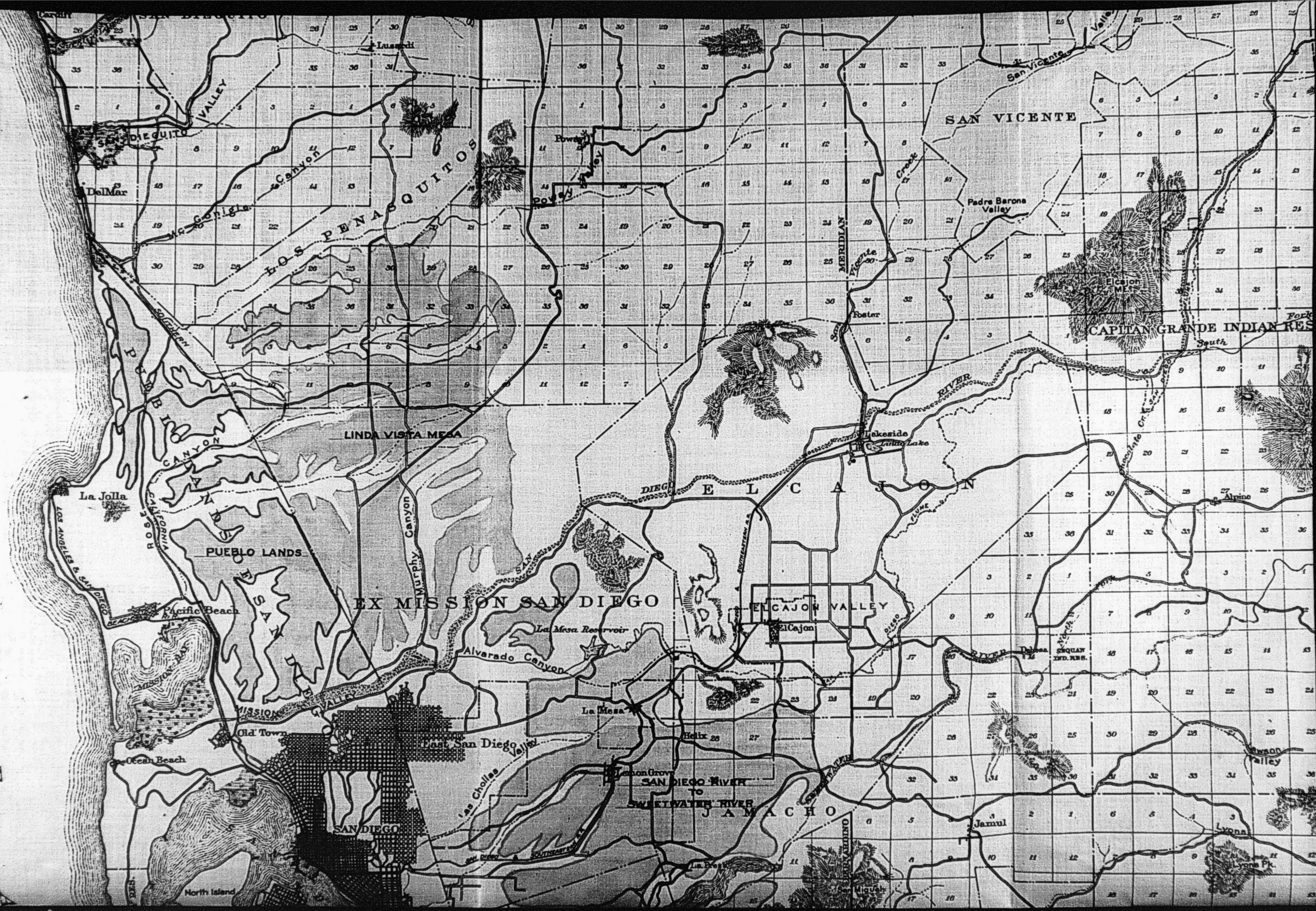
OTAY MESA.

5. The Otay Mesa lies between the Otay Valley and the Tia Juana Valley and extends easterly from Palm Station to the foot of the San Ysidro Mountains. Only that portion lying within San Diego County has been considered. The soil for the most part is adobe, but it also has a red soil which sustains a fair growth of brush. The district contains 10,000 acres of mesa land below an elevation of six hundred feet.

A summary of the acreage in the above described districts is as follows:

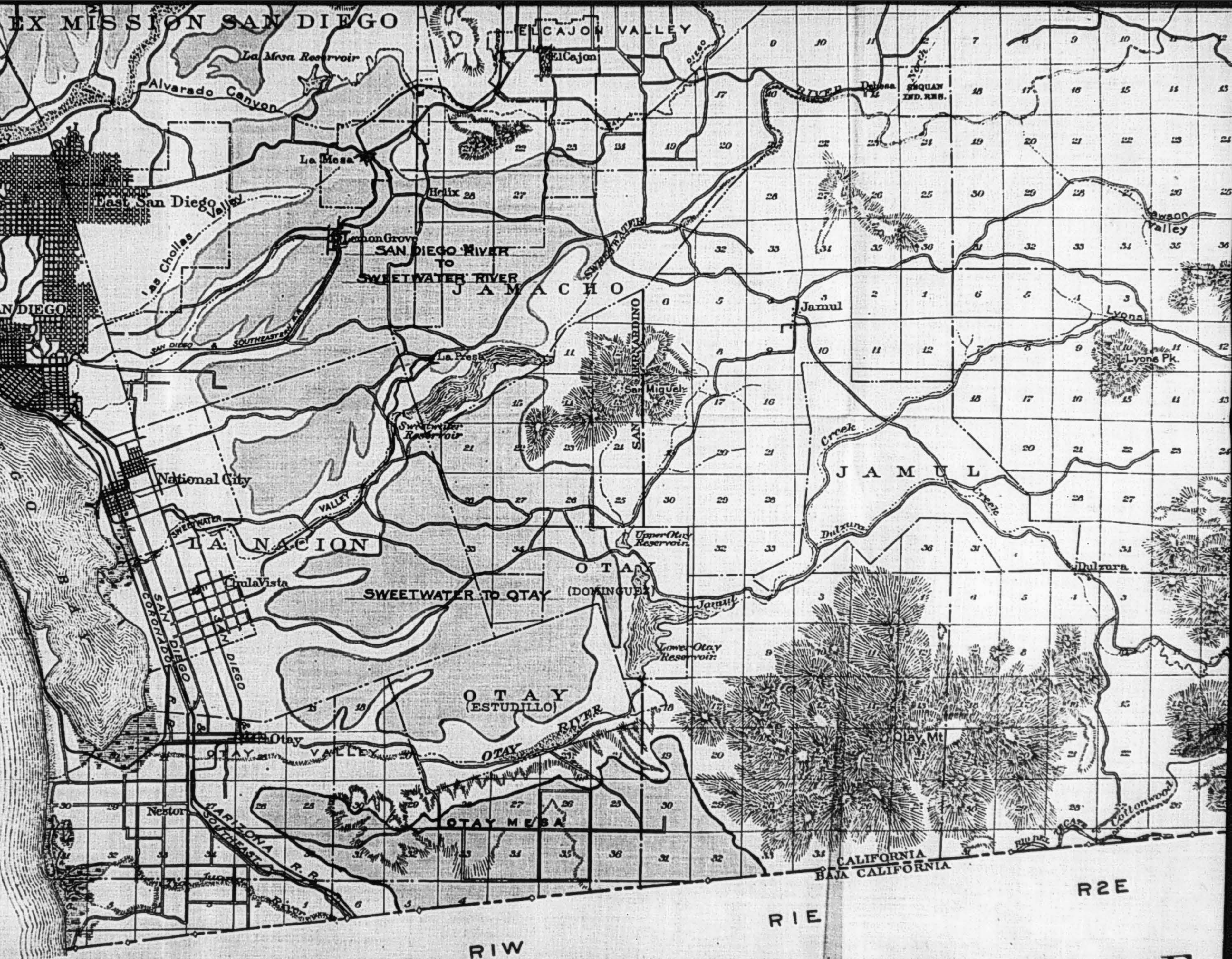
Pueblo Lands of San Diego	9,000 acres
Linda Vista Mesa	16,000 "
La Mesa, Lemon Grove, Encanto and La Presa	16,000 "
Sweetwater Valley to Otay Valley	14,000 "
Otay Mesa	10,000 "

Under intensified farming the total irrigable acreage could be increased from 65,000 to 80,000 acres by utilizing hill sides and canyons slopes which have not been irrigable land in the above estimate.



IRRIGABLE LAND

PUEBLO LANDS	9000 Ac.
LINDA VISTA MESA	16000 "
SAN DIEGO TO SWEETWATER	16000 "
SWEETWATER TO OTAY	14000 "
OTAY MESA	10000 "
TOTAL	65000 "



The following pages include Land Estimates by F. H. Rhodes; Frost Conditions by Dr. Ford A. Carpenter, U. S. Weather Bureau; the Mojave River project by F. C. Finkle; Cuyamaca Water Company and Volcan Land & Water Company conditions; opinion regarding City Conserving and El Capitan reservoir by City Engineer Cromwell; Tia Juana River by C. S. Alverson, and Extracts from the Philip E. Harroun and also O'Shaughnessy-Lippincott reports on Volcan system.

CONCERNING FROST CONDITIONS.

Extracts from "The Climate and Weather of San Diego, California", compiled by Dr. Ford A. Carpenter, U. S. Weather Bureau, Los Angeles. Prepared under the direction of Willis L. Moore, Chief U. S. Weather Bureau. Published 1913.

"San Diego is one of the three places in the United States where the thermometer has not been lower than 32 degrees, viz, Key West, southeast Farrallone, and San Diego."

"San Diego is relatively warm or cool; that is, it is warm in winter and cool in summer, by comparison with other places in the United States. For example, the early part of the year 1912 was mild throughout the entire United States, yet the cool mornings and nights prompted many to ask where they could go for a warmer climate. In nearly every instance where the daily telegraphic temperatures were compared, San Diego was shown to have the highest minimum temperature. San Diego has a cool climate throughout the year, and yet with these moderate temperatures semi-tropical plants have uninterrupted growth. It is one of the rare localities where northern and southern vegetation flourish side by side. In many gardens pines and palms fraternize, banana and lemon trees blossom and bear during all the months of the year and there are rose bushes that have been covered with flowers every day for a dozen years or more. With this proof of the absence of killing frost there is still a tonic in the air, a bracing quality compounded of a moderately high percentage of moisture and comparatively low temperature. This feature is unknown in other southern regions, and puts at rest all fears of San Diego having an enervating climate."

"An important fact to remember is, as General Greely says, that 'the region of equable temperature covers less than forty square miles,' and that in equalibilty the climate reaches its perfection within the city limits of San Diego."

"The month of December, 1911, will go down in the meteorological history of California as one of the frostiest on record. It was the coldest but one in the past fifty years of temperature observations at San Diego. The average daily temperature in December was 53 degrees, and this was the lowest for the last two decades. The number of light and heavy frosts broke all previous records. There were no killing frosts in this vicinity, and none have ever occurred in the history of San Diego.

"As frost in San Diego is a phenomenon, it appears worth while to consider its cause and why this region is comparatively free from its injury.

"HORTICULTURISTS HAVE DECIDED THAT PLANT-GROWTH IS AT A STANDSTILL WHEN THE DAILY MEAN TEMPERATURE IS 43 DEGREES, OR LOWER. OR, IN OTHER WORDS, WHEN THE AVERAGE TWENTY-HOURS' TEMPERATURE IS ABOVE 43 DEGREES, PLANTS ARE GROWING. UNDER THIS CRITERION THE MEAN DAILY TEMPERATURE RECORDS OF SAN DIEGO SHOW THAT FOR FORTY YEARS (OR 15,000 DAYS) THERE WERE SIX DAYS WHEN THE MEAN TEMPERATURE EQUALLED OR DROPPED BELOW 43 DEGREES. ALL OF THESE DAYS OCCURRED IN JANUARY OF 1880, 1882, 1888, AND 1894. PUTTING IT IN ANOTHER WAY, WE MAY SAY THAT SINCE THE BEGINNING OF TEMPERATURE OBSERVATIONS, WHICH COVER A PERIOD OF 15,000 DAYS, THERE WERE 14,994 DAYS OF GROWING WEATHER."

"Cold air is denser than warm air, and air, like water, seeks its level. It is thus seen why the temperature of low-lying districts is very much lower than that of the mesas, benches, or terraces. Advantage is taken of this fact by the orchardists, who plant lemon and orange trees on the terraces, while the olive and harder trees skirt the hillsides. The formation of frost is thus seen to be largely a matter of air-drainage, for frost usually forms first in pools or basins."

"WHY SAN DIEGO HAS NEVER HAD A KILLING FROST.

In the standard "Climatology of the United States" issued by the central office of the United States weather Bureau, appears this statement on page 28:

'The absolute minimum temperature at San Diego, California, is 32 degrees, and at Key West, Florida, 41 degrees. These are the only weather Bureau stations in the United States where a minimum temperature below freezing point has not been experienced.'

The reason why San Diego has never experienced a killing frost is because the ocean, over which blows 75 per cent of San Diego's winds, has a temperature many degrees higher than the land. For example: Shortly before sunrise, at the time of the lowest temperature (36 degrees on December 26, 1911), the temperature of the ocean was 59 degrees, or 23 degrees warmer than the land. The warm air from the ocean is transported over the land, raising the temperature above the danger point."

Southern California experienced a most severe frost in 1913. The foregoing weather report was published in book form previous to that date. Considerable damage was done to tender growths along the lower levels, but this was greatly minimized on the mesas. (R.C.)

THE MOJAVE RIVER PROJECT

BY

F. C. FINKLE
Consulting Engineer.

Complying with your request for certain information regarding the quantity of water and power available from the Mojave River, and the cost of bringing this to San Diego, permit me to state as follows:

The Mojave River water, which is at present unused, could readily be brought to San Diego by means of an aqueduct from 108 to 110 miles in length. Gaugings of all the water, from its water-shed, have been made for the past twenty-five years. The result of these gaugings is to show that, after allowing for necessary losses in handling the water, 122,000 acre feet per annum can be delivered continuously. This amounts to a daily supply of 108,000,000 gallons, which is amply sufficient to supply a city of 1,000,000 people with water for all purposes.

The water of this river is the purest found in Southern California, containing no alkalies, and less mineral in solution than the water of any other stream in Southern California. For verification of the absolute purity of this water, consult Water Supply Paper #237, Page 125, issued by the United States Geological Survey.

The water would be regulated by means of four reservoirs, one of which is already now nearly completed. These reservoirs are as follows:

West Fork Reservoir	capacity	103,000	acre	ft.
Little Bear Valley Reservoir	"	62,000	"	"
West Fork Auxiliary Reservoir	"	27,000	"	"
Grass Valley Reservoir	"	8,000	"	"

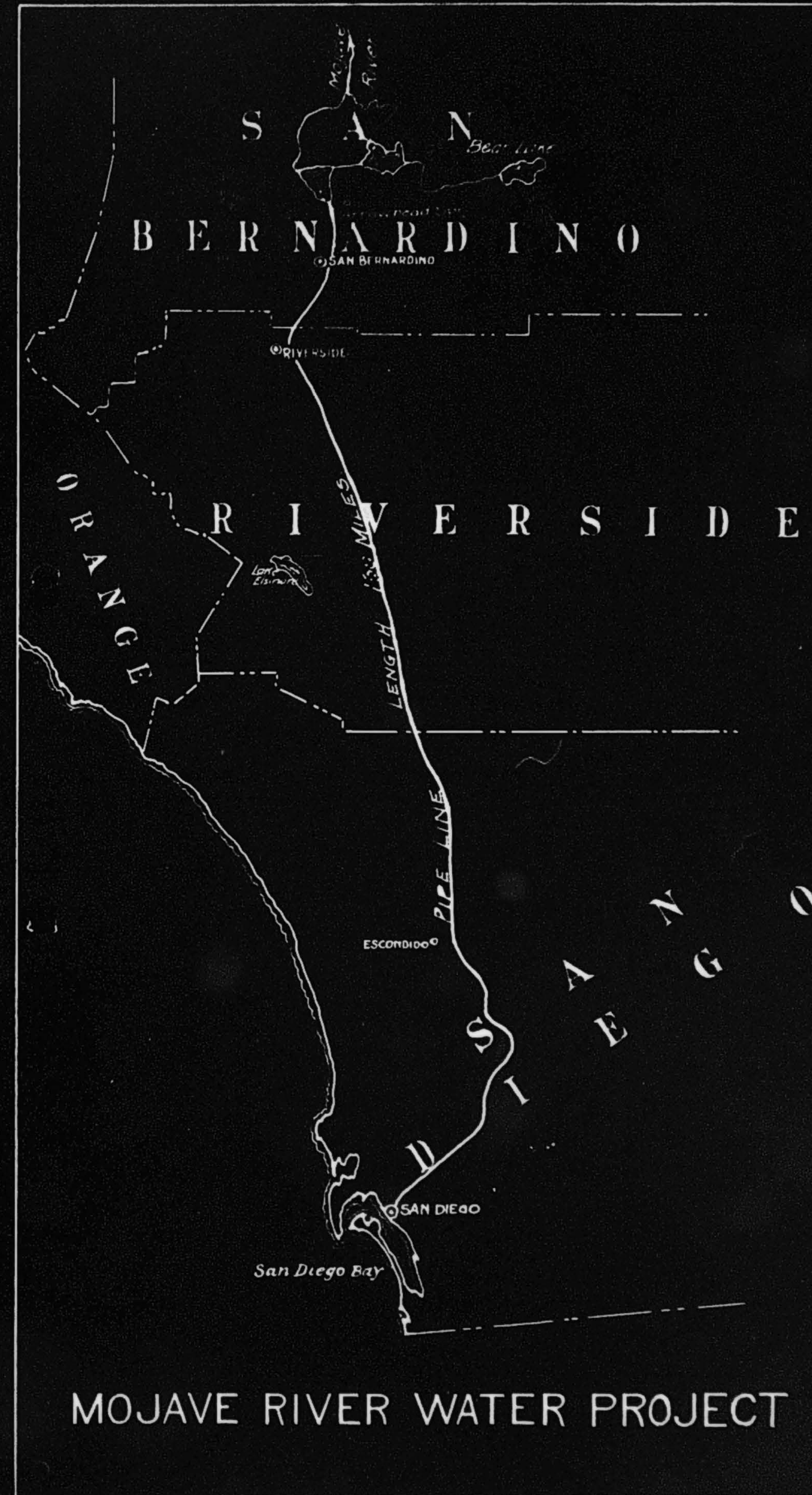
The stream has a good perennial flow in the summer season, and with storage provided by these reservoirs to take care of the dry years and the low months occurring some summers, the total amount available would be 108,000,000 gallons daily.

If the water should be used for irrigation purposes in Southern California it would irrigate 125,000 acres of land as highly improved as any of the best districts tributary to Los Angeles, including Covina, Pomona, Redlands and Riverside. This water will have a fall from its diversion point to where it would have to enter the aqueduct to San Diego, in two power drops aggregating over 3,000 feet. The power developed will amount to 32,224 electrical Horse Power on a 50% load-factor delivered in the City of San Diego. This is equal to 105,466,400 Kilowatt hours per annum, which would have a wholesale market value of nearly \$800,000.00 per annum, based on the actual cost of producing power by the use of fuel oil.

I herewith hand you a map showing the location of the entire project with an approximate location of the aqueduct to San Diego. I have estimated that the cost of the entire project, including the purchasing of all water rights and lands necessary, would be in the vicinity of \$18,000,000.00. This includes not only the delivery to San Diego of the water diverted, but the delivery of the power as well. The value of the power alone would pay interest on this sum at the rate of 4% per annum, leaving the water, sufficient for 125,000 acres of land, or 1,000,000 people living in a city, to make up 1% more on the cost of the project, if constructed with 5% bonds.

In calculating the cost of the aqueduct, I have used a grade which would deliver the water at a sufficient elevation for the reservoir, which can be constructed at El Capitan dam-site on the San Diego River. The Mojave River project would be well adapted for development in conjunction with El Capitan reservoir, as there is a large amount of surplus water along the line of the proposed conduit to San Diego, which could be picked during the winter season and used to fill the El Capitan reservoir site even in dry years, when there is sufficient water from San Diego river to do so.

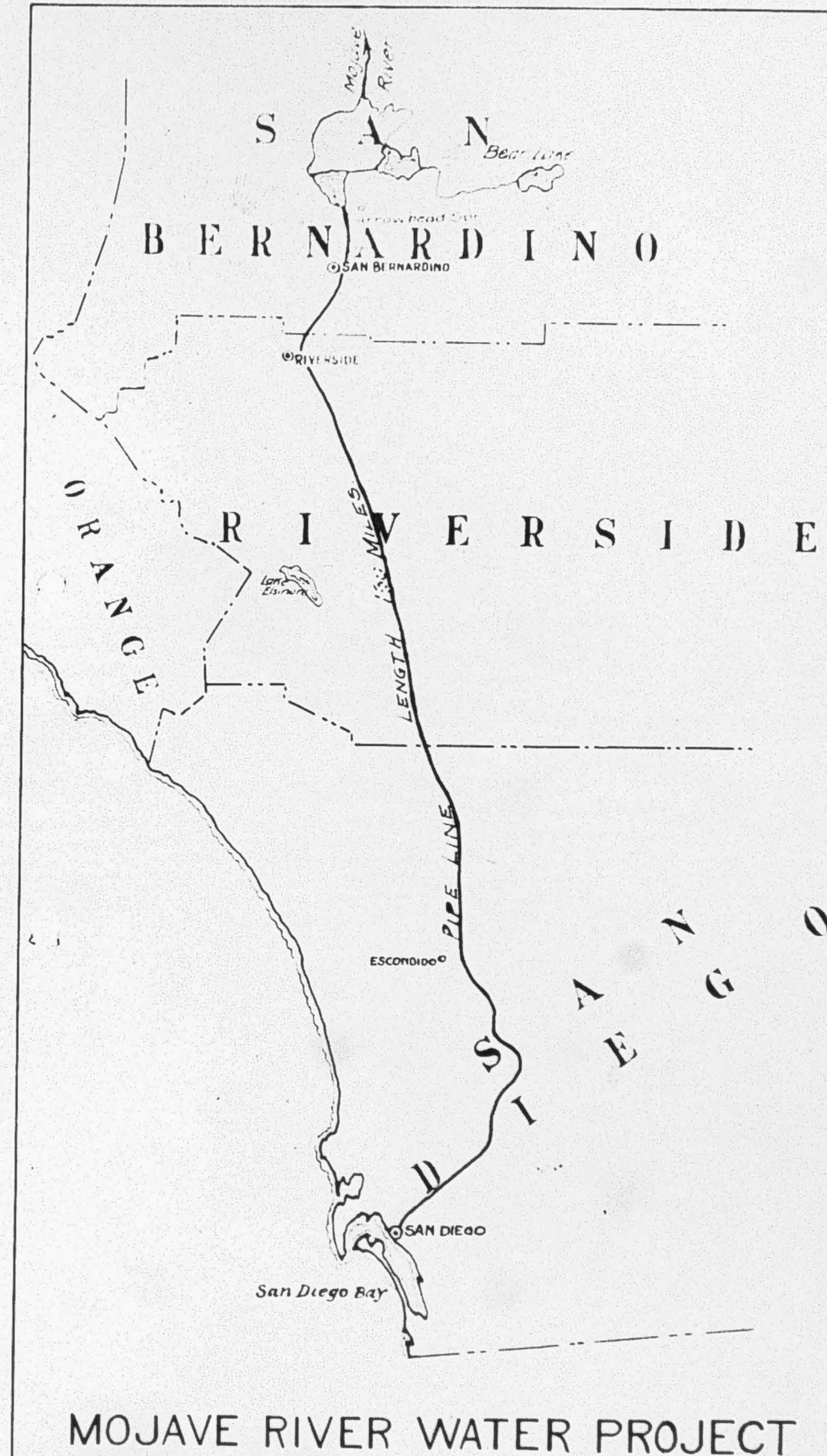
Signed: F. C. Finkle,
Consulting Engineer.



I herewith hand you a map showing the location of the entire project with an approximate location of the aqueduct to San Diego. I have estimated that the cost of the entire project, including the purchasing of all water rights and lands necessary, would be in the vicinity of \$18,000,000.00. This includes not only the delivery to San Diego of the water diverted, but the delivery of the power as well. The value of the power alone would pay interest on this sum at the rate of 4% per annum, leaving the water, sufficient for 125,000 acres of land, or 1,000,000 people living in a city, to make up 1% more on the cost of the project, if constructed with 5% bonds.

In calculating the cost of the aqueduct, I have used a grade which would deliver the water at a sufficient elevation for the reservoir, which can be constructed at El Capitan dam-site on the San Diego River. The Mojave River project would be well adapted for development in conjunction with El Capitan reservoir, as there is a large amount of surplus water along the line of the proposed conduit to San Diego, which could be picked during the winter season and used to fill the El Capitan reservoir site even in dry years, when there is sufficient water from San Diego river to do so.

Signed: F. C. Finkle,
Consulting Engineer.



STATEMENT
OF
CUYAMACA WATER COMPANY'S SYSTEM
ISSUED BY THE COMPANY

This system supplies water for irrigation and domestic purposes to the territory lying between Lakeside and the easterly limits of the City of San Diego, including the Cities of Lakeside, El Cajon, Lemon Grove, East San Diego and the Bostonia, Spring Valley, Normal Heights and Kensington Park Districts. At one time this system was the sole supply for the City of San Diego and within the past few years has supplied large quantities of water to the City.

As developed at present the system consists of the following structures:

Cuyamaca Reservoir, located in the Cuyamaca Mountains about 40 miles northeast of the City. This reservoir is formed by an earth fill dam across the channel of Boulder Creek, and has a storage capacity of 3.52 billion gallons.

Diverting Dam on the San Diego River, which forms a regulating reservoir of 22.5 million gallons capacity.

Flume which generally has a capacity of 21 million gallons daily. The flume consists of the following types of construction:

Redwood Flume, lined with 2 ply "rubber-oid" roofing material-----	30.40	miles
Steel Flume of "Armco Iron" and "Toncan Metal" semi-circular steel plates-----	0.95	"
Concrete Conduits-----	0.42	"
Concrete Syphons-----	0.22	"
Riveted Steel Syphons-----	1.22	"
Tunnels-----	0.79	"
Total length of Flume-----	24.02	"

The flume follows the valley of the San Diego River and encircles the El Cajon Valley to its end near Grossmont.

Murray Hill Reservoir

Eucalyptus Reservoir

These two reservoirs are located at the end of the flume and have a combined capacity of 50 million gallons.

La Mesa Reservoir

This reservoir is formed by the construction of an hydraulic fill dam. The reservoir capacity is 450 million gallons.

By raising the La Mesa Dam to a height of 100 feet a reservoir of 1.83 billion gallons can be secured, and if the height is made 140 feet the resulting capacity is 6.16 billion gallons.

Water from this reservoir will flow by gravity into the Chollas Reservoir of the City of San Diego or into the Sweetwater Reservoir. The La Mesa Reservoir is the only one in this territory situated at such an elevation that it can supply all other reservoirs by gravity.

Distributing Pipe System of the Cuyamaca Water Company consists of 50 miles of pipe ranging from 2 inches to 24 inches in diameter.

Pumping Plants

To reinforce the water supply during dry years three pumping plants have been constructed for pumping water from the sand of the San Diego River. These plants will yield a supply of 3.25 million gallons daily delivered into the company's flume.

The Company also has a number of smaller pumping plants of the "booster variety."

Safe Yield of the System

Mr. Charles H. Lee, hydraulic engineer in the United States Geological Survey Employ, testified before the Railroad Commission of the State of California that the safe net yield of the present system is 507 miner's inches, continuous flow, or 6.55 million gallons daily.

The actual quantity of water supplied to consumers during the year 1915 was an average of 4.1 million gallons daily.

Mr. Lee also testified before the Railroad Commission that the safe net yield of the system when fully developed would be 650 miner's inches, continuous flow, or 8.4 million gallons daily.

The Cuyamaca Company's officials claim that Mr. Lee's estimates are ultra conservative.

Cost of Full Development of System

The estimated cost of the full development of the Cuyamaca system is \$1,250,000. To this should be added the original cost of the system to obtain the total cost when fully developed.

STATEMENT
OF
VOLCAN LAND & WATER COMPANY'S SYSTEM
ISSUED BY THE COMPANY.

This system when completed can supply water for irrigation purposes to lands on the Linda Vista Mesa, to Coast lands, water for domestic purposes to the City of San Diego and surrounding territory, or for a combination of all uses. Owing to elevation, the outlet of San Clemente Reservoir being approximately 700 feet above sea level, this water can be put by gravity, into La Mesa Reservoir, Sweetwater Reservoir, or into Otay Reservoir, at any time.

The completed system contemplates the use of waters of the San Luis Rey, Santa Ysabel, Bernardo, and Santa Maria Rivers, all of which are within the County of San Diego.

The storage facilities will consist of the following reservoirs:

	<u>Depth of Water</u>	<u>Capacity in Acre Feet</u>
Warner Reservoir	(80 feet	82,000
	(90 "	117,000
	(100 "	164,000
Pamo	(140 "	35,000
	(150 "	41,000
	(156 "	47,500
Sutherland	(120 "	15,200
	(130 "	18,400
	(140 "	23,900
Santa Maria Reservoir	(70 "	4,480
	(80 "	9,220
San Clemente Reservoir	(60 "	3,070
	(70 "	4,520
	(80 "	6,400

The transmission system will consist of concrete conduits, concrete pipes, and steel pipes, and steel pipes connecting the various reservoirs with the lands to be irrigated and with the water system of the City of San Diego.

At many points on the transmission system there is an abundance of fall so that the plants can be installed for the development of electric power for commercial sale, for transmission to the City for use in lighting streets, or for such other uses as may develop. Hydraulic Engineer H. Hawgood estimates that 5,400 Kilowatts can be developed.

Mr. Hawgood reports that the following quantities of water can be developed by the completed water system.

86.66 second feet continuous flow
4,330 miners inches "
56 million gallons daily.

On the basis of one miner's inch flow for each ten acres there would be a sufficient supply for the irrigation of 43,000 acres of land. Or if 10 million gallons daily were used for domestic purposes the remaining supply would be sufficient for the irrigation of 35,000 acres.

The estimated cost of the completed physical structures, including all dams, conduits, pipe lines, power plants, etc., is \$4,000,000. To this figure should be added the original purchase price of the system to obtain the total cost.

This system can be developed in separate units, and by the expenditure of not to exceed \$1,500,000 at least 10 million gallons of water can be delivered daily to the City from the Volcan Water System.

Office of the
CITY ENGINEER

City of San Diego, California,

Mar. 9, 1916.

CITY CONSERVING SYSTEM AND
EL CAPITAN RESERVOIR

BY

GEORGE CROMWELL,
City Engineer.

I am submitting herewith a general description of the latent possibilities of the water system owned and controlled by the City of San Diego, together with a description of the latent possibilities for water development on the San Diego River Watershed at the El Capitan Damsite, which in my opinion, is the nearest and next best available supply for the City of San Diego.

The City of San Diego now owns and controls the dams, damsites, reservoirs, sites and water-rights on a total watershed of approximately 570 square miles, of which 470 square miles is on the Cottonwood Watershed, above the Marron Damsite and 100 square miles on the Otay Watershed above the Lower Otay Damsite.

The governemtn and city records for run-off derived from stream measurements made upon various portions of the above watershed, do not date back prior to 1906, and the computation for safe net yield for the proposed and existing reservoirs on this system have been made up from the stream measurements taken since 1906.

The ultimate development of the entire watershed owned and controlled by the City of San Diego, would mean the construction of the following three additional dams:

Barrett	(125 feet high	5,200,000,000 Gal.Cap.
	(175 " "	15,000,000,000 " "
Marron,	115 " "	12,000,000,000 " "
Lower Otay,	140 " "	18,000,000,000 " "

which taken in conjunction with the Morena 150 feet high, 13,000,000,000 gallons capacity and the Upper Otay, 80 feet high, 1,000,000,000 gallons capacity, will give a total storage capacity of 49,200,000,000 gallons with an estimated safe net yield of approximately 23 million gallons per day over the period of years from 1906-1916. However, the records on other watersheds show that the safe net yield for the period of 1890 to 1906 was approximately 50% of that for the period of 1906-1916, so that the same would no doubt hold true of the City's system and the safe net yield of the entire watershed tributary to the city's

system for period 1895-1906, with all contemplated dams constructed, would be approximately 11.5 million gallons per day, which is in my opinion the proper figure to use as the safe net yield of the city's system completed.

The following is a tabulation of the existing dams and contemplated structures, together with the heights of dam, capacity of reservoir, flooded area and area of watershed:

CONSTRUCTED DAMS.			
HEIGHT	FLOODED AREA	CAPACITY GALS.	AREA OF WATERSHED.
MORENA 150	1370 acres	13,000,000,000	135 sq. mi.
UPPER OTAY 80	160 "	1,000,000,000	12 " "

CONTEMPLATED STRUCTURES.			
BARRETT (125 : 175	470 Acres	5,200,000,000 : 15,000,000,000	135 sq. mi.
MARRON 115	880	12,000,000,000	200 " "
LOWER OTAY 140	1200	18,000,000,000	86 " "

The following is a short description of the latent possibilities for the development of water on the San Diego River by the construction of a dam at the El Capitan Site: The area of the watershed above the El Capitan Damsite is 198 square miles and the conditions for run-off and stream flow are good because of the high rate of rainfall and the steep slopes of the watershed tributary to the El Capitan Damsite for the last twenty-one years shows that after allowing for all diversions made by the Cuyamaca Water Company on this watershed above the El Capitan Damsite, there would still have been a net safe yield of 8 million gallons per day over the period 1895-1906 and a net safe yield of 16 million gallons per day over the period 1906-1916.

The dam contemplated at the El Capitan Damsite is 160 feet high with a capacity of 23,000,000,000 gallons and a flooded area of 1150 acres. The elevation of the base of the dam is such that the water could be conveyed by gravity into the city's distributing reservoir at University Heights with a pipe line approximately 25 miles in length.

I consider that the ultimate development of the Valley lands of the San Diego River will require the conservation and storage of the flood waters of the San Diego River and its

principal tributary, the San Vicente Creek; with large reservoirs at the El Capitan Site on the San Diego River and the Mussey Site on the San Vicente Creek, it would be possible to regulate the flood flow of the San Diego River by holding back the peak of the flood, the amount of damage to riparian owners below the dams would be greatly diminished and the great quantities of water which yearly go to waste could be conserved and made to sefvw the mesa lands during the periods of draught.

This matter of the conservation of flood waters by means of large reservoirs on the upper reaches of our main watersheds is of such great importance in my mind, that a systematic effort should be made to educate the public as to the vital necessity for such development.

In many cases the riparian owners have fought the construction of large storage reservoirs on the watersheds above their lands on the basis that such construction would interfere with the water supply on their property. However, they have failed to take into consideration the advantage due to the fact that the proper storage of flood waters will minimize the damage due to excessive floods and at the same time their ground water supply will be increased during periods of drought by the storage of water in large quantities above their lands and make it possible for them to obtain some of the stored waters in case of excessive drought.

Signed: GEORGE CROMWELL,
City Engineer.

TIA JUANA RIVER (MEXICO)

PRELIMINARY REPORT

OF

C. S. ALVERSON. C.E.

SUBJECT: Water development on TIJUANA RIVER, in Mexico. I submit the following preliminary report on the feasibility of securing concessions on the water rights of the TIJUANA RIVER in Baja, California, or Mexico.

My personal knowledge of the section of the country included in the watershed of the TIJUANA RIVER, extends over a period of 25 years. In 1888 I made a topographical survey of the TIJUANA VALLEY and vicinity. Also of the "Valle de las Palms" and "San Ysidro Rancho", and have made frequent trips of inspection of mining and land propositions and otherwise familiarized myself with the conditions in reference to water, land, mining, etc.

LOCATION: The proposed point of diversion and storage of water is located on the Tia Juana River some 2000 ft up stream from the second crossing of the river by the San Diego and Arizona Railroad and distant about 11 miles from the town of Tia Juana, Mexico.

GENERAL DESCRIPTION.

The Tijuana River of Mexico heads near the summit of the divide between the Desert of the Colorado and the Pacific Ocean and some 60 miles easterly from the proposed point of diversion.

The general elevation of the divide is from 4000 to 5000 feet above sea level. The western slope has a considerable growth of pine and other varieties of timber. A considerable portion of the watershed is rough and broken. The main stream with its branches flows in a westerly directions through the valleys and canyons and unites with the Little Tijuana River, from the United States some 5 miles below the proposed point of diversion. The area of watershed above the proposed point of diversion is some 1200 square miles.

RUNOFF FROM WATERSHED.

I have made no actual stream measurements on this portion of the watershed; but I do know from personal observation extending over a period of 25 years that

the runoff is large, and that some years the volume of flood waters is immense as is shown by the high water marks.

The mean annual rainfall on the entire watershed varied from 10 to 40 inches in depth. Take the mean average to be 20 inches in depth and that the available runoff is only 5 per cent or one inch in depth over the entire area gives the following results:

1 square mile 1 inch in depth is 2,328,200 cu-ft
1200 square mile 1 inch depth 2,787,840,000 cu-ft
or 64,000 acre feet or 4,420 mi-ins. for 363 days.

This is certainly a very low estimate for the actual runoff from the watershed.

DAM SITE.

Only preliminary measurements were made with a hand level and tape, with the following results:

The walls of the canyon are trap rock capped with porphyry and nearly vertical for 50 feet in height; from there on the slope is at a good angle.

Measuring from the right bank you have 50 feet in width covered with sand and gravel; the 50 feet of exposed bed rock; the 100 feet of sand and gravel which is the low water channel of the river a distance in all of 200 feet between walls. There is abundance of rock within from 100 to 500 feet for a loose rock fill dam, with reinforced concrete on the water face.

The following elevations are taken from the Railroad viaduct some 2000 feet from stream. The datum for elevation is mean sea level.

Base of rail	270 feet above sea level
Top of granite cap	234 " " " "
High Water Mark	227 " " " "
Present water surface	215 " " " "

Making the (approximate) elevation of the stream bed at proposed dam site 225 feet above sea level.

The cost of building a dam would be normal.

RESERVOIR SITE.

Although the present examination was only what is termed a reconnaissance, it is evident a large quantity of water would be stored. The slope and contour of the valley making an excellent location for a storage reservoir of great value.

LANDS TO BE IRRIGATED.

Starting at the proposed dam with an elevation of 275 feet above sea level or the 50 ft contour of the reservoir, the distributing conduit would skirt the foot hills above the mesa and valley lands.

CONCLUSION.

In my judgment, this is an excellent proposition and that these water rights are valuable.

The building and completion of the San Diego and Arizona Railroad will open up and develop many new industries and bring two countries into closer commercial relations; and at the same time necessitate the proper protection of all legitimate enterprises. That storing and utilizing of the water in the streams is necessary in order to develop this section of the country, there can only be one answer, and that is to do it, or some one else will.

Signed: C.S. Alverson, C. & H. Engineer.

E X T R A C T S

FROM THE REPORT TO THE CITY OF SAN DIEGO
AND TO THE VOLCAN LAND & WATER COMPANY ON
THE SAFE NET YIELD OF A COMPLETED SYSTEM
(THE VOLCAN SYSTEM)

By PHILIP E. HARROUN,
Consulting Engineer,
San Francisco - Aug. 1914.

No questions have been investigated. It is assumed that the Volcan Land & Water Company has legal title to the property which it proposes to transfer to the City, and also to the water which it proposes to conserve and divert, other than those disabilities specifically allowed in this report.

The Volcan Land & Water Company has made available to the writer the results of its investigations extending over the past few years. These investigations consists of surveys, studies of precipitation and runoff, preliminary designs of necessary structures, and in addition there has been made available such cost records as are shown on the books incurred in bringing the property up to its present stage of development. This data has been taken as the basis for the report.

Briefly, the project of the Volcan Land & Water Company consists of the construction of a dam forming a reservoir on the San Luis Rey River at Warner Ranch. The waters in the reservoir are to be diverted into the drainage of the Santa Ysabel River. Upon the Santa Ysabel River three Reservoirs are proposed, the first and most easterly called the Sutherland Reservoir, the second some five miles west called the Pamo Reservoir, and the third below Bernardo called the Carroll Reservoir.

The waters from the Warner Reservoir in passing into the Santa Ysabel drainage may be regulated either in Sutherland or Pamo Reservoirs. The waters from Pamo and Sutherland reservoirs combined with those of the Warner Reservoir are to be carried in a canal, some 25 miles in length, into what is called San Clemente Reservoir. This latter reservoir is a little east of north and some 13 miles distant from the center of San Diego, and is to be used as a regulating reservoir. It is also to carry sufficient storage to provide against interruption in the supply. From San Clement Reservoir the waters would flow by gravity into the University Heights Reservoir in a north-easterly section of the City. The waters from Carroll Reservoir would be carried by independent pipe lines to the City. The general scheme of the system is shown on Plate 1, accompanying the original report.

The safe net yield of this system may be defined as that quantity of water which the system would have been able to deliver during the period of greatest drought of which there is record. The studies required to determine this question are intricate and require much time in the analysis of the many elements of rainfall, runoff, evaporation and other factors entering into the question.

There are available records of rainfall in the near vicinity of the San Luis Rey and Santa Ysabel watersheds at 13 different points all more or less fragmentary but extending back as far as the season of 1872-1873. In addition, the records of some 28 rainfall stations within the drainage areas are available for the past two or three years. These records have been studied and expanded, using the Escondido record as a base, so as to obtain a continuous record at these stations for the last 42 seasons. From these records the Isohyetose lines within the drainage areas under consideration have been developed and from seasonal precipitation since 1872 has been determined.

Stream gaugings of the runoff on the various watersheds are available for the past eleven seasons at Pala on the San Luis Rey River and for the seasons of 1905-1906 and 1911-1912, to date, at Warner Dam. On Santa Ysabel River, gaugings are available from 1906-1917 to date at Pamo, for the past two years at Bernardo. Through a study of these records in connection with the precipitation, the relation between rainfall and runoff has been determined and used in estimating the runoff for the past 42 years. These expanded runoff records have been applied to the various reservoir sites where, in connection with a study of the reservoir capacity, evaporation and other factors, the safe net yield which may be expected from the various units of the project has been determined. The final results of these studies are shown graphically by the various tables and curves accompanying the original report.

The prior demands have been studied and it is believed that the only priorities which will affect the yield of the Warner Reservoir are those of the Escondido Mutual Water Company and of the Rincon Indians.

On June 21, 1912, an agreement was entered into between the Escondido Mutual Water Company and Mr. Wm. G. Henshaw for the Volcan Land & Water Company defining the rights of the Escondido Water Company. It has therefore been necessary to determine what effect this contract would have had upon the safe net yield of Warner Reservoir. It is found that during the critical period of determining the safe net yield it would have been necessary to release from the storage in Warner Reservoir the average amount of 742 acre feet per annum in order to meet this contract requirement. For this reason, therefore, the safe net yield to which the Volcan Land & Water Company would be entitled is 16,854 acre feet.

In the light of legal opinion and the studies which have been made of the information available regarding priorities, it is believed that no further demands can hold against the Warner diversion.

The safe net yield and development proposed upon the Santa Ysabel River is also complicated by priorities upon that stream. As in case of the San Luis Rey River, there have been studied and provided for. Below the Sutherland and Pamo Reservoir sites and above the Carroll site lies the San Pasqual Valle. This valley contains a number of properties is a high state of cultivation through the use of the waters of the Santa Ysabel River. Any development above this valley must provide for the requirements of these lands.

A study of the situation shows that the amount of water required in the San Pasqual Valle over and above that which would originate within the drainage area below the Pamo Reservoir amounts to 3,850 acre feet per annum, and in considering the possibility of the development and safe net yield of the Sutherland and Pamo reservoirs it has been considered that this amount of water must be permitted to pass to the properties in the San Pasqual Valle.

The same condition holds below the Carroll Reservoir. The priorities there consist of the development upon the San Dieguito Ranch and also 50 miner's inches of continuous flow which is furnished to the town of Del Mar. These amount to 1,330 acre feet per annum. This amount has therefore been deducted from the gross yield of Carroll Reservoir and has been provided for these priorities in determining the safe net yield available for the Volcan Land & Water Company.

The determination of the maximum economic conservation upon the Santa Ysabel River, is extremely complicated because of the development proposed in three different reservoirs and of two riparian districts. In addition, the surveys and field investigation of the Volcan Land & Water Company have not yet been carried far enough so as to afford sufficient information from which to say what are the maximum economic possibilities of storage in the three different sites, - at Sutherland, Pamo and Carroll.

Three different studies have been made of the possible combinations of storage and consequent determination of safe net yield which appear to the writer will be ultimately found to cover the economic possibilities of the situation. Until further field investigations have been made, either by the Volcan Land & Water Company, or its successor, the final selection of the economic plan cannot be determined.

CONCLUSIONS.

Finally, it may be said that in the light of the information available the following conclusions are justified:

THAT	the safe net yield of Warner Reservoir will be	15	million gallons daily.
THAT	the safe net yield of Sutherland Reservoir will be	5.9	" " "
THAT	the safe net yield of Pamo Reservoir will be	2.1	" " "
THAT	the safe net yield of Carroll Reservoir will be	2.5	" " "
THAT	the safe net yield of the entire system will be	25.5	" " "
THAT	Allowing 10% for losses in transmission there will be delivered into the City of San Diego	23	million gallons daily.

gallons of 6.8 cents for structures.

The estimates for structures presented in this report are largely based on preliminary surveys that have been made by the Volcan Land & Water Company and which have been kindly presented to your engineers. The figures here used should be taken as preliminary and for the purpose of guiding the judgment of the people of San Diego in the determination of the advisability of proceeding with the construction of this system. Before construction is undertaken, it will be necessary to make more detailed surveys and engineering plans, as usual in works of this magnitude. The figures presented are believed to be liberal and are based upon protracted experience in construction of similar works in this neighborhood. The plans are for permanent construction of a substantial nature along conservative designs as shown in the numerous engineering drawings that accompany the report. The estimate of \$2,871,950., is for structures to bring water from the Warner reservoir to the San Clemente reservoir, which is ten miles north of the University Heights reservoir and at a commanding position for the distribution of water on the Pueblo lands as well as to the City of San Diego itself."

"RELINQUISHMENTS TO SATISFY RIPARIAN RIGHTS ON THE LOWER RIVER:

The Volcan Land & Water Company have acquired practically all the riparian lands on the San Luis Rey River from the Warner's dam site to the ocean. The only priorities on the stream which have to be considered are those of the Pala Indians, the Rincon Indians and the Escondido Mutual Water Company. The City of Oceanside at the mouth of the San Luis Rey River, has protested against the construction of a dam at Warner's, but this protest is not here considered well founded from a physical standpoint. The Pala Indians claim a personal flow of 6 second-feet. Their diversion is just below the Pala gage. The large porous gravel area above the diversion acts as a regulating reservoir, storing the winter flood waters and yielding them in quite a constant flow. The Pauma Creek with a drainage area of 12 square miles is a perennial stream and has its confluent with the main river above the Pala diversion. This creek and the tributary drainage below the Escondido diversion will provide for the diversion of the Pala Indians. No further provision is made in this study for this diversion.

RINCON INDIANS :

The U. S. Indian Service has a contract with the Escondido Mutual Water Company to supply a stipulated flow of water to the Rincon Indian Reservation. Judge F. W. Henshaw, in a written opinion on the Escondido-Indian Service contract states that the Escondido Mutual Water Company are between the Indian Service and the Volcan Land & Water Company. He states that the Escondido Mutual Water

EXTRACTS FROM THE REPORT ON THE VOLCAN LAND AND WATER COMPANY TO THE CITY OF SAN DIEGO, CALIFORNIA, BY M. M. O'SHAUGHNESSY, AND J. E. LIPPINCOTT, MEM. AM. SOC. C. E.

"RESERVOIR LANDS TO BE CONVEYED:

Warner's	2960	acres	at	\$100.	per	acre
Pamo	654	"	"	150.	"	"
San Clemente	166	"	"	200.	"	"
Carroll	829	"	"	75.	"	"
Sutherland	127	"	"	100.	"	"
Santa Maria	80	"	"	100.	"	"
	4817	"				

"Your engineers are not assuming to pass on the title of the riparian rights or other realty holdings of the Volcan Land & Water Company. A certain schedule of these properties has been submitted to the City of San Diego and referred to us by the Volcan Land & Water Company, which shows the character and extent of these rights, which we are assuming in this report to be correct. It will be necessary before any purchases are made by the city for your City Attorney to review these titles as well as contracts with certain claimants to water, such as the Escondido Irrigation District, Indian rights, and small canals along the Santa Ysabel River."

"The complete development of this system, which we would recommend, would yield a total of 19.05 million gallons per day, made up from the several sources in the following amounts:-

Warner Reservoir,	11.6	million	gallons
Pamo	7.0	"	daily.
Additional from Warner's and Pamo combined, with elimination of portion of evaporation losses,	0.45	"	"
Total	19.05	"	"

"To summarize, the cost of development to guarantee a minimum delivery of 10 million gallons daily is \$2,871,950., or 7.9 cents per 1000 gallons delivered to the city.

The cost of developing the entire system to a safe yield of 19.05 million gallons daily (exclusive of Carroll Reservoir) is practically \$6,500,000., or a cost per 1000

Company must satisfy the claims of the Rincon Indian Reservation. The practice in the past has been for the Escondido Mutual Water Company to stop its diversions in the summer time and the Indians to take the entire summer flow, of the San Luis Rey River, which normally amounts to about 75 miner's inches. Warner's Dam is about ten miles above the Escondido diversion. The stream goes dry during the summer months about three miles below the dam site. It is not probable that the water passing Warner's during the summer is the same water diverted by the Indians during the same year, as this summer water goes down stream as an underflow and probably would not travel a distance of seven miles in two or three months. There are several perennial streams flowing from the Pala Mountains which probably sustain the summer flow of the river at the Escondido diversion point. No water is estimated in this report as released at Warner's to provide for the Rincon Indian Reservation.

ESCONDIDO MUTUAL WATER COMPANY :

The Volcan Land & Water Company have entered into a contract with the Escondido Mutual Water Company under date of June 21st, 1912, a copy of which contract is herewith attached as Appendix No. 1. This contract provides that the Escondido Mutual Water Company is entitled to an annual diversion of 1,350,000,000 gallons, that the water may be diverted between November 1st and July 1st, that the maximum rate of diversion shall be 27,000,000 gallons per day, and further that whenever this amount of water is available in the river between the dates mentioned it shall be considered as contributing toward the diversions of the Escondido Mutual Water Company, irrespective of whether such diversion is made or not. There is a further provision that if at any time between November 1st and July 1st, prior to July 1st, 1917, the flow of the river is less than 200 miner's inches, plus the amount required by the Indians, then the said river shall not be included in making up the annual quantity of 1,350,000,000 gallons. If at any time after the first of July, 1917, between November 1st and July 1st, the water flowing in the river shall not exceed 100 miner's inches plus the amount required by the Indians, then the said 100 miner's inches shall not be considered as included in making up the total diversions to which the Escondido Mutual Water Company are entitled. It is also provided that the Escondido Mutual Water Company shall not be entitled to more water or to have delivered to it more water in any year than the actual runoff of the river at its point of diversion during such year, or more water than could be diverted by the Escondido Ditch if the Warner Dam were not constructed.

There are 33 square miles of drainage area above the Escondido diversion point and below the Warner dam site. The West Fork of the San Luis Rey River which is tributary above the Warner Reservoir has 24.4 square miles of drainage area. A study of the isohyets projected from long periods means upon the drainage areas shows the average intensity of rainfall upon the 33 square miles below the Warner dam site

and above the Escondido diversion to be 31.8 inches, and that upon the 24.4 square miles of drainage area tributary to the West Fork to be 32.7 inches. The runoff per square mile from these drainage basins is assumed to be the same.

Table No. III shows the runoff of the West Fork for eighteen months and the runoff of the San Luis Rey River at Warner's Dam for the same period. The total runoff of the West Fork for these eighteen months is 32.5 per cent of the total runoff at Warner's. Adjusting this percentage by the ratio of the areas of the Escondido and the West Fork drainage areas results in the runoff of the 33 square miles tributary to Escondido, being 44 per cent of the runoff at Warner's. This ratio of 44 per cent was used in determining the available supply at the Escondido Diversion points.

A study has been made to determine under the conditions of the Escondido contract, first the amount of water that could have been diverted each seasonal year by the Escondido Ditch if there were no regulations of the river, and second, the amount that could have been diverted each seasonal year from the runoff of the 33 square miles below Warner's and above the Escondido Diversion point. If this latter amount is not equal to 1,350,000 gallons, then it is necessary under the provisions of the contract to release at Warner's Dam sufficient water to bring the total diversions up to the amount which could have been diverted if the dam were not constructed. Table No. IV shows the quantity of water in acre-feet it is necessary to release each seasonal year at Warner's to satisfy the conditions of the Escondido contract. It is seen from this table that upon critical years, or years of little runoff at Warner's, the necessary relinquishments for the Escondido diversion are greatest and upon years of large runoff none have to be made."

"PRIORITIES IN THE SAN PASQUAL VALLEY: SANTA YSABEL RIVER:

There are about 3880 acres of bottom lands riparian to this stream from the head of the San Pasqual Valley to Bernardo. These lands are composed of detrital fill, are porous and have great absorbent capacity. They are fertile and a large proportion of them are already under irrigation. It is estimated that a gross duty of water may obtain throughout this valley of three acre-feet per annum and that a third of this amount may be considered as return water through the gravels. This leaves a net loss in the valley of two acre-feet per annum, which, over the 3880 acres, is a total of 7760 acre-feet per annum.

There is tributary to this area below Pamo dam site 130 square miles of drainage area whose runoff goes toward replenishing these losses."

"RIPARIAN PRIORITIES BELOW CARROLL:

A large portion of the San Diegito Ranch is riparian to the river below Carroll. This ranch has a contract with

the town of Del Mar to supply a contract flow of 50 miner's inches or one second foot. There are about 300 acres of bottom land in this ranch that are susceptible to irrigation by gravity from the river. In order to irrigate the higher mesa lands water would have to be pumped about 150 feet. It is estimated that the riparian priorities below Carroll will be satisfied if 1000 acre-feet per annum is released from the Carroll reservoir on all years except those in which this amount of water would not have passed Carroll dam site, had no dams been constructed on the river."

117°45' R.6.W. R.7.W. R.8.W. 30' R.5.W. R.4.W. 15' R.3.W. (Sheet No. 1) R.2.W. 117°00' R.1.W. R.1.E. R.2.E. 45' R.3.E. R.4.E. 116°30' 33'30"



LEGEND

WATERSHED —

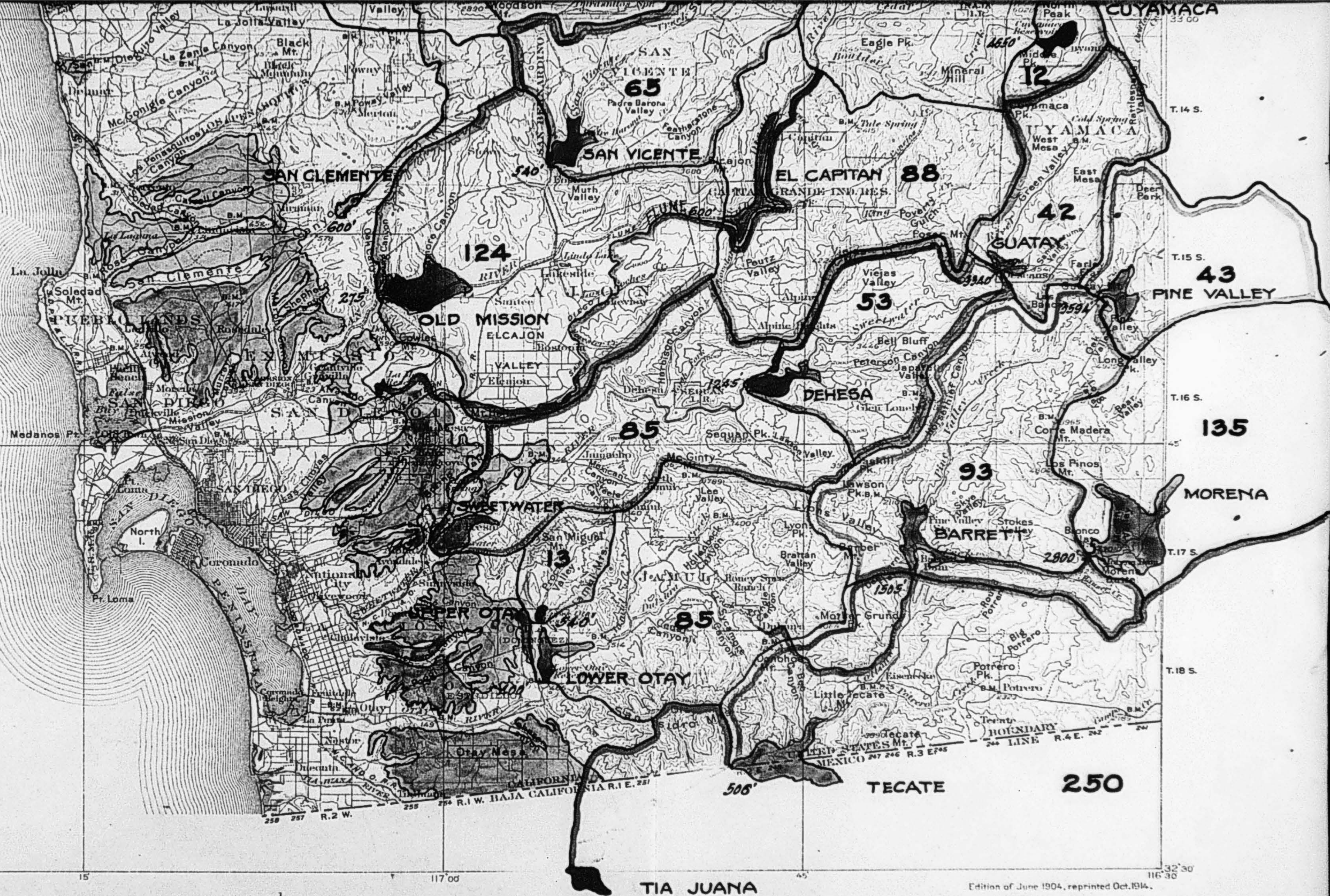
AREA DRAINED IN SQ. MI. — 135

APPROX. ELEV. OUTLET — 2800'

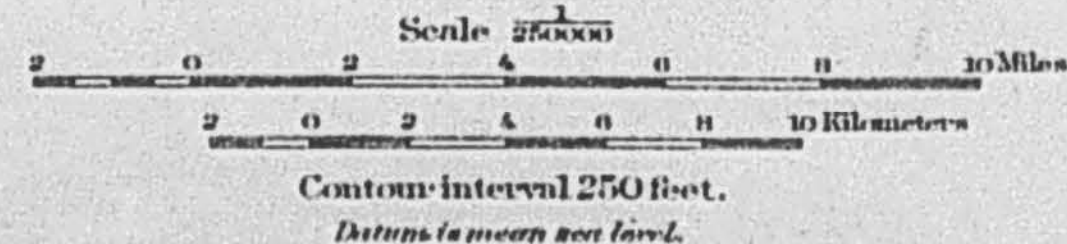
RESERVOIR SITE — MORENA

PIPE LINES AND CONDUITS —

IRRIGABLE LANDS —



Topography by U.S. Geological Survey.
Reduced from the nine atlas sheets covering this area.
Surveyed in 1891 and 1898-1902.



Edition of June 1904, reprinted Oct. 1914.

SOUTHERN CALIFORNIA
SHEET NO. 2

Ed Fletcher Papers

1870-1955

MSS.81

Box: 36 Folder: 4

Business Records - Reports - Choate, Rufus. "Consideration of a plan to develop a mutual supply of water for the City of San Diego and its contiguous territory"



Copyright: UC Regents

Use: This work is available from the UC San Diego Libraries. This digital copy of the work is intended to support research, teaching, and private study.

Constraints: This work is protected by the U.S. Copyright Law (Title 17, U.S.C.). Use of this work beyond that allowed by "fair use" requires written permission of the UC Regents. Permission may be obtained from the UC San Diego Libraries department having custody of the work (<http://libraries.ucsd.edu/collections/mscl/>). Responsibility for obtaining permissions and any use and distribution of this work rests exclusively with the user and not the UC San Diego Libraries.