REPORT ON IRRIGATION

FROM THE COLORADO RIVER BELOW YUMA, ARIZONA. BY

PUMPING VS. GRAVITY CANALS.

by

Jas. D. Schuyler,

Consulting Engineer.

Los Angeles, Cal., Nov. 25, 1901.

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Los Angeles, Cal.,
Nov.25th,1901.

E. H. Rollins & Sons,
335 Pine St.,
San Francisco, Cal.

Dear Sirs:-

In response to your request of 4th inst., received at Rocky Ford, Colo., I stopped at Yuma on my return from Colorado to examine the conditions under which irrigation has been practiced on the Algodones Grant with a view to determining whether or not gravity canals are likely to prove feasible for the general irrigation of that district, as against pumping. The following report has been prepared to embody my conclusions on the matter.

The territory in question comprises a tract of 50,000 to 60,000 acres of alluvial bottom lands extending some 25 miles south of Yuma to the Mexican boundary, and lying between the Colorado river and the Mesa lands to the east. The lands are extremely fertile and productive, and capable of producing enormous crops when provided with a sufficient supply of water for irrigation. The inducement offered for a satisfactory solution of the irrigation problem is therefore quite extraordinary as the soil of the region is certainly unsurpassed in productive power by any lands in the United States. The water supply of the Colorado river, flowing alongside the lands is practically unlimited, the lands have a sufficient slope to enable them to be irrigated readily, the subdrainage of the soil is good, and the soil takes water freely when applied to the surface. All of these conditions are quite as favorable as could be desired. There are only three unfavorable conditions which render the problem one of difficult solution, and these are:

(1) the wide range of fluctuation in the height of the river between high and low water;

(2) the slight fall of the river, and

(3) the heavy load of sand and silt carried by the water in suspension.

FLUCTUATION OF THE RIVER.

The accompanying diagram of the maximum and minimum monthly gage heights at Yuma since 1882 illustrate the fluctuations which occur, and show that the minimum is as low as elevation 113.2 ft on the gage and the maximum as high as elevation 128.3 ft. - an extreme range of about 15 feet. The gage is placed with its zero 100 feet above sea level. As irrigation in that region is practically continuously required the year round a gravity canal to be of effective service must be taken out at some point lower than elevation 113. The depth of water carried by the canal, whether it be 3, 4 or 6 feet, would therefore require its bottom to be that much lower than elev. 113. at its head. In order that a gravity canal shall be able to get out upon the surface and serve lands within a distance of 6 or 8 miles from its head it is necessary to start as high up the river as possible, involving deep cutting at the head, and expensive headworks. Practically the entire tract is subject to overflow in extreme floods, which introduces an added element of danger to canals so constructed as to receive water solely by gravity from the river, subjecting them to destructive washing of their banks, or filling by the deposit of sand. Moreover the river is a capricious one, and is liable to shift its channel entirely away from the most elaborately constructed headworks.

GRADE OF THE RIVER.

The Colorado has a fall of but one foot per mile, which is quite sufficient for a stream of that size, but is not enough for a canal of moderate capacity to enable it to carry along the load of silt received from the river, and any gravity canal built low enough to receive water all the year through, must be built on the grade of the river or a lesser grade, and under these conditions must rapidly fill with silt deposited from the water, unless the water be returned to the river below. This latter expedient could be resorted to at certain times when the water was most heavily charged with silt, and the canal kept scoured out in that manner, provided all other conditions of stability were maintained.

THE SILT PROBLEM.

The disposal of the silt and sand constitutes the chief difficulty in irrigating from the Colorado river. The percentage of silt carried by the river varies very greatly, and the amount of it has never, to my knowledge, been very definitely determined. It is greatest in high water, and ordinarily it consists of very fine sand. When the Gila river is in flood, however, the character of silt is changed to a very tenacious, plastic clay. The sand is easily removed from the canals by scrapers, and teams can enter upon it at once upon turning out the water. The clay mud is much more difficult to handle, and must be allowed to dry out for weeks before one can walk over it. The heads of the Farmers and Ludy Canals have been filled with this mud for the past year, to a depth of 3 to 6 feet, and it is most discouraging and expensive stuff to get rid of, as it is so very sticky and tenacious.

EXISTING GRAVITY CANALS.

There are two gravity canals taken from the river for the irrigation of these lands which have been in use the past year during the higher stages of the river. The Farmers Canal heads within half a mile of Yuma, and has its headgate located about 3/4 mile down the canal from the river. This canal delivered water successfully during high water, but has been dry for several months, and the only water received by the Farmers is from the Rollins pumping plant. As heretofore stated the upper portion of the canal is so badly silted as to require a very heavy expense before it can again be used. At the present stage of the water, with gage reading 17' 6", I am inclined to doubt if it could draw water from the river even if it were cleaned out to its original grade. If water were flowing freely through it the elevation of the ground is such that the water could not be brought out to the surface within six miles of its head. It can never, therefore, serve lands nearer to Yuma than this distance, and can only be available further down the tract. I regard this canal as a practical failure from every point of view, and can see no way in which it is likely to be improved so as to overcome the constant tendency to interruption of its flow.

The Ludy Canal heads about four miles down the river, and is carried into a long narrow lagoon, beginning 3 or 4 miles below its headgate, where the silt is intended to be deposited. A large sum of money, $200,000 and upwards, has been expended upon this canal, which I was told is owned by parties living in the State of Washington, and I was informed that the ultimate intention is to irrigate mesa lands in Sonora. The bed of the canal for the upper mile or two, at the time of my visit, was some two feet higher than the level of water in the river, although the river is liable to go down two to four feet lower still. A small, temporary suction dredge was being operated, cutting out the silt in the bed of the canal below the headgate to give a depth of about 6 feet of water.

To float the dredge a pond had been made by throwing a low dam across the canal at the river and another below the dredge, the water being pumped into the pond by a centrifugal pump at the river. This pond was about two feet higher than the river level. The dredge therefore was cutting the canal bed down to about extreme low water level. As long as the river bed remains in its present position at the head of this canal and the water is kept flowing through it in large volume I have no doubt that it can be successfully used for the irrigation of the lower half or three fourths of the tract in question, through the greater portion of each year. The most questionable features of the work are in the ability to permanently maintain the headworks in the unstable alluvial formation of the river banks, and the ability to hold the river bed from switching off to the opposite side of the valley, leaving the headworks high and dry. There seems to me to be an enormous risk in building and maintaining irrigation canals under such conditions, and while they may be operated successfully for a few years they are constantly liable to disaster.

STABLE GROUND FOR HEADWORKS.

The only firm and stable ground for the location of permanent headworks for a gravity canal on this entire section of the river is embraced within the limits of the military reservation at Yuma, a tract of 40 acres, through which you have right of way granted by Act of Congress for two canals, one of which is constructed and used for the carriage of pumped water from your pumping plant to the Algadones Grant lands. The other right of way, 200 feet wide, has not yet been utilized. The bank of the river is here composed of indurated sand, so firm and solid as to resist erosion, and against which the main channel of the river flows. I am of the opinion that a canal built with substantial headworks of concrete masonry in this material, located at a point a little above the pumping plant, and constructed on a grade sufficient to carry silt without material deposit, can be made as a permanent construction for the irrigation of the lower 40,000 to 50,000 acres of bottom lands, and that no other is likely to prove permanently feasible. Such a canal is feasible and ought to be built, and in my judgment the value of the district as farming lands will warrant such an extensive and costly canal as it is likely to be. It should be made large enough to irrigate the entire tract covered by its flow, and be used as the main source of supply for all but the upper 10,000 acres adjoining Yuma, which is too high to be reached by a gravity canal, and must always depend on pumping alone. To give it sufficient grade to clear itself of silt it would seem advisable to locate its head considerably above low water level, and supplement its flow in the low water seasons by pumping into it.

By this plan I think that the practical difficulties of irrigating the tract can best be overcome, and the problem of providing water be put upon the cheapest and most practicable basis. In short, it does not appear to me essential that all water for the tract must necessarily be pumped, but that both pumping and gravity should be used jointly.

THE IRRIGATORS.

The unsettled condition of land ownership and titles, and the irresponsible character of the class of settlers occupying these lands appear to offer more serious difficulties in the way of solving the irrigation problem than the physical conditions to be overcome. The Algodones Grant has been thrown open to settlement but a few months and but few of the settlers have titles to their lands. Some have entered them under the Homestead Law and some by the Desert Land Act, and the time when they will receive title and can offer adequate security in making contracts for water may be quite remote. They are inexperienced irrigators, they have no stable organization with which capital can deal in making contracts, their land is raw and requires much work in clearing and levelling to prepare it for irrigation, and as a class they are very poor. Nevertheless their lands are very rich and with cultivation will rapidly give the settlers adequate means for making payments, and the field really seems a promising one for the wise expenditure of capital in supplying the needed element for extracting the wealth from the soil, provided the settlers be dealt with diplomatically and fairly.

THE FUTURE OF PUMPING.

The portion of the tract lying nearest to Yuma is naturally that which is most valuable, and which would first come under irrigation. As heretofore pointed out there is an area of some 10,000 acres which must always depend upon pumped water for a supply because of its elevation, although at high water nearly all of this can be reached by gravity for a few months of the year. This portion of the tract is smoothest, is least cut up by depressions and the sloughs left by overflow of the river, and is most readily levelled and prepared for irrigation. At the time of my visit and for two months or more previously every acre of land irrigated in the entire district was drawing its supply exclusively from your pumping works. The farmers have come to depend upon it very largely and would probably rely exclusively upon it if the plant were increased in capacity and improved in a permanent way. They have failed with their own pumping plant and are ready to go out of the business of trying to do their own pumping with their own plant. The present arrangement which you have with them is one which is evidently intolerable, and cannot longer continue, as you are getting no returns on your capital investment and are wearing out your machinery to provide them with water at or below cost. By enlarging and improving the plant there is no reason why you should not control the water supply of the valley and secure a fair interest on your investment.

THE VOLUME OF WATER REQUIRED FOR IRRIGATION.

It has been extremely difficult to arrive at an approximate idea of the volume of water applied in irrigation in this valley, or the amount actually needed, although some estimate is needed in attempting to proportion the size of plant required to supply the demand. Mr. W. S. Ingalls told me that they were applying a depth of 8 to 9 feet per annum, although I could scarcely credit any such extravagant use of water in a region where the subsoil moisture is always within about 5 to 6 feet of the surface. In the Salt River Valley, where the humidity is even less than at Yuma, but where longer experience has taught the farmers to use water with some degree of economy, the average depth applied is from 3 to 4 feet. According to the reports of the Dept. of Agriculture the average depth received by the land under the Mesa Canal including rainfall was as follows:

1896	4.92 feet.
1897	4.93 "
1898	4.08 "
1899	3.26 "

These figures indicate a tendency to use less water each year. In my judgment less water is required in the valley of the Colorado than in the Salt River valley, because the water plane is generally higher, and the soil is more retentive of moisture. Three to four feet in depth should be an ample annual allowance. Five feet would be an outside figure in my opinion, although the farmers may think they need more. If water were sold to them by volume rather than by the acre requirement annually there would be an inducement for them to exercise economy in its use, and enable them to better afford to pay a fair price for what they actually used. It seems to be the general opinion of the people there familiar with local conditions that the farmers can well afford to pay $5.00 per acre per annum for the water they use. If they used as much as 5 acre-feet per acre the cost would be $1.00 per acre-foot. At this price water can be pumped and delivered into the head of the canal at a profit, and it seems to me a reasonable basis for contracts for delivery of water - $1.00 per acre-foot at the pumping station, the farmers to stand whatever loss might occur in the ditches.

From Mr. W. S. Ingall's records of his operation since he took charge of the pumps March 27th,1900, I have endeavored to form an estimate of the amount of water pumped up to the date of my visit. The rates of discharge of the pumps given in the following table are not based on actual measurement, except during the tests made in June last to determine the comparative efficiency of oil and wood as fuel, but are the best judgment of Mr. Ingalls, based on his knowledge of the height of lift and the speed of the pumps.

Table of Approximate Amount of Water Pumped by the Rollins Pumping Plant at Yuma, Arizona, during 1900 and 1901.

Month	Hours of fire under boilers.	Hours of actual pumping.	Approximate rate of pumping. gals. per minute.	Total cubic ft. pumped. (approx)	Total acre-ft. pumped.
1900.					
March	72	68	30,000	17,280,000	396
April	387.5	379	24,000	72,000,000	1650
May	427.3	418.4	24,000	80,000,000	1836
June	285.5	282.5	20,000	45,000,000	1030
July	157.	155.5	18,000	23,500,000	539
Aug.	456.	444.7	20,000	71,000,000	1630
Sept.	366.	356.5	20,000	57,000,000	1309
Oct.	180.5	172.4	19,000)		
Oct.	50.		6,000)	28,000,000	643
Nov.	260.		6,000	12,500,000	287
Dec.	180.		6,000	8,600,000	197
1901.					
Jany.	234.		6,000	11,000,000	252
Feby.	30.		6,000	1,150,000	26
March	142.		6,000	6,800,000	156
April	150.		6,000	7,000,000	161
May	152.		6,000	7,000,000	161
June	84.		6,000	3,800,000	88
July	208.		6,000	9,600,000	220
Augt.	182.		6,000	8,500,000	195
Sept.	294.		6,000)		
Sept.	60		18,000)	21,900,000	503
Oct.	223.		6,000)		
Oct.	61		15,000)	17,300,000	397
Nov.	53.2		18,000)		
Nov.	12.		6,000)	7,700,000	177
Total	4707			516,530,000	11,853.

If the figures in the foregoing table are correct, and I assume that they are approximately so, as Mr. Ingalls has kept a careful record of his work, they show a very interesting difference between the demand for 1900, of 9500 acre-feet, and that of 1901 of 2353 acre-feet. I assume that this was due to the partial success of the Farmers Gravity Canal during the high water period of 1901 in supplying their demands for water.

I estimate the actual cost of this water to the farmers on the basis of the data furnished by Mr. Ingalls as follows:

2450 hours run with big pump at 75¢ per hour	$1837.50
2200 " " " small pump at $10.00 per day	920.00
867 cords of wood used to run big pump, at 8 1/2 cords per day	
414 " " " " " " small pump, at 4 1/2 cords per day	
Total, 1281 cords at $3.00	3843.00
Total cost	$6600.50

This amount divided by the 11,853 acre-feet of water pumped gives an average of 55.68 cents per acre-foot,

or 1.28 " " 1000 cubic-feet,

or 0.17 " " 1000 gallons.

PUMPING PLANT TEST.

A test of the pumps was conducted from June 22nd to 27th inclusive during which the water delivered was carefully measured. The river gage reading during the test was 23' 6", and the lift about 7 feet. The total volume of water pumped during the 82 hours pumping was 18,500,000 cubic feet, or 425 acre-feet. The average delivery of the large pump, (which was the only one used during the test,) was 226,000 cubic feet per hour, or 3760 cubic feet (28,300 gallons) per minute. The fuel consumption was 19 bbls. of oil and 33 cords of wood. Lubricating oil used: 47 qts. engine oil, and 20 qts. of cylinder oil. The total cost of the test, estimating fuel oil at $1.50 per bbl. and wood at $3.00 per cord, was about $219.00 resulting in an average cost of 52 cents per acre-foot delivered. With increased lift the cost of pumping would be greater by the increased amount of fuel used. The maximum lift of 15 feet at extreme low water would probably increase the cost to about 80¢ per acre-foot, with the present plant. With the improved plant the fuel consumption would be materially reduced. As an average for the varying lift required during the year it may be fair to assume that the cost would be about 65 cents per acre-foot. This would be exclusive of interest on the investment or depreciation of plant.

IMPROVEMENT OF PRESENT PLANT.

In considering the improvements which are desirable to introduce in the present plant I have made some computations of the capacity needed for providing water for an area of 10,000 acres. I assume that five feet depth is sufficient, as heretofore discussed, and that the plant should have a capacity of 50,000 acre-feet per annum, of which 20% may be called for in any one month, or 333 acre-feet per day. This is equivalent to 30,000 gallons per minute. The pumps you now have installed are easily equal to the delivery of this amount when in good running order. No new pumps are therefore needed until the demand for water exceeds the amount stated. The improvements which seem to me to be required are the following:

1. A substantial forebay in the river bank in which to place the suction pipes, so constructed as to draw off the surface water only at all stages of the river. This can be made of redwood, but preferably of concrete, with movable flash boards over which the water would be taken in from the river.

2. Reset the large pump, and engine, rigidly connecting them on one substantial base of concrete, placing them about six feet lower than at present, and somewhat further back from the river bank.

3. Dispose of the three uncovered boilers, and provide a duplicate of the single large boiler, set in adobe.

4. Arrange to burn oil as a permanent substitute for wood, saving the expense of firemen and wood "swampers." The test showed that if the oil can be delivered at Yuma in tank cars at $1.50 per bbl. it is a cheaper fuel than the mesquite wood at $3.00 per cord, aside from the saving in labor. This change will necessitate the construction of a storage tank of 200 to 300 bbls. capacity, and pipe lines, small air compressor, etc., for pumping the oil from the tank cars to the storage tank, whence it will flow by gravity to the boilers.

5. Reconstruct the delivery flume, which is rotten and out of repair, substituting for it a larger flume placed on piles along the river bank, and arranged to serve as a settling basin for the heavier sand, with outlets at the side for sluicing the sand back into the river.

6. Reconstruct the building to suit the alterations made in machinery.

If these changes are made and the plant shown to be arranged for permanently doing a large business, it is believed that the farmers will patronize it liberally and proceed with such improvements as will make them permanently dependent upon the plant in the future to the extent, at least, of the area above the reach of gravity canals. Contracts should be secured on a basis of $1.00 per acre-foot, or as near that figure as the farmers can be brought to pay.

Trusting that I have clearly presented my views on the subject, I beg to remain,

Very Sincerely Yours,

Jas D. Schuyler

Consulting Hydraulic Engineer.

SCHU 157

About 2450 hours run with big pump @ 75¢ = 1837.50
" 2200 " or 92 days of small @ 10.00 per day 920.
$2757.50

Wood consumed.
102 days of big pump @ 8½ cords per day = 867 cords.
92 " " small " " 4½ " " 414
Total 1281 " @ 3.00 3.843.00
$6600.50

= total cost for lifting 11,840 acre-feet. or 56 cts per acre-ft.—

If interest for 2 yrs at 6% had been added the total would have been $10.200, or 86¢ per acre-foot. Adding 10% per annum for depreciation on $15.000 as cost of plant or $3000 for 2 yrs. the total would have been $13.200. or $1.11 cts per acre-ft.

Comenced pumping March 27 – 1900

				gals.
March	Fuel run 72 hrs	water 68	about	30,000
Apr	"	" 387½ hrs.	" 379	" 24,000
May	"	427 ⅓ "	" 418.25/60	24,000
June	"	285½ "	" 282 ½ 30	20,000
July	"	152 "	" 155 ½ 30	18,000
Aug		456 "	" 444 40/8	20,000
Sept.		366 "	" 356.5/60	20,000
Oct.		180½	172 25/100	19,000
			2276.14 hrs.	
Oct.		50		6000
Nov.		260		6000
Dec.		180		6000
Jan 1901		234		6000
Feb.		30		6000
March		142		6000
Apr.		150		6000
May		152		6000
June		84		6000
July		208		6000
Aug		182		6000
Sept.		294		6000
Sept.		60		18,000
Oct.		223		6.000
Oct.		61		15.000
Nov.		53,15		18000
Nov.		12.	2375.15	6000.

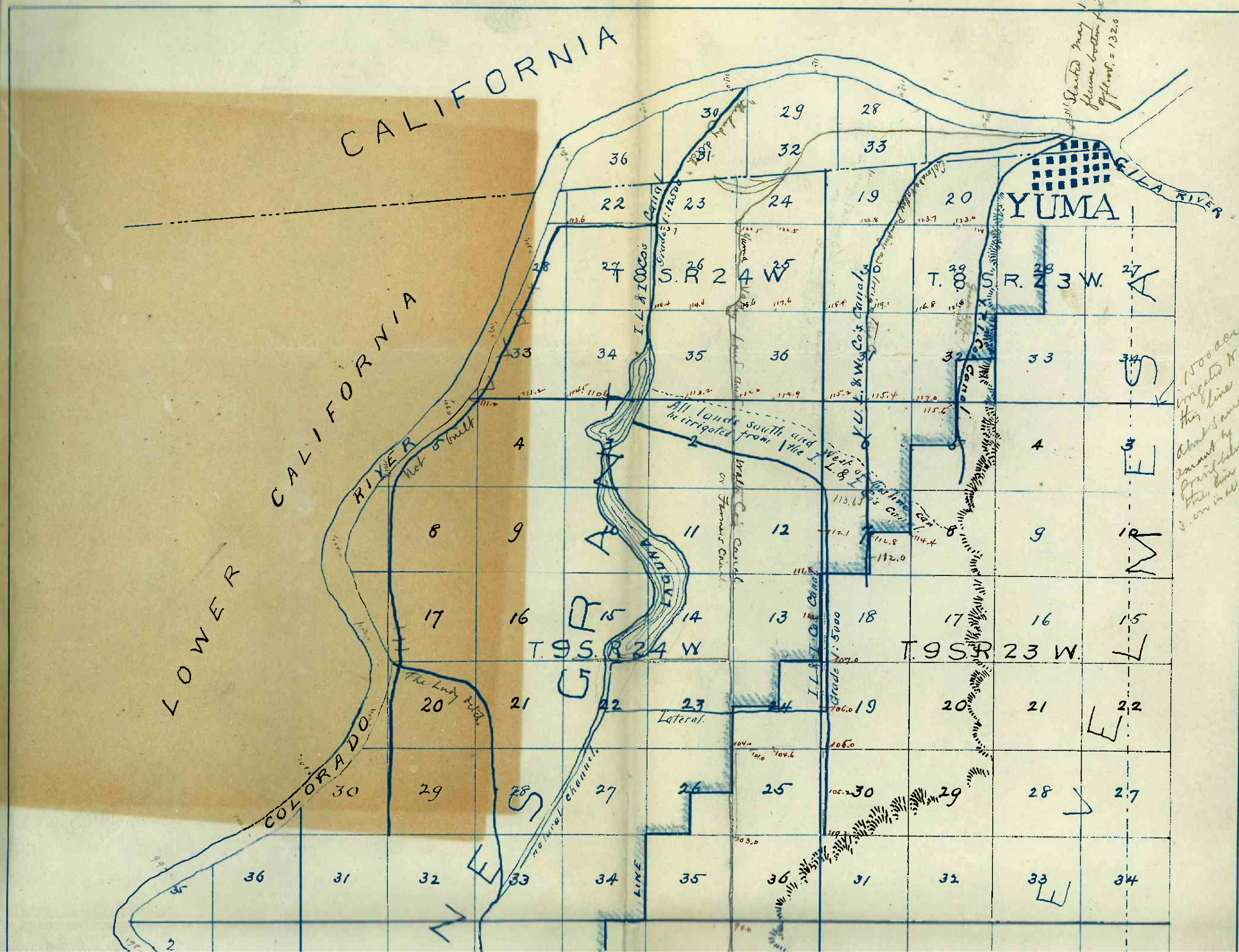
Col. of gal. is about what I pumped for Minis.

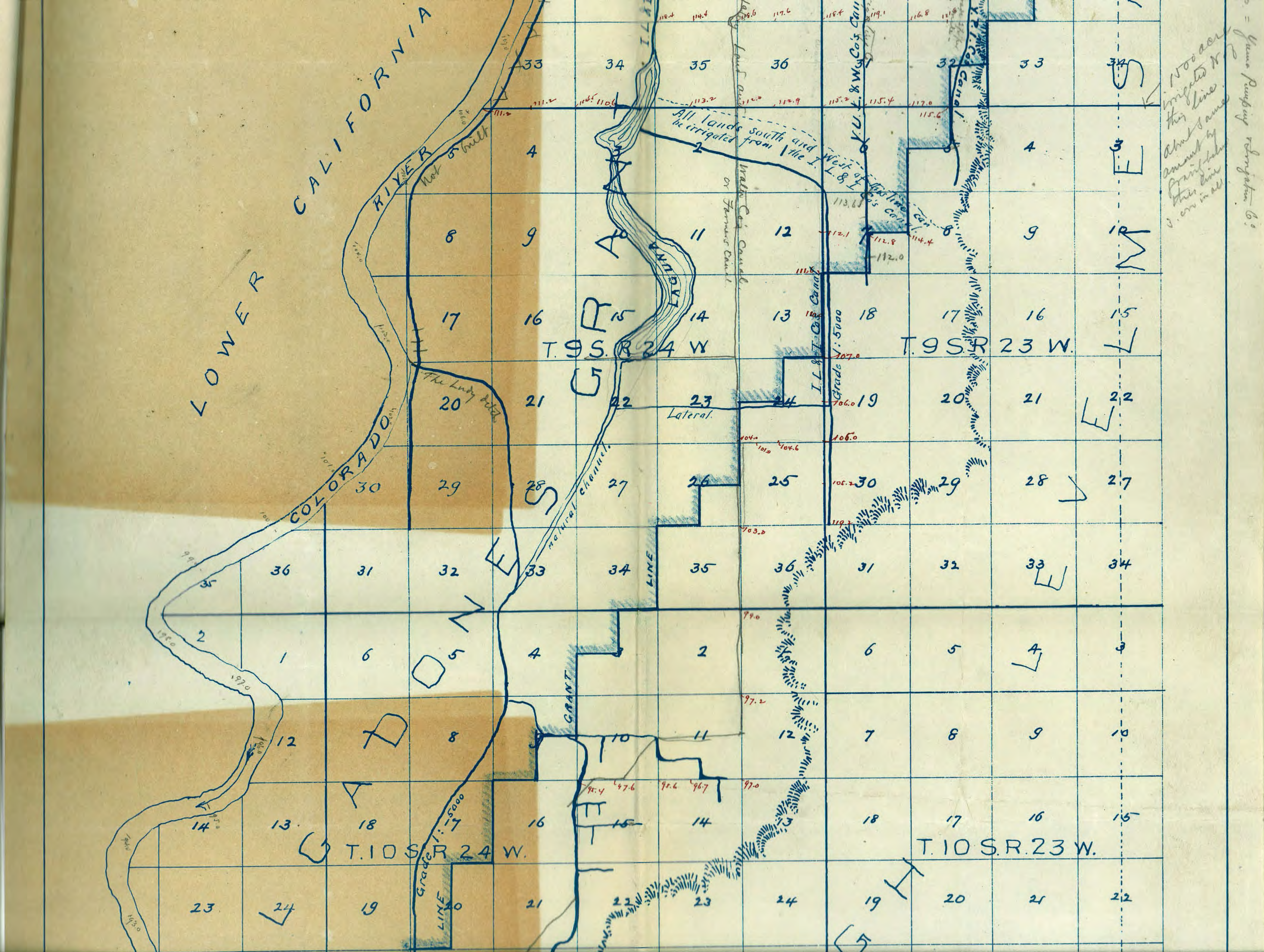
Guage Reading — S.P. Data.

Colorado River.

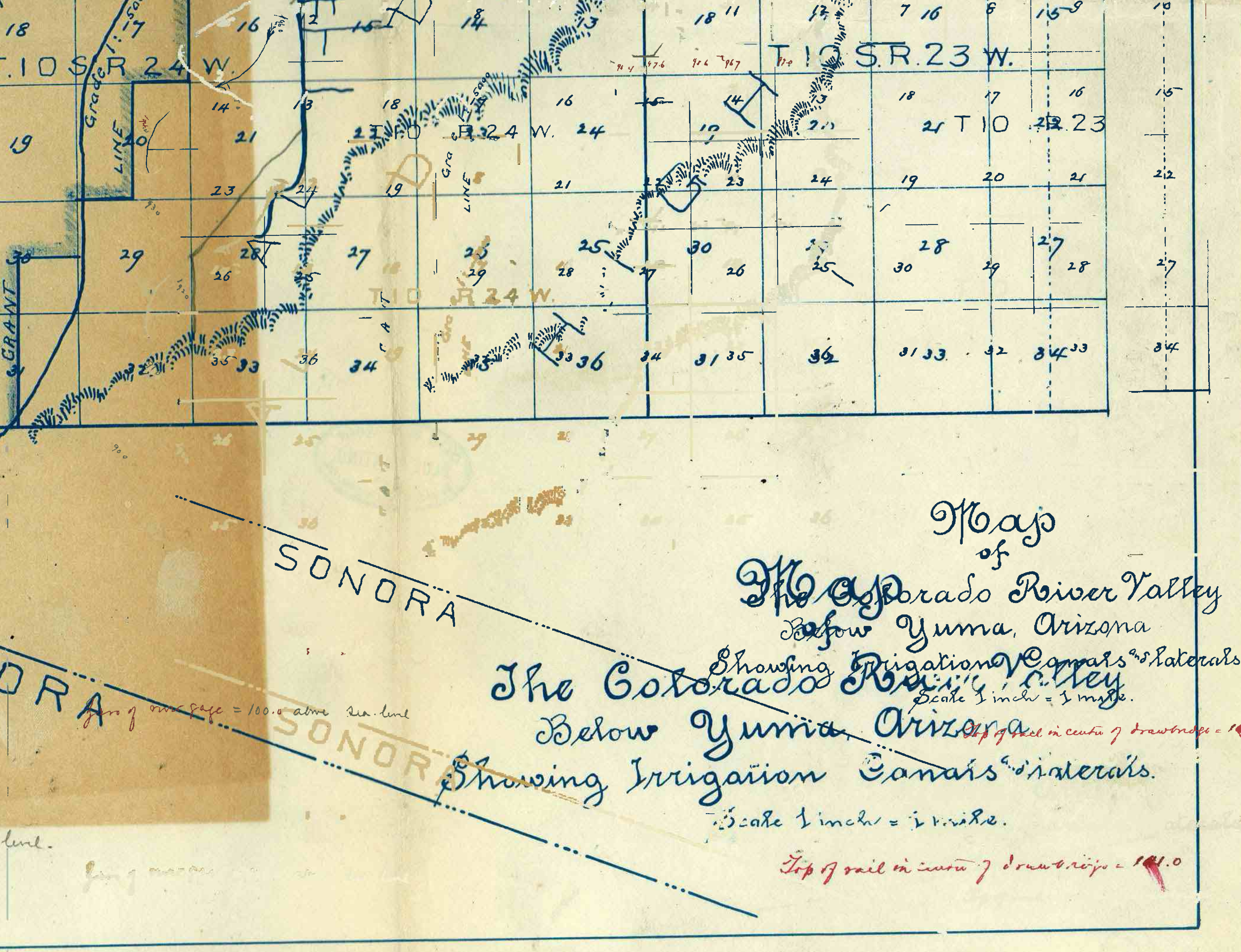
Maximum and minimum (monthly.)

		1882	'83	'84	'85	'86	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Jan.	min	15.6	15.2	14.3	14.2	14.4			15.8	18.5	17.9	17.0	17.5	17.7	17.2	
	max	16.3	16.3	16.7	15.7	20.0			17.1	26.3	18.9	22.9	18.8	18.7	18.4	
Feb.	min	15.7	15.0	14.4	13.3	15.2		16.2	16.6	16.7	18.5	18.0	17.4	18.5	17.7	
	max	16.7	16.7	20.8	14.8	16.6		17.5	17.0	17.7	19.4	18.5	18.9	19.0	18.4	
Mar.	min	16.5	16.2	17.0	14.3	15.2		16.7	16.5	17.1	19.0	18.4	18.6	19.0	17.6	
	max	17.5	18.8	26.8	18.0	18.3		18.8	18.4	19.5	19.5	19.7	19.2	19.7	19.8	
Apr.	min	17.7	17.4	17.7	16.6	16.4		18.4	17.9	18.5	19.4	19.3	18.5	18.9	19.2	
	max	19.0	18.5	20.3	19.4	20.0		19.7	19.5	22.3	20.0	23.1	21.7	20.9	20.3	
May	min	17.3	17.4	18.7	18.2	18.4		18.9	19.3	21.3	20.0	22.4	20.8	20.5	19.5	
	max	20.7	21.9	26.2	22.0	24.4		25.1	23.4	23.7	22.7	25.5	22.0	24.5	24.7	
June	min	20.0	22.2	26.2	21.7	20.0		22.9	20.1	21.2	21.2	21.6	21.4	23.4	24.4	
	max	22.6	23.9	28.3	24.0	26.6		24.5	23.7	22.9	24.1	26.0	23.5	25.7	26.0	
July	min	17.4	18.0	20.0	20.2	16.4		23.2	19.9	19.4	20.0	19.3	20.1	21.0	17.7	
	max	21.8	24.3	27.5	22.7	19.7		18.9	20.2	21.7	21.0	21.6	23.5	25.6	23.1	
Aug.	min	16.9	16.7	18.2		16.2		18.2	18.2	18.7	18.4	18.5	18.6	18.9	16.7	
	max	17.5	19.7	19.7		16.6		19.5	19.4	20.0	20.0	19.3	20.1	21.8	18.0	
Sep.	min	16.6	14.7	15.5		15.4		16.3	18.3	17.5	18.4	18.1	18.0	17.5	16.4	
	max	17.5	16.8	19.5		18.6		19.1	19.4	18.9	24.5	20.7	19.8	18.9	18.0	
Oct.	min	15.9	14.2	14.8	16.1	15.0		16.2	18.2	17.5	18.5	18.4	17.8	17.0	16.7	
	max	17.1	15.3	15.7	16.5	15.4		19.8	18.2	19.5	22.5	21.5	18.1	19.1	17.8	
Nov.	min	16.2	14.7	14.1	15.5	15.2		16.4	18.5	18.2	17.9	18.3	18.1	18.1	17.4	
	max	16.5	15.2	15.7	16.2	15.3		17.0	19.1	19.5	19.9	19.1	15.9	18.6	18.7	
Dec.	min	15.1		13.4	14.5	14.7		16.2	18.5	18.0	17.4	17.9	17.5	17.4	17.1	
	max	16.1		15.0	16.0	15.5		17.1	19.1	19.1	19.0	18.7	19.0	18.7	17.8	


CALIFORNIA
LOWER CALIFORNIA
COLORADO RIVER
GILA RIVER
YUMA
T. 8 S. R. 24 W
T. 8 S. R. 23 W.
T. 9 S. R. 24 W
T. 9 S. R. 23 W.
LAGUNA
Lateral.
natural channel
LINE
All lands south and west of this line can be irrigated from the I. L. & I. Co's Canal



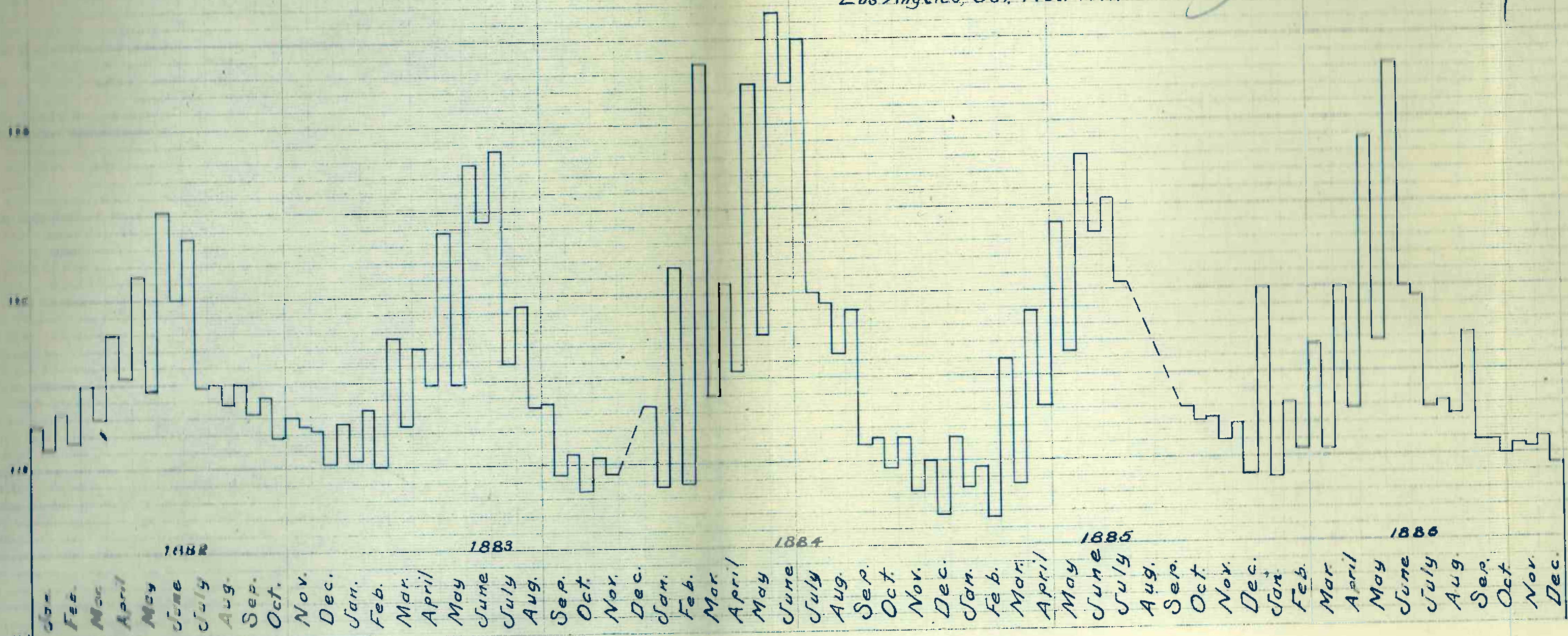
LOWER CALIFORNIA
COLORADO RIVER
All lands south and West of this line can be irrigated from the I.L.&I. Co's Canal.
Lateral.
natural channel.
LAGUNA
Y.U.L.&W. Co's Canal
I.L.&I. Co's Canal
Grade 1:5000
LINE
GRANT
Not built
T.9S.R.24W.
T.9S.R.23W.
T.10S.R.24W.
T.10S.R.23W.

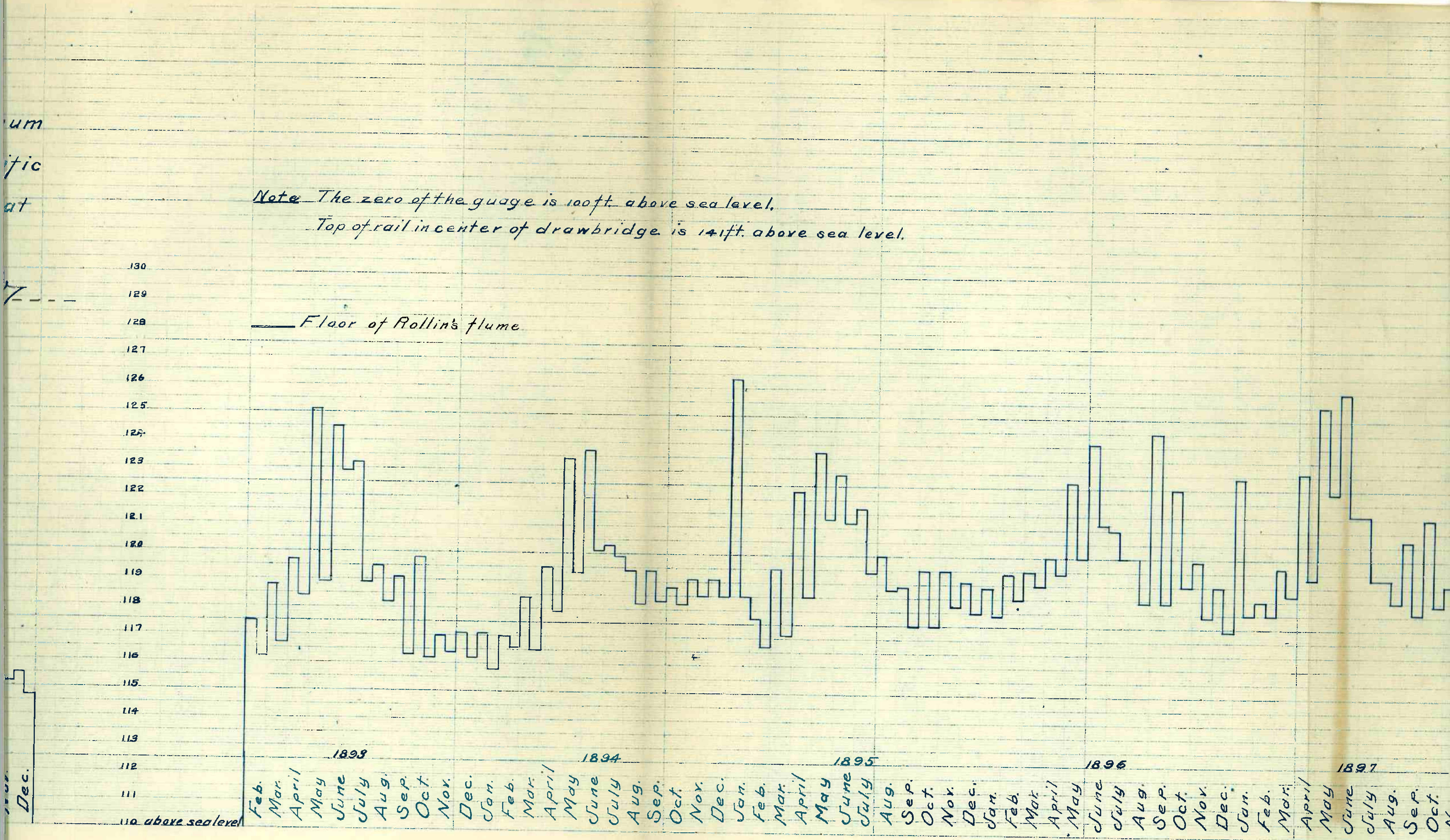

T.10 S.R.24 W.
T 10 S.R.23 W.
T 10 R.24 W.
T 10 R.23
GRANT
SONORA
Map of The Colorado River Valley Below Yuma, Arizona
Showing Irrigation Canals & Laterals.
Scale 1 inch = 1 mile.
Top of rail in centre of drawbridge = 141.0
Zero of river gage = 100.0 above sea level

DIAGRAM— Showing maximum and minimum monthly guage readings at the Southern Pacific R.R. bridge crossing the Colorado River at Yuma— for a period of years.

To Accompany Report of Jas. D. Schuyler

Los Angeles, Cal. Nov. 1901.





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Note The zero of the guage is 100 ft. above sea level.
Top of rail in center of drawbridge is 141 ft. above sea level.
Floor of Rollin's flume
130
129
128
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121
120
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118
117
116
115
114
113
112
111
110 above sea level
1893
1894
1895
1896
1897
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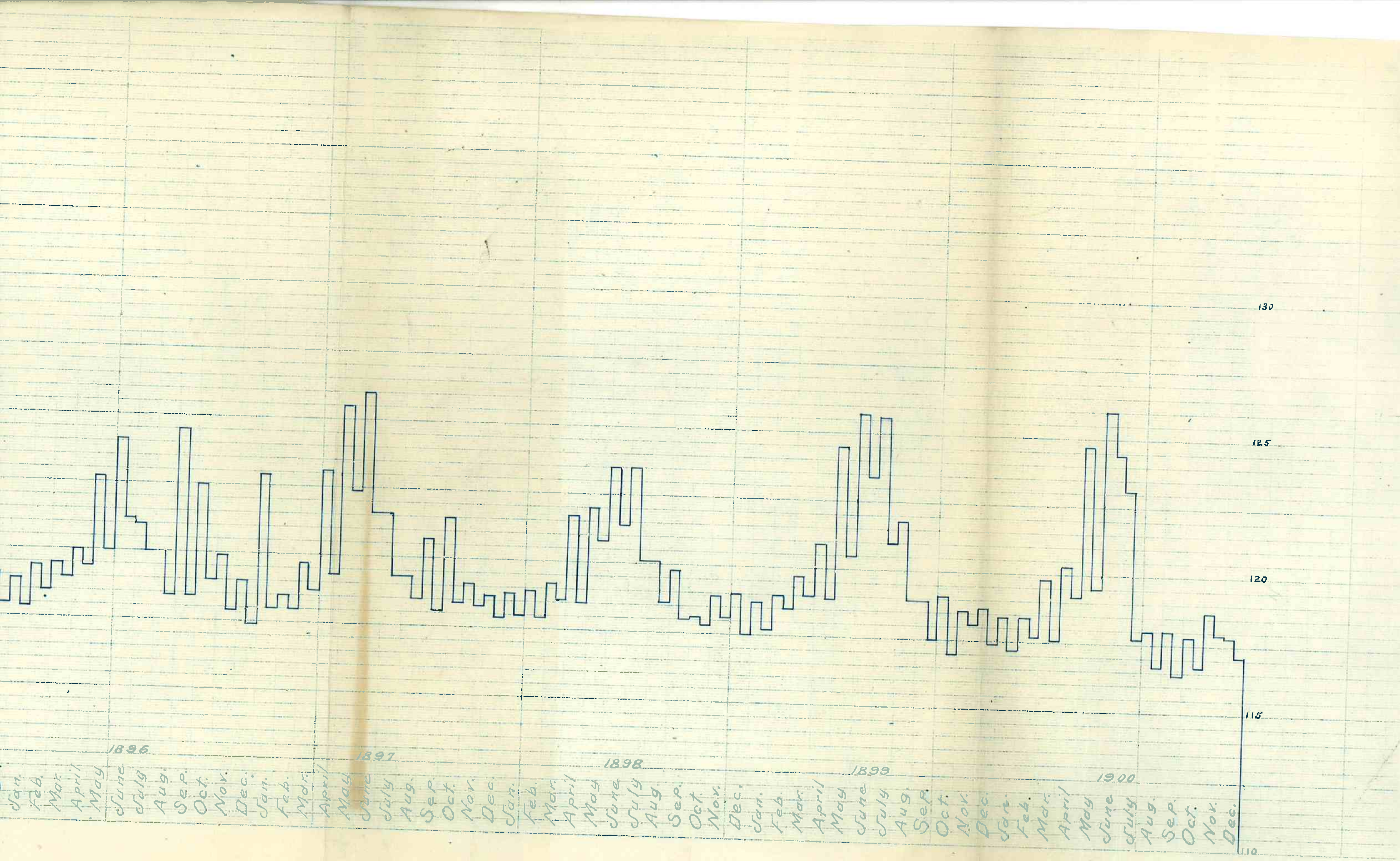
130
125
120
115
110
1896
1897
1898
1899
1900
Jan. Feb. Mar. April May June July Aug. Sep. Oct. Nov. Dec.
Jan. Feb. Mar. April May June July Aug. Sep. Oct. Nov. Dec.
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