

R E P O R T .

ON THE DEVELOPMENT OF THE WATERS OF THE SAN LUIS REY RIVER AND ADJOINING SOURCES IN SAN DIEGO COUNTY FOR IRRIGATION AND OTHER PURPOSES.

THE MAIN OBJECT OF THIS ENTERPRISE is to impound the flood waters of the San Luis Rey River for distribution over a material part of San Diego County for the purpose of irrigation, domestic and municipal use, generation of electric force, and for other purposes that are desirable and important.

In its general characteristics the project possesses remarkable natural advantages towards a successful and economical development, and in its amplitude and tenure it is most extraordinary. It also has the admirable feature of being made available to such an extent as may be desired to meet present necessities, with the opportunities for enlargement from time to time as the increasing demands for water may justify, thus saving in any present unnecessary outlay, and providing a source of revenue for such enlargement as needed from increasing rents, profits and subsidies that will come from its distribution.

Its field of operation, is that belt of several hundred thousand acres of land contiguous to the Coast, and extending to the City of San Diego, which is unsurpassed in fertility of soil, variety of productions and climatic conditions.

By reason of an insufficient rainfall immediate to this section, it is absolutely dependent upon methods of irrigation to insure its productive resources, and as the prevailing streams are intermittent in their flow, and unreliable as a direct source of

supply, -as they are usually dry when and where most needed for use- it becomes necessary to provide means to meet this requirement. The only way to do this is by storage reservoirs, and the only source that has the requisite supply and elevation to command the entire territory is that contemplated by this system.

The nucleus of the undertaking, the San Luis Rey River, runs through this territory, and is the largest stream and most reliable in its flow of any in the County. It heads where the rainfall is the greatest in the high mountains between the Coast and Colorado Desert, some of which are upwards of seven thousand (7000) feet in elevation.

Towards the head of this River, and among these high mountains is a large and comparatively level tract called Warners Valley. Within this Valley, there is reason to believe, once existed a lake covering many thousand acres, which at some time broke away the barrier at its lower sides and formed the narrow outlet which now exists. It is an undertaking of no great moment to fill in this narrow pass, and thereby create a reservoir which, when all are considered, must stand alone upon the Pacific Coast in its magnitude as an artificial storage, together with the possibilities and probabilities that will follow from the use and distribution of its waters over the Country mentioned.

From examinations and surveys made of this Reservoir site and of the general project, it is shown that the bottom width of this narrow outlet is one hundred and ninety-eight (198) feet, and that the bed rock is from five to seven feet beneath the bed of stream. The sides are precipitous and the projecting ledges upon them, as well as other evidences, give assurance of a stable

anchorage for a dam. A stone structure to the height of one hundred and thirty (130) feet, or higher, is within the limits of practicability, and the material therefore is abundant and near at hand. The conditions are favorable for most any class of dam.

The bed of the River at this point is twenty-six hundred and thirteen (2613) feet above mean low tide.

From the peculiar configuration in this locality there exists a natural and ample wasteway at a point upward of half a mile distant, over which all surplus waters can flow, thus securely providing against that most important element of danger.

By the construction of a dam to the height of one hundred and thirty (130) feet, it is estimated that an area of eight thousand and five hundred (8500) acres will be flooded, which will form in many respects an ideal storage basin. It will be compact in form and have deep margins over its greater part by reason of steep mountain slopes on one side and the bench of mesa land upon the other.

In different portions of its bed there are several hundred acres of marsh land, and in other and higher parts there are depressions, or dry lakes as they are called, which often hold water during a large part of the year. This all goes to show the close nature of the soil and its adaptability for storage purposes. In addition, there are many springs along its border, coming from the mountain sides and mesas, which reinforce its qualities in this regard.

The capacity of this Reservoir at one hundred and thirty (130) feet flood plane, is computed at four hundred and four thousand and five hundred (404,500) acre feet, which is equivalent to

(17,620,000,000) cubic feet, or (132,151,000,000) gallons. To a plane one hundred (100) feet above lowest point of Valley and at a desirable level for outlet at dam the volume is 105,000,000,000 gallons.

The catchment area is found by actual measurement to contain two hundred and ten (210) square miles. In character it is of high broken mountains, of granite formation, some of it with denuded sides and presenting many favorable aspects towards giving a large percentage of storage from the rainfall. This coupled with the heavy nature of the storms in this region, and from the fact that the streams at times of rain are usually torrential, even during the summer and fall showers, it is reasonable to conclude that an unusual amount of storage may be obtained. As an illustration of the violent nature and quantity of water coming from the streams of this area, there are places in the River below the Reservoir where the bed is confined to the canon, with widths of from 150 to 500 feet, which show by the drift wood and other indications of high water mark, that the floods have ranged from 10 to 15 feet in depth.

This storage percentage of rainfall is quite variable in different localities, and differs when one year is compared with another. It is dependent upon the nature of the storms, the compactness and formation of water shed and other causes. Where the rains are gentle, and the Country is flat, with deep loose soil the minimum yield is to be expected. The difference and value here in that regard, is demonstrated by the summer and fall rains, at which time the ground is dry and parched; but not withstanding, it is not an unusual occurrence for floods to attend a rain of only a few hours duration and streams to become so swollen as to be impassable.

In the vicinity of San Francisco where water is stored, and where the conditions are not comparable to this, the estimate for actual sale and consumption ranges from 50 to 60 per cent, though in extremely dry seasons it is lower than this. In other portions of the State where the character of Country and rainfall is similar to this Section, the catchment has been rated at 75 and 80 per cent. On this subject the hydraulic engineering author Fanning, makes the following deductions which are gathered from the Scientific investigation of American streams, viz:- From mountain slopes and steep rocky hills, 80 and 90 per cent; wooded swampy land, 60 to 80 per cent; undulating pasture and wood land, 50 to 70 per cent; flat and prairie, 45 to 60 per cent.

The rainfall of the Country is in proportion to the elevation above the sea, being greatest in the higher localities. It is often in marked contrast with the lower levels bordering the Coast, where a variation of 70 per cent is not unusual. From various records kept within this catchment area, and in the adjacent Country having similar conditions, the precipitation is shown to range from 25 to 90 inches per annum. Mr. J. E. Gedney living on lower margin of watershed, measured 92 inches during the winter of 73 and 4. Old residents assert that it is greater than this in other portions. It is commonly of a torrential nature, and is at times accompanied with snow in the elevated parts, which during one storm fell to a depth of nearly six (6) feet.

By reason of these high mountains and the proximity of the Colorado Desert, this Section is subject to summer and fall rains which is especially advantageous, as from their character

considerable benefits will be received. It is not infrequent for it to rain every month in the year in the mountainous portion.

This condition of seasons must have a large influence upon the losses from evaporation of confined bodies of water, and tend to reduce it to a minimum. It will be also aided by the character of Reservoir, as a large percentage of its margin will be deep, and thereby a low temperature maintained. The losses from evaporation have not been determined in this locality, but the action is the reverse of the rainfall as it decreases with the altitude. At San Diego and Los Angeles the annual is given at 37.5 and 37.2 inches respectively, from which difference of level it follows must be less at site of Reservoir.

Assuming the mean annual rainfall at 52 inches, the precipitation on this area would be 190,270,080,000 gallons, which is 27 per cent more than capacity of reservoir. With dam at 130 feet in height the minimum of 25 inches gives 91,476,000,000 gallons, and is 31 per cent less, while from the maximum of 90 inches it would reach the enormous volume of over one million acre feet, or more precisely 329,313,000,000 gallons, which is two and forty-four (2.44) times the cubic contents of storage.

On the question of possible drouths, let this be compared with any other successful irrigation enterprise on the Pacific Slope, and the exceptionable conditions as presented here, and elsewhere, over the undertaking must become apparent.

Beyond question, the proportions are ample, and such as to meet successfully any probable contingencies; but in the event of desiring further security against an unusually dry period, or conserving a greater amount of water, the height of the dam can be

increased at pleasure, until the area flooded will be 10,000 acres or more.

MAIN CONDUIT.

From the main Reservoir at Warners Valley, it is proposed to convey the water by means of a canal along the mountain and rolling hill sides to the two points for distribution and sub-storage, known as Bear Valley and Moosa Canon. These places are at respective distances of 22 and 28 miles, but as tributary streams to each are most convenient for water way, the total length of conduit to supply both will not exceed 19 miles.

The Country over which it runs is excellent for a mountainous one, not being broken in its general character along the alignment. The soil is of such a nature as to be good for canal purposes, and will become close and compact when put to such use. This is demonstrated by other ditches in the locality. It will not be expensive to construct or maintain, by the proper methods, as much of the line is along benches and gentle slopes and not cut by any cross-streams. The principal of watershed above conduit is confined to two or three main channels before reaching canal line. As a rule there is heavy brush along and above the alignment, which will prevent the concentration of storm waters at out of way places, and hence their destructive action when crossing conduit. Where these water courses are crossed, short stretches of flume will be used. Where flumes or culverts are necessary there is an abundance of suitable timber for their sub-structure growing in the vicinity. Throughout the length of conduit, there is considerable source of catchment aggregating an area of 13 square miles, which is

principally collected in two main streams. At the points where these are crossed they are very narrow, and each have valleys directly above with excellent facilities for controlling works by which their waters can be intercepted and conveyed to the Distributing Reservoirs. The condition at other points are very favorable for securing most of the water coming from their catchment area. The proportion of rainfall upon it, is nearly equal to that of main storage basin, and as the square miles are equivalent to the catchment basin of the principal Reservoir of the San Diego Flume Co. its value is apparent.

At three points along main conduit tunnels will be advisable. One of them will save about six miles of construction around a very rough and difficult mountain. Its length will be 2200 feet. The other two cross sharp spurs with considerable advantage and have lengths of 300 and 500 feet.

The conduit is to have a maximum carrying capacity of 600 cubic feet per second, which is equivalent to 30,000 miners inches under a four inch pressure. It need not be constructed to its full capacity in the beginning, but any smaller proportion can be adopted, and subsequently increased without materially interfering with its continued use.

The substitution of a flume for a canal has been considered, but a comparison of the local conditions, requirement, etc; give, in point of first cost, maintenance and future necessities, a decided preference to a canal. A flume deteriorates with age, soon requires constant care and expense to prevent excessive leaks and finally an entire renewal is necessary. A ditch, under the

condition of this one, will improve with use, both as to its carrying capacity and waste from seepage.

This has all been demonstrated since the early mining days of California, and that, the advantages flumes, as first used, were in the most part based upon theory only. A ditch can be increased in carrying capacity while in use and at no unusual outlay. Whereas beyond a side board, this is not possible with a flume. In the beginning any losses that may come from such a conduit will be of no consequence since the supply will largely exceed immediate demands.

B E A R V A L L E Y R E S E R V O I R .

Bear Valley, the site of principal Distributing Reservoir is a deep depression among the foothills of main range, containing about 1000 acres and bounded by steep rocky slopes. It is an admirable place for storage, and from its commanding position with reference to the Irrigable belt below it has great value as a point for distribution, and will give unusual security and convenience to the enterprise. It has an independent watershed of its own of nearly eight square miles on which the rainfall ranges from 8 to 40 inches and in favorable seasons affords a large amount of catchment. It is a source of the San Elijo Creek, which runs through Escondido and is perennial in Reservoir site.

The lower end of valley forms into a narrow rock gorge, presenting in large compact masses unmistakable bed rock on bottom and side of canon and gives an excellent site for the safe and economic construction of a dam. Like the condition existing at the

main storage dam, a natural spillway is also provided, which is fully one-third mile distant, and in this respect, as well as for the erection of a dam it is superior and generally unexceptionable. A dam to the height of 130 feet will conform to this spillway and is advisable. It will have a capacity of 7,785,000,000 gallons. Should it be desired in the future to increase the storage at this point, it can be augmented to the extent of 5,000,000,000 or 6,000,000,000 gallons by a structure about midway of the Valley where there is a suitable point. The elevation of the lower dam site is 1400 feet above the sea.

M O O S A R E S E R V O I R .

The Reservoir site at "Moosa Canon" is situated some ten miles to the N. W. of Bear Valley, and is on a tributary of the San Luis Rey River. It is very level and bounded upon all sides by abrupt mountain slopes. In formation it is unique for a storage basin. At the lower end of Valley is a solid ledge of granite through which the stream has cut a deep and narrow outlet, and is a superb site for a dam. The Capacity of this Reservoir has not been determined by contour lines, but in general characteristics it excels that of Bear Valley, and in my opinion proportional heights of dam will give equal if not much larger cubic contents.

This Reservoir will be the distributing source for the San Luis Rey Valley proper, Monteserrate and Guajome Ranchos, Oceanside and the desirable country adjacent to them. Its elevation is 400 feet above the sea.

It has a catchment area of 28 square miles, a part of which is high precipitious and rocky, and upon which the rainfall

is about the same as Bear Valley. A large amount of water annually passes from it, and in favorable seasons it will be practically self sustaining. A fine stream is always flowing in bed of its main Creek.

This principal stream heads at the same place as that of Bear Valley, and is equally available for the diversion of water from the main conduit. In its course to Reservoir, it runs through the Valley Center Country, from which direct distribution can be made by a ditch system over a great many thousand acres, or in fact the major portion of the district.

When these associated conditions of this project are considered and comparison made with others, their very extraordinary and numerous advantages become apparent. Aside from the splendor of the main storage basin, the distributing Reservoirs of this system are each larger than many of the main storage Reservoirs of other enterprises, and with most of them there are no opportunities whatever for storage distributing source as this has.

In addition to these two distributing Reservoirs with which the main conduit makes direct connection, it can be turned into the Guejito Valley at several places on a low ridge, the summit of which it follows some two miles before reaching its terminus. This is at an elevation of 2200 feet, and will enable a supply to reach any point under that level, of which there are several thousand acres near by included in the Guejito Ranchos and country adjacent to it. It will also be the most direct way to furnish the San Pasqual Valley, to which the water will run in a natural channel, and without any expense further than turning it from conduit. The same point and partly by the same means is the

most convenient and practicable way to supply the Rincon, Euama, Auga Tibia, and Pala Districts lying to the North. The fertile district known as Fallbrook could be irrigated from this enterprise.

IRRIGABLE COUNTRY.

The country to be irrigated by this system is more definitely defined as being that strip extending from San Diego northward some 50 miles, and running back from the Pacific Ocean from ten to thirty miles. In character it consists of Valleys, Mesas and undulating upland, which varies, in its material part, from sea level to 1000 feet in elevation, though the major portion runs from 400 to 600 feet.

Reference to the accompanying miniature Map will better convey an idea of its extent and general outlines. The boundaries of the total area that will conveniently come under this design embrace over 400,000 acres. Over some of this there are broken and isolated parts not convenient or intended to irrigate, yet the larger portion, or about three-fourths is most desirable, and susceptible of the highest advancement. The City of San Diego, with its Pueblo lands of 48,000 acres are included, and from its natural conditions and requirements as to abundance and purity of water it must, sooner or later, look to this source for all its supply.

In distributing the water over this belt, various methods can be resorted to or many combinations made. At various places natural streams will be available and convenient as conduits from one point to another and also for direct diversion. Flumes, ditches and pipes of different kinds will enter to some degree into the

distributing system and can be alternated. Much will depend upon the intent of the supply and the conditions surrounding its conveyance from one locality to another.

In the beginning, a ditch system will be used wherever practicable, as it will be the most economical. In the future these can be improved by lining them either with asphalt or cement or replacing them with pipes, as may be desired.

W A T E R P O W E R .

In conveying the water from the Main Reservoir to the Bear Valley and Moosa Reservoir there is a difference in level between the two places of over 1000 feet, which can be made available for the generation of electric power, and in doing so, without any resulting loss of water. The base of the lower Bear Valley is 1400 feet above the sea, and between that point and first distribution, there will be several hundred feet which can be turned to proportional account. In addition, should pipe lines be used as a means of conveyance to any of the lower levels, the places of outlet will have their ratios of power corresponding to pressure and volume. Should the City of San Diego, which is over 1000 feet, below distributing source, receive its supply through pipes, the value and convenience of the power thereby developed would be of great importance.

Along the main conduit there are two principal points where this power will be generated; one, at its lower end where turned down the mountain side into either distributing reservoir, each giving 700 feet, and the other at mouth of main tunnel, where the alignment makes a precipitous descent of 300 feet, all giving

admirable conditions for the pressure control of any amount that may be discharged.

With a maximum of 600 feet per second, and all this fall utilized, the gross amount given therefrom would equal 68,040 horse power. It is usually estimated that about 70 per cent of this becomes net, though makers of some water wheels now claim as high as 92 per cent. At the three hundred feet fall from tunnel, 21,412 horse power gross can be developed. Any smaller amount used at either point, or combined, will be in due proportion to head and volume.

In electric transmission the resulting efficiency depends upon the distance conveyed in conjunction with weight and substance of transmitter.

Its value in such form, to the Company and to the Country is hardly to be estimated, and as a coming source of revenue it would justify the expense of the undertaking. This agent is constantly growing in the wants and necessities of progress. The scarcity and price of fuel in this Section must give it a high market value. In different portions of the State the rentals per horse power runs from \$50 to \$150 per annum.

It is intended to use this force where power is necessary in all operations of construction, or to make all dams, ditches, tunnels, transportation &c. Machinery of the present day of nearly all kinds is being successfully fashioned to its use, and there is no question of the great economy and utility that will be given from its application on its work. The canal line leaves the River quite rapidly, and by the plans of out-take, the difference between them at the distance of a mile will be sufficient to give

considerable power. This can be increased from time to time as conduit is extended, until any amount that may be required can be obtained sufficient for simultaneous operations from one extreme of the works to the other. Before reaching main tunnel a fall of 1200 feet can be secured.

C O N S T R U C T I O N .

The engineering phases of the enterprise, of which there are no difficulties to surmount, consists of the dam at the main storage Reservoir in Warners Valley with its provisions for flood waste &c; the conduit from this point to the sub-storage and distributing reservoirs in Bear Valley and Moosa Canon; erection of dams at these points; conversion of storage and distribution at other places; system of distribution over the country to be irrigated and otherwise supplied; generation of electric power for construction, revenue, etc.

In the construction of dams, which are to be of granite or stone order, it is proposed to adopt such plans and provide such factors of safety as will be more than ample to withstand any probable disrupting influences. In the main, their bases and sides are to be of cement masonry and firmly attached to bedrock at all places. For the material parts of dams, it is contemplated to use asphalt mixtures instead of cement, as for such purposes it is not only economical but possesses peculiar and desirable qualities. It is an adhesive, impervious and flexible substance, with properties which will give monolithic strength to a structure and conform to any tendencies of subsidence. As a reinforcement to this, and as a material that would act as a safeguard under any circumstances, it

is proposed to put puddle earth on water side, in such mass that it can never become water soaked, and in combination have such inherent strength as to preclude any element of failure. This type is considered on account of the great security it will give, as well as the natural opportunities offered in pursuing economical measures.

This main conduit is to be trapazoidal in cross-section, with a maximum capacity of 600 cubic feet per second. This will be a little more than the cubic contents of the main Reservoir, but such size is desirable towards intercepting and giving facilities to control the surplus water from floods, and also better providing for what water can be secured from the watershed contiguous to it, which, as above stated, has a rainfall nearly equal to the principal catchment area. Moreover, it is necessary that this, as well as other irrigating conduits, have an accumulating capacity in order that water may be delivered during the irrigating season.

The tunnels are estimated with a sectional area of 70 feet, with requisite grade to carry full volume. It is expected they will be through granite and have all the advantageous features that such will give.

It is not the aim to complete the system at once, but instead to take such steps as will secure an amount of water sufficient for the immediate demand in irrigating the country most convenient and economical to supply, and thereafter make such additions at intervals as inducements and developments may offer. The natural conditions are favorable to this course, and in the beginning it can be given such magnitude as will best adapt it towards securing an income, and in a comparative way be conducted on a moderate scale. The Section lying directly under it and meeting

this plan includes Escondido, San Pasqual, San Marcos, Valley Center and the country contiguous to them. In fact it embraces all the belt to the North of the San Bernardo River, which includes an area of 200,000 acres to select from. Several towns are within the territory. It is not to be understood that this is the limit of the country requiring irrigation at the present time, for all the sections I have included under the general system, not only desire a supply, but for years have been making efforts and entertaining various plans by which it may be obtained. The system throughout, however, for distributing water should only be extended as inducements and the increasing demands may warrant. The City of San Diego is and has been equally urgent and, from recent steps, shows a determination to meet, not only her municipal needs and expectations to an indefinite future, but also secure water for the irrigation of the 48,000 acres of Pueblo lands immediately adjoining the City proper. It is undoubtedly a most important source from which to secure a contract. In addition, a contract to supply the Linda Vista Irrigation District may be secured.

To furnish the sections outlined, or such parts as are especially desirable and convenient, and also to provide for probable inducements from other localities immediately following operations, this plan may be adopted preparatory to distribution.

Plan No. 1.

Warners Valley Dam, to height of 100 feet----	\$350,000.
Main conduit, capacity 600 cubic feet per Sec,	240,000.
Diverting Dam at Bear Valley,-----	20,000.
Diverting Dam at Moosa,-----	10,000.
Total,-----	\$620,000.

Construction to this extent would make available from 15,000 to 20,000 miners inches, or sufficient for general distribution over the principal country.

Instead of erecting the Warners Valley Dam, a diverting structure can be substituted and placed in river one mile below, where there is a more suitable point for such purpose. This would save a mile of the main conduit and would become a permanent source for diversion. Then, erect dams at Bear Valley and Moosa Canon, with which the cost would be:-

Plan No. 2.

Diverting Dam, (50 feet high) -----	\$ 28,000.
Main Conduit, complete, (18 miles constructed)	250,000.
Bear Valley Dam, 130 feet high and spillway--	287,000.
Moosa Dam, 50 feet high-----	75,000.
Total-----	\$620,000.

This would be enough to meet the advancing development for a few years to come, and also for extensions to some desirable places not included in the belt.

It would place the enterprise on a safe basis, and from the revenue obtained would not only give profitable returns upon the investment, but would be sufficient for further improvements and extensions, giving additional subsidies from which the entire system could be perfected.

In the beginning, a further material reduction could be made in first outlay by reducing size of main conduit, height of Bear Valley Dam, and omitting any structure at Moosa. This latter will not be necessary until the demand for, and the value of water to be stored thereby would justify. The lands of and adjacent to

San Luis Rey Valley could be irrigated with water received direct from main conduit, and conveyed to them by the channel of the streams running through Valley Center and Moosa.

On this basis the estimates are as follows:-

Plan. No. 3.

Diverting Dam,-----	\$ 28,000.
Main Conduit, capacity 300 Cubic feet per sec.,	170,000.
Bear Valley Dam, 100 feet high,-----	<u>220,000.</u>
Total-----	\$418,000.

This outlay for the main works would be enough for the first two years, as under ordinary conditions of the River it would furnish what would likely be required during that period. It would enable the territory to be put under a system as the last above, and secure fully the same amount of subsidies. In some respects it would be preferable, as from a given amount of investment, a better and more extensive system of distribution could be made.

D I S T R I B U T I N G S Y S T E M .

The cost to the Company of distribution will depend upon the manner adopted and as whether it be delivered:-

First,--- By wholesale, to an Irrigation District, or to a Land Company.

Second,--- By retail to individuals.

The country embraced is especially convenient towards pursuing cheap methods, as the topography will admit of the use of natural waterways to a large extent, and in many places water can be conducted by such means for a long distance. It is expected to take advantage of these natural opportunities, for although the

loss of water will be greater by such means, it will be cheaper and more satisfactory to provide for such loss from the large supply in the main works, and later on, when desired, substitute such other plan of distribution as experience will prove best suited to the end sought.

By this course, distribution can be done mainly by a cheap ditch system, carried in mains at such elevation as to command the best country, and therefrom, delivered to any desired point by means of ravines, channels &c., where such are crossed that most conveniently meet the aim. In many places the crown of the territory can be followed either by the main or laterals, and distribution made to large areas upon either side.

An inspection of the country shows a wonderful provision for this plan, and reference to the Map hereto attached, will define in general terms as to how this way provides for some of the principal sections. The radiation from lower end of main conduit, of streams entering the San Bernardo River on one side and San Luis Rey upon the other will be noticed, and still further is to be seen the connections of prominent interior water courses with Distributing Reservoirs or Channels leading into them.

Escondido and San Marcos, embracing 25,000 acres, are Irrigation Districts waiting for a supply, and will only require the water to be delivered to them at some available point from which distribution will be made by the District. The inhabitants over most of the remaining portions of the country have, for some time, had the subject of forming Districts under consideration, and I have no doubt, were such desired by the Company, could easily be effected. It is probable from such steps, that three additional

divisions would follow:--- One would include Valley Center; another San Luis Rey Valley with Oceanside and the country to the south as far as San Marcos Creek; the third would cover the material country to the San Bernardo River.

District Distribution.

In such subdivisions, delivery could be made at comparatively small expense. To supply Valley Center and principal part of San Luis Rey, it would simply require the water turned loose from the lower end of the main conduit, as the first District would extend to it, and the Moosa Ravine would mainly conduct to the other. Escondido is similarly advantageous, but will receive supply in conjunction with others. San Marcos would necessitate a conduit connecting with the Bear Valley Reservoir, which would also be the medium for furnishing the District to its south, and a convenient way to part of the San Luis Rey.

The cost of this delivery under this alignment, and with such dimensions of waterway as to give an adequate amount is estimated to-wit:-

Valley Center,-----	\$ 1,000.
San Luis Rey, in part and to high levels,----	10,000.
Escondido, San Marcos and others,-----	<u>274,000.</u>
Total-----	\$285,000.

The last item can be considerably reduced in the beginning.

Combining this with the cost of the different plans above given the totals appear, viz:-

Plan No. 1-----	\$320,000.	
Distributing-----	<u>285,000.</u>	<u>\$905,000.</u>
Plan No. 2-----	320,000.	
Distributing-----	<u>285,000.</u>	<u>\$905,000.</u>
Plan No. 3-----	418,000.	
Distribution-----	<u>285,000.</u>	<u>\$703,000.</u>

These combined Districts, with boundaries, to cover the desirable and accessible ground, aggregate an area of 150,000 acres. The revenue to be expected from all these Districts on the minimum basis of \$300 per miners inch, with quantity of one inch to ten acres, foots up to \$4,500,000. The annual rental of \$3.00 per acre gives \$450,000. This basis is tangible.

The value of water, or rather a bonus for supply, has heretofore been conceded as averaging \$1000 per miners inch in Southern California. In some localities \$3000 have been given. It is, of course, regulated by circumstances and conditions. In a few and exceptionally favorable places for development it has been disposed at prices ranging from \$300 to \$600. The per annum rental for quantities of water varying from five to twenty acres per miner inch, ranges between \$2.50 and \$15.00 per acre.

Distribution by the Company.

Instead of assuming that the country is covered with Irrigation Districts, measures may be taken by the Company for direct supply. In this procedure, it can also be given any magnitude, or conducted in such proportions as will conform to some specified expenditure, and otherwise towards a like financial success.

In the absence of Irrigation Districts, it is probable there would not be the immediate necessity to the Company to make developments requiring distribution over more than about 70,000 acres after which extensions could be suited to inducements.

With this in view, and that additional developments and extensions will be provided for by the accruing revenue, I confine to it any further estimates. The sections and parts that are available under the methods outlined are:- Valley Center, San Luis, San Pasqual, Escondido, San Marcos and country lying westerly of the latter as far as the Coast.

To provide a supply mains would be projected as follows: To Valley Center from end of main conduit along and near crown of country north westerly, affording distribution upon either side of natural watercourses; to San Luis Rey from conduit by way of Moosa. The Puama and Montesserate Ranchos can supply from these distributaries by the local streams, and be enabled thereby to reach their higher and better grounds, which is not feasible by any diversion that either place could make from the river; even allowing that it would furnish a supply when needed which it does not. This will apply to every interest upon the River and is twofold important. San Pasqual will be reached via Guejito Creek from the main conduit, requiring only to be turned therefrom. Escondido, San Marcos and other country to the west by the main from Bear Valley Reservoir.

The total cost is estimated at \$420,000 which contemplates mains of requisite capacity so located as to supply the most available country and that natural streams will be used where

practicable. Escondido and San Marcos are Districts and will do their own Distribution.

This sum associated with the different plans of construction gives the following totals:-

Plan No. 1-----	\$620,000.	
Distribution-----	420,000.	<u>\$1,040,000.</u>
Plan No. 2-----	620,000.	
Distribution-----	420,000.	<u>1,040,000.</u>
Plan No. 3-----	418,000.	
Distribution-----	420,000.	<u>\$838,000.</u>

A further plan may be used which is not without its advantages, viz:-

Warners Valley Dam to height of 60 feet; affording storage capacity of 15,548,000,000 gallons-----	\$130,000.
Main conduit, to capacity of 300 cub. ft, pr. sec.-----	170,000.
Bear Valley Dam 100 ft. high affording storage capacity of 3,816,000,000 gallons-----	220,000.
Distribution-----	<u>420,000.</u>
Total cost-----	<u>\$940,000.</u>

I have not considered the irrigation development of the portion lying to the south of the San Bernardo River, as the belt outlined is deemed sufficient in the beginning to meet the most desirable procedure. There is no doubt that the water supply being once developed, the Company will find the urgency for water over the whole country so great, and such inducements will be offered as will justify and provide for the delivery thereto, at an early

date. The land owners are fully alive to the fact that, though their possessions are capable of yielding in productions and net profits with any portion of the World it cannot be done without water, and that the possibility of obtaining it by individual effort is beyond their control.

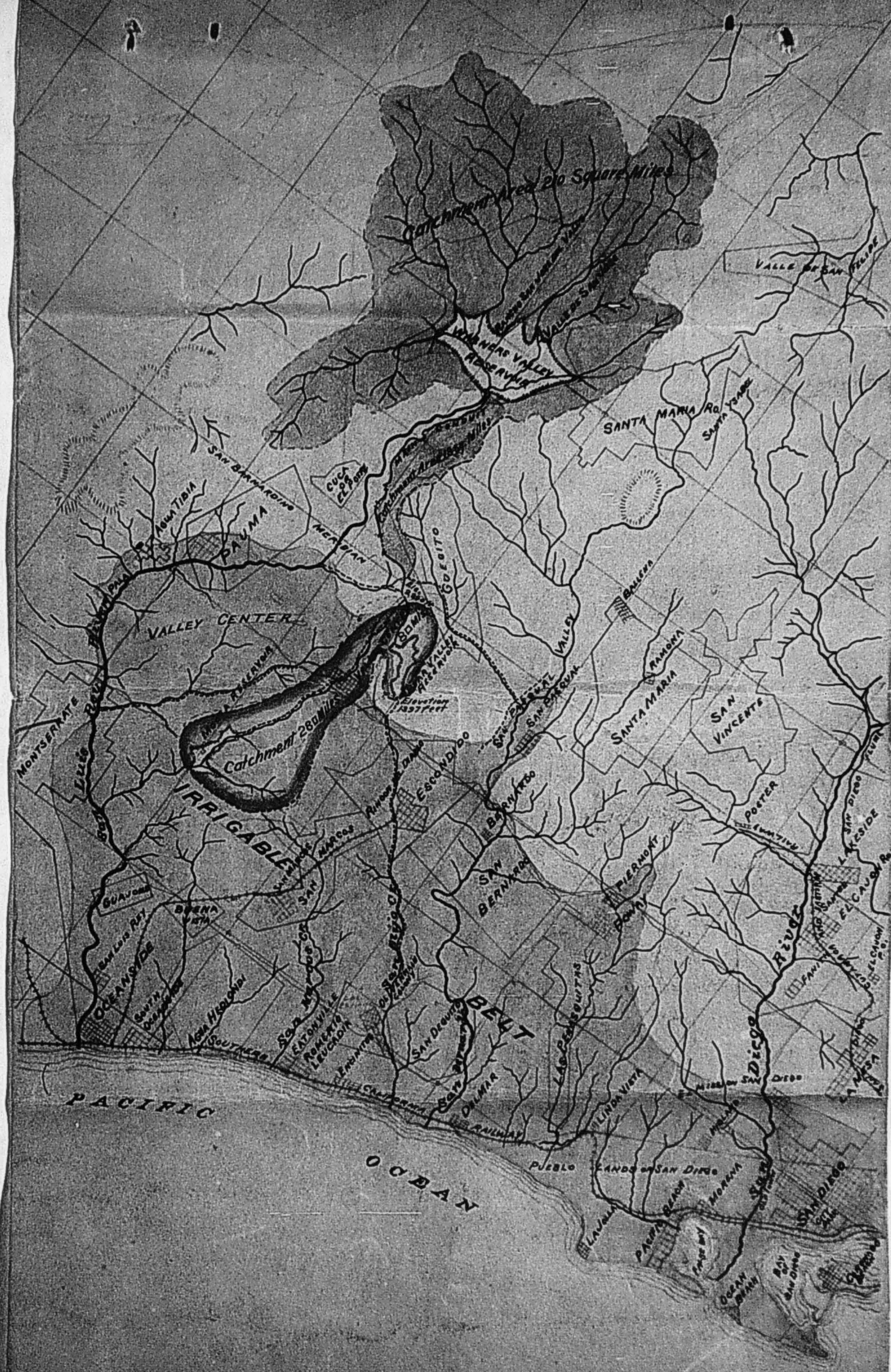
To the end of securing it, many have already offered one half of their holdings on an equitable division, or an equivalent cash bonus, merely as a right to a given amount of water; usually one miners inch to ten acres of land, besides an annual rental averaging \$3.00 per acre for all time.

The market value of this land under irrigation will range from \$100.00 to \$300.00 per acre, which is very cheap when compared with land values similarly conditioned in other parts of Southern California. Should the Company desire to take lands not embraced in any irrigation District, it could easily secure fully 100,000 acres as a subsidy therefore. To this include the revenue that will come from the electric distribution and the probable results are manifest.

Signed, F. P. Mc.Cray.

Hydraulic Engineer.

San Francisco, June 1893.



Ed Fletcher Papers

1870-1955

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**Business Records - Reports - McCray, F.D. -
"Report on the Development of the Waters of the
San Luis Rey River and Adjoining Sources in San
Diego County for Irrigation and Other Purposes"**



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