

REPORT
ON WATER SUPPLY OF THE
BERNARDO RANCHO.

By WM. S. POST.
Apr. 19, 1913.

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Mr. Ed. Fletcher,

San Diego, Cal.

Dear Sir:-

Replying to your request for an opinion as to the future water supply of the Bernardo Rancho as affected by the proposed diversion of the Volcan Land and Water Company, I submit the following study of the physical situation:

The watershed of the Santa Ysabel at the Bernardo Bridge is 265 square miles. The proposed diversion of the Volcan Land and Water Co. is at a point 20 miles upstream, where the drainage area is 110 square miles.

At least one-half of the drainage area now tributary is unaffected.

Tabulated, the supply present and future, is as follows:

	<u>Present</u>	<u>Future</u>
A. 155 sq miles of drainage area	full supply	full supply
B. The excess in wet seasons of 110 sq miles which cannot be diverted 15%	" "	15% of full supply
C. Return waters of the San Pasqual Ditches	" "	" " " "
D. Salvage on the waters now evaporated from the San Pasqual and Bernardo Gravels	now not used	Available

To assign the quantitative values to these items is a matter on which there may be properly a certain range of judgment. However, I am of the opinion that experienced hydraulicians would not vary so greatly that the economic situation of the Bernardo Rancho cannot be definitely predicted. In my solution I follow the general method which has been proven by U. S. Geological Survey investigations and verified on the Los Angeles Aqueduct by exhaustive experiments.

A. U. S. Water Supply Paper No. 300, pgs 528 et sequi, give the following discharges for Santa Ysabel Creek, at its entrance into the San Pasqual Valley:

	<u>Acro-feet.</u>
1906 - 9 months. -----	61,700
1906-7 -----	35,700
1907-8 -----	11,200
1908-9 -----	47,100
1909-10 -----	33,900
1910-11 incomplete -----	(10,000) say
1911-12 -----	<u>15,300</u>
7-year mean -----	30,700

That is, for the 7 years since 1906, 128 square miles have furnished an average of 30,000 acre-feet per year to the San Pasqual and Bernardo Valleys. But this as already indicated, is only one-half the drainage area tributary to these valleys. The Government data for the remainder of the watershed is not so complete; the stations on the Santa Maria Creek and at Bernardo Bridge having been only established in 1912. However, these data show, that in the season 1911-12,

when the 128 square miles above referred to contributed 15,300 acre-foot, 60 square miles of Santa Maria Creek contributed in addition 1,000 acre-foot. The Santa Maria Creek drainage area contains much flat land yielding a low run-off. The remainder of the shed (exclusive of Santa Maria Creek) is precipitous and is estimated to have yielded 2,000 acre-foot, or a total of 3,000 acre-foot. Therefore in my opinion the source of supply designated "A" will yield at least one-fifth of the supply of the supply reported by the Government in years of low rainfall, and that it will reach one-third in seasons of high rainfall. Take one-fourth as an average, as we are dealing in averages, my opinion of the quantitative amount is therefore one-fourth of 30,000 or 7,000 acre-foot.

B. The economic limit of storage of a well designed water system is taken by competent engineers at 85% of the possible storage. There is therefore on the average 15% of 30,000 acre-foot, or 4,500 acre-foot which will not be diverted, but enter the San Pasqual Valley.

C. In irrigation in gravels such as the San Pasqual Valley, it is known that irrigated and pumped waters filtrate and return to the gravel beds and are not entirely lost to the stream. On the Santa Ana River water has been proved to be "used five times." In the calculations of the Los Angeles water supply one-third is taken as the recoverable water for re-use.

Measurements of existing irrigation have been taken on the following ditches in the San Pasqual Valley for 1912 as follows:

East San Pasqual Ditch	-----	826	Acre-foot
West San Pasqual Ditch	-----	<u>1646</u>	" "
Total	-----	2472	" "

One-third of this water is believed to return to the gravels for the benefit of lower users and the Bernardo Rancho - viz: 800 acre-feet, while 1,600 acre feet may be considered to be permanently lost by plant transpiration etc.

D. In this same year 1912 5,000 acre-feet at least passed under the Bernardo Bridge, a shrinkage of 15,500 acre-feet in some 10 miles. We have accounted for 1,600 acre-feet by transpiration from irrigation. There remains 11,700 acre-feet. This paragraph discusses this shrinkage, and applies the results of the exhaustive experiments and studies of W. C. Mendonhall and C. E. Lee for the Government and Wm. Mulholland for the Los Angeles Aqueduct.

In a word this shrinkage is an exact measure of the water now evaporated from the gravels of the San Pasqual where the water plane is within 5 feet of the surface. In general the evaporation from such a surface is equal to that from a lake surface, or 5 feet of vertical depth of water per annum. There are approximately 6 square miles of such areas in the San Pasqual Valley (2 of which lie on the Bernardo Rancho itself), or say 3,800 acres. The direct evaporation losses may therefore reach $5 \times 3,800$ acres or 18,000 acre-feet.

As already shown this loss is actually found to be 11,700 acre-foot for the year 1912, and a more thorough study would undoubtedly show a much closer agreement in these figures.

Now this is a loss which the riparian owners cannot claim in equity for it is a preventable loss. It may be even argued that it can be filed on for non-riparian use as legally as that water which annually passes Bernardo Bridge on its way to the Ocean. It is preventable by the simple method of drawing down the water plane 5 feet. At this point arises the only question of damage which in my opinion is significant in such valleys as the San Pasqual and Bernardo. Who should pay for the increased pumping lift and equipment for this five feet? It is argued on agricultural grounds that the unwatering of these moist and swamp lands results in increased returns and that additional land area is reclaimed, to balance against an undoubted increase of pumping lift.

Underground Storage. I have used average figures showing the average supply to San Pasqual Valley is 30,000 acre-foot plus about one-fourth, or 37,000 acre-foot. This is subject to shrinkage ultimately by thorough cropping of the 4,000 acres of riparian lands to the extent of approximately 12,000 acre-foot by plant transpiration. There remains 25,000 acre-foot on the average for such uses, as the Bernardo Rancho may wish to put it to, diminished by the diversion of the Volcan Land and Water Co., which is taken as 20,000 acre-foot. The net result is that 5,000 acre-foot are permanently available for the Bernardo Rancho, after full development

of the entire agricultural area above has been reached and the full diversion of the Volcan Land and Water Company has gone into effect.

The method of averages is distinctly proper in this case as the gravels of the San Pasqual are in themselves a great storage and equalizing reservoir, containing 75,000 acre-feet of storage in the first 55 feet of depth. It may be conceived with a thorough economic use of all the water, the water plane may reach this level as in the seven dry years of 1896-1904, but on the return of wet years the gravels will again surcharge, and at no time during the driest known series of years, will the Bernardo Rancho have to cease drawing full 5,000 acre-feet.

Conclusions. The evidence appears to be that the present losses through non use of water in the San Pasqual and Bernardo Valleys is from 12,000 to 18,000 acre-feet.

The diversion of the amount proposed by the Volcan Land and Water Co. which is 20,000 acre-feet, would therefore affect those valleys to the extent of the difference or from 2,000 to 8,000 acre-feet. But this amount is exceeded by the amount which on the average is wasted under Bernardo Bridge into the Ocean.

The Bernardo Rancho is secure under these conditions in the future use of 5,000 acre-feet, equivalent to 340 Miner's Inches continuous flow or 500 Miner's Inches for 8 months irrigation.

Ed Fletcher Papers

1870-1955

MSS.81

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