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REPORT

of

HYDROGRAPHIC

and

IRRIGATION CONDITIONS

in

THE RIO GRANDE VALLEY

NEW MEXICO

1910

HERBERT W. YEO

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INTRODUCTION

Pursuant to your letter, dated El Paso, Texas, May 23, 1910, directing Mr. H. J. Gault, Constructing Engineer, and myself as assistant to him, to obtain data for report as to the past, present and contemplated future irrigation in the drainage area of the Rio Grande in New Mexico above Elephant Butte, also its effects on the normal flow of the river at San Marcial in consideration of the possible release of any part of the water appropriation for the Rio Grande Project which may not be required for that project, and also to guard against any encroachment by subsequent appropriations upon the water rights of that project; on May 25, 1910, Mr. Gault and myself proceeded to Santa Fe, N. M., to examine the records on file in the Territorial Engineer's office.

From Santa Fe during the month of June Mr. Gault directed the work in the Espanola Valley and on the Rio Chama and its tributaries. Mr. Gault was ordered in from the field July 2nd and returned to the El Paso office.

From that time I took charge of the field investigations with Mr. Z. D. Clarke, as my assistant.

Practically all the streams having irrigated lands that lie above the proposed Engle reservoir, were examined.

Teams belonging to the natives in the various vicinities

were hired from time to time as the occasion required, this being generally our means of conveyance. There were 2100 miles traveled by this means.

Returning to El Paso October 1st, the field data has been written in form to submit to you.

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GENERAL DESCRIPTION

of

THE RIO GRANDE VALLEY

from

WHITE ROCK CANYON OF THE RIO GRANDE

to

OLD FORT CRAIG, NEW MEXICO.

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This part of the Rio Grande Valley under consideration, extends in a north and south direction for about 175 miles and is near the center of New Mexico. The principal ranges of mountains on the east are the Sandia and Manzano and on the west the Jemez, the Ladrones and the Magdalenas.

The altitude at Fort Craig is about 4,400, and at the mouth of White Rock Canyon about 5,200 or 5,250.

The precipitation varies from 7.5 to 10.0 inches per annum, according to the locality. The summer rains usually give a precipitation of about 2.5 inches, and these extend from about July 1 to October 1. The summer showers are of little benefit to growing crops. They are of short duration, are usually very local and are often of great violence. At most times the sun comes out very warm after the showers and, the moisture not having a good opportunity to sink into the ground, is soon evaporated and the plant life has been benefitted but little. When the heavy summer showers fall on the high mountains or on lands with a steep slope, the run-off is great, and often great quantities of water come down the arroyos and seriously injure the ditches and crops in the valleys. These arroyos may have but little water at any time for a long period of years, and then high water may come and cause considerable destruction from their floods. There are very few means of lessening the destruction caused by these floods from these arroyos.

The snowfall is light and of little benefit. This lies on the ground from four to seven days. A very great part of it evaporates and the remainder furnishes but little water to replenish the moisture of the ground. When the soil is sandy the replenishment

is great, but where the soil is clay, as is most of the valley floor, the clay being fine and having a general horizontal stratification, the replenishment is very small.

The growing season extends from about March 1 to November 1. This does not apply to all crops or to all places, but this is quite accurate for a general statement. Irrigation is for the most part necessary for a crop. In a few places it is possible to raise native hay from the seepage from the river, or some other crops after the annual high water of the river has subsided and left the ground moist, but generally, irrigation is necessary.

The crops are in the main alfalfa, corn, wheat, melons, chili, fruit, (i.e. apples, grapes, peaches, pears, plums) and truck. The markets are usually local for all except alfalfa and wheat. Good crops can be raised, generally.

The methods of farming, as a rule, are antiquated. No particular attention is given to seed selection. The crops are cultivated in an imperfect way, and often irrigation is made to take the place of cultivation. It is believed that greater acreage in wheat would be for the best interests of the people in general.

The water supply for the country above Albuquerque has in the past been perennial, but such will be lessened in the future. Below Albuquerque the supply has been intermittent for a great many years.

There are areas of considerable extent in places, that are rendered unfit for cultivation, because of over irrigation on the tracts above. This, of course, is not so great in extent as

upon tracts which have perennial supply. There are a great number of acres that are not irrigated that are capable of irrigation. There are, in the entire area under consideration, about 121,000 acres. Of this amount there are 45,220 acres irrigated. The total number of ditches which are listed, is 79, and the total capacity is 2,145 cubic feet per second. This is greater than in 1896 when the capacity of the ditches was 1,779 cubic feet per second, and the area irrigated 31,700. This shows an increase in the capacity of the ditches of 366 cubic feet per second, and of 13,520 acres in the irrigated area.

This area is treated further under the following headings; From White Rock Canyon to the Pueblo of San Felipe; From the Pueblo of San Felipe to Albuquerque; From Albuquerque to Alamillo Canyon; and From Alamillo Canyon to old Fort Craig. A general description of each area and a description of each ditch is given.

****

GENERAL DESCRIPTION

of

THE RIO GRANDE VALLEY

from

ALAMILLO CANYON

to

OLD FORT CRAIG

****

THE SOCORRO-SAN MARCIAL VALLEY

This valley is 50 miles long and attains a maximum width of 2 1/2 miles a short distance above Socorro.

Irrigation is very ancient. Coronado mentions, in 1541, four pueblos which were located in the vicinity of Socorro.

In 1598, when Onante was traversing the Rio Grande valley with his colonists, he found three pueblos near Socorro and one near Alamillo. Socorro was so named because corn was secured here and sent back to the main part of the expendition, which could travel but slowly.

In 1680, when the Spaniards were leaving New Mexico because of the rebellion, they tarried a while at Alamillo. In 1681, the expedition sent out to recover New Mexico, found pueblos at Senacu (now San Antonio), San Pascual, Socorro, Alamillo and Sevilleta. Contadero was mentioned.

It would seem that irrigation has been practiced in the vicinity of Socorro from Coronado's time and that Contadero was known as a place in 1681.

The altitude of this valley ranges from 4,400 at the south to 4,650 at the north. The precipitation is 10 inches per annum and 4 inches during the summer showers.

Beginning at the north and upper end, at the mouth of Alamillo Canyon, formed by two basaltic flows on either side of the river, the valley, extending in a southerly direction and for the most part lying between low mesas, which are in places worn away till they have become gentle slopes, terminates near old Fort Craig, where the great lava flow from the east approaches close to the Rio Grande.

To the west of the main part of the valley are the high Magdalena mountains, which at times during the summer showers send down great quantities of water in their arroyos, and likewise on the east the Chupadero mesas make their contribution, but with less violence.

The west side of the valley from the upper to the lower end is irrigated. At Pueblicito a small amount on the east side of the river is cultivated. The area on the east side from Bosquecito to San Marcial is also under cultivation. The lower part of the valley is not so extensively cultivated.

Thirteen ditches were noted which have a combined capacity of 331 cubic feet per second, and which irrigate 10,060 acres. The capacity of two ditches, the Elmendorf Canal and the Acequia de Cuba, was obtained, but there was no irrigation under these this year. There are probably 20,600 acres that might be irrigated by these. It is estimated that there are about 4,500 acres additional that are in the valley and are not tabulated. A great part of this area is in swamps, alkali ground, etc., but there is some which is good land, but the amount under any particular ditch is not known, so it is not segregated. The total area which is not irrigated is estimated at 34,915 acres.

The increase of irrigation since the report made by Mr. W. W. Follett, Consulting Engineer, to the Department of State in 1896, is noticeable. The capacity of the ditches was then 294 cubic feet per second, and the area irrigated was 5,700 acres. The increase in the capacity of the ditches is 148 cubic feet per second, and the increase in the acreage is 4,360 . This seems too great, but probably one estimate is high and the other low. At any

rate, the greatest difference is in the area under the Acequia Lemitar. This is located on topographic map of the Socorro Quadrangle published by the U. S. Geological Survey.

The type of diversion structures consist of the temporary wing dam, made of posts, brush and mud or some variation of the same. All of these are destroyed by the high water in the spring, and have to be rebuilt every summer.

Of regulating gates and sluice gates little need to be said. No sluice gates were noticed. Most of the ditches have no regulation gates, as when there is water in the river of sufficient height to enter the ditch, it can be used. The regulating gates that existed were often some distance from the head of the ditch. True headgates are very rare.

One serious condition in this valley is, that in the future there will be an annual shortage of water after July 1, due to increased irrigation higher up the Rio Grande and its tributaries. The summer floods from the Rio Puerco and Arroyo Salado will be available, but they frequently tear out the diversion works and are soon past. These waters are not the best for irrigation. The water from the Rio Puerco is yellow and very highly charged with an extremely fine silt that is destructive to some crops. This destruction is caused by smothering. The silt being of microscopic fineness, when the water is evaporated from it, it is deposited as a film over the plant. This film is practically air tight and as the particles are so very small, plant life cannot respire. The waters of the Arroyo Salado are red and, as the name implies, salty.

However, the waters from these two streams were used by some to advantage, as where the best farmers were found, there the best crops were raised.

The soil is more of a clay composition than in the valley above, due to the waters of the Rio Puerco emptying a short distance above. In some places it is claimed alfalfa should be irrigated every week, because of this. The soil, in the lowlands near Socorro, which are annually flooded by seepage from the river, have much clay.

The crops are corn, wheat and alfalfa in the main, with native hay, chili, melons, truck and fruit. Fruit is sometimes injured by spring frost. Smudging is not practiced. The area in fruit is small as the water plane is too close to the surface except along the slopes of the mesa. Large tracts, in the vicinity of Socorro, are in native hay. The markets for the products are local or at the mining camps of Magdalena and Carthage.

The value of land ranges from $20.00 to $100.00 per acre, that for native hay being the lowest, and that for alfalfa being the highest. The majority is probably valued at $40.00 per acre.

The irrigation season extends generally from April 1 to September 1, but more or less irrigation is done all the year.

The sands which blow in from the west and which trouble the valley above are not of any extent in the Socorro-San Marcial valley.

For the economical operation and maintenance of irrigation works in this valley, a permanent weir should be built at Alamillo Canyon. This should divert water into a main canal on the west side and possibly a small ditch on the east side. It is believed that

this could be done with no great expense, as rock and gravel are near the site. The main canal could be run on a light grade and at Latear a drop of 50 feet put in for power purposes. There is a small amount of land on the east side at Pueblito which would require about 8 cubic feet per second of water and water could probably be flumed across, as the river bed is about 500 feet wide. The location of this canal would be easy, as the edge of the mesa is not badly cut up. With a canal carrying 150 cubic feet per second, about 675 horse power could be developed at Latear. This could probably be operated during nine months of the year, excepting July, August and September. Power from such a plant could be used in pumping water from the low grounds for drainage when the river is at flood stage. No lift would be over 8 feet and such waters could be raised very cheaply.

Another weir should be constructed near the plaza of Bosquecito and main canals taken out on either side to irrigate all lands below. There would be over 31,000 acres below this weir. Power plants could probably be developed on these if it were advisable.

With the proposition of improvement, there should be a system of dikes built along the river to keep out the flood waters.

With two permanent weirs, proper main canals, a power plant, a proper drainage system, and scientific farming, it is believed that the valley could support four times the population that it now does. But it is doubtful if the present owners would be able to pay the cost of such improvements, unless terms of payment were made to cover a number of years. But it will probably not be very many years till such is done.

Here follows a description of each ditch, beginning with

the one farthest south.

Acequia Contadero

The heading of this ditch is on the east side of the Rio Grande about one-half mile north of the Santa Fe Railroad bridge, which crosses the Rio Grande at San Marcial.

The diversion works are temporary, but were not examined.

The ditch was examined September 28, 1910, near the railroad bridge and was flowing .50 cubic foot per second. The following are the data for the maximum capacity: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 2.0 ft., equals 10.0 square feet, the sectional area, and the velocity being 2.0 feet per second gives a capacity of 20.0 cubic feet per second. The ditch would have to be cleaned to obtain that capacity.

The irrigated area was estimated at 1,000 acres and the additional area that might be irrigated at 1,000 acres.

The lands irrigated are near the plaza Contadero, and Spanish settlements were made before ~~1681~~. 1861

The value of the lands irrigated ranges from $40.00 to $100.00 per acre. The value of this land is not so great as formerly, as the river bed is filling in and that is raised, raising the water plane. The amount in salt grass pasture is increasing, and the area in cultivated crops is decreasing.

Acequia San Marcial

Evidences were noticed on the west side of the Rio Grande of several old ditches which formerly irrigated lands on the west side of the Rio Grande in the vicinity of San Marcial, but from the evidences none of these have been in use during the past two years. The bed of the Rio Grande has been filling up in the vicinity of San Marcial for a number of years, and the water plane has been

raised, until in places it is above the ground surface. In April 1908 the water surface in the Rio Grande to the north of the Depot Hotel was two feet higher than the main street of the town near the bank. Information was received on September 28, 1910, that the rock wing dams, or more properly jetties, constructed by the Santa Fe Railway to protect its grade through San Marcial, had caused a narrow channel to scour near these jetties. This channel is lower than the main channel and the water draining into it, after the river becomes practically dry, has lowered the height of the water plane considerably. From the limited observations made, this condition is believed to be about correct.

On September 28, 1910, there were about 5 cubic feet per second flowing in the Rio Grande at the railroad bridge at San Marcial, and on September 29, there were about 2 cubic feet per second. The water was evidently from the Rio Puerco.

Acequia La Mesa

The heading of this ditch is on the east side of the Rio Grande about one mile in a northeasterly direction from plaza Val Verde. The ditch is located in the bottom lands and for the most part does not run near the mesa.

The diversion works are temporary, and consist of a dam across the river bed made by driving posts into the river bed and filling in about them with brush, sod, mud, etc. This dam was partly destroyed, and water could be diverted into the ditch only at flood stages. This is the only dam across the bed of the lower Rio Grande that was noticed and examined.

The ditch was examined on September 28 and 29, 1910, and was dry, as the water in the river could not be diverted with the

poor diversion dam. The data for the maximum capacity are as follows: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.5 ft., equals 7.5 square feet, the sectional area, and the velocity being 1.5 cubic feet per second, gives a discharge of 11.25 cubic feetper second.

The area irrigated was estimated at 200 acres, and the additional area that might be irrigated at 200 acres.

The crops under this ditch are not as good as under the Val Verde ditch.

The date of construction was not learned. The report of Mr. Follett gives it before 1869.

The value of the land was estimated to range from $40.00 to $80.00 per acre.

Acequia Val Verde

The heading of this ditch is on the east side of the Rio Grande about five miles north of Val Verde. The ditch is located close to the mesa and wastes into the Acequia Contadero.

The diversion works were temporary but were not examined. From the testimony received, it is evident that they were efficient.

The ditch was examined September 29, 1910, and was dry. There was very little water in the river. The following are the data for the maximum capacity: $\frac{12.0 \text{ ft. plus } 15.0 \text{ ft.}}{2}$ x 2.0 ft. equals 27.0 square feet, and the velocity being 1.5 feet per second gives a discharge of 40.5 cubic feet per second.

The area irrigated was estimated at 800 acres. The additional area that might be irrigated was not estimated, but it is included in the general summary of non-irrigated lands.

The people of Val Verde who were interviewed, testified that during this year there was sufficient water for their crops.

They did not have water all the time, but seem to have been able to use what there was to advantage. There was water in the ditch on September 25, which probably came from floods that came down from the Arroyo Salado on September 22, and the Rio Puerco on September 25.

The soil is good; free from alkali and the water plane is not near the surface. The crops were good this year; Wheat yielded 30 bushels and corn 40 to 50 bushels to the acre.

Maps show about 5,000 acres in the valley about Val Verde. There are but the two ditches, the Val Verde and De Mesa, and their combined acres of irrigated land is 1,000 acres, so there are about 4,000 acres that are not irrigated.

The farming lands I was told could be purchased for $40.00 per acre. Bosque land can be bought for $15.00 per acre. Probably the market value is about $30.00 per acre.

The date of construction is not learned, but is old. The report of Mr. Follett gives it as before 1869.

The area of irrigated lands is increasing during the last few years. A flood came down the river some years ago and covered the irrigated lands with sand, but it is being brought into cultivation again.

Elmendorf Canal

The heading of this ditch is on the west side of the Rio Grande about east of San Antonio. This was built on lands owned by the company which owns the Bosque del Apache Grant. This company has made and had approved by the Territorial Engineer two water right applications. One was on January 4, 1906, for 97 cubic feet per second, to irrigate 6,780 acres, and was probably for lands on

the east side of the river. The other was on January 12, 1906, for 286 cubic feet per second; this to irrigate 20,000 acres and this was probably the canal under consideration. The one on the east side was not built so far as was learned. The company is now in litigation, the exact nature of which was not learned.

There was no sort of diversion dam and no water was used this year. The dam was temporary from the evidences remaining.

The ditch was examined on September 23, and the following data pertains thereto: $\frac{25 \text{ ft. plus } 30.0 \text{ ft.}}{2}$ x 2.0 feet, equals 55 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 110 cubic feet per second.

It would seem that there are altogether 26,780 acres of irrigable land on the Bosque del Apache Grant.

The date of construction is not known, but is recent.

The value of irrigated lands ranges from $20.00 to $100.00 per acre, with most at about $40.00.

Acequia San Antonito

The heading of this ditch is on the west side of the Rio Grande about one mile north of San Antonio. It irrigates lands in the vicinity of the plaza of San Antonito.

The diversion works are temporary, but no data were secured.

The ditch was examined on September 23, 1910, and was dry. The data for the maximum capacity are as follows: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 1.0 ft., equals 7.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 10.5 cubic feet per second.

The area irrigated was estimated at 400 acres. No data

were obtained on the amount of additional land that might be irrigated under the ditch.

The date of construction was not learned, but was in 1881 according to Mr. Follett's report.

The value of the land ranges from $20.00 to $100.00 per acre, with most at $40.00.

Acequia San Pedro

The heading of this ditch is on the east side of the Rio Grande, about one mile north of the plaza of San Pedro.

The diversion works are temporary, but no data are at hand concerning them.

The ditch was measured above irrigation on September 23, 1910, and was dry. The data for the maximum capacity are as follows: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 1.0 ft., equals 7.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 10.6 cubic feet per second.

The area irrigated was estimated at 400 acres, and there are probably 600 acres in addition that might be irrigated, according to the best maps available.

The lands are good and are comparatively free from alkali and the ground water plane is not near the surface.

The date of construction was not learned, but according to the report of Mr. W. W. Follett to the Department of State, it was previous to 1855.

The value of the irrigated area was estimated to range from $40.00 to $75.00 per acre.

Acequia Bosquecito

The heading of this ditch is on the east side of the Rio Grande, about one and one-half miles north of the plaza of Bosquecito. The ditch was constructed ti irrigate lands about Bosquecito.

The diversion works are temporary.

The ditch was dry on the day of examination, September 23, 1910. The following are the data for the maximum capacity: $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$, x 2.0 ft., equals 18.0 square feet, the sectional area, and 2.0 feet being the velocity gives a discharge of 36.0 cubic feet per second.

The area of irrigated lands was estimated at 1,000 acres, and there are probably about 1,500 additional acres that might be irrigated under the present ditch.

The lands are good and the values probably range from $40.00 to $100.00 per acre.

The date of construction was not learned, but it is old; the report of Mr. W. W. Follett gives it as before 1855.

Acequia San Antonio

The heading of this ditch is on the west side of the Rio Grade about six miles south of Socorro, or near the plaza of San Jose.

The diversion works are temporary.

The ditch was dry on the day of examination, September 23, 1910, as the river was dry. The data for the maximum capacity are as follows: $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 2.0 ft., equals 18.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 36.0 cubic feet per second.

The area irrigated was estimated at 800 acres. The value

of the land irrigated ranges from $20.00 per acre for some in native hay to $100.00 per acre for some in alfalfa. About $40.00 per acre is the general price of land.

A part of the land under this ditch is within the zone that is badly waterlogged and super-saturated because it is below the surface of the river at high water, and is overflowed or supersaturated as the case may be. There is of course considerable alkali.

The date of construction was not learned, but it is old.

It is very probable that one of the pueblos of Coronado's time was located at or near San Antonio.

Acequia Los Lopez

The heading of this ditch is on the west side of the Rio Grande three-fourths of a mile northeast of the Santa Fe Railroad station at Socorro.

The diversion works are temporary, being a wing dam of brush and mud.

The ditch was dry on the day of examination, September 24, 1910, as the main channel was on the east side of the river bed and was carrying all the water, consequently considerable work would be necessary to divert it to the west side, as the river is from 500 to 600 feet wide at this place.

The following are the data for the minimum capacity if the ditch were cleaned: $\frac{8.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 2.0 ft., equals 17.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 25.5 cubic feet per second.

There are 3,000 acres under this ditch, but it was estimated that 75% of the land was unfit for cultivation, which would

leave about 750 acres cultivated, and this is more likely too much than not enough.

The conditions which cause the deterioration of lands are mentioned more fully under the description of the Acequia Socorro.

The value of the lands irrigated ranges from $20.00 to $100.00 per acre, but most of the lands are valued at about $40.00 per acre.

This is a very old ditch. It was originally built for a hacienda; the exact date was not learned, but it was prior to 1800.

The location of the ditch can be seen on the topographic map of the Socorro Quadrangle published by the U. S. Geological Survey in 1906. The name is not given, however.

Acequia de Cuba

The heading of this ditch is on the west side of the Rio Grande one and one-fourth miles north of the Santa Fe Railroad depot at Socorro

There were no diversion works. All such works had been destroyed by the annual high water of the spring of 1910, and the head of the ditch on the day of examination, September 24, 1910, was 1.5 feet above the river bed, and was dry. The data for the maximum capacity, provided the ditch is cleaned, are as follows: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 2.0 ft., equals 14.0 square feet, the sectional area, and the velocity being 1.5 cubic feet per second, gives a discharge of 21 cubic feet per second.

There are not over 600 acres under this ditch and a great portion of it is not farmed, and the few who desire to farm cannot keep the ditch in condition for use. There was not as much

land farmed this year as last year. The seepage and overflow from the river is rendering the cultivation of the lands under this ditch very difficult. Some lands were irrigated this year by waste water from the Acequia Socorro.

The value of the lands irrigated this year would probably range from $30.00 to $40.00 per acre.

The ditch was built to irrigate lands in the vicinity of the plaza of Cubs, and is quite old, but the date of construction was not learned.

The river on September 24, 1910, was flowing 93.0 cubic feet per second at the head of this ditch, and the water was probably from the Arroyo Salado.

Acequia del Pueblito

The heading is on the east side of the Rio Grande about 5 miles north of Socorro and 1/2 mile north of the Plaza del Pueblito.

The diversion works are temporary and were not in condition for operating on the date of examination, September 24, 1910.

The ditch was dry. The data for the maximum capacity were obtained about 1/2 mile from the head of the ditch and are as follows: $\frac{4.0 \text{ ft. plus } 5.0 \text{ ft.}}{2} \times 1.5$ equals 5.85 square feet, the sectional area. The velocity being 1.2 feet per second, gives a discharge of 7.0 cubic feet per second.

A very close estimate was made of the cultivated area. There were 60 acres in crops and 100 acres in native hay. The maps have about 800 acres of valley land on the east side of the river below Pueblito, and there are therefore about 640 acres in bosque. The land is not elevated very much above the river. It is probable

that if the trees were removed from along the river, the erosion would be great.

The value of the land probably ranges from $20.00 to $40.00 per acre. The farming is not very good.

The date of construction was not learned.

Acequia Socorro

The heading is on the west side of the Rio Grande about 6 miles north of Socorro or 2 miles southeast of Lemitar.

The diversion works are temporary according to testimony. They were not examined.

The ditch was examined on September 24 above the first irrigation and at this time was carrying about 1.5 cubic feet of water per second. This was running to waste out of the ditch at the crossing of an arroyo near Pueblito. The ditch had been broken there a few days before by a small amount of water in the arroyo. A few people at the lower end of this ditch received service this year.

The data for the maximum capacity were obtained at a very good section of the ditch, about half a mile below its heading, and were as follows: $\frac{12.0 \text{ ft. plus } 15.0 \text{ ft.}}{2}$ x 2 equals 27.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 40.5 cubic feet per second.

The head of this ditch was relocated during the past few years and is now about 2 miles farther up the river than previously.

The estimate as to the amount of land under this ditch that is in actual cultivation is not very reliable. There are probably about 3,100 acres under this ditch. Of this amount there is about 25% depending upon irrigation, or 775 acres. Probably 50%

of the remainder, or 1163 acres, are flooded in the spring by seepage or overflow from the river, for which there is no necessity for irrigation. There are about 580 acres in bosque and about the same amount worthless because of swamps and alkali. In the seepage and overflow area the crops that are farmed are mostly the native hays. The crops on the lower edges of the mesas are alfalfa, melons, chili, wheat, corn, truck and fruit. Three cuttings of alfalfa are secured. Some cut one and some two crops of native hay; the two cuttings furnish the better grade.

The value of the irrigated lands ranges from $20.00 to $100.00 per acre. The average value is about $40.00.

Irrigation at Socorro and near Socorro on the west side of the Rio Grande, is decreasing, due to seepage. The bed of the Rio Grande is becoming higher, caused by the depositing of sediment. The floods which rush down with great velocity from the Rio Puerco and the Arroyo Salado, encountering the lighter grade and wider channel of the Rio Grande, deposit their silt to a considerable extent. During the summer months many of these floods encounter a dry sand bed in the Rio Grande, the water percolates through the sand, the sediment remains on the surface, and thus the grade is raised. The effect to the river bed in the vicinity of Soccorro, the river bed here being wider generally than the average width, and with these two especially muddy streams entering a short distance above, must be that the deposit of silt is much greater than if the channel was narrower. The river bed is higher than a considerable part of the valley lands. When high water continues for some time in the spring, seepage is manifested on the low lands near the west side of the valley. From information received, water occurs in these places more than one foot deep. It was noticed during May 1910

that there was water over a great portion of the lands in the vicinity of Socorro. Drainage without a pumping system would be difficult and expensive. A high line canal from Alamillo Canyon with the development of power near Latear, is necessary for the full development of the country under consideration.

The date of construction of the ditch was not determined, but it is old.

There was a pueblo at Socorro during Coronado's expedition. The river however has changed during the past century, I am told, from a channel close to Socorro to one near the east side of the valley. The waste water at or near the end of the ditch is emptied into the Acequia de Cuba.

The location of this ditch, except the change made in the upper two miles, may be seen on the topographic map of the Socorro Quadrangle published in 1906 by the U. S. Geological Survey.

Acequia Lemitar

The heading is on the west side of the Rio Grande 1/2 mile southeast from Alamillo station.

The diversion works are temporary, consisting of a wing dam of brush and mud, pointing up-stream at an angle of about 30 degrees to the bank. This dam was examined September 24, 1910. The dam does not entirely cross the river.

On September 24th the ditch was examined above the head of irrigation and at that time was flowing 1/2 of a cubic foot per second. The data for the maximum capacity when the ditch is cleaned, are: $\frac{10.0 \text{ ft. plus } 15.0}{2} \times 2.5$, equals 31.25 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 46.87 cubic feet per second.

According to testimony furnished, there was no water in the ditch from July 1 to the time of examination.

The area under the ditch is about 4500 acres, 25% or 1125 acres of which are in bosque and uncultivated tracts. There are therefore about 3,375 acres of irrigated lands. This seems to be a very large acreage to be irrigated for the capacity of the ditch, but it was learned that some waste water was received from the next ditch upstream, the Acequia Polvadera.

The people in the vicinity of this ditch seem to be good farmers. They had good crops of wheat, corn and chili. Alfalfa produced two good crops this year and one poor one. This is irrigated every ten days. A great part of the ground is quite impervious and no great amount of water can be received into the soil at an irrigation, hence the many irrigations. The fruit raised on the slope of the mesa looked very well. The general appearance of the farms was indicative of prosperity.

Seepage from the river is not troublesome.

The value of the lands irrigated ranges from $40.00 to $100.00 per acre.

The date of the construction is not known, but the ditch is old. The plaza of Lemitar, for which the ditch was built, is old.

The location of this ditch may be seen on the topographic map of the Socorro Quadrangle, published in 1906 by the U. S. Geological Survey.

Acequia Polvadera

The heading is on the west side of the Rio Grande about 3/4 of a mile northeast of Alamillo Station. The ditch was con-

structed to irrigate lands near the plaza of Polvadera.

The diversion works are a brush and mud wing dam extending upstream at an angle of 30 degrees to the bank of the river. A small amount of water, less than 1/10 of a cubic foot per second, was being diverted on September 24, 1910. On September 26, by an examination that was made from the train, it was evident that the dam had been repaired on September 27th, and that all the water in the river was being diverted. This was estimated to be 5 cubic feet per second.

The data for the maximum capacity was secured on September 24th, and are as follows: $\frac{6.0 \text{ feet plus } 7.5 \text{ feet}}{2}$, x 1.5 equals 10.12 square feet, and the velocity being 1.5 of a foot per second, gives a discharge of 15.18 cubic feet per second.

The area irrigated was estimated at 250 acres and the area which is in bosque at 100 acres. Probably most of the latter could not be irrigated.

The farms had good crops. The value of the land ranges from $40.00 to $100.00 per acre. Most of the land is valued at $50.00 per acre.

The floods from the Rio Puerco frequently furnish water to this ditch, while those below do not receive it. The date of construction was not learned, but it is known to be old.

The location of this ditch may be seen on the topographic map of the Socorro Quadrangle published in 1906 by the U.S. Geological Survey.

Acequia Alamillo

The heading is on the west side of the Rio Grande near the lower end of the canyon and about 1-3/4 miles above Alamillo

station.

The diversion works are temporary, being a brush and mud wing dam extending a part of the distance across the river.

The ditch was examined on September 24, 26 and 28. On the 26th it was examined above all irrigation, the ditch being dry. The data for the maximum capacity were as follows: 4.0 ft. plus 6.0 / 2 x 1.5 equals 7.5 square feet, and the velocity being 1.5 feet per second, gives a discharge of 11.25 cubic feet per second. On September 28th there was a little water flowing in the ditch near the head. This was estimated to be about 1 cubic foot per second.

The area irrigated was estimated to be 150 acres. There are probably 150 acres additional under the ditch that are in swamps or bosques. The change in the river bed since 1878 in the vicinity of Alamillo makes favorable the conditions for swamps.

The date of construction could not be learned, but it is probably about 20 years old.

The value of the land is not so great as farther south. It probably ranges from $30.00 to $100.00, with most about $40.00.

Abandoned Ditches

About 1 mile north of the present plaza of Alamillo is a sort of alcove, which extends to the west and into the mesa. On the maps made by Lieut. Wheeler in 1877 and 1878, the Rio Grande is shown as occupying this alcove, the river being in form of a loop. The channel has changed to the east side since then. The alcove is now occupied by low grounds which have salt grass, pastures and meadows. The old plaza of Alamillo was formerly at the west end of this alcove, but it has been moved about a mile south.

Two abandoned ditches were on the north side of this

alcove. Each were when in operation probably 3 feet wide on the bottom and carried a velocity of 1.5 feet per second. The discharge was probably about 7.5 cubic feet per second. One of these ditches was about 5 feet above the valley and the other about 15 feet. These were not examined in the canyon where they formerly had their headworks.

Some seepage was noticed to the north of this alcove. It is probably moisture coming out of the great amount of sand and lava that lies to the north.

On the east side of the river according to the map made by Lieut. Wheeler, and near the mouth of the Alamillo Canyon, there was a small plaza named La Joyita, where there was some farming. It is believed that this has been abandoned, as our information was that that there was no irrigation on the east side of the river. Some investigations were made and these seemed to bear out the information.

....

GENERAL DESCRIPTION

of

THE RIO GRANDE VALLEY

from

ALBUQUERQUE, NEW MEXICO,

to

ALAMILLO CANYON

....

This portion of the valley under consideration is 60 miles in length and from 1/2 to 2-1/2 miles in width. In altitude it ranges approximately from 4650 to 4950 feet above sea level.

The soil is the generally clayey soil, interspersed with patches of sandy soil, common to the lower Rio Grande valley. There is less of the tight clayey soil here than there is in the Socorro-San Marcial valley lying below. This is owing to the Rio Puerco which supplies most of this tight clayey soil, emptying into the Rio Grande at the lower end of this valley.

There are some alkali lands and some waterloggeed lands, but these with proper treatment could in most cases be readily restored to first-class lands. There are some lands below the mouth of the Rio Puerco which are below the water surface of the Rio Grande, and these are alkaline and waterlogged, and the expense of restoration might not be justified by the results obtained.

The precipitation is about 9 inches per annum and about 4 inches during the season of summer rains, taking the records at Albuquerque and Socorro for data. The summer showers in this, like all other valleys of the lower Rio Grande, are of little benefit. They are mostly of short duration, local and often of such violence as to produce destructive floods from the arroyos entering the valley. All arroyos of any great capacity debauch into the valley from the east. They have their source in the Manzano Mountains and drain considerable territory, and part of it at high altitudes. The arroyos on the west have less capacity as they are short, the Rio Puerco being near, and the drainage area is at a lower altitude.

The snowfall is light and is rapidly dissipated by evaporation, and what is allowed to melt is small in amount and furnishes little water. There are never periods of alternate raining and snowing, thawing and freezing, such as occur in higher latitudes and produce so much ground storage. Another factor against ground storage is the fact that there is practically no gravel, and that the layers of silt which make up the soil are to a great degree deposited in horizontal strata. Water percolates through these horizontal strata of sediment.

The general irrigating season is from April 1 to October 1, but irrigating is done at all times. Considerable winter irrigation is practiced. As is the general rule, the people often irrigate in the early spring when the crops do not need irrigating. The methods of irrigating by most of the farmers of the Rio Grande valley are wasteful of water, and the people of this part are no exception.

The three principal crops are wheat, corn and alfalfa, while fruit, chili, melons, truck and native hay are secondary crops. The fruit is mostly grapes, peaches, apples and pears, with some apricots. Fruit cannot be grown at all places in the valley floor, because of the water being too near the surface. There is considerable area where only short rooted crops can be grown. Fruit is sometimes injured in the spring by frost. This is mostly applicable to peaches. There are, however, no reasons why considerable quantities of fruits of very good quality cannot be raised if scientific farming was practiced. Good crops of wheat and medium crops of corn were raised this season. It is probable that in the future, wheat will be planted more and more, as it is harvested about the

time the water fails.

There was a general shortage of water this year from July 1 to October 1, and possibly a little later. There are also no reasons to expect much better conditions in the future, with additional diversions being made above.

The value of general farming land ranges from $40.00 to $50.00 per acre, but alfalfa land in good condition is generally valued at about $100.00 per acre.

For the most economical administration and maintenance of irrigation in the area under consideration, there should be a permanent weir constructed close to Old Albuquerque and two canals should head here, one being on the east side to irrigate about 4,000 acres, and one on the west side to irrigate about 8,500 acres. This would include all lands down to the Pueblo of Isleta.

At the Pueblo of Isleta another permanent weir should be constructed and canals taken out, to irrigate all lands to Alamillo canyon. Each could be located with light grades, and on the east side with a power plant with a 50 foot drop could be located near Casa Colorado, and on the west side another one with a 50 foot drop a short distance below Belen.

As there is a precipitous sandy bluff from 40 to 80 feet high extending up the river for over a mile from the head of the ditches at Atrisco, it would seem that the most reasonable place to build a weir, would be in the vicinity of Old Albuquerque, though this location is also unfavorable.

This would discontinue ten temporary diversion dams, if the water was allowed to run down the main canals until the territory of each ditch was reached.

A more favorable location for the construction of a weir

is to be found at the Pueblo of Isleta, but being some 15 miles down the river there would be less land available for irrigation. The river at this point is not so wide and the lay of the land is favorable for canal construction. Gravel is the material to be found at the proposed diversions. The proposed place of diversion was once a point of land projecting to the west, but the Indians made a cut through it so as to get a ditch through for irrigating lands below it. Later the river itself followed through this cut and is now the present channel. If this weir was built the diversion works of 31 ditches could be abandoned.

If any power plants were constructed they could probably be operated about nine months in the year, or except July, August and September.

Dikes for protection from the annual overflow of the river are built in the vicinity of Albuquerque and Atrisco. If similar dikes were constructed where beneficial, and if well located, and well constructed drainage ditches were built, considerable additional areas could be cultivated. There are now in round numbers 22,000 acres irrigated and 29,000 not irrigated, while practically all of it could be. This only includes lands in the valley floor. With all these lands under an economical distribution system, and with scientific farming, there should be about three thousand more people on these farms.

It is quite doubtful if the present owners of lands in this valley could or would be willing to bear the cost of such improvements as mentioned, but the time will come in a few years when such improvements will be made. A corporate irrigation enterprise would be necessary.

In the area under consideration 42 ditches have been tabulated with a combined capacity of 1189.42 cubic feet per second. The area irrigated was estimated at 22,860 acres and the additional area under the ditches that might be irrigated at 29,115 acres.

Several ditches were found, upon comparison with the report of Mr. W. W. Follett to the Department of State in 1896, to have been unmentioned by him. Most of these are known to be new. The total capacity of all ditches in 1896 was 1174 cubic feet per second, and the total acreage 17,930. From this it would seem that the capacity of the ditches has been increased 15 cubic feet per second and the acreage 4,830. As the acreage in both reports are estimates, the increase may not be so much.

A short account of a few items of history may not be out of place in this connection.

The country about Isleta has been irrigated since before the advent of the Spaniards under Coronado in 1540-41. At that time there were eight pueblos and they were given the name of a province. The pueblos in the vicinity of Bernalillo were the only others which were more populous. The pueblo of Isleta has remained in the same location since it was seen by Coronado.

In 1681 the pueblo of Isleta was an occupied pueblo, and upon the unsuccessful attempt at reconquest, a part of the pueblo migrated with the retreating Spaniards and now live at Ysleta, Texas.

The settlements at Belen and Tome are very old. It is likely that there was nearly as much land under irrigation about 1800 as there is now. It was at least a thickly settled community in 1807, when Lieutenant Pike was taken through to Chihuahua.

The advent of the railroad lessened the acreage irrigated

but the number of acres irrigated are evidently increasing at the present time.

Here follows a description of each ditch, beginning with the one farthest south.

Acequia San Geronimo

This name is applied to a ditch that was formerly in operation and supplied water for irrigation near the plaza of San Geronimo. This will be in the Rio Grande Valley below Albuquerque instead of the Socorro Valley, as another report has it. The ditch was examined September 26, 1910, and had evidently not been operated for some years.

The heading of this ditch was formerly a short distance below where the Rio Puerco enters the Rio Grande, and the remains of the plaza San Geronimo are about west of the plaza La Joya, and on the west side of the river.

South of San Geronimo and between the mesa and the track of the Santa Fe railroad is a tract of about 200 acres that was formerly a meadow, but it is now strongly alkaline and practically worthless. There is but little salt grass upon it. North of San Geronimo and extending to the Rio Puerco and lying between the mesa and the Santa Fe railroad, is another tract of 400 acres that is not cultivated. This is not so alkaline. The major portion of this latter tract was cultivated at one time.

It was estimated that the tract south of San Geronimo was from 1 to 2-1/2 feet below the water surface of the Rio Grande. Accurate levels were taken at La Joya station, north of San Geronimo, and it was found that the lowest part of the channel was but 1.2 below the ground surface on the west side of the railroad track, and that during high water in the river the water surface was from 1.5 to 2.0 feet above this ground surface. The railroad company has elevated this track twice. They have to riprap the river side of their grade from La Joya station to Alamillo canyon, to keep it from being eroded.

The filling up of the bed of the Rio Grande more rapidly near La Joya than elsewhere, is accounted for by the fact that the Rio Puerco empties but a short distance above. This river flows for about 140 miles through a clayey soil and in an earthen canyon from 10 to 40 feet deep and from 50 to 75 and even 100 feet wide, and with a grade of 10 feet to the mile. The soil is very fine and consequently is highly charged with a fine silt. When this reaches the wide bed of the Rio Grande with a fall of five feet to the mile, the velocity is greatly lessened, and this causes settlement. Also on the wide bed of the Rio Grande evaporation and percolation are greater; percolation is a very important factor when the bed of the Rio Grande is dry. These conditions are true below the place under consideration, but they are most evident there.

Acequia La Joya

The heading of this ditch is on the east side of the Rio Grande nearly west of the plaza Las Nutrias.

The diversion works are a temporary dam consisting of brush, mud, etc. This was examined September 26, 1910. There being no water in the river at this point, the ditch was dry.

The following are the data for the maximum capacity: $\frac{9.0 \text{ ft. plus } 11.0 \text{ ft.}}{2} \times 1.5$ ft., equals 15.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 22.5 cubic feet per second.

The area irrigated is about 600 acres and the extendible area with the river at its present width is 750 acres.

There was no water from August 25 until after the date of examination. Two good crops of alfalfa were raised. Fruit was killed this spring by late frosts. Smudging is not practiced.

Alfalfa is irrigated every two weeks when water is available. The lands irrigated are worth from $40.00 to $100.00 per acre. Generally the community seemed prosperous.

The following information is applicable to the following ditches: Las Nutrias, Picacho, San Juan, Sabinal, Las Islas and Casa Colorado.

The area now irrigated under these ditches is very much less than it was before the advent of the Santa Fe Railroad into this locality. Previous to that time nearly every one was compelled to farm in order to make a living and practically all the land was farmed. During the construction of the railroad the wages were from $1.50 to $2.00 per day, and great numbers ceased to farm and became laborers on construction work. After construction was completed, other industries were established which required laborers, and thus the number of farmers were less and the condition has continues to the present time. At the present time there are no Mexicans who are leaving the towns to become farmers, but rather the reverse, as some are selling out to Americans and going to the towns. In places there are now 75% less of land farmed than formerly.

The soil and climate are good. The water supply is not assured, but too much dependence is placed upon irrigation. Little or no cultivation is done to corn, when at times thorough cultivation would conserve the moisture that is in the ground. Great benefits could have been secured this year if this had been done. The scientific cultivation and care of fruit is practically unknown. There is enough information to know that fruit can be grown of good quality and in paying quantities if properly cared for. Smudging

in the spring is often necessary. Grapes are grown with the best results under present methods.

These conditions, in the main, are true of a great part of the valley of the Rio Grande.

Acequia Las Nutrias

The heading of this ditch is about one mile south of Sabinal station, and ends below the plaza of Las Nutrias.

The diversion works consist of a brush and mud wing dam.

This was examined September 26, and was dry, there being no water in the river. The data for maximum capacity, when the ditch is cleaned, are: $\frac{8.0 \text{ ft. plus } 10 \text{ ft.}}{2}$ x 1.5 ft., equals 13.5 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 20.25 cubic feet per second.

The area irrigated is about 1200 acres and the extendible area about 1,000 acres.

The crops are the general ones of the valley, and the value of land from $40.00 to $100.00 per acre.

There had been no water in the ditch for two months previous to the examination, or after July 25th.

Near the plaza Las Nutrias, some dry farming was being done on the alluvial fan of an arroyo. The crops were corn and melons and were reasonably good. The waters which came down the arroyo were allowed to run among the crops.

Acequia Picacho

The heading of this ditch is on the west side of the Rio Grande about one-quarter mile southeast of Sabinal station.

The diversion works were examined September 26, 1910, and

were temporary, being a mud dam in the lowest channel of the river. This was diverting the entire flow of the river on that date.

The examination of the ditch was made about 100 feet below the point where it entered the river bottom. The flow was .25 foot per second. The following are the data for maximum capacity: $\frac{4.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 2.0 ft., equals 11.0 square feet, the sectional area, and the mean velocity being 1.5 feet per second, gives a discharge of 16.5 cubic feet per second.

The area irrigated was estimated at 600 acres. There are about 1,000 acres of land that are now in salt grass pasture that might be irrigated, and 2,200 additional acres.

The area in cultivation at the lower end of this ditch near the Rio Puerco is very well farmed.

The value of the land is from $40.00 to $100.00 per acre.

The date of construction was not learned,but it is old. The report of Mr. W. W. Follett to the Department of State records it as being 1868.

Acequia San Juan

The heading of this ditch is on the east side of the Rio Grande north of Casa Colorado. The distance is not known as the heading and diversion works were not visited.

The diversion works are temporary, but the exact nature is not known.

The ditch was examined on September 26th above any irrigation, and was dry. The data for the maximum capacity of the ditch when it is cleaned, are: $\frac{10 \text{ ft. plus } 13.0 \text{ ft.}}{2}$ x 2.0 ft., equals 23.0 square feet, the sectional area, and the mean velocity being 1.5 feet per second, gives a discharge of 34.5 cubic feet per second.

The area irrigated under this ditch was estimated at 1700 acres, and the additional area that might be irrigated at 800 acres.

This is a large ditch and irrigates a large body of good land. The methods of irrigation are reasonably good. The date of construction was not learned, but it is an old ditch.

Values of irrigated land range from $40.00 to $100.00 per acre.

This is probably the San Jose No. 1 of the report of Mr. W. W. Follett to the Department of State. No ditch by the name of San Jose could be found, even though repeated inquiries were made. The San Jose No. 2 of Mr. Follett's report could not be located, but it has probably been merged into another.

Acequia Sabinal

The heading of this ditch is on the west side of the Rio Grande one-half mile southeast of Jarales.

The diversion works were examined September 8, 1910, and consisted of a wing dam common to the Albuquerque valley. This was made of posts driven into the mud, and brush, sod and mud piled about them. There was no water diverted as there was none flowing in the river, all being in pools.

For the first one-quarter mile the ditch was constructed over a sand bar. The data for the maximum capacity are $\frac{9.0 \text{ ft. plus } 12.0 \text{ ft}}{2}$ x 2.0 ft., equals 21.0 square feet, the sectional area, and the mean velocity being 2.0 feet per second, gives a discharge of 42.0 cubic feet per second.

This is a long ditch, extending for a mile below Sabinal station, having a length of about 12 miles. The ditch has been constructed for about 200 years.

The area irrigated was estimated at 1200 acres, and the

area which might be irrigated at 1700 acres. There is not so much irrigated now as before the railroad was built.

Acequia del Bosque, or Acequia de las Islas

The heading of this ditch is on the west side of the Rio Grande about one mile in a southeasterly direction from Jarales. The river at this place is over one-fourth mile wide.

The diversion works on the day of examination, September 8, 1910, consisted of a wing dam extending upstream at an angle of about 60 degrees to the bank. The deepest channel in the river was close to the west bank of the river. This wing was made of poles driven in the sand, and brush, sod and mud placed about them. There was no water in the river except in pools, so none was diverted.

The data for the maximum capacity are: $\frac{8.0 \text{ ft. plus } 10.0}{2}$ ft. x 1.5 ft., equals 13.5 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 27.0 cubic feet per second.

The area irrigated was estimated at 500 acres and the area that might be irrigated at 1,000 acres.

There are two names applied to this ditch. The exact status, however, could not be learned, but it is something like this: There were formerly two ditches but for some reason parts of them have been merged into one. There are a very great number of such changes on the west side of the Rio Grande from Los Lunes to Sabinal, which shows that the river is quite changeable along that distance.

Value of land from $40.00 to $100.00 per acre.

Acequia Casa Colorado

The heading of this ditch is on the east side of the Rio Grande about one mile northeast of Jarales, and the main area is irrigated in the vicinity of Casa Colorado.

The diversion is temporary, being a typical wing dam of this section.

The ditch was dry on the day of examination, September 8, 1910, there being no water in the river except in pools. The maximum capacity is according to the following data: $\frac{10.0 \text{ ft. plus } 12.0}{2}$ ft. x 2.0 ft., equals 22 square feet, the sectional area, and the velocity being 2.0 feet per second, makes a discharge of 44.0 cubic feet per second.

The area irrigated was estimated at 1,200 acres, and the area that might be irrigated in addition, at 800 acres.

The value of irrigated land ranges from $40.00 to $100.00 per acre.

Acequia San Francisco

The heading is on the west side of the Rio Grande, east of the town of Belen, and about one-half mile south of the wagon bridge which crosses the Rio Grande.

The diversion works are temporary. On the date of examination, September 8, there was a wing dam of posts driven into the river bed, and brush, sod and mud placed about them. This was at an angle of about 45 degrees to the bank and was about 100 feet long, as that was what was required to extend across the deepest channel. This channel was close to the west bank. The dam would divert water readily. The river was dry except in pools.

The data for the maximum capacity are $\frac{10.0 \text{ ft. plus } 12.0 \text{ ft}}{2}$

x 1.5 ft., equals 16.5 square feet, the sectional area, and the velocity being 1.75 feet per second, gives a capacity of 28.87 cubic feet per second.

The irrigated area was estimated at 200 acres, and the additional area that might be irrigated at 100 acres. The ditch according to testimony is very old. The irrigated lands lie between Jarales and the river.

The value of the land was estimated to range from $30.00 to $100.00 per acre.

Acequia Jarales

The heading of this ditch is on the west side of the Rio Grande at the Belen wagon bridge. It irrigates lands in the vicinity of the plaza of Jarales.

The diversion works on the day of examination, September 8, 1910, consisted of a ditch which extended to the deep channel of the river and was excavated in sand bar for about 200 feet. There was no water in the river.

The maximum capacity of the ditch, measured near the headworks, is computed from the following data: $\frac{10.0 \text{ ft. plus } 12.0}{2}$ ft., x 2.0 ft., equals 22 square feet, and the velocity being 2.0 feet, gives a discharge of 44.0 cubic feet per second.

The area irrigated under the ditch was estimated at 500 acres, and the area that might be irrigated at 700 acres.

The acequia Jarales wastes into the Acequia San Francisco. A part of the Acequia San Francisco was formerly the lower part of the Acequia Jarales. A new ditch was dug from the lower part of the Acequia Jarales to the river, and the combination resulting therefrom is the Acequia San Francisco, reported upon previously.

The value of the land is from $20.00 to $100.00 per acre.

Acequia Del Rincon

The heading of this ditch is on the west side of the Rio Grande about one mile north of Belen wagon bridge. Irrigates lands between Belen and the river.

The diversion works were a wing dam, made by driving posts into the river bed and placing brush, sod and mud about them.

The diversion works and ditch were examined September 9, 1910. The ditch was not carrying any water, as the river was dry. The maximum capacity is computed from the following data: $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2} \times 1.5$, equals 9.0 square feet, the sectional area, and the velocity being 2.0 feet per second, makes a capacity of 18.0 cubic feet per second.

The area irrigated under this ditch was estimated at 200 acres, and the area that might be irrigated at 400 acres.

This ditch probably wastes into the acequia Jarales but no definite information was obtained.

The value of the irrigated lands range from $20.00 to $100.00 per acre.

The date of construction was not learned, but it is probably very old, as the settlements about Belen were of considerable importance at the beginning of the 19th century.

Acequia de Los Innocentes and Acequia Garcias

These two ditches are in some way combined into one ditch. The testimony of three different persons was not in accord and the exact status of affairs is not known, but it is believed that the same ditch is known in different places under different names. This may be somewhat similar to the Jarales ditch.

The heading of this ditch is about 300 feet north of the Acequia del Rincon.

The diversion works on the day of examination, September 9, 1910, consisted of a mud wing dam. There was practically nothing but mud in the dam.

There was no water in the ditch as there was none in the river.

The following are the data for the maximum capacity: $\frac{5.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.5 ft., equals 8.25 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 16.5 cubic feet per second.

The area of land irrigated under the ditch was estimated at 300 acres, and the area that might be irrigated at 300 acres.

The value of the land would range from $20.00 to $100.00 per acre.

Acequia Sousal

The heading of this ditch is about three miles north of Belen wagon bridge, and irrigates lands in the vicinity of the small plaza of Sousal.

The diversion works were a brush and mud wing dam retained in place by posts which were driven into the river bed.

The ditch was esamined September 9, 1910, and was dry, as there was no water in the river. The following are the data for the maximum capacity: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 2.0 ft., equals 14.0 square feet, the sectional area, and the velocity being 2.0 gives a capacity of 28.0 cubic feet per second.

The irrigated area was estimated at 200 acres and the area that might be irrigated at 500 acres.

The value of the land is about $40.00 to $100.00 per acre.

The date of construction was not learned.

Acequia Eularmes

The heading of this ditch is on the east side of the Rio Grande and west of Tome, and the lower end is near the bridge at Belen.

The diversion works are a mud and brush wing dam.

The ditch was examined above the upper end of irrigation on September 8, 1910, and was dry, as there was no water in the river. The following are the data for the maximum capacity: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 2.0 feet, equals 14.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 28.0 cubic feet per second.

The irrigated area was estimated at 300 acres, and the area that might be irrigated at 300 acres.

The location of this ditch is such that it does not get close to the mesa, but remains on the valley floor. It does not get much farther east than the ranches of Tome.

The date of construction was not ascertained.

The value of the land is from about $40.00 to $100.00 per acre.

Acequia Los Chaves

The heading of this ditch is on the west side of the Rio Grande about three miles south of the wagon road bridge over the Rio Grande at Los Lemas.

The diversion works are temporary, being of brush and mud.

The ditch was examined near the head on September 9, 1910, and was dry, as there was no water in the river. The following data is for the maximum capacity: $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 2.0 ft., equals

18.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 36.0 cubic feet per second.

The area irrigated was estimated at 300 acres, and the area that might be irrigated at 1,200 acres., As will be seen, the larger part of land which is under this ditch was not irrigated. Some of this is sandy. Land that is not held by speculators, is farmed by the Mexican owners.

The date of construction was not learned.

The value of irrigated lands range from $40.00 to $100.00 per acre.

Acequia Madre de Tome

The heading of this ditch is on the east side of the Rio Grande about one mile south of the wagon bridge over the Rio Grande at Los Lunas.

The diversion works are temporary.

The ditch was examined September 8, 1910, above the head of irrigation and was dry, as the river was dry. The maximum capacity is computed from the following data: $\frac{5.0 \text{ ft. plus } 6.5 \text{ ft.}}{2} \times 1.5$ ft., equals 8.26 square feet, and the velocity being 2.0 feet per second gives a capacity of 17.25 cubic feet per second.

This ditch is located between the plaza of Tome and the Ranchos of Tome, and wastes into the public spillway. This is a spillway at the lower end of the valley of Tome into which a number of ditches waste.

The irrigated area was estimated at 500 acres, and the area that might be irrigated is 900 acres.

Value of the land is $40.00 to $100.00 per acre.

Acequia Constancia

The heading of this ditch is on the east side of the Rio Grande about one-half mile north of the wagon bridge which crosses the Rio Grande near Los Lunas.

The diversion works are temporary, and on the date of examination, September 7, 1910, consisted of small dam of sand and mud in a secondary channel of the Rio Grande. No water was diverted as the river was dry.

The maximum capacity is found from the following data: $\frac{6.0 \text{ ft. plus } 7.5 \text{ ft.}}{2} \times 1.5$ ft., equals 10.12 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 20.24 cubic feet per second. The ditch is about 11 miles long. A waste-way is provided which wastes into the public spillway, but the ditch continues on down below the plaza at Constancia. The people who farm at the lower end of this ditch secure very little water. This, like nearly all other Mexican ditches, is of nearly the same capacity for the greater length. The capacity at the head is usually that of two-thirds of the length. Often when all are using water the ditch is not of sufficient capacity, and the ones at the lower end are not supplied.

The office of Mayor Domo is usually a political job and the ones at the lower end of the ditches are the poorer ones, and least influential, and do not get their rights.

The area irrigated was estimated at 500 acres, and the additional area that might be irrigated at 1,000 acres.

The value of the lands irrigated ranges from $40.00 to $100.00 per acre.

There is no ditch heading on the east side of the Rio Grande below the plaza of Constancia until the ditch for Casa Colorado is reached. There is therefore a distance of about seven miles which does not have any irrigable land on the east side.

Acequia Fernadez

The heading of this ditch is on the east side of the Rio Grande about three-quarters of a mile north of the wagon bridge which crosses the Rio Grande in the vicinity of Los Lunas.

The diversion works are temporary. On the day of examination, September 7, 1910, they were found to be only a cut into the river bed. No water was diverted as the river was dry.

The maximum capacity is computed from the following data: $\frac{5.0 \text{ ft. plus } 6.5 \text{ ft.}}{2}$ x 1.5 ft., equals 8.62 square feet, the sectional area, and the mean velocity being 2.0 feet per second, gives a capacity of 17.25 cubic feet per second.

The area irrigated was estimated at 175 acres and the additional area that might be irrigated at 500 acres.

This ditch empties into the public spillway at the lower end of the valley of Tome.

The date of construction could not be learned.

The value of the lands will probably range from $40.00 to $100.00 per acre.

Acequia Huning

The heading of this ditch is on the west side of the Rio Grande about 2 1/2 miles north of the town of Los Lunas; this is one of the large community ditches of the Rio Grande valley.

The diversion works are temporary, but were not examined.

The ditch was examined on September 7, 1910, above the head of irrigation and was dry, as the river was dry.

The maximum capacity is computed from the following data: $\frac{16.0 \text{ ft. plus } 20.0 \text{ ft.}}{2}$ x 2.0 ft., equals 36.0 square feet, the sectional area, and the velocity being 2 feet per second, makes a capacity of 72.0 cubic feet per second.

The area irrigated was estimated at 1,500 acres, and the area that might be irrigated at 2,200 acres.

The area which was formerly irrigated by the Acequia Belen is now irrigated by this ditch. The Acequia Belen formerly had diversion works about a mile south of the wagon bridge at Los Lunas, but these diversion works were maintained with difficulty, so in the year 1910 arrangements were made by the owners of the Acequia Belen whereby water was secured from the Acequia Huning. The connecting ditch which leads from the Acequia Huning to the Acequia Belen was noted. The name Huning is applied as the one who built the ditch and owned considerable land under it. This has been built within the past fifteen years.

The settlements at Belen are old. In 1766 there were 38 Spanish families residing there besides some gentile Indians. The exact date of construction is not known.

The value of irrigated land ranges from $40.00 to $100.00 per acre.

Company Ditch

All information concerning this ditch was given by Mr. Huning, of Huning & McConnell of Los Lunas.

The heading of this ditch is on the east side of the Rio Grande about 3 miles north of the wagon bridge which crosses the

Rio Grande at Los Lunas. It was constructed by Owen & Meredith for the purpose of irrigating a portion of 335 acres owned by them. This ditch was not in use this year, and has only been used for one season. The capacity of the ditch is probably about 5 cubic feet per second.

No examination was made.

Acequia Las Cercas

The heading of this ditch is on the east side of the Rio Grande about four miles south of the Pueblo of Isleta.

The diversion works are temporary, according to information received, but they were not examined.

The ditch was examined on September 14, 1910, above the first irrigation. It was dry, as there was no water in the river. The following are the data obtained for the maximum capacity: $\frac{8.0 \text{ ft. plus } 11.0 \text{ ft.}}{2}$ x 2.0 ft., equals 19.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 38.0 cubic feet per second.

The area irrigated was estimated at 375 acres, and the additional area which might be irrigated at 600 acres.

The value of the land was estimated to range from $40.00 to $100.00 per acre.

This ditch wastes into the public spillway.

Acequia Valencia

The heading of this ditch is on the east side of the Rio Grande, a very short distance south of the south boundary of the Pueblo of Isleta Grant.

The diversion works are known to be temporary, but were not examined

The ditch was examined on September 14, 1910, above the

first irrigation and was dry, as there was no water in the river. The following are the data for the maximum capacity when the ditch is cleaned: $\frac{11.0 \text{ ft. plus } 13.0 \text{ ft.}}{2}$, x 2.0 ft., equals 24.0 square feet, the sectional area, and the velocity being 2.0 feet per second gives a discharge of 48 cubic feet per second.

The area irrigated was estimated at 500 acres and the additional area that might be irrigated at 950 acres.

The principal crop under this ditch is wheat.

The value of lands range from $40.00 to $100.00 per acre.

This wastes into the public spillway.

Acequia Los Lunas

The heading of this ditch is on the west side of the Rio Grande about one-half mile south of the south boundary of the Pueblo of Isleta Grant. This was built to irrigate lands in the vicinity of the town of Los Lunas and is very old, but the date of construction could not be learned.

The diversion works are temporary, being a brush and sod wing dam, on the day of examination, September 9, 1910. This was diverting so small an amount of water that it was immeasurable.

The data for the maximum capacity of the ditch are as follows: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.5 ft., equals 7.5 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 15.0 cubic feet per second.

The principal crops are alfalfa, wheat, corn, melons and fruit. Grapes do well and apples fairly well. There seem to be very few scientific horticulturists. Peaches do well, but as there is no smudging, they are often destroyed in the spring time by frosts.

The value of the land ranges from $40.00 to $100.00 per acre.

The area irrigated was estimated at 600 acres and the additional area under the ditch at 900 acres.

Acequia Peralta

The heading of this ditch is on the east side of the Rio Grande about 2 miles south of the Pueblo of Isleta.

The diversion works, it was learned, are temporary, but they were not examined.

The ditch was examined on September 14, 1910, at the head of irrigation and was dry, as the river was dry. The following are the data of the maximum capacity of the ditch when cleaned: $\frac{11.0 \text{ ft. plus } 13.0 \text{ ft.}}{2}$ x 2.0 ft., equals 24.0 square feet, the sectional area, and the velocity being 2.0 feet per second gives a discharge of 48.0 cubic feet per second.

The area irrigated was estimated at 600 acres, and the additional area that might be irrigated at 480 acres. The irrigable lands all lie without the grant to the Pueblo of Isleta, but the heading of the ditch is within the grant. A considerable amount of wheat is raised. The soil is generally good.

This ditch empties into the public spillway.

The ditch is probably very old, as the settlement of Peralta is very old.

The value of the irrigated land ranges from $40.00 to $100.00 per acre.

Acequia del Medio

The heading of this ditch is on the east side of the Rio Grande, about 1 1/2 miles below the Pueblo of Isleta.

The diversion works are temporary, but were not examined.

The ditch was examined on September 14, 1910, above the beginning of irrigation, and it was dry, as the river was dry. The following are the data for the maximum capacity when the ditch is cleaned: $\frac{10.0 \text{ ft. plus } 12.0 \text{ ft.}}{2}$ x 1.5 feet, equals 16.5 square feet, the sectional area, and the velocity being 1.5 feet per second gives a discharge of 24.25 cubic feet per second.

The area irrigated, which is all without the Pueblo of Isleta Grant, was estimated at 200 acres, and the additional area that might be irrigated at 300 acres.

The value of the land was estimated at $40.00 to $100.00 per acre.

Acequia Los Leutes

The heading of this ditch is on the west side of the Rio Grande, about 1 1/2 miles south of the Pueblo of Isleta.

The diversion works are temporary, being on the day of examination, September 10, 1910, a brush, sod and mud wing dam.

This ditch was examined at the head on September 10, and was flowing .25 cubic foot per second. The following are the data for the maximum capacity with the ditch in its present condition: $\frac{5.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.0 ft., equals 5.5 square feet; the velocity being 1.5 foot per second, gives a capacity of 8.25 cubic feet per second. The data for the maximum capacity, the ditch being cleaned, are; $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 2.0 ft., equals 14.0 square feet, and the velocity being 2.0 feet per second, gives a discharge of 28.0

cubic feet per second.

A great many ditches were in practically the same condition when examined. There was about one foot of sediment in them.

The area irrigated was estimated at 350 acres and the additional area that might be irrigated at 650 acres.

According to the information furnished by a member of the Pueblo of Isleta, this ditch was built by the Indians of that pueblo to irrigate lands on their grant, but during the past 25 years, the Mexicans who own land to the south of the grant and receive water from the ditch, have been doing work in connection with the maintenance and operation, and claim an interest in it.

This ditch is very old.

There had been no water in the ditch during the last half of August, nor any during the first part of September.

Acequia del Bosque

This ditch heads on the east side of the Rio Grande, about one mile below the Pueblo of Isleta, and just below the Acequia de la Maquina, and was built this year (1910), to irrigate 1,000 acres of land owned by Solomon Luna.

The following are the data for the maximum capacity: $\frac{12.0 \text{ ft. plus } 14.0 \text{ ft.}}{2}$ x 1.5 ft., equals 19.5 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 29.25 cubic feet per second.

This spills into the Acequia Valencia.

This ditch is claimed to be built under an old water right.

Acequia de la Maquina

The heading of this ditch is on the east side of the Rio Grande about a mile below the Pueblo of Isleta.

The diversion works are temporary, but were not examined.

The ditch was examined on September 14, 1910, at the head of irrigation, and was dry, as the river was dry. The data for the maximum capacity are as follows: $\frac{10.0 \text{ ft. plus } 12.0 \text{ ft.}}{2}$ x 1.5 ft., equals 16.5 square feet, the sectional area, and the velocity being 1.5 feet per second, makes a discharge of 24.75 cubic feet per second.

This ditch is owned by Bernadino Sedillo, who operates a grist mill by it. Some land is irrigated by the ditch, probably 150 acres, and there are probably 200 acres that might be irrigated.

The value of the land is about $50.00 per acre.

This ditch spills into public spillway.

Acequia del Casique

The heading of this ditch is on the east side of the Rio Grande about one-fourth mile below the Pueblo of Isleta.

The diversion works are temporary, being of brush and mud on the day of examination, September 14, 1910. No water was being diverted, as there was none in the river.

The following are the data for the maximum capacity, the ditch being cleaned: $\frac{12.0 \text{ ft. plus } 14.0 \text{ ft.}}{2}$ x 2.0 ft., equals 26 square feet, the sectional area, and the velocity being 1.5 feet, gives a discharge of 39.0 cubic feet per second.

The area irrigated was estimated at 500 acres, and the additional area that might be irrigated at 500 acres.

This wastes into the Rio Grande after crossing the Acequia Maquina, the Acequia del Bosque, the Acequia del Medeo and the Acequia Peralta. This is the only other spillway for all the ditches in the valley about Peralta and Tome. All others empty into one

another or into the public spillway.

The value of the land under this ditch probably ranges from $40.00 to $100.00 per acre.

Acequia de Picurid

The heading of this ditch is on the east side of the Rio Grande and opposite the Pueblo of Isleta.

The diversion works on the day of examination, September 14, 1910, consisted of the ditch made in the sands of the river bed. This ditch was extended upstream to the deepest channel at an angle of 30 degrees to the bank, and was made by slip scrapers.

There was no water diverted as there was none in the river. The maximum capacity is found according to the following data: $\frac{9.0 \text{ ft. plus } 11.0 \text{ ft.}}{2}$ x 1.5 ft., equals 15 square feet, the sectional area, and the velocity being 1.5 feet per second gives a discharge of 22.5 cubic feet per second.

The area irrigated was estimated at 200 acres, and the additional area that might be irrigated at 500 acres.

The value of the land was estimated at $40.00 to $100.00 per acre.

The date of construction of this ditch was not learned, but it is old. Most of this valley was farmed when Lieutenant Pike was taken through it in 1807.

Acequia Chical

The heading of this ditch is on the east side of the Rio Grande, and about 200 feet above that of the Acequia de Picurid and opposite the Pueblo of Isleta.

The diversion works are temporary; on the day of examination, September 14, 1910, they consisted of a wing dam made of some

brush and sand and mud. This ditch is but a short distance below a gravel cliff, which is on the east side of the Rio Grande nearly opposite the Pueblo of Isleta.

The ditch was examined September 14, 1910, near the head. It was dry as there was no water in the river. The following are the data for the maximum capacity: $\frac{10.0 \text{ ft. plus } 12.0 \text{ ft.}}{2} \times 2.0$ ft. equals 22.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 33.0 cubic feet per second.

The area irrigated, all of which is within the Grant to the Pueblo of Isleta, was estimated at 400 acres, and the additional area that might be irrigated was estimated at 500 acres.

This ditch is singular in the fact that it can spill into either the Acequia Picurid or into the Acequia Valencia.

The date of construction was not learned, but it is old.

Small Community

The heading of this ditch is on the east side of the Rio Grande, and about 100 feet above the Acequia Chical.

The diversion works are temporary. On the day of examination, September 14, 1910, they consisted of a cut in the river bank only. Earlier in the season there had probably been a small wing dam, but it had been eroded.

The data for the maximum capacity are as follows: $\frac{0.0 \text{ ft. plus } 2.0 \text{ ft.}}{2}$, x 1.5 ft., equals 1.5 feet, and the velocity being 1.5 feet, the discharge is 2.25 cubic feet per second.

The area irrigated was 25.0 acres, mostly planted in melons, chili and corn.

The date of construction is probably comparatively recent as there was no name for it.

Acequia del Pueblo de Isleta
or
Acequia de los Indios

The heading of this ditch is on the west side of the Rio Grande, east of the plaza of Pajarito. This ditch is probably ancient as it is believed that the Pueblo of Isleta has moved but little, if any, since the time of Coronado.

The diversion works are temporary, and when examined on September 9, 1910, consisted of a wing dam of brush, sod and mud.

The ditch was examined near the head and was flowing according to the following data: $\frac{10.0 \text{ ft. plus } 15.0 \text{ ft.}}{2}$ x 2.0 ft., equals 25.0 square feet, the sectional area, and the velocity being 1.00 gives a discharge of 25.0 cubic feet per second. This was taking out practically all the water which was in the river. The data for the maximum capacity are as follows; $\frac{10.0 \text{ ft. plus } 20.0 \text{ ft.}}{2}$ x 2.0 feet, equals 30.0 square feet, and the sectional area, and the velocity being 2.00 feet per second, gives a discharge of 60.0 cubic feet per second.

The area irrigated under this ditch was estimated at 700 acres and the additional area that might be irrigated at 500 acres. All lands irrigated are within the Pueblo of Isleta Grant. The methods of irrigation were quite good. A considerable quantity of fruit, grapes, apples and peaches are raised by this Pueblo and hauled long distances for sale.

The value of the land is about $40.00 to $100.00 per acre.

Acequia Padilla

The heading of this ditch is on the west side of the Rio Grande about one-half mile northeast of the plaza Pajarito. It was built to irrigate lands in the vicinity of Padilla. This is

probably an old ditch as the plaza is an old one.

The diversion works are temporary, but were not examined.

The ditch was examined and the discharge estimated on September 10, 1910, at a section about one-quarter mile below the heading of the ditch. The flow was .25 cubic foot per second. The data for the maximum capacity are as follows, when the ditch is cleaned: $\frac{6.0 \text{ ft. plus } 9.0 \text{ ft.}}{2} \times 2.0$ ft., equals 15.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 30.0 cubic feet per second.

The area irrigated was estimated at 700 acres and the additional area that might be irrigated at 500 acres.

The value of the irrigated lands range from $40.00 to $100.00 per acre.

Acequia Pajarito

The heading of this ditch is on the west side of the Rio Grande about 1 1/2 miles south of the bridge across the Rio Grande at Albuquerque.

The diversion works were examined on September 14, 1910, and are temporary. They consisted of a long wing dam nearly 2,000 feet in length which was built at an angle of about 45 degrees to the bank. This was made in part by driving posts into the river bed and placing about them brush and mud, and in part by a dike of sand and mud thrown up by slip scrapers. This was being repaired on the day of examination. The flow in the ditch was measured about 1,000 feet below the point of diversion. The data for the flow on that day are as follows: $\frac{12.0 \text{ ft. plus } 14.0 \text{ feet}}{2} \times .50$ feet, equals 26.0 square feet, the sectional area, and the velocity being 1.2 feet per second, gives a discharge of 7.8 cubic feet per second.

The data for the maximum capacity are as follows: $\frac{12.0 \text{ ft. plus } 18.0 \text{ ft.}}{2}$ x 2.0 feet, equals 30.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 60.0 cubic feet per second.

The area irrigated was estimated at 1,500 acres, and the additional area that might be irrigated at 300 acres.

The value of the lands irrigated was estimated to range from $40.00 to $100.00 per acre.

This ditch is probably very old, as the plaza of Pajarito is a very old one.

Acequia Lagunita

The heading of this ditch is on the east side of the Rio Grande about one-half mile south of the wagon bridge over the Rio Grande at Albuquerque.

The diversion works are temporary. On the day of examination, September 10, 1910, they consisted of a ditch which was cut across a sand bar to the west side of the main river bed, where the main channel was carrying about 10.0 cubic feet per second. No water was flowing in this ditch as it was not deep enough. It was intended that this ditch should carry the water across this sand bar and that it would then flow down on the east side of the main river bed through a seconday channel till the point of diversion was reached. This diversion dam was of the wing type and was made of brush and mud, and was located about one-half mile below the ditch across the bar.

The ditch was examined near the head on September 10, 1910, and was dry. The irrigated area was examined September 14, 1910. The maximum capacity is according to the following: $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 1.5 ft., equals 13.5 square feet, the sectional area,

and the velocity being 1.5 ft. per second makes a discharge of 20.20 cubic feet per second.

The irrigated area under this ditch is of small extent, a considerable portion being very low. The name Lagunita is applied to the plaza because of the small lake in the bottom lands, caused by the overflow of the river. In spring, I was told, there was no road that was passable along these bottom lands. The American Lumber Company has a big plant upon lands that might be irrigated. There is also a considerable area below the lower end that might be irrigated if the ditch were enlarged. This ditch is about eight miles long, but does not reach to the south end of the valley lands, which are on the east side of the river. The valley terminates northeast of the Pueblo of Isleta.

The irrigated area was estimated at 1,000 acres, and the additional area that might be irrigated at 4,600 acres.

The value of the land ranges from $40.00 to $100.00 per acre.

In a few places above the ditch were noticed grasses and weeds which indicated moisture. This was seepage from the mesa or possibly from the Manzano mountains, but in no place was it great enough to show moisture on the surface.

The date of construction was not learned, but it is probably not very old.

Community Ditch

The heading of this ditch is on the east side of the Rio Grande about 600 feet below the wagon bridge which crosses the Rio Grande at Albuquerque.

The diversion works were temporary. There was a mud dam in the channel on the east side of the river. A ditch had been dug

across the sand bar in the immediate vicinity of the bridge, but it was not deep enough to conduct any water from the west channel. A small amount would start from the west side but would sink away before it got half the distance across the sand bar.

The ditch was examined near the head on September 13, 1910, and was dry. The maximum capacity is computed from the following data: $\frac{4.0 \text{ ft. plus } 5.0 \text{ ft.}}{2}$ x 1.5 ft., equals 6.75 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 13.5 cubic feet per second.

The area irrigated was estimated at 175 acres, and the additional area that might be irrigated at 200 acres.

This ditch is owned by four men, three of whom are Manuel Candelario, Jesus Candelario and Porfirio Sabera.

The crops were alfalfa, chili and truck, and the value of the land would be about $100.00 per acre.

A dike is built in the vicinity of Albuquerque to protect the town from inundation. The southern limit of this dike was not learned.

Acequia Vieja de Atrisco

This name is given to this ditch because there has been a later ditch built to irrigate near Atrisco, and from what could be learned it might be that the later one irrigates a part of the territory formerly irrigated by the Acequia Vieja.

The heading of this ditch is on the west side of the Rio Grande, and southwest from Old Albuquerque, and it is the first on the west side of the river above the wagon bridge which crosses the river at Albuquerque.

The diversion works are temporary, being a mud and brush

wing dam, extending across the channel which was carrying the water. The dam had been recently repaired and was diverting practically all the water in the river on the date of examination. The ditch was flowing about .50 cubic foot per second at the head on September 16, 1910. The data for the maximum capacity are as follows: $\frac{9.0 \text{ ft. plus } 12.0 \text{ ft.}}{2}$ x 1.8 ft., equals 18.90 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 37.80 cubic feet per second.

The area irrigated was estimated at 450 acres, and the additional area that might be irrigated at 200 acres.

This is an old settlement and this ditch is probably very old.

The irrigated area ranges in value from $40.00 to $100.00 per acre.

There is a dike along the river near the head of this ditch, but it was not ascertained how far down the river it extended.

Acequia Nueve de Atrisco

The heading of this ditch is on the west side of the Rio Grande, and about 100 yards farther up the river than the Acequia Vieja.

The diversion works consist of a wing dam made by driving poles in the river bed and placing sods, brush and mud thereabouts.

The data for the flow on September 16, 1910, measured near the head of the ditch is as follows: $\frac{9.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x.30 ft., equals 2.85 square feet, the sectional area, and the velocity being 1.2 feet per second gives a discharge of 3.42 cubic feet per second. The data for the maximum capacity when the ditch is cleaned are:

9.0 ft. plus 12.0 ft. x 2.0 ft., equals 21.0 square feet, the sectional area, and the mean velocity being 2.0 feet per second, gives a discharge of 42 cubic feet per second.

The area irrigated was estimated at 1,200 acres, and the area that might be irrigated at 400 acres.

A dike has been built at varying distances back from the river to prevent destructive inundations.

This ditch is not so old as the one lower down the valley.

The value of the land ranges from $40.00 to $100.00 per acre, and probably most of the land is worth about $50.00 per acre.

Acequia de Arenal

The heading of this ditch is on the west side of the Rio Grande, southwest of Old Albuquerque, and about one-fourth mile northwest of the heading of the Acequia Nueve de Atrisco.

The diversion works are temporary, but were not examined.

The ditch was examined on September 16, 1910, above any irrigation, and in a good section, and the flow on that date was estimated at one cubic foot per second. The data for the maximum capacity are as follows: $\frac{6.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 2.0 ft., equals 15.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a capacity of 30.0 cubic feet per second.

The area irrigated was estimated at 900 acres, and the extendible area at 250 acres.

The value of the land irrigated ranges from $40.00 to $100.00 per acre.

The date of construction was not learned.

Acequia de Atrisco

The heading of this ditch is on the east side of the Rio

Grande, almost due west of Old Albuquerque, and near the high sand cliffs on the west side of the river.

The diversion works are temporary, consisting of a mud and brush wing dam.

The ditch was examined on September 16, 1910, near the head, and it was flowing one cubic foot per second. The maximum capacity is found from the following data: $\frac{3.0 \text{ ft. plus } 4.5 \text{ ft.}}{2}$ x 1.5 ft., equals 5.62 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 11.25 cubic feet per second.

The area irrigated was estimated at 325 acres, and the additional area that might be irrigated at 150 acres.

The date of construction could not be learned.

The value of land ranges from $50.00 to $100.00 per acre.

Small Community

The proper name of this ditch was not learned. Its heading is on the west side of the Rio Grande, a short distance above that of the Acequia de Atrisco, and is in close to the sand hills which are blown in from the west and are being deposited in the valley floor.

These sand hills extend from Atrisco to La Joya, not continuously but in patches.

The diversion works are temporary. On the day of examination, September 16, 1910, it consisted of a long ditch excavated for over one-fourth of a mile, extending up the river bed, close under the high sand bluff which is on the west side, to the channel carrying the water. A great part of this was made by a shovel.

The ditch was examined on September 16, 1910, and was

flowing about one cubic foot per second. The data for the maximum capacity are as follows: $\frac{3.0 \text{ ft. plus } 4.5 \text{ ft.}}{2}$ x 1.5 ft., equals 5.62 square feet, the sectional area, and the velocity being 2.0 feet per second, makes a discharge of 11.25 cubic feet per second.

The area irrigated was estimated at 335 acres, and the additional area that might be irrigated at 150 acres.

The value of the land is from $40.00 to $100.00 per acre. The date of construction is not known. Information given by an elderly resident concerning the ditches at Atrisco, did not include this one. It is probable that it is not very old, but such is not an assured fact.

....

GENERAL DESCRIPTION

of

THE RIO GRANDE VALLEY

from

THE PUEBLO OF SAN FELIPE, N.M.

to

ALBUQUERQUE, N.M.

and

INFORMATION CONCERNING THE DITCHES FOUND THEREIN.

....

GENERAL DESCRIPTION

The Rio Grande valley from the Pueblo of San Felipe to Albuquerque is 27 miles long, and varies in width from one-fourth to three and one-fourth miles, the widest portion being about three miles north of Albuquerque.

The eastern boundary of this part of the Rio Grande valley is a gravel mesa. Eastward about ten or fifteen miles from the northern part are the Placer Mountains, and eastward about ten miles from the southern part are the high Sandia Mountains. The western boundary at the northern end is a high lava mesa. This extends from the Pueblo of San Felipe to a place less than a mile south of the Jemez River. Only one small tract of ground near the Pueblo of San Felipe is irrigated on the west side of the river. From the south end of the lava mesa to the south end of the tract under consideration, the west boundary is the great earthen mesa lying between the Rio Grande and the Rio Puerco. This breaks off on the east side in most places as a true mesa formation. In some places there is considerable sand near the valley, caused by the winds blowing over this great mesa and carrying the sand along until it is brought to the east edge, where the velocity is not so great, and owing to the sheltered conditions the sand is deposited. The sand is not seriously encroaching on the valley. A great amount must blow into the river west of Albuquerque.

The area under consideration ranges in altitude from 4,950 at Albuquerque, to 5,100 at the Pueblo of San Felipe.

The soil is very good, varying from the clay deposited from the Rio Grande as silt, to very sandy, which was either caused by sand being blown from the old or present bed of the Rio Grande or from the sand being deposited from the arroyos which debauch

on the valley floor. From irrigation and the cleaning of the ditches some soil has resulted. This, in amount, is not so very great. The amount of gravelly soil from the arroyos is very small and is hardly worthy of consideration.

The annual precipitation is about 8 inches. The summer rains, which extend from about July 1 to October 1, give a precipitation of about 2.5 inches.

The water supply for irrigation has in the past been practically perennial as far down the river as Albuquerque, but it is likely that, with the additional diversions above, such will not be the case in the future. Contemplated diversions totaling about 400 feet from Red River and the Rio Grande will seriously affect this perennial supply.

The crops are mainly alfalfa, corn, wheat, melons, chili, fruits and truck. Great quantities of wine are produced near Bernalillo and Albuquerque. The Indian Pueblos raise corn for the most part. The markets are mostly local.

For the most economical maintenance and operation of irrigation in this part of the valley, a permanent weir should be built about one-half mile below the Pueblo of San Felipe, and a main canal located on the east side of the valley from here to Albuquerque, where a drop with a fall of 75 feet could be constructed and power developed. The small ditch on the west side of the river for the Pueblo of San Felipe could also secure permanent diversion works if this weir were built. It might be possible to cheaply flume water across to the settlements near Corrales. This was not investigated. Such a ditch would permit the abandonment of the headings

of ten ditches and the discontinuance of about twenty-five miles of ditch, as most ditches do not irrigate any land for a distance of 2.5 miles from the heading.

The history of the area under consideration is interesting. Coronado found twelve or fifteen pueblos in the vicinity of the present town of Bernalillo and he wintered there. This was the most populous district at that time.

In 1681, when a futile attempt was made to reconquer New Mexico, there were pueblos at Alameda and Sandia, which were abandoned by the inhabitants on the arrival of the expedition. Corn was found in these pueblos, and it was burned. There was a pueblo at San Felipe.

It is quite probable that the present ditches are for the most part practically the same ditches that were constructed by Pueblo Indians previous to the conquest.

In connection with a description of the country along the Rio Grande, as seen by an American expedition from Santa Fe to Peralta in 1846, the Rio Grande is mentioned as being a clear stream near the Pueblo of San Felipe. At that time Algodones was the largest town on the Rio Grande in New Mexico.

The total area under consideration is about 18,000 acres, of which amount 7,800 acres are irrigated and the remainder, 10,200 acres, are not irrigated. Thirteen ditches with a combined capacity of 384.0 cubic feet per second, furnish water for these lands.

The present area irrigated is greater than in 1896, using the report of Mr. W. W. Follett to the Department of State as one source of information, and the report of Mr. Phillip E. Harroun in Bulletin 140, U.S. Geological Survey, the data being collected

in 1895.

Mr. Follett gives 226 cubic feet per second as the combined capacity of the ditches, and 5,670 as the acreage irrigated. There has therefore been an increase of 158 cubic feet per second in the capacity and an increase of 2,130 acres in irrigated area.

Following this general description, there is a description of each ditch, beginning with the one farthest south in the area under consideration.

Acequia Albuquerque

The heading of this ditch is on the east side of the Rio Grande about 2-1/4 miles north of Old Albuquerque.

The diversion works are temporary.

This ditch was examined September 16, 1910, at the head of irrigation. There was water in the ditch. The data for the discharge are $\frac{5 \text{ ft. plus } 6.5 \text{ ft.}}{2}$ x 1.5 ft., equals 8.625 square feet, the sectional area, and the mean velocity being 1.5 feet per second, gives a discharge of 12.93 cubic feet per second. The data for the maximum capacity are $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 2.0 ft. equals 12. square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 24.0 cubic feet per second. This is more than Mr. W. W. Follett gives in his report and more than Mr. P. E. Harroun gives in his. The following is copied from Mr. Harroun's report: "Its length is 4.3 miles, of which 3.7 miles are in service. One half mile below the head it crosses under the Duranes ditch, passes to the east and through between Albuquerque and Old Town, tailing Duranes. Its flow is about 16 cubic feet per second. At the time visited, in August 1895, its width was 12 feet, area 7.8 square feet, mean depth 0.65, mean velocity 1.38 feet, and the maximum sectional velocity 1.54 feet per second, and its discharge 10.8 cubic feet per second". It is very likely that the ditch has been enlarged since 1895.

The acreage irrigated in 1910 was estimated as being 700 acres, and the extendible area 650 acres. A dike along the river protects the lands from floods. The value of the lands ranges from $50.00 to $150.00 per acre as farming property. The nearness to the city of Albuquerque affords a convenient market.

The date of construction could not be learned from the

inquiries made in the immediate vicinity, but it must be very old. Mr. W. W. Follett, Engineer U. S. Water Boundary Commission, gives it as 1706.

Acequia Duranes

This ditch heads on the east side of the Rio Grande about 2 1/2 miles north of Old Albuquerque.

The diversion works are temporary.

This was examined September 10, 1910, and measured less than one-half mile from the heading. The following are the data for the flow on that day: $\frac{6.0 \text{ ft. plus } 7.5 \text{ ft.}}{2}$ x 1.0 ft., equals 6.75 square feet, the sectional area, and the velocity being 1.2 feet per second, gives a discharge of 8.10 cubic feet per second. The maximum capacity would be from the following data: $\frac{6.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 2.0 feet, equals 15.0 square feet, the sectional area, and the mean velocity being 2.0 feet per second, gives a discharge of 30.0 cubic feet per second. The following is copied from data secured by Mr. P. E. Harroun in 1895: "The Duranes ditch heads about three miles above Old Albuquerque, passes below the town and tails about one mile further down. Its total length is four miles; its service 3.5. It has the common brush diverting dam and carried about 11 cubic feet per second, when at its full capacity. At a point 300 feet below the head its width was 11 feet, area 8 square feet, mean depth 0.73, mean velocity 0.93 foot, and the maximum sectional velocity 1.01 feet per second, and the discharge is 7.6 cubic feet per second." It will be noticed that the data secured in 1910 gives a greater maximum capacity than that in 1895.

The irrigated area was estimated at 600 acres and the extendible area at 650 acres. A dike protects the land from the

high water in the river.

The value of the land probably ranges from $50.00 to $150.00 per acre, considering the tillable land alone and its being near the good market at Albuquerque.

Mr. W. W. Follett reports this ditch to be constructed in 1706.

Acequia Barrella

The heading of this ditch is on the east side of the Rio Grande about 2 miles below the steel wagon bridge which is below the town of Corrales.

The diversion works are temporary, but were not examined except from the west side of the river.

The ditch was measured September 16, 1910, at a representative section in the bosque and before it had reached any of the irrigable lands. The data for the flow on that day are: $\frac{7.0 \text{ ft. plus } 8.5 \text{ ft.}}{2}$ x 0.5 ft., equals 3.9 square feet, the sectional area, and the mean velocity being 1.2 feet per second, gives a discharge of 4.68 cubic feet per second. The data for the maximum capacity are $\frac{7.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 2.0 feet, equals 17.0 square feet, and the mean velocity being 2 feet per second, gives a discharge of 34.0 cubic feet per second.

The following is copied from the data secured by Mr.P.E. Harroun in August 1895: "It was being cleared of silt, deepened and carried up the river to where a brush dam was to be constructed. Upon completion this ditch will carry 20 cubic feet per second. Its length is 4.5 miles, taking out a short distance above the town of Albuquerque. Service is first required one mile below the head." It is evident that this ditch must have had its capacity increased

subsequent to the time mentioned by Mr. Harroun. There is conclusive evidence that the cross section as given for the maximum is correct, and as the velocity for a small amount of water was 1.2, it is doubtful if a velocity of 2.0 feet per second is too much.

The irrigated area was estimated as being 650 acres and the extendible area 650 acres. A dike along the river protects these lands from the annual high water in the spring.

The value of lands under this ditch were estimated at $40.00 to $100.00 per acre.

Constructed before 1800.

Acequia Los Griegos

The heading of this ditch is about one and one half miles south of the steel bridge which is below the town of Corrales.

The ditch and diversion works were examined on September 16, 1910, and the diversion works were of singular construction.

On the day of examination the main channel of the river was on the west side of the river bed at the site of the steel bridge. About one-quarter of a mile below this bridge a temporary wing dam was made by driving into the river bed posts and poles, and weaving brush about and between them, and then throwing sods and mud against this brush work. This was made in an effort to divert the river to a channel on the eastern side of the river bed, but it was not operating successfully at the time of examination, but seemed to have done so earlier in the season when the river was higher and before any small channel had been eroded. The water was going around the west end of this diversion dam. The angle was about 60 degrees with the bed of the stream. About one half of a mile or more down the river there was a second diversion dam which was built for a similar purpose, and was in a similar condition as the one described

above. The river was, however, at the time of examination, near the east bank of the river bed at the heading of the ditch, and a wing dam of post, brush and mud diverted the water into the ditch. The river, when carrying any amount of water approximating 200 cubic feet per second, changes its channel in the bed of the river continually. At times this change is very rapid and again quite slow. The methods pursued in order to get water into this ditch illustrates but one of the many methods of diverting the waters into ditches. Other methods are spoken of in connection with other ditches.

The flow of this ditch was measured on September 16, 1910, at a representative section above the head of irrigation and west of the dike built for protection against floods. The following are the data: $\frac{4.0 \text{ ft. plus } 5.0 \text{ ft.}}{2}$ x .50 ft., equals 2.25 square feet, and the velocity being 1.2 feet per second, gives a discharge of 2.70 cubic feet per second. The data for the maximum capacity are $\frac{4.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 2.0 ft., equals 11.0 square feet, sectional acre, and the mean velocity being 2.0 feet per second, gives a discharge of 22 cubic feet per second. The following is copied from the data of P. E. Harroun, secured in 1895: "At a point 1-1/2 miles below the head where service is first required it has a surface width of 9 feet, sectional area 12.3 square feet, mean depth 1.37 feet, mean velocity 1.73 feet, and the maximum sectional velocity 1.84 feet per second, while its discharge is 21.3 cubic feet per second. Its total length is 6.6 miles. It passes through the town of Albuquerque and discharges through the flats below to the river." It seems that the capacity of this ditch in 1895 was the same as now.

The irrigated area was estimated at 550 acres and the extendible area at 1300 acres.

The value of irrigated lands probably ranges from $40.00 to $100.00 per acre. Constructed before 1800.

Acequia Los Ranchos

The heading of this ditch is about one-fourth of a mile northeast of the wooden bridge to Corrales and about one and one-half miles north of the plaza of Alameda. According to the information furnished by an Indian, the south boundary of the Sandia Pueblo grant is near the heading of this ditch.

The diversion works are a cut in the river bank with nothing else. At about one-quarter mile below the head is a big regulating gate which regulates the supply when the river is high.

The ditch and diversion works were examined September 17, 1910, and the following are the data for the flow on that day: $\frac{10.0 \text{ ft. plus } 11.0 \text{ ft.}}{2}$ x .90 ft. equals 9.45 square feet, the sectional area, and the velocity being 1.2 feet per second, gives a discharge of 11.34 cubic feet per second. The maximum capacity has a discharge according to the following data: $\frac{10.0 \text{ ft. plus } 12 \text{ ft.}}{2}$ x 2.0 ft equals 22 square feet, and the mean velocity being 2.0 feet per second, gives a discharge of 44 cubic feet per second. This data was all obtained from a representative section about 150 feet above the regulating gate mentioned above.

The following is from the report of Mr. P. E. Harroun: "Where the section becomes fairly constant its surface width is 12 feet, sectional area 11.4 square feet, mean depth 0.95 foot, mean velocity 1.98, and maximum sectional velocity 2.11 feet per second and a discharge of 21.6 cubic feet per second. From the

head the ditch is carried a distance of 4.6 miles where it bifurcates, one branch being carried towards the foothills and through the upper portion of the town of Albuquerque, while the other branch turns to the west and discharges into the Barella ditch, after passing under Los Gregos ditch. Its total length, including branches, is 13 miles, of which about 10 miles are in service."

The area under irrigation was estimated at 1300 acres and the extendible area 3000 acres. There is a considerable part of the non-irrigable area that is sandy, caused by windblown sand from the river and there is also considerable land under this ditch that has been irrigated and proper drainage was not provided, and it is now so alkaline that salt grass pastures are the result.

I was informed that the irrigation season extends from March to November, but it is probable that during March and October the extent of irrigation is not great.

The value of land is from $20.00 per acre to $100.00 per acre. Some tracts are in fruit and vineyards and might be more valuable than $100.00.

A dike along the river protects the lands from inundation from high water.

The date of construction was not learned, but is a very old ditch.

Acequia Alameda

The heading of this ditch is about one mile northeast of the heading of Los Ranchos ditch. According to information furnished by a member of the Pueblo of Sandia, the south boundary of

the Pueblo of Sandia Grant is close to the heading of this ditch.

The diversion works on the day of examination were a brush and mud wing dam formed in the usual manner of this section, by driving posts into the river bed and entwining brush.

The ditch heading and ditch were examined September 17, 1910, and there was a small amount of water in the ditch according to the following data: $\frac{5.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x .30 ft., equals 1.65 square feet, the sectional area, and the velocity being .75 foot per second, gives a discharge of 1.24 cubic feet per second. The data for the maximum capacity when the ditch is cleaned are $\frac{6.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 1.8 ft., equals 13.5 feet, and the velocity being 1.5 feet, which is low, gives a discharge of 20.25 cubic feet per second.

The following is extracted from the data secured by P.E. Harroun in 1895: "Its surface width is 13 feet, sectional area 16.1 square feet, mean depth 1.24 feet, mean velocity 1.52 feet, and maximum sectional velocity 1.86 feet per second, and the discharge is 24.5 cubic feet per second. Irrigation under this ditch first begins one-half mile below the head, and is carried nearly continuously to the tail, a distance of 4.3 miles, where it is turned loose upon the land, much of its waters forming swamps, and finally finding its way into Los Ranchos ditch." It is probable that this ditch has been allowed to decrease in capacity.

The irrigated area was estimated at 400 acres and the extendible area at 1450 acres. The area under this ditch is near the mesa and at the upper end of the Albuquerque flat. The heading is very neae to where the river runs farthest east bwtween Bernalillo and Albuquerque and close to where its western trend is

begun.

The value of lands under this ditch will range from $20.00 to $100.00 per acre.

The date of construction was not learned, but as there was a pueblo there in 1681, and as corn was found there, it is likely that either the Alameda or Los Ranchos ditches were in operation at that time, but as Coronado mentioned 12 or 15 pueblos in the vicinity of Bernalillo in 1540, it is believed that Alameda may have been one of them. It is hardly probable that this or Los Ranchos ditch has been maintained uninterrupted during the time subsequent, but the locations of these are probably, for the most part, close to where they formerly were.

Acequia Madre de Corrales

The heading of this ditch is on the west side of the Rio Grande about four miles south of Bernalillo, and irrigates lands in the vicinity of Corrales.

The diversion works were temporary.

The ditch was examined and current meter observations were made near the head of the ditch on September 15, and observations of the lower end of the irrigable area were made September 16, 1910. The following is the cross section at the place of measurement:

$$\frac{0.0}{0.0} - \frac{3.0}{2.0} - \frac{3.0}{7.5} - \frac{2.5}{13.7} - \frac{0.0}{15.0}$$

The velocities .6 depth are $\frac{0.0}{0.0}$ $\frac{1.80}{2.0}$ $\frac{1.92}{7.5}$ $\frac{1.60}{13.7}$ $\frac{0.0}{15.0}$

The total discharge is 64.0 cubic feet per second. The average velocity is 1.70 feet per second.

There are about 1400 acres of irrigable land in the west side of the river that are under the Corrales ditch or could be brought under by an extension of it, if dikes were constructed

similar to the one on the east side of the river. There are about 600 acres irrigated according to the best estimate possible, and there would be about 800 acres that might be irrigated.

The value of irrigated land is from $40.00 to $100.00 per acre.

The ditch is old.

Acequia Montoyo

The heading of this ditch is on the west side of the Rio Grande about two miles below Bernalillo.

There were no diversion works on the day of examination, September 15. A temporary diversion dam had been made in May, but a flood came down the river and washed it away and no other had been built. The head of the ditch was in a cut bank, and was about two feet above the river bed. There was but very little irrigation this year and that before May.

The following are the data for the maximum capacity: $\frac{1.0 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 1.0 ft., equals 2.0 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 3 cubic feet per second.

The ditch not being provided with a diversion dam shows that the people are not good farmers. Of course there are but few of them and it often takes just as much labor to put in a temporary wing dam for a small ditch as it would for a large one.

The irrigated area was estimated at 100 acres and the area that might be irrigated at 100 acres.

The next ditch above this on the west side of the river is at the Pueblo of San Felipe. Nearly all the irrigable lands in the upper Albuquerque valley are on the east side of the river.

The river is probably to a great extent kept on the west side of the valley by the greater deposits of silt, sand and gravel from rivers and arroyos on the east than on the west side.

The value of the irrigated area is probably from $20.00 to $40.00 per acre.

No information was obtained as to the age of the ditch.

Acequia Sandia

The heading of this ditch is on the east side of the Rio Grande, west of Bernalillo and at the wagon bridge.

The diversion works were on the day of examination, September 17, 1910, a ditch running from the proper head of the ditch, through a sand bar to the channel which was carrying the water on the west side of the river. This ditch across the sand bar was run at an angle of about 30 degrees from the bank. This was quite serviceable but the ditch was not carrying its full capacity, but probably as much as was needed for irrigation at that time.

The data for the discharge on September 17 and also for the maximum discharge were secured at a representative section about 1,000 feet below the head of the ditch. For the discharge on September 17, 1910, $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x .50 ft., equals 3.0 square feet, the sectional area, and the velocity being .75 feet per second, gives a discharge of 2.25 cubic feet per second. This maximum capacity data/are, $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 2.0 ft., equals 18.0 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 36.0 cubic feet per second.

The following is extracted from a report by Mr. P. E. Harroun in 1895: "Owing to the low state of the river, the ditch was carrying at the time a gaging of but 7.4 cubic feet per sec-

ond, with a surface width of 10.3 feet, area 4.1 square feet, mean depth .39 foot, mean velocity 1.80, and the maximum sectional velocity 2.14 feet per second. Its discharge when full is in the neighborhood of 18 cubic feet per second". It appears that the ditch now has a greater capacity than in 1895.

The irrigated area was estimated at 1,000 acres, of which a considerable portion was in native hay. There are in addition about 1400 acres under this ditch that might be irrigated, but are not. A considerable portion is in bosque and has a great amount of large cottonwood trees which are quite valuable for fuel. The lands under this ditch are all in the Pueblo of Sandia Grant, and are among the very best in the Rio Grande valley.

The date of construction is not known. The pueblo of Sandia is known to have been supplied by this ditch since 1693 and it is probable that its construction antedates Coronado's arrival in 1540, as he found several pueblos in this vicinity.

Acequia Bernalillo

This ditch has its heading on the east side of the Rio Grande nearly west of the plaza of Algodones. It irrigates lands mostly in the vicinity of Bernalillo and is about six miles in length.

The diversion works are temporary, being of stakes and brush.

The ditch was examined September 19, 1910. The cross section is quite variable for a ditch in the floor of the Rio Grande valley. At the arroyo at Costura the bottom width is 4 feet and the velocity 1.75 feet per second. The method of crossing this arroyo is unique for a community ditch. The ditch is carried under the arroyo in a 4' x 4' wooden culvert and the top of the culvert is flush with the bottom of the arroyos. The bottom of the arroyo

had evidently been graded, and is comparatively narrow. There are embankments on either side about six feet high and with slopes which are probably 1 to 1, and on the inside faced with concrete which had been mixed rather dry and thrown upon the embankments and then tamped with a shovel or some other broad tool. There were evidently no forms used and the job was a good one and seemed to answer the purpose very well.

The cross section of the ditch near the upper end was wider and the velocity was not so great.

The following are the data of flow on the day of examination, September 20, 1910, $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.2 ft., equals 7.2 square feet, the sectional area, and the velocity being 1.3 feet per second, gives a discharge of 9.36 feet per second. The data for the maximum capacity are $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 1.5 ft., equals 10.5 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 15.75 cubic feet per second.

The capacity of the ditch is greater at Bernalillo than at its head. It receives surplus water from both the Santa Ana ditch and the Algodones ditch. The following is an approximate maximum capacity taken at the bridge east of the Post Office at Bernalillo, $\frac{10.0 \text{ ft. plus } 14.00}{2}$ x 1.8 ft., equals 21.6 square feet, the sectional area, with a velocity of about 1.2 feet per second, gives 25.92 cubic feet per second as the discharge. This estimate is made from memory, but as we were camped at this place for over a day, the errors are not very great.

The following is extracted, for the sake of comparison, from a report of Mr. P. E. Harroun made in 1895: "This is one

of the largest ditches in this section, having immediately above its point of service***** the upper edge of the town of Bernalillo ****** a width of 15 feet, area 19.5 square feet, mean depth 1.30 feet, mean velocity 1.28 feet, maximum sectional velocity 1.58 feet per second and a discharge of 25.1 cubic feet per second."

The area irrigated under the ditch is about 800 acres and there are about 400 more that might be irrigated. The northern limit of swamp lands, caused by excessive irrigation and inadequate drainage, is near Bernalillo. The wine made at Bernalillo is of more than local fame in New Mexico. The grapes are pressed by tramping. No modern methods are used in the manufacture.

The value of the land is from $40.00 to $100.00, as a rule, but some pieces may go higher than this.

The date of construction is probably ancient. Coronado found the main pueblo in the Rio Grande valley at Bernalillo, and it is possible that a portion of the present ditch is older than 1540.

Acequia de los Ranchitos del Pueblo de Santa Ana

The heading of this ditch is on the east side of the Rio Grande about one mile south of the Pueblo of San Felipe.

There are no diversion works. The ditch is constructed to the river bank and the current being at the opening, water is diverted without any diversion works.

The following are the data obtained September 19, for the discharge: $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.0 ft., equals 6 square feet, the sectional area, and the velocity of the section being 1.2 feet per second, gives a discharge of 7.2 cubic feet per second. The maximum capacity, when the ditch is cleaned, is according to the

following data: $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 1.5 ft., equals 10.5 square feet, the sectional area, and the velocity being 1.75 feet per second, gives a discharge of 18.37 cubic feet per second. The surplus waters from this ditch empty into the Bernalillo ditch. The gaging was made near the head at a representative section.

The following is extracted from published data secured by Mr. P. E. Harroun in 1895: "At a point 300 feet below the head it has a surface width of 8 feet, sectional area 7.8 square feet, mean depth 0.98 foot, mean velocity 2.69 feet, maximum sectional velocity 2.90 and a discharge of 21 cubic feet per second. Although this section was in light sand, there was no scour nor was there any deposit of silt. At a distance of three miles below the head and immediately above the point from which water is first drawn for irrigation, the ditch was found to have a width of 7 feet, sectional area 8 square feet, mean depth 1.14 feet, mean velocity 1.64 feet and a discharge of 13.1 cubic feet per second. At this point there was found a deposit of silt where the sectional velocity fell below 1.80 feet per second. The total length of this ditch is 8.4 miles."

This ditch crosses under the arroyo at Costura in a wooden culvert similarly to the Bernalillo ditch.

The irrigated area was estimated at 600 acres. The area over which irrigation might be extended is quite limited. Diking the river might make the extendible area as great as 300 acres. The general conditions of farming were good.

The date of construction was not learned, but it is probably one of the prehistoric ditches. This ditch is used by the Indians of the Pueblo of Santa Ana. This pueblo is on the north bank of the Rio Jemez about 15 miles as the road is located, from

the ranchitos. Each year these Indians raise their crops on their ranchitos and haul them to their pueblo over one of the most sandy roads ever seen by the writer, and use them while they remain in their pueblo over winter. The reason assigned for this semi-annual migration is, that at the pueblo of Santa Ana there is a church for the Indians. It is also probable that their secret pagan ceremonies can be more easily observed there. The sentimental associations of the pueblo are incomprehensible to a white person.

Acequia del Pueblo de San Felipe - West Side

The heading of this ditch is on the west side of the Rio Grande about one-half mile south of the Pueblo of San Felipe.

This irrigates but a small amount of land and from the testimony of the Indians, this will probably be abandoned next year because of the difficulties in maintaining the diversion works. The Government some time in the past put in a weir for this ditch, but four years ago a portion on the east end was washed away, and this damage and subsequent damages have never been repaired. This weir was evidently two parallel rows of 6 x 6" timbers dirven into the sand about 6 feet apart and reinforced by lateral and longitudinal bracing. It is probable that lava rock had been put in between the rows of timbers, but these probably sank into the sand, and others were not brought to take their place, and the dam not being supported by any weight, was washed out. This weir was ~~not~~ designed to raise the water about two feet higher than the present bed of the river. It is quite probable if this weir had been properly taken care of, it would not have been destroyed.

The heading of this ditch had been repaired the day before examination, August 20, 1910. The ditch was constructed up to the

old weir. A number of the 6 x 6" timbers had been cut out close to the west end so as to make an opening for the entrance of the water into the ditch. There was some brush and rock just below the weir which served as a spillway for the surplus water into the ditch.

The following are the data for the discharge on August 20, 1910:

Cross section	$\frac{0.0}{0.0}$ -	$\frac{0.9}{1.5}$ -	$\frac{0.9}{3.0}$ -	$\frac{0.9}{6.0}$ -	$\frac{0.7}{7.0}$ -	$\frac{00}{00}$
Revolutions of meter / Time per second	0.0 / 00	7 / 62	7 / 62	8 / 62	$4\frac{1}{2}$ / 60	00 / 00
Velocity per second	0.0	.286	.286	.335	.166	00

Total discharge 1.47 cubic feet per second.

The maximum capacity is according to the following data: $\frac{6.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 1.5 ft., equals 11.25 square feet, and the velocity would be about .75 foot per second, making a discharge of 8.44 cubic feet per second.

The area irrigated was estimated at 100 acres and the additional area that might be irrigated at 100 acres.

No information as to the date of construction could be obtained except that it was old.

Acequia Algodones

The heading of this ditch is on the east side of the Rio Grande about one-quarter mile below the pueblo of San Felipe.

This irrigates lands in the vicinity of Algodones and wastes into the Bernalillo ditch.

The diversion works on the day of examination, August 20, 1910, were a wing dam over 1,000 feet long and built upstream with an angle of about 30 degrees to the east bank. This dam was the

common one of poles driven into the sand, and brush and sod placed over these poles. A comparatively small amount of water can spill over it without seriously injuring it. Such a dam will stand much more water spilling over, where the river bed is gravel. This dam is above the lower ditch for the Pueblo of San Felipe and above the weir mentioned in connection with that ditch.

This ditch was examined for flow on September 19, 1910. The section secured was very representative and at a point about one-half mile below the heading. The following are the data: $\frac{5 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.0 ft., equals 6 square feet, and the velocity being 1.3 feet per second, gives a discharge of 7.8 cubic feet per second. The maximum capacity of the ditch when cleaned is $\frac{6.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 2.0 ft., equals 14.0 square feet, the sectional area, and the velocity being 1.7 makes a discharge of 23.8 cubic feet per second.

The following is copied from published data secured by Mr. P. E. Harroun in 1895: "After leaving the head, the ditch is carried a distance of three miles along the bottom lands to the town of Algodones, where the water is first used for irrigation. Its total length is 4.8 miles, only the lower 1.8 miles of ditch being available for irrigation ******* The Algodones ditch as gaged 600 feet below the head, carries 9.9 cubic feet per second. Its sectional area is 7.8 square feet, mean depth 0.82 foot, mean velocity 1.27 feet, maximum sectional velocity 1.44 feet, and its surface width 9.5 feet at full capacity."

The area irrigated was estimated at 400 acres and the additional acreage under the ditch also at 400 acres.

The principal crop is alfalfa, and good crops are raised.

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GENERAL DESCRIPTION

of

THE RIO GRANDE VALLEY

from

W H I T E R O C K C A N Y O N

to the

P U E B L O O F S A N F E L I P E

.....

The Rio Grande valley from White Rock Canyon to the Pueblo of San Felipe is about fourteen miles long and attains a maximum width of two miles at Pena Blanca.

West of this valley are the Jemez mountains. To the east at varying distances is the Cieneguilla mesa. The Gallisteo River entering the valley from the east, has the Cerros and Placer mountains to the north and south of this stream, respectively. The valley floor is, for the most part, immediately surrounded by comparatively high earthen mesas.

The altitude ranges from 5,200 at the Pueblo of San Felipe to 5,272 at White Rock Canyon. There are no meteorological records in this valley, but taking the nearest records,and taking into consideration the testimony given about rainfall, it is very probable that the annual precipitation approximates 10 inches and that the precipitation during the summer rains is approximately four inches.

The greater part of this area was probably, from time to time, irrigated by the Pueblo Indians, before the conquest by the Spaniards. After the conquest in 1693, the Indians of the Pueblo of Cochiti were moved from their home in the hills down to the present location of their pueblo. They irrigate on both sides of the river. The Indians of the Pueblos of Santo Domingo and San Felipe occupy sites close to those occupied before the advent of Coronado and irrigate on both sides of the river. The Mexican settlements at Pena Blanca are old.

The soil is good, being mostly a sandy loam. There is much less clay in this valley than in the valleys farther down. Below the mouth of the Gallisteo there is more than above. Great quantities of clay are brought down by this intermittent river, but

the soil, generally, is very good.

The principal crops are corn and alfalfa. The Indians raise most of the former and the Mexicans the most of the latter. Wheat, grapes, deciduous fruits, melons and truck are the other crops.

The main body of irrigable land is on the east side of the river, and is continuous from the north end to the south end. This is intercepted by the Santa Fe and Gallisteo rivers. There are three bodies of irrigable land on the west side of the river. The upper one is near the Pueblo of Cochiti. The one next below is at Sile, which is locally named Shile. Between these two is a sand cliff from 25 to 50 feet high on the west side of the river. The river is immediately adjacent to this cliff. The lowest body of irrigable land is west of the Pueblo of Santo Domingo and is farmed by the Indians of that Pueblo. There is some land above the Pueblo of San Felipe, on the west side of the river, but I was told there was no farming there.

The United States Geological Survey located and surveyed a dam site and a reservoir site above the Pueblo of San Felipe, and these are treated more fully under "Reservoirs".

The water supply for this valley has always been sufficient and perennial, and will probably continue so for some time to come.

It would be for the best interests of all concerned if a permanent weir were built at the lower end of White Rock Canyon and a ditch constructed on the west side to irrigate lands in the vicinity of the Pueblo of Cochiti, and another ditch constructed to irrigate all lands on the east side of the river. It would be

very feasible to extend this east ditch to Algodones and there erect a power plant, which could be operated all the time. Seven ditches were examined with a combined capacity of 130.10 cubic feet per second. The area irrigated was estimated at 4,500 acres, and the additional area that might be irrigated was estimated at 1,550 acres.

According to this estimate there has been an increase since 1896 in both the capacity of ditches and the acreage irrigated, as the report of Mr. W. W. Follett records ditches with a combined capacity of 85 cubic feet per second, and an irrigated area of 2,400 acres. The capacity of ditches has therefore been increased 45 cubic feet per second, and the irrigated area by 2,100 acres.

Acequia San Felipe

This ditch heads on the east side of the Rio Grande about a mile south from the Pueblo of Santo Domingo and on the Pueblo of Santo Domingo Grant.

The Indians of the Pueblo Santo Domingo and of the Pueblo of San Felipe are usually quarreling about the maintenance and operation of this ditch. The side of the question as presented by the Indians of San Felipe was heard, but the other side was not, so no conclusions will be drawn. Practically all the land that is irrigated is located on the grant of the Pueblo of San Felipe, but a small amount (probably not exceeding 15 acres) in the grant of the Pueblo of Santo Domingo receives its water from this ditch. Most of the irrigated lands are north of the Pueblo of San Felipe, but some are south.

Very good crops of corn are raised.

The diversion works are temporary and were not examined.

The ditch was examined on August 19 and September 19, and the gaging was made at the latter date, about three-quarters of a mile from the heading and a mile above irrigation on the grant to the Pueblo of San Felipe. This was made where the ditch is built on the side of a bluff and the river is directly below it. It probably could not be maintained if the Santa Fe Railroad had not dumped in a great amount of rock to prevent the river from eroding into their right-of-way. The data for the flow on the date of examination are as follows: $\frac{5 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.0 ft., equals 6.0 square feet, the sectional area, and the velocity being 1.3 ft. per second, makes a discharge of 7.8 cubic feet per second. The maximum capacity is according to the following data: 6.0 ft. plus

8.0 ft. / 2 x 2.0 ft., equals 14.0 square feet, the sectional area, and the velocity being 1.7 feet per second, gives a discharge of 23.8 cubic feet per second.

The irrigated area was estimated at 700 acres. A part of this at the lower end of the ditch is not successfully irrigated, because the water supply is not sufficient at times with the ditch at its present capacity. The additional area capable of irrigation is about 300 acres.

The date of construction is not known, but is probably ancient.

Acequia Santo Domingo, West Side

Neither the diversion works nor any part of this ditch were examined. The primary reason for this neglect was, that permission could not be gotten to examine the ditch and measure the water at the time when we wanted to do this, August 19, 1910. The Governor was in Santa Fe and his permission was necessary, and then the entire council was to go along and witness the gaging. This was more a waste of time than the importance of the information would justify. A general idea only was gained from information received from the Indians and from a distant view. The width of the ditch and depth of water are probably fairly accurate.

The heading is on the west side of the Rio Grande about two miles in a northwesterly direction from the Pueblo of Santo Domingo.

The diversion works are temporary.

The width of the ditch being 6 feet and the depth being 1.5 feet, and using the other ditches in the vicinity as criterions,

it is probable that the velocity would be about 1.5 foot per second, all of which would give a maximum capacity of 13.5 cubic feet per second.

From available maps and from the distant inspection given, an estimated of 300 acres is made for the irrigable area. The additional area that might be irrigated is probably 300 acres.

All lands under this ditch are owned and cultivated by the Indians of the Pueblo of Santo Domingo. All crops are transported across the river to the pueblo, where they are used.

Acequia Santo Domingo, East Side

The diversion works are temporary, it was learned from testimony, but they were not examined, and data for flow were secured on August 19 at a point one-half mile west of the church at Peña Blanca. This was above any irrigation. The cross section was

$$\frac{0.0}{0.0} - \frac{0.5}{1.5} - \frac{0.9}{2.3} - \frac{0.5}{5.0} - \frac{0.0}{6.5}$$

which equals an area of 3.01 square feet. The mean velocity was found to be 0.35 foot per second, which gives a flow of 1.05 cubic feet per second. The condition of the ditch was very poor for a reasonable discharge. The deposit of silt was very great. The ditch evidently had not been cleaned this summer. The maximum capacity when cleaned would be the result of the following: $\frac{6 \text{ ft. plus } 8 \text{ ft.}}{2}$ x 2.0 ft., equals 14.0 square feet, and the velocity being 1.2 foot per second, gives a discharge of 16.8 cubic feet per second.

This ditch crosses the Rio Gallisteo. Any water that comes down this river is caught in the ditch as it crosses in an open cut.

It is probable that the Peña Blanca ditch wastes into

this ditch, but no definite information was obtained.

The irrigated area is about 1,000 acres. The additional area that might be irrigated is 200 acres.

Corn and wheat are the principal crops. Some alfalfa is raised and three cuttings are made per annum.

The following is information furnished concerning the wing dam for this ditch, and the conditions are very similar for many others. When the river begins to fall in the spring, a low dam is put in. The flow of the river being great, the dam diverts a small percentage of it, but as the river falls the amount diverted by the wing dam is not great enough to fill the ditch, so additional height or additional length has to be constructed to get the same amount of water. This process has to be repeated three or four times before the river gets its general low summer flow. This requires considerable work and a great deal of it is done by wading about in the water. Sould a considerable rise come down the river in midsummer, the weir is likely to be seriously injured, and has to be repaired.

The age of the ditch is not known, but as the pueblo has been at the present location at least since 1598, it is very probable that the ditch is at least that old.

Acequia Shile

The heading of this ditch is on the west side of the Rio Grande about 2 1/2 miles north of Shile. The name of the ditch is spelled as locally pronounced, as it is believed that "Sile" does not correctly spell the name.

The diversion works are temporary, but were not examined.

The ditch was not examined as the river was too high for

fording in safety, and very reliable information was obtained from Mr. John Dixon of Cochiti. The ditch is about the size of the Cochiti ditch on the west side of the river, and therefore has a maximum capacity of 13.0 cubic feet per second. It probably irrigates 300 acres and there are probably 300 additional acres that might be irrigated.

No information could be obtained as to the date of construction. It was built by the Mexicans, and the owners of the lands under it are Mexicans.

Acequia Peña Blanca

This ditch has its heading on the east side of the Rio Grande about 100 feet north of the wagon bridge which is built across the river above the Pueblo of Cochiti, and below the tie plant in White Rock Canyon. The main body of irrigated land is in the vicinity of Peña Blanca, which is about three miles from the head of the ditch.

The diversion works are singular. Wickerwork cylinders, made of willows, three or four feet long and a foot and a half to two feet in diameter, and open at one end (and very probably open at both ends, were made. These cylinders were placed diagonally to the channel and were set upright and filled with gravel, as it was nearby in the bluffs. Brush was placed on the upper side of these and then gravel and sand, and a good diversion dam was made. It was only temporary, however.

The following are the data for flow on August 19, 1910, as measured at a section about 500 feet below the bridge.

Cross section	0.0 / 0.0	2.0 / 2.0	2.3 / 4.0	2.4 / 6.0	0.0 / 8.0
Revolutions of meter / Time in seconds	0.0 / 0.0	7.0 / 71	49 / 50	50 / 50	0.0 / 8.0
Velocity in feet per second	.00	.25	2.35	2.38	00

Mean velocity per second 1.48 ft.

Area of section 13.00 sq. ft.

Total discharge 19.33 cu. ft. per second.

The maximum capacity is about one foot higher than when gaged, and this would give an additional flow of about 17.5 cubic feet per second, and therefore the maximum capacity is about 37 cubic feet per second. The area irrigated is about 1,000 acres. The additional acreage that might be irrigated is about 200 acres.

It is very probable that this ditch wastes into the Santo Domingo ditch.

The summer floods from the Santa Fe River are a source of trouble to this and to the Cochiti ditch. These cross the river bed in an open cut and are destroyed every time there is a freshet in the river.

Irrigation begins in April and ceases in October. Fruit is not a sure crop because of late frosts. Smudging is not practiced.

Acequia Cochiti, East Side

The heading of this ditch is on the east side of the Rio Grande near the plant for loading ties. The ties are cut on Rio Santa Barbara, floated down Embudo Creek and then on down the Rio Grande to the lower end of White Rock Canyon, where they are taken from the river. From here, over a branch line, to the main line

of the Santa Fe, the ties are shipped to Albuquerque, where they are creosoted and are then ready for use.

The diversion works are temporary, being a long wing dam of brush and rocks. This dam was over a thousand feet long and ran upstream at an angle of about 30 degrees. The bed of the river along here has some rocks in it, but a very short distance below the bed is quicksand, in fact it is quicksand at the bridge. The handling of the ties is quite detrimental to the maintenance of this dam, as they bump against the dam and break it, and while they float on the surface, they influence the current considerably. The dam was unserviceable on the day of examination, August 19, 1910, but was to be repaired the following day.

The ditch, before emerging from the canyon, is located in a tunnel 777 feet long, through a cemented gravel ridge. The tunnel is above the wagon bridge and close to the mouth of the canyon.

There was no water in this ditch on the day of examination but it is approximately of the same size as the ditch for the Pueblo of Cochiti, which is on the west side of the river, and the discharge of that will be applied to this. The maximum capacity is therefore 13.0 cubic feet per second.

The area irrigated is about 700 acres and the additional acreage that might be irrigated is about 200 acres.

The date of construction is not known, but it is probably within the last few years.

Acequia Cochiti, West Side

The heading of this ditch is on the west side of the Rio Grande, about two miles north of the Cochiti wagon bridge and about

one mile north of the tie loading plant. This heading is in the White Rock Canyon, and follows along the side for about two miles. The entire length of the ditch is over four miles, and the main body of irrigated land is north of the Pueblo of Cochiti. This is the first ditch in the lower Rio Grande valley and is probably very old, as the Pueblo of Cochiti has occupied its present site since 1694, and it is very likely that they farmed that ground previously.

The diversion works are a temporary brush and rock wing dam, extending upstream at an angle of about 30 degrees to the bank. The bed of the river being rocky and gravelly here, such a dam can be maintained. This is so built that considerable water can spill over the top of it without any great damage.

This ditch was examined and a gaging made on August 19, 1910, at a section about one-half mile north of Cochiti wagon bridge. The following are the data obtained:

The cross section	$\frac{0.0}{0.0}$ -	$\frac{1.2}{2.0}$ -	$\frac{1.2}{4.5}$ -	$\frac{1.0}{7.0}$ -	$\frac{0.0}{9.5}$
Revolutions of meter / Time in Seconds	$\frac{00}{00}$	$\frac{14}{60}$	$\frac{12}{64}$	$\frac{12}{62}$	$\frac{00}{00}$
Velocity in feet per second	00	.58	.49	.50	00

The total flow was 3.62 cubic feet per second and the sectional area was 8.20 square feet and the mean velocity .44 foot per second.

The maximum capacity is one foot deeper than this, and would give a discharge of about 9.5 cubic feet per second in addition. The maximum capacity is therefore about 13.0 cubic feet per second.

The area irrigated is about 300 acres and the extendible area is not over 50 acres.

Considerable work for the protection of the irrigable

land from erosion has been done, but more is needed. The Pueblo of Cochiti has a very progressive member in Mr. John Dixon, a graduate of Carlisle Indian School, who has many good ideas for the improvement of conditions.

The following information concerning crops was secured: Three good crops of alfalfa are secured; each crop is irrigated usually three times, but sometimes four times. Corn and wheat are irrigated six or seven times. Irrigation begins about March 1st in dry years. There is very little fruit raised by the Pueblo of Cochiti, and what is raised is of seedling stock. The summer rains are so variable that no reliance is placed upon them to supplement irrigation.

ESPANOLA VALLEY

This is the cradle of Spanish rule in New Mexico. The first settlers coming up from Mexico in 1589, established themselves at Chamita, and on December 15, 1598, dedicated their church with great pomp and ceremony. A few years later this settlement was abandoned and during 1600 or 1607 a new settlement was started at Santa Cruz and has endured to this day, except during the period from 1680 to 1693 which was the time of the Spanish evacuation, when it was occupied by the Indians. Three Indian pueblos remain in the valley close to where they were found by the Spaniards. The inhabitants have now become considerably mixed with the Mexicans.

The valley is about 25 miles long and lies in a north and south direction. The Embudo Canyon is to the north and the White Rock Canyon to the south. On the east are a series of bad lands or low clay mesas very much eroded. The high mountains of the Sangre de Cristo are still farther east. On the west is the Black Mesa occupying the upper part, while the Pajarito Mesa covers the lower portion. The altitude probably ranges from near 5400 to 5650 feet elevation above sea level. The climate is considerably colder than in the Albuquerque valley, snow falling to a considerable extent during the winter. The annual precipitation however is not high, being between 10 and 11 inches, these being the data for precipitation at Embudo and Espanola.

A considerable amount of water is added to the Rio Grande by streams in the Espanola valley. Santa Clara Creek and the Rio Chama enter on the west, the latter being practically a perennial stream. On the east Pojuaque Creek and the Rio Santa Cruz make great contributions. Neither of these are perennial but would be

if the waters were not used for irrigation. During the spring while the snow is melting on the high mountains, the contribution of water from all streams and arroyos is very great.

Acequia Los Ranchos

The heading of this ditch is on the west side of the river, 5 miles south of Espanola and 2 miles north of the station of San Ildefonso.

This was examined on June 1, 1910. The following data were obtained for computing the discharge: 5.0 ft. plus 7.0 ft. x 1.2 equal 7.2 square feet, and the velocity being 1.2 feet per second, makes a discharge of 8.64 cubic feet per second. The fall is 0.6 per 100 feet.

The area irrigated was not estimated on the day of examination, but by segregation it must be about 220 acres.

Hobert Ditch

The heading of this ditch is about 1 mile north of San Ildefonso Butte, or Black Mesa as called by some. The ditch was not in operation as the river had been cutting where the headgates were located. The river is changing some and not cutting so much on the east side and it may be possible to reestablish this heading. This was designed to irrigate the Hobert ranch and later the Indians of the Pueblo of San Ildefonso received water from it. About 1000 acres of land could be irrigated under this ditch. There is a new Hobert ditch which has neither diversion works nor headgates. The water flows in this about 1/2 of a mile and is then raised by a pump for about 5 feet to irrigate 50 acres of orchard land. The new Hobert ditch was constructed this year.

The following data were obtained for the flow on June 3,

1910: $\frac{1.5 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 0.7 equal 1.58 square feet. N equals .030 and the grade being .027 gives a velocity of .50, which gives a discharge of .785 cubic feet per second. The maximum capacity is about 1.0 cubic feet per second.

San Ildefonso Pueblo Canal

This has not been in operation for several years. The heading was on the east side of the river about a mile or a mile and a half above the San Ildefonso Butte. Water was supplied for a time to the Indians by the Hobert ditch, but its heading was washed out. This ditch was built by the Indian Service and it is said that they may endeavor to put in new headworks for the irrigation season of 1911.

Small Community

The heading of this ditch is on the west side of the river about one mile below the Pueblo of Santa Clara. The diversion works were in poor condition. No water on the day of examination, June 1. Maximum capacity 4.5 cubic feet per second. Area irrigated 160 acres. This is owned by Thomas Chavarria and four others, all Mexicans.

Private

The heading is on the west side of an island near the west side of the river and opposite the Pueblo of Santa Clara. This is owned by Francisco Naranjo. The diversion works were the extension of the ditch out into the river. There was no headgate. The flow on June 1st was .75 of a cubic foot per second. The maximum capacity is about 1.5 cubic feet per second. The area irrigated was probably 20 acres. The additional area that might be irrigated is estimated at 100 acres.

Acequia de Los Indios (Santa Clara)

The heading of this ditch is on the west side of the Rio Grande about 1 mile south of Espanola. This ditch had a combined headgate and sluicegate located about 500 feet below the diversion works.

The diversion works were a dam, consisting of brush, sods and stones, across a small channel. On the day of examination, June 1, ties, which were being driven down the river by the Santa Barbara Tie & Pole Co., were interfering with the diversion works and the head of the canal. The Indians were expecting to get damages. The outer bank of the ditch is protected by riprap between the diversion dam and nearly to the headgate, to prevent erosion by the water in the river.

This ditch being the first ditch examined in connection with this report, three different measurements were made and the results are given that the differences may be noted.

Measurements at the headgate:

5.5 feet wide and 1.5 feet deep with a velocity of 3 second-feet, equals a discharge of 15.75 cubic feet per second.

Measurements below headgate:

$\frac{6.0 \text{ ft. plus } 11.0}{2}$ x 1.5 equals 12.75 square feet, and a velocity of 1.1 gives a discharge of 14.02 cubic feet per second.

Measurements at a place farther down the ditch:

2.0 feet x 8 feet x 1.2 feet equals 19.2 cubic feet per second.

It is probable that the discharge is between 16 and 19 cubic feet per second.

The area irrigated is probably about 600 acres. If this

ditch was enlarged, improved and run on a lighter grade, it would irrigate quite an additional body of land, probably 500 acres. The crops are corn, wheat, alfalfa, truck and fruit.

Espanola Ditch

The heading of this ditch is on the west side of the Rio Grande about 1 mile south of the Chama River and east of the D. & R. G. Ry. mile post 369, from Denver. There are no headgates but there is a spillway about 1/4 mile from the head.

Data for the flow on June 2 and for the maximum capacity were obtained at two different places as follows:

$\frac{7.0 \text{ ft. plus } 9.0}{2}$ x o.7 ft. equals 5.6 square feet, and the velocity being about 1.18 gives a discharge of 6.60 cubic feet per second. The maximum capacity being $\frac{7.0 \text{ ft. plus } 11.0}{2}$ x 1.5 feet equals 13,5 square feet, and the velocity being 1.96 gives a discharge of 26.46 cubic feet per second.

The other measurements were $\frac{6.5 \text{ ft. plus } 8.5}{2}$ x 0.7 equals 5.25 square feet, and the velocity being 1.75 makes a discharge of 9.18 cubic feet per second.

The maximum capacity is $\frac{6.5 \text{ ft. plus } 8.5}{2}$ x 1.5 equals 11.25 square feet, and the velocity being 2.65 gives a discharge of 29.81 cubic feet per second. There is therefore 3.35 cubic feet per second difference between these two maximum capacities.

No separate estimate was made of the acreage, but from later estimates 490 acres have been segregated as the area irrigated, and 100 acres as the additional acres that may be irrigated.

Most of the farm land is values at about $60.00 to $75.00 per acre, while some of the fruit land will probably bring $400.00 or even more.

Benafio Vigil was mayor dome. The waters are used down to

and including Espanola.

Acequia del Medio de San Juan

The heading of this ditch is on the east side of the river about 1/2 mile above the bridge at San Juan.

The diversion works consist of a brush dam across one of the secondary channels of the river.

The area of the cross section on the day of examination, June 8, 1910, was 5.85 square feet; n was .025; s was .00017; v was .50 foot per second and Q was 2.92. The following are the data for the maximum discharge; s is .00017; n is .025; v is 1.1; A is 11.0 square feet; v is .76 of a foot per second and Q is 8.36 cubic feet per second. The diversion dam was being raised by the Indians on the day of examination because the river was falling rapidly. There was now 2 inches going over the dam, while previously there had been 6 inches. By raising the water 4 or 6 inches they could again get water into their ditch. They were also digging at the bottom of the ditch.

This ditch irrigates pasture lands mostly, along the river bottom. The excessive use of water has formed pools and lakes in places. The lands are all within the grant of the Pueblo of San Juan. The ditch is old. The pueblo has been at the present location since 1693 and so far as learned, may have been there long before that time.

There are about 250 acres irrigated. The value of the lands cannot be more than $25.00 per acre.

Acequia San Juan

The heading of this ditch is on the east side of the Rio Grande about 2 miles above San Juan.

The diversion works are a brush and [redacted] wing dam.

No headgates were noticed.

The data for the flow on June 8 were: A equals 21.0 sq. ft; v equals .75 of a foot per second and Q equals 15.55 cubic feet per second. The data for the maximum capacity were; s equals .0001; r is 1.8; n equals .025; a equals 27.0; v equals .83 and Q equals 22.41 cubic feet per second.

The area irrigated is about 660 acres. It was estimated that 1000 acres could be irrigated if the ditch was improved and extended down the valley.

This is probably one of the oldest ditches, as it is the ditch for the ancient Pueblo of San Juan.

The lands under this ditch should range in value from $25.00 to $200.00. Some of this land is very good fruit land.

Acequia Alcalde

The heading of this ditch is about 2 miles above Alcalde. The diversion works were not examined.

The following are the data for the flow on June 8, 1910: s equals .00044; r equals 1.2; n equals .025; v equals 1.50 feet per second; A equals 12 square feet; Q equals 15.6 cubic feet per second.

The data for the maximum capacity are: A equals 16.1 square feet; n equals .025; s equals .00044; r equals 1.4; v equals 1.5 feet per second and Q equals 24.15 cubic feet per second.

The area irrigated was estimated at 700 acres. It is probable that if this ditch was extended and the construction improved, about 200 acres additional could be irrigated.

Acequia Pueblito

The heading of this ditch is on the west side, about 4 miles above the Chamita, on one of the secondary channels of

the river.

On June 8, data were secured at three different sections on this ditch concerning the flow and the maximum flow. The results are very uniform. Only one set will be recorded here, the others will be found in the note book.

Data for June 8, were: s equals .0003; A equals 6.5 ft. plus 7.5 equals 7.0 feet; r equals .87; n equals .025; v equals .86 of a foot per second; Q equals 6.02 cubic feet per second.

Data for the maximum capacity were; s equals .0003; n equals .0225; r equals 1.3; A equals 14.2; v equals 1.37 and Q equals 19.45 cubic feet per second.

This irrigates about 400 acres. There is very little extendible area owing to the river being close to the bluff.

This irrigates lands farmed by the Indians of the Pueblo of San Juan who have left the main pueblo. The farming is reasonably good.

Private

Above the preceding ditch. Small, wide and very low velocity. The maximum capacity is 1 cubic foot per second. Irrigates 10 acres.

Las Acequias, La Canon Garcias, Del Bosque, Los Luceros or Plaza del Bosque.

No especial description will be made of these ditches, the data are not extensive and are shown in the tables.

Acequia del Medio

The heading of this ditch is about 1/2 mile below the mouth of Embudo Canyon, and just about at the head of irrigation in the valley.

The diversion works consisted of a short wing dam, without a headgate into the ditch. The dam was so constructed that the water would spill over it, and in addition thereto, the ditch bank was, for a considerable distance constructed to permit the water to spill over it when full. Thus an effective regulator was maintained. The material at the head of this ditch was coarse gravel and this allowed spilling over the bank.

The following are the data for the flow on June 11, 1910; $\frac{4.5 \text{ ft. plus } 7.0}{2}$ x 1.2 feet equals 6.9 square feet, the sectional area and the velocity 1.35 feet per second, gives a discharge of 9.31 cubic feet per second.

The following are the data for the maximum capacity: Sectional area 9.6 square feet; v equals 1.75; and Q equals 16.8 cubic feet per second.

The irrigated area was estimated at 330 acres. No additional acreage could be conveniently irrigated.

There is considerable land under this ditch and some under the Los Chicos which has been rendered unproductive by over irrigation. In the vicinity of the Baptist Mission School this condition is particularly noticeable where some orchards have been killed. Alkali is manifest in considerable quantities. Drainage could be installed at no great expense.

Fruit grows well here and with scientific culture could be made into one of the best fruit growing sections in the valley of the Rio Grande in New Mexico.

The crops are fruit, chili, alfalfa, wheat, corn and truck.

The value of the land ranges from $20.00 to $200.00 per acre and probably more on the best fruit lands.

Acequia los Chicos

The heading of this ditch is on the east side of the Rio Grande at the mouth of Embudo Canyon and is about 2 miles above La Joya.

The diversion works are a wing dam of rocks.

The following are the data for the flow on June 11, the day of examination; $\frac{4.0 \text{ ft. plus } 6.0}{2}$ x 0.8 equals 4.0 square feet, the sectional area; r equals .73; n equals .025; s equals .00023; v equals .65 of a foot per second and Q equals 2.60 cubic feet per second. A chip floated 100 feet in 115 seconds and using .75 as the coefficient it would make the mean velocity of .86 feet per second.

The data for the maximum capacity are: A equals 9.9 square feet; v equals 1.12; n equals .025; v equals 0.90 of a foot per second and Q equals 9.0 cubic feet per second.

The area irrigated was estimated at 220 acres. Very little additional land could be irrigated from this ditch with its present heading.

There is some very productive apple land under this ditch which are probably valued at $300.00 or $400.00 per acre.

West Rincondada

The heading is on the west side of the river near the mouth of the canyon at the head of the valley.

The diversion works were a wing dam consisting of cobble stones and cedar brush extending nearly across the river.

The maximum capacity was estimated with imperfect information at 2 cubic feet per second.

The area irrigated was 46 acres.

The farming was not so good as on the east side of the river.

East Rincondada

This ditch heads on the east side of the Rio Grande about 1 mile above the Rincondada valley. The ditch and the irrigated area was examined on June 11. The diversion dam was examined on August 3rd, and also a re-examination of the irrigated area. The diversion dam was built of cobble stones and cedar brush and extended across the river.

The ditch had a very low velocity in the canyon, being .33 of a foot per second. The sectional area was 7.2 square feet and the discharge was 2.4 cubic feet per second.

The area irrigated was estimated at 50 acres. There is no extendible area.

The crops are fruit, alfalfa, grain and truck.

This should be one of the best fruit sections in New Mexico.

Power Canal

About 1 1/2 miles below Cieneguilla is a temporary diversion dam built of rocks for the purpose of diverting water through a flume to operate a grist mill that was being installed. On the day of examination, August 3, preparations were being made to start the operations. This flume was originally constructed to furnish power for a gold mill, but this seems to have proven a failure.

It might be mentioned here that there are very good opportunities for power development in this canyon. The fall of the river here is from 15 to 30 feet per mile. From the data obtainable it would seem that the minimum flow is 150 cubic feet per second and a minimum flow for nearly all the time of 200 cubic feet per

second. Their power possibilities are therefore very great.

Cieneguilla

There is only one ditch and it takes out of the Rio Grande on the west side. It irrigates about 10 acres. The maximum capacity is about 1 cubic foot per second.

Various springs irrigate small patches of land on the valley floor and on the sides of the canyon. Most of these are in native hay.

MILLIGAN GULCH

This is an intermittent stream between the Magdalena and San Mateo mountains and flowing in a southeasterly direction and entering the Rio Grande about 3 miles bwlow old Fort Craig.

As far as known, there are neither reservoir sites nor irrigated lands on this stream, and even though it drains a high mountain country, there is nowhere a perennial flow. The waters of very heavy storms reach the Rio Grande.

ALAMOSA RIVER

This is a stream rising west of the San Mateo mountains, and flowing in a southeasterly direction, empties into the Rio Grande about 12 miles north of the Engle dam. This is incorrectly shown in the U.S. Reclamation Service maps of the Engle reservoir as Cañada Creek.

This river was not visited during the summer of 1910, but the writer has previously ascertained the conditions near the mouth. Considerable information was also obtained from Mr. G. W. King, of San Marcial, New Mexico, who was personally acquainted with the conditions along the upper part of the river. Believing that this river had little effect on the water supply of the Engle reservoir, an expensive trip was avoided.

The U.S. Geological Service surveyed a reservoir site on this river near the Ojo Caliente military reservation and showed a dam site for the same in a rock canyon. The dam was proposed to be 125 feet high and would create a reservoir with a surface of 1,185 acres, and a capacity of 59,000 acre-feet. The altitude of the drainage area tributary to this reservoir, ranges from 6100 to 10,000 feet, and the area is about 400 square miles. The precipitation being about 15 inches per annum, would probably cause the reservoir to be filled annually.

Information obtained from Mr. G. W. King is, that below the dam site the stream bed of the river is very gravelly and porous, and that if the stored waters were allowed to flow down the river bed, they would be greatly diminished by sinking before they reached the wide valley below Plaza Cañada Alamosa where

Monticello Post Office is located and where the water should be used. A concrete canal about 12 miles long would probably be necessary to carry the water from the reservoir to the lands to be irrigated. Extensive surveys would be necessary to determine the feasibility of this proposition.

Mr. King estimates the low summer flow near Ojo Caliente at 10 cubic feet per second. This all sinks below Cañ ada Alamosa. Only the heavy storms furnish water to the Rio Grande.

There are a number of small ranches at intervals on both sides of the canyon from Ojo Caliente to Cañada Alamosa, most of them being less than 1/8 of a mile wide and totaling not more than 100 acres. It is probable that there are 2,000 acres of irrigable land below Cañada Alamosa.

The irrigating season is from April 15 to September 15.

Land values range from $40.00 to $50.00 per acre.

ARROYO SALADO

This is an intermittent stream above Socorro which empties into the Rio Grande, and the amount of water annually contributed is great.

This was not visited, but it was learned that most of the farming done was without irrigation. No estimate therefore was made of the irrigated area. If the storage reservoir reported upon by the U. S. Geological Survey were feasible and built, there are probably 5,000 acres east of the Sierra Ladrones that could be irrigated.

RIO PUERCO

The Rio Puerco rises in the northern part of Sandoval County and flows directly south and empties into the Rio Grande about 23 miles north of Socorro. The valley is comparatively narrow. The stream has a fall of 10 feet per mile.

The drainage area is practically of a sedimentary formation, with clays predominating and some sandstone. The floor of the valley is all clay, and as far as could be learned bed rock is only visible in one place in the river bed; my informant did not remember the exact location, but it is some place in the vicinity of Casa Salazar or San Francisco. The channel is in an earth canyon from 20 to 40 feet deep for practically its entire length, and this channel is becoming greater every year. The flow is intermittent. The snow from the high Naciemento mountains furnishes a large flow for a very short time in the spring, and after this has gone off the various showers furnish an intermittent flow. The annual precipitation probably varies from about 10 inches near the mouth to about 14 inches near the source at Cuba. The high mountains of course have a greater precipitation.

The valley ranges in altitude from 5700 to 6900 feet. The climate, because of the range of altitude, varies considerably. The snow fall at Cuba remains for some time, while that which falls near the Rio Grande remains but a few days.

The crops raised differ with locality and will be treated under each ditch. As a great part of these depend upon the summer rains for their water supply, and as these rains are not reliable, many crops are partial failures. Many expedients are used to secure a supply from local showers.

All markets are local. The general industries being

the raising of sheep, goats and cattle. All crops are used locally and also considerable forage and food stuffs are secured from outside markets.

Farming on the Rio Puerco is uncertain; in the main it is unprofitable and will always be so on the lower part unless storage works are built. The most feasible place for such are near the source or about Cuba. The following is extracted from the report of Mr. W. W. Follett to the Department of State:

"The head waters of the Rio Puerco originally formed part of the Apache Indian country and settlements were not made by the Mexicans till 1872; but then a large body of them moved in at once and all of the available water was quickly appropriated."

Some information was received concerning some reservoirs in the vicinity of Cuba. These will be described under "Reservoirs".

Fourteen ditches were listed on the Rio Puerco, which had a combined capacity of 61.04 cubic feet per second and which irrigated 944 acres. There are, according to the estimate made, 61,800 acres which could be easily irrigated if there were an adequate water supply.

Hydrographic Data

The flow of the Rio Puerco on August 26, 1910, at the heading of the Acequia de Cuba 2 miles above Cuba was nothing. About one-half mile below this, where the river was in an earth canyon 25 feet deep, the flow was 1 cubic foot per second. At the head of the Acequia Cochitaña on the same date the flow was 1.25 cubic feet per second. This is therefore the seepage as far

as was visible for all the drainage above Cuba. On August 27 there was .50 of a cubic foot per second at the dam at the head of the Acequia San Luis. On September 6, 1910, there were 3.0 cubic feet per second at the station of Rio Puerco on the Rio Puerco. A rough estimate was made of the maximum flow for the summer on that date and the estimate was 3400 cubic feet per second. This estimate is probably within 25% of the true amount. On September 27, 1910, the flow at a section about 5 miles southwest of Sabinal was 3.0 cubic feet per second.

On September 26, 1910, there were 15 cubic feet per second flowing at the mouth of the Rio Puerco.

Rio Puerco Station, or Cerro Plaza

This is located on the Rio Puerco where the Santa Fe Railroad crosses the Rio Puerco. The report of Mr. W. W. Follett records a ditch here with a capacity of 4 cubic feet per second, and an area of 150 acres irrigated. There was no irrigation in 1910 and there has probably not been for several years, as a few dying cottonwood trees give evidences of former irrigation. A few houses yet remain of the former plaza.

It is probable that the cause of no irrigation at present is, that the river is now in an earth canyon from 25 to 40 feet deep and that it would require a large amount of money to build a dam that would be permanent as there is no bed rock. Any temporary dam requires a great annual expenditure.

There are about 20 square miles of land below here that could be irrigated if water could be furnished.

Plazas, Los Quilites and San Luis Rey

There were settlements on the Rio Puerco in 1878, but Mr. W. W. Follett does not mention them in his report and from information received in 1910 they have been abandoned a great many years.

Plaza San Ygnacio

There is no irrigation here any more. Five people were living here in 1910.

From San Ygnacio to Cerro is a distance of 30 miles, and assuming that there is a strip of land 1/4 of a mile wide along the river for this distance, there would be 4800 acres of irrigable land, and that would not take into consideration any high line ditches. From what was seen of the country and from what has been obtained from topographic maps, it is possible to irrigate over 10,000 additional acres by high line canals. It is therefore probable that 15,000 acres could be irrigated between San Ygnacio and Cerro if there were any means of securing an adequate supply of water.

Plaza San Francisco

This was formerly a settlement with irrigation, but now one man is the sole inhabitant. This has been deserted because of the unreliable water supply and because the river is in a deep earthen canyon and diversion works cannot be maintained. The Rio Puerco Irrigation Company, of Albuquerque, New Mexico, has filed plats for an irrigation project in the vicinity. Information concerning the reservoir in connection with this project is found under "Reservoirs" and under "Water Right Application No. 78".

It is the intention of this company to irrigate 19,200 acres. A part of the contemplated area is south of San Ygnacio. It is probable that 18,000 acres could be irrigated under this project and would not include any lands for which an irrigated area was estimated in connection with San Ygnacio.

Acequia Guadalupe

The heading of this ditch is on the west side of the Rio Puerco, above and northwest of the plaza of Guadalupe. The headworks are temporary, being a brush and mud dam.

The ditch was examined September 13, 1910, by Mr. Z. D. Clark, levelman, and was dry owing to the river being dry. The data for the maximum capacity are as follows: $\frac{2.0 \text{ feet} + 4.0 \text{ feet}}{2}$ x 1.5 foot equals 4.5 square feet, the sectional area, and the velocity being 1.5 foot per second, gives a discharge of 6.75 cubic feet per second. According to testimony, this ditch has never been full of water.

There are some contentions about the management of the ditch. The people at Casa Salazar said that they had helped to build the ditch and the dam, and that now the people of Guadalupe want them to pay for the water, and this they refuse to do. The people of Guadalupe said that there was not enough water for all. The Acequia Casa Salazar is an extension of the Guadalupe ditch. The area irrigated at Guadalupe was 50 acres, and at Casa Salazar none. The methods of farming were generally not the best.

The additional area that might be irrigated at a reasonable cost was estimated at 500 acres provided a water supply could be obtained. The value of the land is probably about $25.00 to

$40.00 per acre, and most of it is at the lower figure. The crops are corn and truck.

Small Community Ditch

The heading of this ditch is on the east side of the Rio Puerco about 1 mile down stream from Cabezon.

The diversion works consist of a brush dam.

The ditch was examined August 29, 1910, and was dry, as the river was dry. The maximum capacity was estimated at 2 cubic feet per second. The area irrigated was estimated at 25 acres, which were planted in corn and garden truck. There was neither alfalfa nor fruit. There is no additional area that might be irrigated. There was no water for irrigation after the early summer and but few slight summer rains.

The length of the ditch is about 1 1/2 miles.

Small Community Ditch

The heading for this ditch is about 1 mile below Cabezon and the diversion works are the same as for the ditch previously mentioned. The same dam does service for this ditch as for the one previously mentioned. The ditch was examined Aug. 29, 1910, and was dry; the river was dry. The maximum capacity was estimated at 2 cubic feet per second. The acreage irrigated was estimated at 60 acres, and there are no opportunities for extension. The length was estimated at 1 1/2 miles.

There was no water for irrigation from the early summer rains. The crops are corn and truck.

ACEQUIA CABEZON

The headings for these two ditches about about 1/2 mile wide north of Cabezon. The diverson works consist of a brush dam. One ditch is on the west side and the other on the east side of the dam. These were dry on the date of examination, August 27, as the dam could not divert the small amount of water which was in the river.

The data for the maximum capacity for the east ditch are as follows; $\frac{1.3 \text{ ft. plus } 2.5 \text{ ft.}}{2}$ x 1.3 ft., equals 2.47 sq. ft., the sectional area, and the velocity being 2.0 ft. per second, gives a discharge of 4.94 cubic feet per second.

This irrigates 30 acres of corn, beans and truck. No opportunity to extend the area.

The data for the maximum capacity for the ditch on the west side are as follows: $\frac{1.5 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 1.3 ft. equals 2.92 square feet, the sectional area, and the velocity being 2.0 ft. per second gives a discharge of 5.84 cubic feet per second.

This irrigates 60 acres of corn, beans and truck. There are no opportunities of extending the irrigated area.

There was no water for irrigation in these ditches from the early summer until after the date of examination. The usual summer rains which benefit the crops so much did not occur. The crops were to a great extent failures. The soil is a stiff clay. The land values probably range from $20.00 to $40.00 per acre. Alfalfa is hauled from Albuquerque.

The ditches were constructed in 1872.

Acequia San Luis

The heading of this ditch is on the west side of the Rio

Puerco, about 1 mile above the Plaza San Luis and about 6 miles above Cabezon. This irrigates lands in the vicinity of San Luis.

The diversion works consist of a brush dam 15 or 2o feet high made by putting in cedar brush with the stems up stream. This is more than temporary but has to be repaired each year. The dam did not divert the water, as 1/2 cubic foot per second was leaking through it on the day of examination, August 27, 1910. The ditch was dry.

The data for the maximum capacity were as follows; $\frac{7.5 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 1.3 ft. equals 10.72 square feet, the sectional area, and the velocity being 2.0 feet per second gives a discharge of 21.45 cubic feet per second.

The area irrigated was estimated at 180 acres. It will be noticed that the capacity of this ditch is very great for the number of acres irrigated. This is probably due to the fact that when there is any water in the river in summer, a great amount can be diverted, and thus all who have lands under the ditch can get some water. Many of the summer flows are but for a few hours, as the storms are local and the grade of the river steep. The irrigated area is extendible to a slight degree.

The crops are corn, beans and truck. No attempt is made here or at any other place on the Rio Puerco to raise the drouth resisting crops. The present practice is for the people to eat the corn and the stock are fed the fodder.

Very little cultivation is done. Irrigation is made to take the place of cultivation. Cultivation would often conserve the moisture when it is most needed.

The value of the land ranges from $20.00 to $40.00 per acre.

The date of settlement was 1872 and the ditch was probably constructed at that time.

This ditch is probably the same as Las Tijeras mentioned by Mr. W. W. Follett in his report. He gives the acreage at 600 acres.

La Ventana

This was formerly a plaza but is now entirely deserted. Mr. W. W. Follett mentions 200 acres as being irrigated here. It has been found to be impossible to maintain a diversion dam at this place. The soil seems to be of such a nature that when it becomes wet it becomes soft and dissolves to some extent. It is probable that this has been deserted for sometime, about five years or more.

There are 19,000 acres of irrigable land between La Ventana and Cabezon, most of it being on the east side of the river and includes the present irrigated lands at San Luis and Cabezon. There is neither a water supply nor storage possibility for this acreage.

Acequia Gonzalita

The heading of this ditch is on the east side of the Rio Puerco about 2 miles south of Cuba. This irrigates lands near the plaza of that name. The entire length of the ditch is about 4 miles. The diversion works are said to be a brush dam, but these were not examined.

The ditch was examined August 27, 1910, and was dry.

The maximum capacity was estimated at 2 cubic feet per second. There had been no water in the ditch since May and the local showers at the upper end were very light and very few.

This irrigates 40 acres near the upper end of the ditch and about 10 acres 3 miles farther south and 1 mile north of Senorito Creek.

The settlements at the upper end were probably suffering more because of a lack of water and rains than any other place visited during the summer. A ditch had been built along the edge of the valley so that any water might be caught which ran off from the gently sloping hills. This would be conducted to the particular spot to be irrigated. The crops were almost an absolute failure. The conditions at the lower end were very much better. Rains had fallen in that locality and the run-off had been caught and the little ranch had a prosperous appearance.

The date of construction of this ditch is not known, but it may have been in 1872. It was learned, however, that a number of new ranches have been taken up nearer the source of the river, and that this has been detrimental to the spring flow of the river.

With the conditions as they were this year, the value of the land cannot exceed $20.00 per acre.

Acequia Cochitaña

The heading of this ditch is on the west side of the Rio Puerco about 1 mile south of Cuba. There were no regulating works and the ditch needed cleaning. The diversion works consisted

of a brush and mud dam about 15 feet high. The brush was cedar branches and the general plan can be seen in the photograph.

The ditch was dry on the day of examination, August 26, 1910, but a part of the 1.25 cubic feet per second which was flowing over the dam could have been diverted with a little work. The following are the data for the maximum capacity: $\frac{3.0 \text{ ft. plus } 4.5 \text{ ft.}}{2}$ x 1.0 ft. equals 3.75 square ft., the sectional area, and the velocity being 1.5 ft. per second gives a discharge of 5.62 cubic feet per second.

This ditch is about 1 1/4 miles long and irrigates about 100 acres of land that is planted to corn, oats, truck, etc. The extent of the additional area that might be irrigated was not known. The value of the land is estimated at about $25.00 per acre.

Acequia de Cuba

This is a community ditch on the east side of the Rio Puerco, and the heading is about 2 miles above Cuba at the false canyon. This was examined on August 26 and was dry, as there was no water in the river and the diversion works were washed out.

The maximum capacity was estimated at 2.0 cubic feet per second. It is so located and so designed that it may intercept any side hill drainage that may occur.

The acreage irrigated was estimated at 160 acres.

Community on the West Side

The heading of this ditch is practically opposite that of the Acequia de Cuba. It was dry on August 26 and the maximum capacity was estimated at 5.85 cubic feet per second. The area irrigated was estimated at 180 acres, which were made up of sever-

al isolated patches.

The diversion works were destroyed, but evidently had consisted of brush and mud.

Community

The heading is on the east side of the Rio Puerco about 2 1/4 miles above Cuba. This was examined on August 16, 1910, and was dry, and had been since the middle of May.

The maximum capacity was estimated at 1 cubic foot per sectond. The area irrigated was estimated at 25 acres, and but very little more could be irrigated.

Archeveca

The heading is on the west side of the river and about 2 1/2 miles above Cuba.

The last water for irrigation was obtained on May 15th, and the maximum capacity was estimated at 2.0 cubic feet per second, and the area irrigated was estimated at 60 acres. The crops were oats, beans, potatoes and corn. There was a good local shower on August 10, 1910.

Private

The heading is 2 3/4 miles above Cuba and on the west side of the river. It was dry on August 26, and had been for a long time.

The maximum capacity was estimated at 1.0 cubit feet per second and the area irrigated at 12 acres. No more could be irrigated on account of topographic conditions.

Private

The heading is 2 7/8 miles above Cuba and is on the west side. The ditch was dry. The maximum capacity is 1 cubic foot per second, and the area irrigated was estimated at 12 acres.

Bluewater Creek

This is a creek which somewhere in the vicinity of Grant becomes the Rio San Jose; the exact location of the change could not be determined, but it will be considered in this report as being Bluewater Creek as far down as just above the mouth of San Mateo Creek. This creek rises in the mountains, forming the continental divide. It is perennial only above the village of Bluewater.

Irrigation at Bluewater is not in a prosperous condition. As it is not possible to raise very good crops without irrigation, and owing to the failure in 1909 of the dam for the reservoir of the Bluewater Development Co., and also for the fact that the company is not preparing to rebuild the dam, the conditions are discouraging. I was told this company sold water rights for $75.00 per acre. Since the dam failed they have been buying back these rights for half price or less. There was very little water this summer and it was said the company used nearly all of it on their farm. The condition of the country before the dam broke could not be well estimated. There were evidently a number of ditches which have been used that were so badly obliterated that no estimates could be made, so the ditches listed are the ones which were seen this year.

The principal crops are oats and timothy hay. Because of the altitude but two crops of alfalfa can be raised. Potatoes

do very well; various kinds of truck can be raised.

The reservoirs on the creek are described under "Reservoirs".

West Side Ditch

The heading of this ditch is above the village of Bluewater. It was examine d on August 31st and .50 of a cubic foot per second was flowing.

The following are the data for the maximum capacity: $\frac{7.5 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 1.0 ft. equals 8.25 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 12.37 cubic feet per second. The estimated area irrigated is 100 acres.

East Side Ditch

The heading of this ditch is about 2 miles above the village of Bluewater. The maximum capacity was estimated at 2.0 cubic feet per second. The area irrigated was estimated at 40 acres.

The total irrigable area from Bluewater to Grants is estimated at 7,000 acres. I was told that the Bluewater Development Company intend to irrigate 10,000 acres within this distance, but part of this is probably up on the drainage of the Rio San Mateo.

RIO SAN JOSE

This is the most important, yet it is an intermittent tributary of the Rio Puerco. It rises in the high mountains in western New Mexico. which form the continental divide. It is known as Bluewater Creek from just above the mouth of San Mateo Creek. The name San Jose will be applied to all that portion below.

The first settlements above the mouth of the stream that are of any consequence are at El Rito. There were formerly some about San Jose spring, but I was told that these have been abandoned.

The general soil of this drainage is clay, sedimentary formation, much weathered. The river from El Rito station to the mouth is in an earth canyon of varying depth. The amount of sediment contributed by this river to that of the Rio Puerco is considerable.

There is a large body of irrigable land between El Rito Station and Shawnee. A very reliable estimate cannot be made, but it is probable that 25,000 acres could easily be irrigated if water were available. It is believed that the topography is such that water could be diverted and run in some reservoirs that could be cheaply constructed on the plains. This would have to be investigated to be reported upon authoritatively. The settlements at El Rito have been irreparably injured by the continued failure of the water supply, due to the additional diversions near Bluewater village.

A reservoir site was surveyed above El Rito Canyon by the U. S. Geological Survey and it is described under "Reservoirs".

The Pueblo of Laguna is located on this river. It has been irrigating for several hundred years, but the lake from which it received its name has been destroyed during the past century for some reason or other. It is probable that formerly it was located above the pueblo and near the station of Horace.

The Pueblo of Acoma located about 18 miles from this river, has considerable land that is irrigated by it.

Between Grants and Horace on the east side of the river there is a fine body of irrigable land. A part of it extends up into the valley of a tributary, which comes down from the mountains to the east.

The portion of the Rio San Jose between McCarthy and Casa Blanca was not visited, so no report will be made upon it. It is believed that there is some irrigation, but no reliable information was obtained.

Hydrography

On August 31, 1910, there was no water in Bluewater Creek at the village of Bluewater, and none in the Rio San Jose at Grants. There was water standing in pools in the river between these places; this had come out of the San Mateo on August 30th.

On September 1st there were 2 cubic foot in the river at Horace and 5 cubic feet in the river at McCarthy.

On September 3rd there were 2 cubic feet in the river 2 miles above Laguna and 5 cubic feet per second at Laguna.

On September 5th there were 2 cubic feet per second flowing at a section 4 miles below Laguna, and 1.0 at Mesita Negra. All the flow sank 1/2 mile below Mesita Negra.

Acequia Mesita Negra

The heading of this ditch takes out on the south side of the river about 1/4 mile above Mesita Negra, and extends along the edge of the mesita to El Rito plaza.

The ditch was dry on September 5, the day of examination. The data for the maximum flow are: $\frac{2.5 \text{ ft. plus } 4.0 \text{ ft.}}{2}$ x 1.0 ft. equal 3.25 square feet, the sectional area, and the velocity being estimated at 1.25 ft. per second, the discharge is 4.06 cubic ft. per second.

The area irrigated was estimated at 160 acres. There is a much larger area under the ditch. The crops were mainly corn, alfalfa and truck. Some grain was grown.

There are about 25,000 acres of irrigable land below the point of diversion.

Community (Indian)

The location of the heading of this ditch failed to be recorded, but it is on the north side some distance, approximating 2.0 miles above Laguna.

The flow on September 3 was 1.0 cubic ft. per second and the data for the maximum capacity are: $\frac{1.5 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 1.5 ft. equal 3.37 square ft., and the velocity being estimated at 1.25 of a foot per second, the discharge is 4.21 cubic feet per second.

The area irrigated was estimated at 160 acres in non-contiguous patches.

The principal crops were corn, melons and truck.

Acequia Casa Blanca

The heading of this ditch is on the South side of the river. No particular attention was paid to it, as it was expected to get the irrigated area from the Indian Department, but this was not gotten. It was thought that about 260 acres were irrigated but the estimate is not reliable.

There are about 2000 acres of irrigable land between Casa Blanca and Laguna.

The principal crops are alfalfa, fruit, grain and corn.

Community

The heading of this ditch is about 3.4 mile above the station of McCarty and on the south side of the river. The general location of the ditch is on the north side of the A. T. & S. F. R.R. track. This ditch irrigates lands on both sides of the river. Some fruit is raised on the north side of the railroad track.

The flow was estimated to be 1.0 cubic foot per second on September 1, 1910, and the data obtained for the maximum capacity are as follows: $\frac{2.0 \text{ ft. plus } 3.0 \text{ ft.}}{2} \times 1.5$ ft. equal 3.75 square feet, the sectional area, and the velocity being estimated at 1.5 feet per second gives a discharge of 5.62 cubic feet per second.

The area irrigated was estimated at 40 acres. There are probably about 2000 acres below this tract that might be irrigated of there was water.

Community

The heading of this ditch is about 1 1/4 miles above the station of McCarty. on the south side of the river. There was no water on September 1, 1910. The maximum capacity was estimated at 3.00 cubic feet per second.

The area irrigated was estimated at 60 acres and there is no opportunity to irrigate any more on account of the topographic conditions. The crops were in fair condition, but the usual amount of water was not available.

Community

The heading of this ditch is on the south side of the river and about 2 1/2 or 3 miles from McCarty.

On September 1 the flow was found to be 1.0 cubic feet per second. The computation of the data for the maximum flow gives 5.62 cubic feet per second.

About 3/4 of a mile below the head the ditch is narrowed until the capacity is 1.0 cubic feet per second. It continues with this capacity to the end, 1/2 mile below.

The area irrigated was estimated at 60 acres and there are no feasible opportunities to extend the area.

The three preceding ditches are owned and operated by Indians of the Pueblo of Acoma.

North Side Community

This ditch is located close to Grants. It was examined August 31st and was dry. The maximum capacity was estimated at 2.0 cubic feet per second and it was estimated to irrigate 40 acres, There is no opportunity for extension.

South Side Community

The heading is close to Grants. This was examined August 31st and was dry. The maximum capacity is 1.0 cubic ft. per second and the area irrigated was estimated at 20 acres. There is no opportunity for extension.

CEBOLLETTA CREEK

This is an intermittent tributary of the Rio San Jose. It rises in the high mountains east of Mount Taylor and has several branches, each of which possesses a small Indian or Mexican settlement. These settlements were visited on September 5, 1910, Chupidero being excepted.

The crops this year were nearly a failure, due to the fact that the summer rains upon which so much dependence is placed, did not come until August 15th instead of about July 1st.

On the west branch of this creek is the settlement of the Laguna Indians named Paquate.

There are two ditches which take out of the creek; one of these is on the east side and the other on the west side. Each will irrigate 150 acres in an indifferent way. There was no water in these ditches on September 5th, when examined. The maximum capacity was roughly estimated at 4.0 cubic feet per second.

Chupidero

This is a small settlement which was not visited and examined closely, but it was seen from a distance and it was estimated that there were about 40 acres irrigated. This estimate is not considered to be very close.

Cebollitta

On the middle branch of this creek is the settlement of Cebollitta. It was estimated that there were about 80 acres in actual cultivation, and five or six ditches were used. There was a failure in the fruit crop this year. Alfalfa requires one or two irrigations per crop, depending on the summer rains. This

is a struggling Mexican settlement.

Cebolla

On the east branch of this creek is the Mexican settlement of Cebolla, which is high upon the mesa and next to the mountains, at an altitude of 6,500 feet. There are two ditches and the total area irrigated is 140 acres; each ditch irrigates 70 acres.

Moquino

This settlement is located at the junction of the Cebolla and Cebolletta branches and there are about 60 acres irrigated. The number and capacity of the ditches was not determined. The crops were a partial failure. Fruit, corn, wheat, melons and truck were raised.

All of these settlements are eking out a bare existence. There are very likely no chances of storing any great amount of water. About 1000 additional acres of land could be irrigated on top of this mesa if water was available. There are also 5,000 acres of exceptionally fine land on this creek, which lies below the mesa on an alluvial fan and is in the valley of the Rio San Jose.

The amount of water annually contributed to the Rio San Jose by this stream must be considerable. There is considerable snow in the mountains in the spring, and the run-off is considerable and of long duration. The summer showers are known to be great also.

CANYON DE AGUA

This is a small Mexican settlement receiving its irrigation water from a creek flowing south from Mount Taylor. The acreage irrigated will be compiled according to the report of Mr. W. W. Follett, which gives one ditch of 20 cubic feet per second capacity and which irrigated 1000 acres.

This is a very old settlement, ante-dating 1800.

ACOMA CREEK

This is an intermittent tributary of the Rio San Jose and the name Acoma is applied as no other could be learned, because the creek has its source south of the Pueblo of Acoma, and passing near the pueblo empties into the Rio San Jose between Casa Blanca and Laguna.

This and the pueblo were visited on September 2, 1910. The pueblo is the oldest continuously occupied village in the United States. There has been no change since 1540, when Coronado saw it, and it was then an ancient village. Being situated on a rocky mesa, makes it nearly impregnable.

There are two branches of this stream, one to the north and one to the south of the pueblo. A day or two previous to September 2nd there had been a local shower on the north branch of considerable magnitude in the vicinity of the pueblo. The ground was quite wet and in places was difficult to cross with a team and wagon. Judging from the character of the grass growing thereon, this area was a natural meadow. At any rate there was good pasture at the pueblo, while down near the mouth of the creek there was none. If any reservoirs could be located above the pueblo, a considerable body of land could be easily irrigated. It was estimated that there are 3,000 acres below the pueblo.

The drainage area of this is large and considerable water must be contributed in the spring.

There was one ditch noted, and it was near Casa Blanca.

Community

The heading of this ditch was on the west side of the creek and about 1 mile from the San Jose. It was dry on September

5, 1910, but the data for the maximum capacity was obtained, which are as follows: $\frac{2.5 \text{ ft. plus } 4.0 \text{ ft.}}{2}$ x 1.5 ft. equal 4.87 square feet, the sectional area, and the velocity being 1.0 feet per second, the discharge would be 4.87 cubic feet per second.

The area irrigated was estimated at 180 acres, made up of numerous small patches.

SAN RAFAEL SPRINGS

These are springs situated near the town of San Rafael and are located at the east base of Zumi mountains, an uptilted sedimentary formation. These are very large springs and flow from the ground. To the east is a great lava flow which begins about Grants and which reaches down to near McCarty. These springs are evidently artesian. They flow the same the year around and have the same temperature. The water if left corked in a bottle for 24 hours becomes impotable. A sediment is left on the inside of a teakettle.

I was informed by Mr. Havercamp that 600 acres were cultivated and 1100 acres were in native hay from these springs.

The following data were obtained for the flow of a ditch which came from these springs: $\frac{3.5 \text{ ft. plus } 6.0 \text{ ft.}}{2} \times 1.3$ ft. equal 6.17 square feet, the sectional area, and the velocity being 1.25, makes a discharge of 7.71 cubic feet per second. This was but a small part of the flow of the springs. If 600 acres are irrigated, it would seem as if the duty of water is very high, but it is probable that the general sub-irrigated condition aids in the irrigation. The 1100 acres of hay land are not irrigated. The moisture is transmitted naturally.

Between San Rafael and the Rio San Jose there was noticed a cienega about 3 miles above Horace, and it contained about 10 acres. This was in grass and native hay.

The lava in the flow mentioned is extremely creviced and the local people say it is full of water, but on the contrary but a small amount was running out at the lower end of the flow.

SAN MATEO CREEK

This is an intermittent tributary of the Rio San Jose. It rises from springs which are located on the north side of Mt. Taylor and has a perennial flow to the plaza only. Some irrigation is attempted below the plaza, but it is hardly worth mentioning. These San Mateo cprings formerly afforded a favorable camping grounds for the Navajo Indians. I was informed that 47 years ago the Mexicans came in and have held the place since then.

Both irrigation and dry farming are practiced. The dry farming is done in the most favorable places and some of the crops had a good appearance on August 30th. There is a great amount of irrigable land on this creek that can never be irrigated because of the short water supply. About 2000 acres could be irrigated between San Mateo and Puertocito, if water was available. 20,000 acres could be irrigated between Puertocito and the Rio San Jose. No water, however, can ever be stored to irrigate any great amount of this. There is a reservoir site at Puertocito that might be made available, which is described under "Reservoirs."

The soil is a clay, being made up of weathered sedimentary marls, and in a great many places the creek has cut a deep channel in the soil. The soil around San Mateo is better than below along the creek. A number of ranches below San Mateo were seen which depended on the raising of goats. Water for domestic purposes had to be hauled.

This creek contributes some water during the summer months to the Rio San Jose, and when the snow is melted rapidly in the spring the flow is great. It is believed that the flow of this

creek will not be endangered by any storage, as the cost would be excessive. It would require a reservoir of more than 1000 acre-feet to be a feasible one.

The crops raised are oats, alfalfa, corn and truck. As this year was an exceptionally dry one, the crops in places were not good.

The value of the lands irrigated range from $20.00 to $75.00 per acre.

West Ditch

The heading of this ditch is at the upper end of the Plaza. This was dry on August 29, 1910, and the maximum capacity was estimated at 2.0 cubic feet per second.

East Side

This ditch on August 29, 1910, was carrying 1.0 cubic foot per second, the entire flow of San Mateo Creek on that day. The maximum capacity was estimated at 2.0 cubic feet per second. It was estimated that there were about 200 acres irrigated under these two ditches, but the area irrigated under each ditch was not segregated.

ARROYO CHICO

This is an intermittent tributary of the Rio Puerco, which enters it from the west at a place about 4 miles below Cabezon. The stream lies north of Sierro Chivato.

The general drainage area is a sort of semi-bad lands formation and is made up of a badly eroded country. The run-off is not great. There was noticed a slight flow where the earth canyon is quite deep about 6 miles from Cabezon. This was in places about 1.0 cubic foot per second.

There was no irrigation and probably will not be much at any time. Several springs were noticed for watering stock. This was examined on August 29, 1910.

RIO DE LECHE

This is a small creek flowing down from the west side of the Naciemento Range, entering the Rio Puerco below Cuba. There was no water on the surface in the upper part of the valley, but in the lower part where the channel is in an earthen canyon, about 1 cubic foot per second was flowing. This would show that seepage was not very great, and in this kind of soil very little could be expected, as little soaks in and little could be contained as the voids are very few.

Community

This is a community ditch heading about 1/2 mile east of Cuba. The diversion works consisted of a temporary dam. The ditch was dry, as was also the river, on the day of examination, August 26, 1910.

The maximum capacity data are: $\frac{2.0 \text{ ft. plus } 4.0 \text{ ft.}}{2}$ x 1.5, equals 4.5 square feet for the sectional area, and a velocity of 2.0 ft. per second gives a discharge of 9 cubic feet per second.

The area irrigated was 80 acres, but the indications are that the acreage is from 150 to 200 acres. 300 or more could be irrigated.

The crops are oats and corn. Only the spring flow is used.

The value of the land is $25.00 per acre.

Small Community

This ditch heads about 1.8 of a mile west of the heading of the Acequia de Leche. The diversion works are temporary.

The river and ditch were dry on August 27, 1910, the day

of examination. The maximum capacity is .50 cubic feet per second.

The area irrigated is 2 acres. The crops are corn and melons.

The value of the land is $25.00 per acre.

Acequia del Rio de Leche

This ditch heads on the north side and near the foot of the mountains. The diversion works are temporary. On the day of examination, August 26, 1910, the ditch and river were dry. The maximum capacity equals 2.50 cubic feet per second.

The area irrigated is 100 acres and it is poorly irrigated. The crops are corn, oats, alfalfa, melons, potatoes and truck.

The value of the land is $25.00 per acre.

Small private ditch

The heading is a short distance below the Acequia del Rio de Leche, but on the south side.

The diversion works are temporary. The river and ditch were dry on the day of examination, August 26, 1910. The maximum capacity is 10 cubic feet per second.

There are 5 acres irrigated.

The crops are oats and garden truck. The value of the land is $25.00 per acre.

RIO NACIEMENTO DEL PUERCO

This rises on the west side of the Naciemento Range of the Jemez mountains, and flowing west enters the Rio Puerco about 1 mile below Cuba.

This is said to have a reservoir site on it above where our examination ceased. ("See Reservoirs")

The flow from this was more at the edge of the mountains than any of the other tributaries of the Rio Puerco. Wheeler's maps, upon which the field work was done from 1873 to 1877, shows there was a settlement at Naciemento, but does not show Cuba. Naciemento means "birth place" and upon the part near the foot of the mountains was formerly the favorite lambing grounds for sheep. The source of this being at about 9000 feet, there is considerable run-off when the snow melts.

The formation of the Naciemento Range is laccolithic, being a granitic intrusion under a probable cretatious formation. A peculiar granite dike runs along the base and parallel to the range. This I have been told has produced some good dam sites for reservoir sites.

On August 26 the discharge of Naciemento Creek at the old smelter was .75 of a cubic foot per second.

Small Community

Heading on the north side of Rio Naciemento about 2 miles from the foot of the mountains. This is near a shale hill which lies on the south side of the creek and points north from the main ridge, the hill lying between Senorita Creek and Rio Naciemento.

Diversion works are temporary. This was examined Sept. 26; the river and ditch were both dry. The maximum capacity is

2.0 cubic feet per second.

It irrigates 80 acres, which are partly in the drainage of the Rio de Leche. This probably receives the surplus spring flow.

The crops are corn, oats, beans and truck. The value of the land is $25.00 per acre.

Small Community

The heading is located 1/2 mile east of the former or lower ditch. The diversion works are temporary. The river and ditch were dry on the day of examination.

The maximum discharge is 1.50 cubic feet per second. It irrigates 60 acres, partly in the drainage of the Rio de Leche.

The value of the land is $25.00 per acre.

Small Private Ditch

The heading is near the former, but on the south, and the ditch is about 1/2 mile long.

The diversion works are temporary. On the day of examination, August 26, both the river and ditch were dry. The maximum capacity is 1.0 cubic feet per second. It irrigates 2 acres. It receives the spring floods only.

The land is valued at $25.00 per acre.

Small Community

The heading is on the south side of the Rio Naciemento about 100 feet below old smelter. The diversion works are temporary. It was examined August 26 and the flow was .05 of a cubic foot per second at that time. The maximum capacity is 1.0 cubic foot per second. There are 90 acres poorly irrigated.

The value of the land is $35.00 per acre.

Acequia Comun

It heads about 1/4 mile below the old smelter and on the north side of the river.

The diversion works are temporary. It was examined on August 26 and the flow was .25 cubic foot per second.

The maximum capacity is 2.50 cubic feet per second.

It irrigates 200 acres, part of which is in the drainage basin of the Rio de Leche. The methods of farming are very poor.

The crops are corn, alfalfa and oats.

The value of the land is $40.00 per acre.

Small Private

The heading is on the north side at the old smelter. The diversion works had previously been a gravel dam, but on the day of examination, August 26, had been washed away, and for this reason the ditch was dry, and also probably because there was another ditch with a prior right.

The maximum capacity is 2.0 cubic feet per second.

It irrigates 2.0 acres. The value of the land is $25.00 per acre. There has been no water in the ditch since the spring.

RITO LA JARA

This is an intermittent tributary of the Rio Puerco. It rises in the high mountains to the northeast of Cuba and flows into the Rio Puerco near Cuba.

The topographic map of the U. S. Geological Survey showing very little possibilities on it, the examination was not thorough. It was learned later that there was irrigation to some extent and the estimate of the acreage on this creek will not be very accurate. There are not over 300 acres irrigated, and the water supply is greatly supplemented by summer rains.

Small Community

The heading is on the south side 3/4 of a mile from the Rio Puerco. The diversion works cut into the channel of the creek.

The creek was dry at the point of diversion on the day of examination, August 26, 1910.

The maximum capacity is 1.50 cubic peet per second.

It irrigates 60 acres. The area could be extended to include 100 acres if water was available. The creek below the point of diversion has cut an earthen canyon about 25 feet deep. There was .50 of a cubic foot of water flowing August 26, 1910.

RITO DE LOS PINOS

All information concerning irrigation on this creek was received from testimony and from the map of the Gallina Quadrangle published by the U. S. Geological Survey.

This rises on the west side of the Haciemento mountains and empties into the Rito La Jara. This is an intermittent tributary.

The map shows several houses on the creek and a rough estimate of 40 acres was made for the area irrigated. It is definitely known that no more land can be irrigated without storage. The present condition will probably continue for a long time.

ARROYO SAN JOSE

This was not examined in 1910 because of incorrect information furnished at Cuba concerning the settlements to the north.

The topographic map shows that there is a dry lake on this arroyo, and from the general conditions of the country it would seem that it might be a feasible site for a reservoir. The irrigation is of no importance.

RIO JEMEZ

This river rises in the high mesa formed mountains of the same name andflowing in a southeasterly direction, enters the Rio Grande about 4 miles above Bernalillo.

In the higher part of its course there is much timber and grass, and the topographical formation is such that there are a number of feasible reservoir sites. While breaking down from these high mesas, the river runs in deep canyons where power plants are feasible, if there was any near market for the power. The main body of irrigable land is in the vicinity of Jemez Pueblo where the upper canyon ends and the valley begins.

Below the junction of the Rio Saludo, Zia Indians irrigate some of the valley bottom. Here the water supply fails and a broad sandy valley continues to the lower canyon, which continues to the Rio Grande. Above this lower canyon of the Rio Jemez is a reservoir site which was surveyed by the U. S. Geological Survey and which with several others is reported upon under "Reservoirs". In the 12th Annual Report of the U. S. Geological Survey is the following: "The discharge of this river was measured at various times in 1889 and was found to vary from 85 second-feet in the spring to 20 second-feet in October. This was a year of unusual drouth and the floods were very low and of short duration". On August 10, 1910, there was no flow below Zia. I was told by the Indians that from the middle of June to the middle of July that they had no water. Their ditch heads about five miles above their pueblo. However, about August 20th there had been such a flood that the water had run all the way to the Rio Grande. On Aug. 23rd before noon there were 6 cubic feet per second flowing at

Jemez Pueblo, and an hour later it was flowing about 30 cubic feet per second, caused by a heavy shower to the west. Above this area affected by the storm, the river was clear.

This river annually contributes a considerable supply to the Rio Grande. The snow remains for a long time in the parks in the high parts of the mountains.

Private

The heading of this ditch is on the east side of the Rio Jemez, a short distance below the Pueblo of Zia and on the east side of the river. It was not examined except at a distance, and there was probably about 2 acres in it. It was estimated that the capacity of the ditch is about 1 cubic foot per second.

Private

The heading of this ditch is on the west side of the river and opposite the Pueblo of Zia. The diversion works and the heading had been entirely eroded so that irrigation had not been possible since June. The area irrigated was estimated at 6 acres and the maximum capacity at 1 cubic foot per second.

Acequia del Pueblo de Zia

The heading of this ditch is on the east side of the river and near the plaza of San Ysidro.

The diversion works consisted of a wing dam of brush, reinforced with some sand from the river bed.

The data for the flow on August 23, the day of examination, were as follows: $\frac{3.0 \text{ ft. plus } 4.0 \text{ ft.}}{2}$ x .80 foot equal 2.80 square feet, the sectional area, and the velocity being

1.20 foot per second, gives a discharge of 5.36 cubic feet per second. The data for the maximum capacity are: $\frac{3.0 \text{ ft. plus } 4.5}{2}$ ft. x 1.2 equal 4.5 square feet, the sectional area, and the velocity being 1.50 feet per second, gives a discharge of 6.75 cubic feet per second.

The area irrigated was estimated at 225 acres, and there yet remain 275 acres of land that might be irrigated if it were leveled and put in good condition for cultivation.

The land under this ditch is not very good. It would seem as if it was deposited by the debris from the Rio Salado. It is mostly of a clay nature and contains considerable salt in places. The methods of irrigation were very crude and wasteful of water. The tillage was not good. The crops were corn, alfalfa, wheat, melons and truck of various kinds. All were consumed locally. This pueblo has poor lands, an insufficient water supply and the people are not well to do.

The people of this pueblo have lived in this vicinity so long that they have legends of having had four different pueblos within five miles of their present pueblo.

Community (2)

These ditches are located near the plaza of San Ysidro and divert about 1.0 cubic feet per second, and flood about 60 acres of salt grass pasture that lies very low and close to the river bed.

Community

The heading of this ditch is about 1 mile above the plaza of San Ysidro and on the west side of the river. This ditch

is about 1 3/4 miles long and irrigates about 100 acres.

The data for the flow on the day of examination are: $\frac{4.5 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x .50 ft. equal 2.62 square feet, the sectional area, and the velocity being .80, gives a discharge of 2.10 cubic feet per second. The data for the maximum capacity are: $\frac{4.5 \text{ ft. plus } 6.5 \text{ ft.}}{2}$ x 1.0 ft. equal 5.5 square feet, the sectional area, and the velocity being 1.80 feet per second, gives a discharge of 6.60 cubic feet per second.

There is no shortage of water at San Ysidro. Three crops of alfalfa are raised, each crop being irrigated three times. Good corn is raised. Frost often kills the peaches, but apples are not seriously injured. The summer rains are of little benefit. The mthods of farming are good and the crops were in good condition generally. All products are consumed locally.

The value of the land probably ranges from $25.00 to $75.00.

Practically all land is irrigated. The soil is not very good, being largely of a fine red clay.

Community

The heading of this ditch is 1 1/2 miles above the plaza of San Ysidro and on the west side of the Rio Jemez.

The data for the flow on August 23rd are as follows: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x .95 ft. equal 4.75 square ft., and the velocity having been found by float to be 3.0 feet per second, the discharge is 14.25 cubic feet per second. The maximum capacity was estimated at 31.22 cubic feet per second.

The area irrigated was estimated at 210 acres, which

seems to be a very small acreage for such a large ditch.

The conditions in regard to crops and soil are similar to the preceding ditch.

Lower Jemez Pueblo Ditch

The heading of this ditch is a short distance below the pueblo and on the east side of the river.

The diversion works were made of a few cobbles and some gravel.

The flow on August 23rd was estimated at 2.0 cubic feet per second, and the maximum capacity at 3 cubic feet per second.

This is a comparatively long ditch to irrigate 50 acres, but the area is in small, non-contiguous patches. It is believed that if this ditch was widened and located on a light grade, and in an economical manner, that considerable additional land could be irrigated on the east side of the river within the pueblo lands, and some of the land on the alluvial fan on the east side near the mouth of the Rio Salado. It is also believed that it would furnish water for the indians of the Pueblo of Zia, who have a prior right over the Mexicans at San Ysidro.

Aceguia Madre del Pueblo de Jemez

The heading of this ditch is on the east side of the river and about 2 1/2 miles above the pueblo. The length was estimated at 2 3/4 miles.

The diversion works are temporary, being of cobbles and brush on August 23, 1910.

The following are the data for the flow on August 23:

$\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.05 ft. equal 5.25 square feet, and the velocity being 1.8, gives a discharge of 9.45 cubic feet per second. The maximum capacity was estimated at 16.80 cubic feet per second.

The area irrigated was estimated at 200 acres. There are about 50 additional acres that could be easily irrigated. The ditch irrigates the lands near the pueblo and it is of considerable size. The methods of farming are good and the soil under the ditch is good.

The climate is suitable for the growing of fruit. That seen near the pueblo looked well. Apples, peaches, plums and grapes were seen. Melons and chili were plentiful. Little alfalfa was raised, but much corn which appeared thrifty.

This ditch is of very old construction, being at least constructed in 1696.

West Side Ditch, Jemez Pueblo

The heading of this ditch is on the south side of the river and about 3 miles above the pueblo.

The diversion works were not examined, but were known to be temporary.

The data for the flow on August 23rd are as follows: $\frac{4.5 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.30 feet, equal 6.82 square feet, and the velocity having been determined to be 1.9 feet per second, gives a discharge of 12.96 cubic feet per second. From the data obtained an estimate of the maximum capacity was made of 26.45 cubic feet per second.

The area irrigated was estimated at 1500 acres. Most of the land was planted to corn, but some wheat and alfalfa are raised.

This ditch could not be run any higher, but 500 acres could be irrigated in addition if considerable work was expended in levelling.

Acequia Molino

This is a small ditch that was built for the purpose of running a small Mexican grist mill. The cross section is 5.00 square feet and the mean velocity was estimated by float at 2.0 feet per second. The discharge was therefore 10.0 cubic feet per second. It was estimated that the maximum would be 1.-- higher, which would give a cross section of about 11.0 square feet, and the velocity was estimated at 3.00 feet per second, and the discharge would be 33.00 cubic feet per second.

The area irrigated was estimated at 5 acres, and no more could be irrigated.

The value of the land would be about $50.00 per acre.

Private

The heading of this ditch is on the east side of the river about 9 miles below Jemez Hot Springs. It was estimated that the maximum capacity was 2.0 cubic feet per second.

The area irrigated was estimated at 7 acres. The lands were very near the creek bed.

Private (2)

The headings of these ditches are located one on the east and one on the west side of the river, about 4 miles below

area cannot be extended.

Small Private

This ditch has its heading about 1 1/2 miles above the Hot Springs and on the west side of the river. It irrigates a ranch which is just above the natural dam. This is a unique geological formation, being a natural dike of aqueous tufa extending nearly all the way across the valley. It is about 15 to 20 feet high, measuring from the lower side. The water is still slowly ebulating up through a crevice on the apex, and the sedimentation by oxidation continues.

The maximum capacity of this ditch was estimated at 1.5 cubic feet per second, and the area irrigated at 20 acres. There are no opportunities for extending the areas.

Private

The heading of this ditch is on the west side of the river and about 3 or 4 miles above the Jemez Hot Springs. The maximum capacity was estimated at 1 cubic foot per second and the area irrigated at 5 acres. The irrigable area was not extendible.

Ditches (?)

The number was not determined. There was formerly about 160 acres irrigated on the Rio Jemez above the branch from Sulphur Springs, but during 1910 no irrigation had been practiced. Good crops of oats were formerly raised, and it is believed that this area could easily be reclaimed.

Rio Salado

This is a tributary of the Rio Jemez. It was not

learned whether it was perennial or of an intermittent nature. This was not visited where the irrgated area is located. From several different persons it was learned that there were from three to five families resided along it upon small ranches. It can therefore be assumed that there is from 20 to 50 acres irrigated.

A reservoir site was surveyed by the U. S. Geological Survey on this stream and it is described in this report under "Reservoirs".

This stream is singular, in that it rises on the west side of the Jemez mountains and flows around the south end and then joins the Rio Jemez. Its waters are salty.

RIO DE LAS VACAS

This is a perennial tributary of the Rio Jemez. It rises in the high parts of the Jemez Mountains and flowing in a southerly direction, it empties into the Rio Jemez close to where it breaks out of the mountains. Practically no irrigation is done above the mouth, but information was received that there were two ranches in the canyon which made use of irrigation. These it was said had about 40 acres each in them. Not much irrigation is needed.

The high valleys of this stream contain a great amount of grass, while the mountains are covered with timber. Many cattle are ranged in these high valleys. On August 25, 1910, considerable fog was experienced in one of these.

A reservoir site was surveyed on this stream by the U. S. Geological Survey, and it is described in this report under "Reservoirs".

It is, however, doubtful if the present conditions will change much for a number of years. There is not much additional land on the Rio las Vacas that can be successfully irrigated.

Acequia Comun

The heading of this ditch is near the mouth of the river. It was estimated to be 1.5 miles long.

The diversion works were not examined. They are said to be a dam consisting of cobble and brush.

The data obtained for the flow on August 23, 1910, are as follows: $\frac{1.0 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 0.5 ft., equal 1.0 square feet, and the velocity being 1.5 feet per second, the discharge

is 1.5 cubic feet per second. The maximum capacity was estimated to be 2.85 cubic feet per second.

The area irrigated was estimated at 40 acres, and most of this is along the Jemez River. A large amount of the land seemed to be planted to fruit, and as it would be protected from all winds, it would seem to be a good place for it. Alfalfa, corn and wheat were also noticed.

RIO CEBOLLA

This is a perennial tributary of the Rio de las Vacas. Its entire course is within the high mountains.

Four ranches were noticed. Little water is used for irrigation, as native hay is the principal crop. Other reasons for the use of little water are from the fact that the growing season is short, the summer showers bountiful and the farming is in the river bottom. Some oats and potatoes are grown.

Two ditches of .50 cubic feet per second capacity were noticed, which probably irrigated 10 acres.

Probably no additional acreage will ever be brought under cultivation so as to affect the present run-off of this stream. (See information under "Reservoirs".)

PEÑAS NEGRAS CREEK

This is a perennial tributary of the Rio de Las Vacas. It is situated in the highest parts of the Jemez mountains and is of no great length. The entire drainage is either covered with high grass or thick timber.

Some ranches were seen, but the crops of native hay and oats are raised without irrigation. It is believed that the conditions will not be changed so as to greatly affect the present water supply of this creek.

Some irrigation had formerly been practiced. Probably 100 acres had been irrigated.

RIO CALISTEO

This is an intermittent tributary of the Rio Grande, entering it from the east near the Pueblo of Santo Domingo. It is the first stream south of White Rock Canon, which contributes a great amount of clay to the silt of the Rio Grande. This was examined from the mouth to Lamy, and practically all the distance the river bed was in silt or quicksand. As the grade of the river is high, great quantities of this are moved during high water. This is one of the streams in an earth canyon. This canyon now extends from the mouth to Kennedy and has cut back a long distance in the past few years, and this fact has lessened the irrigation along its banks considerably. It was formerly possible to divert water from the bed of the stream, but now in many places this is 15 feet below the general surface, and with the torrential floods and the character of the soil, diversion dams cannot be maintained.

The amount of water which is discharged into the RIo Grande annually is great, but very intermittent in summer. I was told it was not fordable on August 5th, and this is believed to be true, but the flow soon subsided, it being caused by a local summer shower some place on the head waters.

The head waters of this river in the sixteenth and seventeenth centuries was occupied by several important pueblos, but now the inhabitants are confined to a few impoverished Mexicans, who in addition to their farming raise goats and cattle.

It is probable that some reservoirs of small capacity

might be found in the vicinity of Kennedy, but it is believed that any that might be constructed would be unimportant.

On August 19th the Galisteo was dry at the mouth. On September 20th there was 1 cubic foot per second flowing at Domingo. On the same date there was 1.5 cubic feet per second flowing at Cerrillos.

Near Kennedy a ranch of about 10 acres was seen which was supplied by a ditch with 1 cubic foot per second capacity.

From the lower end of the canyon below Cerrillos to the Rio Grande, there are about 900 acres of land that might be irrigated if water could be supplied.

There is a large amount of irrigable land above Kennedy which might be irrigated if any water could be supplied. There are probably 600 acres that could be irrigated between Kennedy and Cerrillos.

It is probable that above Kennedy the people mainly depend on dry farming methods for crop raising.

SANTA FE CREEK

This is an intermittent tributary of the Rio Grande and rises in the high mountains east of the city of Santa Fe, and its general course is in a westerly direction.

The main body of irrigable land is near Santa Fe, though some irrigation is practiced at Cieneguilla and some at La Bajada, places lower down.

At Santa Fe there was formerly an Indian pueblo of considerable pretentions, which the Spanish caused to be evacuated and of which they took possession, therefore, irrigation on Santa Fe Creek is of prehistoric date. It was formerly near or below the town but now, by means of terraces, the irrigable area has been extended up into a canyon.

The city of Santa Fe has a small reservoir for its water supply for domestic uses.

The U. S. Geological Survey made a survey for a reservoir, which will be described under "Reservoirs".

The climate is very favorable for the growing of fruit and Santa Fe fruit is well known. Other crops are alfalfa, corn, wheat, oats, melons and truck. The value of the irrigable lands is quite variable. At the lower end of the irrigated area where the storm water flow only is available, the land is not worth over $20.00 per acre, but the most favored location for fruit growing has a value of $500.00 per acre. The crops are all consumed locally. There is some little dry farming done close to the mountains above Santa Fe.

Contrary to generally expressed opinions, it is believed that the Rio Santa Fe contributes quite an amount of

water to the Rio Grande, the drainage area being considered. Testimony was given that the summer showers never produced a flow to the Rio Grande. This was proved to be fallacious, as there must have been a flow at the mouth of at least 300 cubic feet per second at one time this summer. The subsequent evidences were used as data. This maximum flow of course would not last over an hour. The spring run-off during the time the snow is melting is great.

There is probably a feasible reservoir site at Cieneguilla, which was noticed and which is found tabulated under "Reservoirs".

At Cieneguilla is a very small settlement.

The tight geological formation causes the underflow to be brought near to and to the surface. Below Cieneguilla the river or creek enters a canyon and this extends to near La Bajada. Most of the farming that is done at Cieneguilla depends on the ground waters under the surface, but there is a little diverted and applied to some land, the area being about 10 acres. It is probable that there is a feasible dam and reservoir site at this location. The waters would be used about La Bajada.

La Bajada is a small Mexican settlement on the Rio Santa Fe and is located about 7 miles from the Rio Grande and at the base of a high mesa where the river breaks through a canyon. This was visited on August 18 and there was no water in the ditch and had not been for some time. Two cubic feet per second were flowing at the mouth of the canyon, but no adequate provisions were made for the diversion. All of the water sinks when the

flow is small before it gets down as far as the plaza. The bed of the Rio Santa Fe is sandy all the way, but along by La Bajada there is a large amount of gravel.

The estimated capacity of the ditch was 9.37 cubic feet per second. Several spillways and regulating gates were noticed. The area irrigated was estimated at 100 acres. There are 5000 acres of irrigable land between La Bajada and the Rio Grande, but no water will ever be available for so much land.

Just below the upper end of the canyon near Cieneguilla a small ditch takes out on the south side and irrigates about 10 acres in two parcels of land on the south side of the canyon. A large part of the ranch was in fruit. The flow in this ditch on August 18 was 1.5 cubic feet per second, and this was the maximum according to the conditions then existing.

Acequia del Lopez

The heading of this ditch is on the south side and at the plaza of Agua Fria. There was no water on August 15, 1910. The maximum capacity was determined to be 6.0 cubic feet per second.

Private

The heading of this ditch is on the south side of the creek about 4 miles from Santa Fe and about 1 mile from the monument erected to General Perez. The diversion works were a gravel dam. There was a trace of water in the ditch on August 15.

The following are the data for the maximum capacity: $\frac{2.0 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x .80 ft. equal 2.00 square ft., the sectional area, and the velocity being 1.00 foot per second, gives

a discharge of 2.00 cubic feet per second.

The area irrigated was estimated at 15 acres.

This ditch secures water during the flood seasons. During midsummer it is mostly dry. The geological conditions are such that some of the underground flow is brought to the surface.

Acequia La Joyas

The heading of this ditch is on the south side of the creek and opposite the ranch of Mr. Jones, which is about 1 mile west of Santa Fe. There was no water in the ditch on the day of examination, August 15th,1910. The maximum capacity is according to the following data: $\frac{4.5 \text{ ft. plus } 5.0 \text{ ft.}}{2}$ x .90 ft. equal 4.27 square feet, the sectional area, and the velocity being 1.2 feet per second, gives a discharge of 5.12 cubic feet per second.

Small Community

This ditch has a temporary diversion dam and temporary headworks, just a short distance east of the Governor's mansion at Santa Fe.

The flow on August 15 was found to be 0.52 of a cubic foot per second, and the maximum flow was estimated to be 1.91 cubic feet per second.

Acequia de los Jollitas

The heading of this ditch is above the town.

This was examined on August 15, 1910, and was dry. The data for the maximum capacity are as follows: $\frac{1.0 \text{ ft. plus } 2.5}{2}$ ft. x .80 equal 1.40 square feet, and the velocity having been

estimated at 1.5 feet per second, gives a discharge of 2.10 cubic feet per second.

Acequia Madre

The heading of this ditch is on the south side of the creek and a short distance below the electric light plant. This was examined on August 15 and was dry.

The data for the maximum flow are as follows:

$\frac{6.5 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.0 ft. equal 6.75 square feet, the sectional area, and the velocity being 2.5 feet per second, gives a discharge of 16.87 cubic feet per second.

This ditch is a very long one, being probably 5 miles long and irrigates at the lower end many isolated tracts.

The area irrigated was estimated at 400 acres.

Acequia Murial

This ditch heads on the north side of the creek, a short distance above the lower exposure of limestone along the creek. It is quite long and irrigates considerable land in the vicinity of the city of Santa Fe.

The diversion works consist of a dam of cobbles, brush and gravel common to the mountain country.

The ditch was dry on the day of examination, Aug. 15,1910. There was water flowing past the diversion works. There is some arrangement whereby a system of rotation is used by the ditches on this creek.

The data for the maximum capacity are as follows:

$\frac{2.0 \text{ ft. plus } 4.0 \text{ ft.}}{2}$ x 1.0 ft. equal 3.0 square feet, the sectional area, and the velocity being estimated at 1.5 feet per second, gives

a discharge of 4.5 cubic feet per second.

The area irrigated was estimated at about 100 acres, which are near Santa Fe.

Acequia Los Lopez

The heading of this ditch is on the south side of the creek and a short distance above that of the Acequia Murial.

The diversion works are temporary. On the day of examination there was no water in the ditch.

The following are the data for the maximum capacity: $\frac{1.5 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 1.3 ft. equal 2.92 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a flow of 4.38 cubic feet per second.

The area irrigated was estimated at 35 acres.

Small Community

The heading of this ditch is just below the reservoir ~~xxxx~~ for the city of Santa Fe. The diversion works are temporary and the flow on August 15th was close to the maximum; the data for the flow being as follows: $\frac{1.0 \text{ ft. plus } 2.0 \text{ ft.}}{2}$ x .80 ft. equal 1.2 square feet, the sectional area, and the velocity being estimated by floats at 1.25 feet per second, gives a discharge of 1.5 cubic feet per second.

The area irrigated was estimated at 10 acres.

Small Community

The heading of this ditch is on the north side of the creek but a short distance below the reservoir for the city of Santa Fe. The water for this ditch, however, is carried across

the valley from the south side to the north in a pressure pipe which probably has a sag of 25 feet. The head of the pipe rests upon bed rock. The grade of this ditch is very light.

This was examined on August 15, 1910, and the flow was according to the following data: $\frac{2.0 \text{ ft. plus } 2.5 \text{ ft.}}{2}$ x .40 ft. equal .90 square feet, the sectional area, and the velocity having been found to be .60 foot per second, gives a discharge of .54 cubic feet per second. The data for the maximum flow are as follows: $\frac{2.0 \text{ ft. plus } 3.5 \text{ ft.}}{2}$ x .80 ft. equal 2.20 square feet, the sectional area, and the velocity being 1.0 foot per second, gives a discharge of 2.20 cubic feet per second.

The area irrigated was estimated at 25 acres.

Small, Private

This ditch irrigates a small ranch above the Santa Fe reservoir and is located on the south side of the creek. On August 15 there was no water. The maximum capacity was estimated at 1.0 cubic foot per second. The area irrigated was estimated at 3 acres.

Cienega Creek

This is an intermittent tributary of the Rio Santa Fe. It is peculiar because the underground flow of the plains is brought to the surface naturally and manifested in the form of springs in a sort of a canyon. In some places the moisture comes to the surface and irrigates the ground without any run-off. There are about 160 acres irrigated in that way at the upper end of the valley.

About 1000 feet above the Catholic Church a ditch takes

out on the south side, and is about a mile long and irrigates about 40 acres.

The data for the maximum capacity are: 2.0 ft. plus 2.5 / 2 ft. x .80 ft., equal 1.80 square feet, the sectional area, and the velocity being estimates at 1.0 per second, gives a discharge of 1.80 cubic feet per second.

There was no flow on August 18, 1910, the day of examination. One cubic foot per second was flowing below all ditches.

The first arroyo coming into Cienega below the Church has about 40 acres irrigated by sub-irrigation. This extends for about a mile along the arroyo, and a little reservoir is built to irrigate about an acre at the lower end.

Acequia Comun

About 1/4 of a mile above the Church a ditch has its heading on the north side of a very small canyon and extends for about 500 feet, where it empties into a small reservoir of 2 or 3 acre-feet capacity. The water is taken out of this in an iron pipe and flows down the valley in a ditch of 1.50 cubic feet per second capacity.

The area irrigated was estimated at 40 acres.

The present conditions will probably continue on this creek for a number of years.

Bonanza Creek

This is an intermittent tributary of the Rio Santa Fe and is situated south of Cienega Creek and about 15 miles from Santa Fe.

This was visited on August 18. It was estimated that there were 30 acres farmed and 60 acres in salt grass. The water

supply for this is permanent because the underflow from the great plains south and west of Santa Fe seems to be brought to the surface because of the geological formation. There is also some flow at times caused by run-off. It was estimated from the conditions of the valley that there must have been a flood of about 300 cubic feet per second some time within two weeks previous to the time of visitation. This was evidently an uncommon flood, however. It is believed that this creek never furnishes any water to the Rio Grande except in times of floods, and that no new condition will arise in the near future which will noticeably affect the present water supply.

CANADA DE COCHITI

This rises on the east side of the Jemez Mountains and flows in an easterly direction and enters the Rio Grande in White Rock Canyon. It is an intermittent tributary.

This was not visited, but it was learned that about seven families lived upon it and irrigated small patches of land. There is probably about 35 to 50 acres irrigated.

This probably will not experience any change of conditions which will affect the present water supply.

POJUAQUE AND NAMBE CREEKS

These will be treated together as they are in reality one creek, being named Nambe Creek above the mouth of Tesuque Creek.

This rises in the high mountains in the vicinity of Baldy and flows by the Pueblo of Nambe and the old Pueblo of Pojuaque, and empties into the Rio Grande just above the Pueblo of San Ildefonso. This is the first creek on the east side of the Rio Grande above White Rock Canyon.

Irrigation along parts of this is very old, as the pueblos will attest. The pueblo of Pojuaque is now known as the Mexican plaza, but this is largely due to the fact that the former Indians have become so mixed with the Mexicans that they are now all classed as Mexicans. These pueblos have occupied the same sites since 1693, and probably were located very close thereto for some centuries before.

About seven miles above Nambe the creek breaks out of the mountains in a beautiful water fall about 300 feet in height. This was examined on June 4, 1910. It is probably for this that Mr. Ernest H. Fisher, of Cimarron, made an application on February 27, 1909, for water amounting to 30 cubic feet per second, with which it was contemplated to develop 3000 horse power. On January 10, 1910, Duval and Norment, of Santa Fe, made application for 30 cubic feet per second of water with which to develop 4500 horse power. These two are not at exactly the same location, but with the maps available the location cannot be exactly determined. No work was being done on June 4th. There are good opportunities for continuous

power plants with a minimum flow of the creek being probably about 25 cubic feet per second.

The irrigated area is located on both sides of the creek, as will be shown by the ditches.

The general soil away from the river bed is clay. Some of the lands are true clay bad lands.

The creek bed below Nambe is wide and is composed of gravel and sand. A great deal of water is lost by seepage and evaporation.

The flow of the creek at the head of irrigation just below Nambe Falls was estimated at 50 cubic feet per second. The flow in the ditches was listed at 23 cubic feet per second. Accordingly, there is a loss of 27 cubic feet per second. It was noted on the days of examination that the waters would rise and sink in the creek bed. This seems to be a very peculiar condition as compared with that of the Santa Cruz. It had about the same amount of flow at the head of irrigation, but only 32.0 cubic feet were diverted, while on the Santa Cruz 80.7 cubic feet were diverted. Also the area irrigated was estimated on Pojuaque at 3100 and that on Santa Cruz at 5100. So far as could be learned, these two streams have a similar discharge on their coming out of the mountains. The discharge of Pojuaque in March 1889 was 20 cubic feet per second at the Rio Grande (12th Annual Report of the U.S. Geological Survey, Part 2, Page 260.)

The ditches are not described but will be found in the tables.

Twenty-five ditches were listed and probably there were ten others which were not listed. The total capacity was

estimated at 90.0 cubic feet per second and the total acreage irrigated at 2630. Even with 50 cubic feet per second at Nambe Falls and with but 23 cubic feet per second being used by the ditches, there was no water at the lower end of the creek. It is not advisable that any more land be brought under irrigation without storage. It is very probable that there are no feasible reservoirs, judging from the country and from the fact that no applications have been filed with the Territorial Engineer. It was estimated that about 2000 acres of land near Nambe were so situated that they could be irrigated if a water supply could be provided.

The crops raised are wheat, corn, alfalfa, chili, truck and fruit. The methods of farming in places are very good. The irrigation season varies. The irrigated lands vary in altitude from 5500 to 6500 and the total length of the irrigated valley is about 15 miles.

The value of the land in a few places is more than $40.00 per acre.

TESUQUE CREEK

This creek is the first creek north of Santa Fe. It rises in the high mountains and after leaving the mountains it flows in a northwesterly direction, and uniting with the Nambe Creek, forms Pojuaque Creek. This is not a perennial stream, being perennial only above the Pueblo of Tesuque.

This was examined on June 4 from the mouth to the Pueblo of Tesuque, and on August 5th from the Pueblo of Tesuque to Tesuque. On August 2nd or 3rd there had been very heavy rains near Tesuque and the creek it was estimated had had a discharge of about 300 cubic feet per second. All diversion works had been washed out. The diversion works usually consisted of a ditch extended into the channel which was carrying the water, or else a sort of wing dam made of brush, gravel and cobbles. These are all very temporary.

The soil under this area is of two general kinds. About the Puebloe of Tesuque and below, there is a clay soil of the clay bad lands, while about Tesuque the soil is more of a granite formation, being made up of decomposed rock from the mountains.

The fruit farms about Tesuque made an excellent appearance and were well cared for. The farming of the Indians and Mexicans below was not so good.

The crops are wheat, corn, truck, fruit and alfalfa.

Irrigation was practiced in this vicinity from the earliest times.

Only two ditches are given special mention, all others being explained in the tables.

No information has been obtained about any reservoirs.

Acequia Barranca

The heading of this ditch is on the west side of the creek about 1/2 mile from its confluence with Nambe Creek. This is about a mile long and irrigates some lands on Pojuaque Creek.

The following are the data for the flow on June 4, 1910: 1.2 ft. x 0.3 ft. x 2.22 ft. the velocity per second, gives a discharge of .80 cubic foot per second. The maximum capacity is about 4.0 cubic feet per second.

The irrigated area is about 150 acres.

Acequia de Ciserio Romero

The heading of this ditch is about 1 3/4 miles from the confluence with Nambe Creek.

The data for the flow on June 4, are: 2.0 feet, the width, x 0.3 foot, the depth, x 1.0, the velocity, equals .60 cubic foot per second, The maximun, 2.0 ft. x 0.5 ft. x 1.5 ft., the velocity, equal 1.5 cubic feet per second.

The area irrigated was estimated at 200 acres.

SANTA CLARA CREEK

This river rises in the Jemez mountains and flows east and empties into the Rio Grande near the Pueblo of Santa Clara, from which it gets its name. This is in a canyon most of the way, but about 1 1/2 miles from the Rio Grande it widens and affords a small valley. There are a number of small ranches in the canyon. Ditches are taken out where the canyon widens and on the north they irrigate lands owned by Mexicans, and on the south lands owned by the Indians. The Indian ditches are very old and have been used probably since before Coronado's advent in 1540.

This is a perennial stream while in the canyon, but upon reaching the wide channel the waters sink in the sandy bed during the dryest part of the summer. This was examined June 1, 1910, for about 6 miles up the creek. At that date no water was running below the canyon. Another cursory examination was made on August 16th and there was about 1 cubic foot per second at the D. & R.G. R.R. bridge north of the Pueblo. Copious rains had recently fallen in the vicinity but a few days previous.

Some reservoir sites of small capacity were said to be located on this creek, but none were examined and it is believed that there are none which are feasible, as the creek has a great fall.

The principal crops are corn, wheat, alfalfa, truck and fruit. Good crops are obtained on the land along the Rio Grande.

There are 640 acres irrigated on the Rio Grande from this ditch.

Small Indian

This is a little ditch on the north side of the creek about 1 3/4 miles west of the Rio Grande. It was dry on the day of examination.

The cross section is 2.0 feet x 0.4 foot, equals .80 of a square foot. The slope is .003, and n is .030, which all computed gives a discharge of 1.12 cubic feet per second. The mean velocity is about 1.4 feet per second.

The area irrigated was nothing, as there was no crop this year.

Acequia Juachipauque

This creek is located on the north side of the creek about 2 miles from the Rio Grande and irrigates the mesa lands of the Mexican settlement at Juachipauque.

This ditch has the use of water on Saturday, Sunday and Monday, alternating with the south side Pueblo ditch. There was no water in this on the day of examination. This is supposed to have the same capacity as the Pueblo ditch, which was carrying 5.6 cubic feet per second. The width of this ditch is 3 feet and the fall where examined was .95 foot per 100 feet.

The area irrigated was estimated at 300 acres. No additional area could be irrigated without storage, and as it is now there is a shortage in the summer.

Acequia del Pueblo de Santa Clara

The heading of this ditch is on the south side of the creek and about opposite the Acequia Juachipauque. The diversion works were typical of this creek, being a wing dam of stones and

gravel and easily washed out. There were no head gates. The ditches start out in an open cut. The ditch was taking all the water on June 1.

The following are the data for the discharge: 2.0 ft., the width, x 0.6 foot, the depth, x 3.0 feet, the mean velocity, equals 3.6 cubic feet per second. The velocity was determined by float.

The area irrigated was about 350 acres, mostly on the valley floor in the vicinity of the Rio Grande. Water is used on Tuesday, Wednesday, Thursday and Friday.

Information was received from Herman Velarde that there were 10 more ditches in the canyon, and that the average area irrigated under each ditch is about 10 acres.

These ditches in the canyon irrigate crops of hay and grain for the most part.

RIO SANTA CRUZ

This river rises in the high mountains and flows in a westerly direction and empties into the Rio Grande near Espanola. It may be classed as an intermittent stream along its lower course. It would be perennial if it were not for irrigation.

Settlements were made at Santa Cruz in 1607 and have been occupied ever since except during the Spanish evacuation from 1680 to 1693. The Acequia Santa Cruz is therefore very old. The settlements about Chimago are also very old.

Irrigation along this river has practically reached its limit, but there is much good land along the Rio Grande that could be irrigated from this stream if water could be supplied. There are now 2300 acres irrigated along the Rio Grande and there are probably that many more that could be easily irrigated.

The character of the soil is variable. In some places it is sandy, in others gravelly and in others it is clayey. The country through which it flows being bad lands, it follows that there is considerable clay. A large amount of very poor clay land is found under the area that is along the Rio Grande, between Santa Cruz and San Juan.

The irrigating season generally extends from April 15 to September 15 on the lower part, and from April 1 to September 1 in the upper part.

The altitude of the irrigated area ranges from 5600 to 6200 feet above the sea level.

The principal crops are alfalfa, native hay, corn, chili, wheat, truck and fruit.

Thirty four ditches are listed, with a capacity of

164.95 cubic feet per second and irrigate5111 acres. On June 6 the river was estimated to be flowing 50 cubic feet per second, and the combined flow of all ditches on that date was 80.70 cubic feet per second.

A great many of the small ditches were carrying their full capacity. No attention was being paid to the irrigation by flooding of a few adjacent acres of wild hay adjacent to the river, consequently a large amount of the water diverted was returning to the river. A considerable amount of water also was returning from excessive irrigation of the cultivated areas.

The creek bed is wide and evaporation is of course very high. The bottom is gravel nearly the entire length.

This was examined again on August 4th and 5th, 1910, and the ditches with a casual inspection seemed to be carrying about one-fifth their capacities. The wing dams had been improved. The flow on August 4th at a mile above Santa Cruz was 1.5 cubic feet per second, and water had evidently not run to the mouth after June 1st.

A measurement was made of the discharge of the river at Chimago and it was found to be 14.46 cubic feet per second. On June 6 the discharge at the same place was about 45.00 cubic feet per second, while at the mouth there was no discharge. In the 12th Annual Report of the U. S. Geological Survey the discharge of the Santa Cruz into the Rio Grande is given at 15 cubic feet per second for March 1889. It is probable from indications that the maximum discharge is somewhat near to 500 or 800 cubic feet per second.

It was not learned definitely, but it is probable that most of the ditches do not have any mayor domo. No smaller ones

turn in the water at the head gate and everyone helps himself.

It is not believed that there are any feasible storage propositions, and without these there will be no additional developments that will lessen the present supply to the Rio Grande.

Rio Chiquito or Rio Quemada

This creek or river is known by two names. It rises near Truchas Peak, flows in a westerly direction and uniting with the Rio Frijoles, forms the Rio Santa Cruz. The fact that it is known by two different names caused some confusion, but by consulting several maps it is believed that the true conditions are now assured.

The lowest settlements in regard to location are near Escondido, the next above are at Rio Chiquito, while the highest are at Quemada Plaza or Cordova Post Office.

The Plaza of Rio Chiquito is situated in an isolated valley. The irrigated lands are in the vicinity of the plaza and are watered by 3 ditches. The Acequia del Llano is described, while data for the other two ditches are tabulated in this report.

There is also a small tract of about 10 acres and belonging to the people of Escondido, situated close to the confluence of the Rios Chiquito and Frijoles. This tract is irrigated by 5 ditches.

High in the mountains, water is diverted from the Rio Quemada to irrigate lands on the Rio Truchas.

The soil is gravelly. The altitude is about 6600 feet above sea level. The water supply is perennial.

The crops are native hay, potatoes and truck. Cattle and goats are raised by the farmers.

Owing to the mountainous character of the country there is no land available for the extension of the irrigated area.

A reservoir on the Rio Santa Cruz (See "Reservoirs") would flood a part of this land.

This settlement can be reached by a miserable wagon road from Chimayo. There is no separate description of any ditch, nor any separate tabulation.

Acequia del Llano

The heading of this ditch is about 1/4 mile above the plaza of the Rio Chiquito. This is about 5 miles long and extends to Chimayo and beyond. It irrigates lands on the Rio Chiquito and an arroyo from Truchas and along the Santa Cruz.

On the day of examination the flow was 8.4 cubic feet per second, the width being 4.0 feet, the depth .7 foot and the velocity being 3.0 feet. The maximum capacity is according to the following data: the width 4.0 feet, the depth .90 foot and the velocity being 3.0 feet, and the discharge 10.8 cubic feet per second.

The area irrigated is about 500 acres, and the extendible area 200 acres.

The valley at Quemado Plaza

This is an isolated valley about 1 mile long and 1/4 mile wide, and contains about 160 acres and is irrigated by 4 ditches, each of 2 cubic feet per second, making a total capacity of 8 cubic feet per second. The aneroid gave this valley as being 6800, but this is probably too low. There is no extendible area as the country is mountainous.

RIO FRIJOLES OR RIO PANCHUELO

This creek united with the Rio Mateo and forms the Rio Santa Cruz.

There is a very small irrigated area on this creek at its mouth, being about 35 acres, with 5 ditches. A large part of this is in native hay. This is located on the Cundiyo Grant at an altitude of 6600 feet and at the plaza of Escondido. It is very much isolated and the farming is not well done. The crops are mostly native hay and truck.

A reservoir site is on the Santa Cruz and covers lands on this creek.

The water supply is perennial, but the irrigable area is hardly extendible because of the mountainous character of the country. This is a struggling Mexican settlement.

No separate description is made of each ditch, nor any separate tabulation.

THE RIO CHAMA

This is one of the perennial tributaries of the Rio Grande and the only one of that nature that empties into it from the west in New Mexico. It rises in the high mountains in Colorado and drains the east slope of the continental divide in its upper part. It is one of the greatest contributors to the Rio Grande and the first that contributes a considerable amount of silt.

The main body of irrigable land is located at the lower end for a distance of about 25 miles between Abiquiu and the mouth.

For a considerable distance or from El Vado to Abuquiu, the river is for the most of the distance in a canyon and irrigation is confined to small isolated patches.

There is a small valley near El Vado, and above that is a canyon for a short distance. There is irrigation then for the next 25 miles; the main body of land is at Parkview.

The climate of the Abiquiu valley is such that fruits can be raised, while the climate at Parkview is such that the late and early frosts practically prohibit the growing of fruits. Only the hardy grains and vegetables and forage can be grown at the high altitudes.

The Rio Chama was gaged just below the D. & R. G. R. R. bridge on August 4th and 148.58 cubic feet per second were flowing. This was the result of a flow caused by summer showers, and judging from the silt carried, probably came from the Rio Puerco or its tributaries. The flow was estimated there on June 2, 1910, at 1200 cubic feet per second, with the maximum flow at 12,000 cubic feet per second.

The flow on June 20 was estimated at 300 cubic feet per second at a section about midway between Ojo Caliente Creek and

El Rito. The flow of the Chama at Abiquiu might be reasonably estimated at 250 cubic feet per second on June 20. In the 12th Annual Report of the U. S. Geological Survey the discharge of the Chama at Abiquiu was estimated at 750 cubic feet at the time between March 26 and April 4, 1889. The following data are taken from Water Supply Paper No. 11, page 65. The flow is for the Chama at Abiquiu.

1895	June 21	404	second-feet	
"	July 25	206	"	"
"	Aug. 18	209	"	"
"	Oct. 29	72	"	"
"	Nov. 26	77	"	"
1896	Jan. 19	129	"	"
"	Sept. 5	47	"	"
"	Oct. 28	51	"	"
"	Nov. 19	65	"	"
"	Dec. 12	76	"	"

The following table gives the mean monthly discharge in second-feet as estimated by me from the available data:

	Mean in Sec-ft.		Acre-feet
January	130	about	8060
Feburary	130	"	8060
March	500	"	31000
April	750	"	45000
May	750	"	45000
June	500	"	31000
July	200	"	12400
August	200	"	12400
September	50	"	3000
October	60	"	3720
November	70	"	4200
December	70	"	4200
			208040

It would therefore seem as if about 200,000 acre-feet are annually contributed to the water supply of the Rio Grande. Even though this estimate is approximate, it is believed that the true discharge determined after a series of years of observations, will show this ostimate is correct within 25,000 acre-feet per annum.

The mean annual increase in the flow of the Rio Grande is 550,190 acre-feet in the Espanola Valley. The area irrigated was estimated at 5,535. It is therefore estimated that about 25,000 acre-feet are used and evaporated, and that the flow of the Rio Chama is about 50% of the amount entering.

Acequia Salazar

The heading of this ditch is on the west side of the Rio Chama about 1 1/2 miles above the D. & R. G. R. R. bridge. The ditch is not over 2 miles long.

The diversion works are temporary, being a wing dam made of posts driven into the gravel of the river bed, and brush, sods and boulders placed about them. The valley floor in the vicinity of this ditch and along the extreme lower end of the Rio Chama is little above the bed of the river. This dam raises the water nearly to the general ground surface in that particular locality, and consequently the land becomes water logged both from the dam and the ditch.

The following are the data secured about the flow of the ditch on the day of examination, June 2, 1910: $\frac{8.0 \text{ ft. plus } 10.0 \text{ ft.}}{2}$ x 1.5 ft. equal 13.5 square feet, the sectional area, and the float velocity being 1.86, which closely corresponds with a calculated velocity for a grade of .09 foot per 100 feet, gives a flow of 25.11 cubic feet per second. The maximum capacity: $\frac{8.0 \text{ ft. plus } 10.0}{2}$ ft. x 2.08, equal 18.72 square feet, the sectional area, and the velocity being 2.30 feet per second, as computed from a grade of .09 foot in 100 feet, and n being .025, gives a discharge of 43.0 cubic feet per second.

All lands irrigated are on the Rio Chama.

Small Private

The heading of this ditch is on the east side of the Rio Chama just below the main brush and cobble dam for the Acequias San Jose and Guique.

The diversion works are temporary, consisting of a wing dam of no importance, but sufficient to divert a small amount of water.

The maximum capacity is about 1 cubic foot per second and the area irrigated is 10 acres.

Acequia San Jose

The heading of this ditch is on the west side of the Rio Chama about 4 miles above the railroad bridge and near to where the Chama runs over the last lava falls or rapids.

The diversion works are a temporary brush and rock dam extending across the river. The brush consists of cedar branches and these are weighted down with rock. There was a sluice-way about 500 feet from the dam. The Rio Chama carries considerable sand when high.

The examination was made on June 2, 1910. The following are the flow data: $\frac{10.0 \text{ ft. plus } 11.5 \text{ feet}}{2} \times 1.0$ equals 10.75 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 16.12 cubic feet per second. The maximum $\frac{10.0 \text{ ft. plus } 13.0 \text{ ft.}}{2} \times 1.9$ ft. squals 21.85 square feet, the sectional area, and the velocity being 2.0, gives a discharge of 43.70 cubic feet per second.

The area irrigated is probably about 1200 acres. This ditch irrigates much good land about Plaza San Jose, and the people generally have enough water. The value of the land is generally

about $60.00 or $75.00 per acre, but some will run to $200.00.

Acequia Guigue

The heading of this ditch is on the north side of the Rio Chama at the south end of the Black Mesa.

The diversion works are the same as for the Acequia San Jose.

Measurements for discharge were made on June 24, 1910, at two different sections. The data for flow on the day of examination, June 14, are as follows: $\frac{7.0 \text{ ft. plus } 13.0 \text{ ft.}}{2} \times 1.3$ ft. equal 13.0 square feet, the sectional area, and the mean velocity being 1.5 feet per second, gives a discharge of 19.5 cubic feet per second. The data for the maximum capacity are: A is 17.42 sq. Ft., R is 1.2, N is .025, S is .00045, V is 1.34, C is 24.04. The area irrigated was estimated at 240 acres. This irrigated area could be extended 250 acres by scientifid farming.

The land ranges in value from $20.00 to $200.00.

This ditch is peculiar in the fact that it has some drops and some spillways in it. There are several located a short distance below the dam. The ditch starts out at an elevation and drops down by various kinds of falls until a favorable location for a canal is found near the river bed. If this ditch were kept up on a light grade, from 100 to 200 acres could be irrigated thereby.

The oldest Spanish settlements in the United States were made near the mouth of the Chama on lands now irrigated by this ditch.

Acequia Schilli

The heading of this ditch is on the west side of the

river about 1 mile above Bear Creek. This ditch is over 2 miles long and takes water from Bear Creek at times. It crosses this in an open cut. Large floods therefore destroy the ditch at the crossing.

The diversion works are a temporary dam of cedar brush and rocks. No sluice gates were noticed. The ditch and diversion works were examined on June 8, 1910. The data for the flow on that day are: $\frac{5.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.0, equal 6.0 square feet, the sectional area, and the velocity being 1.8 feet per second, gives a discharge of 10.8 cubic feet per second. Another is: $\frac{7.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x 1.0, equal 7.5 square feet, the sectional area, and the velocity being 1.6 feet per second, makes a discharge of 12.0 cubic feet per second. These results differ by 1.2 cubic feet.

Two observations were made for maximum capacity. One, $\frac{5.0 \text{ ft. plus } 7.5 \text{ ft.}}{2}$ x 1.2 ft., equal 7.5 square feet, the sectional area, and the velocity being 2.0, gives a discharge of 15.0 cubic feet per second. The other, $\frac{7.0 \text{ ft. plus } 8.5 \text{ ft.}}{2}$ x 1.3 equal 10.0 square feet, the sectional area, and the velocity being 1.57 feet per second, gives a discharge of 15.8 cubic feet per second. These are quite close, being .8 of a cubic foot per second difference.

The area irrigated was estimated at 200 acres, and the additional area that might be irrigated at 100.

The values of land should range from $40.00 to $75.00 per acre.

Community

The heading of this ditch is about 1 1/2 miles below the mouth of the El Rito. The diversion works are temporary.

This was examined on June 20, 1910, and the velocity

was found to be very light, being .44 of a foot. The following is the flow data for that day: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 2.5 ft. equal 12.5 square feet, the sectional area, and the velocity being .44 of a foot per second, gives a discharge of 5.50 cubic feet per second. The data for the maximum capacity are: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 3.0 feet, equal 15.0 square feet, the sectional area; the velocity being estimated at .60 of a foot per second, gives a discharge of 9.0 cubic feet per second.

The area irrigated was estimated at 150 or 175 acres. The additional area that might be irrigated is not great, as the valley floor on this side in this vicinity is not wide. There is a succession of narrow ranches as it is now.

South Rio Chama, or Acequia Martinez

The heading of this ditch is on the west side of the Rio Chama about 2 miles above the first ford below the mouth of El Rito.

The diversion works are temporary. The data for the flow are as follows: 3.0 ft. x 0.8 ft. x 1.5 ft. equal 3.60 cubic feet per second.

The ditch was said to be 10 miles long, but the maps show that by taking certain facts into consideration, it cannot be so long as that. It is probable that 6 miles is nearer the true length. The area irrigated was estimated at about 200 acres. Some more land could be irrigated than is irrigated, but no reliable estimate can be made. The irrigated area is made up of small patches.

Acequia Tierra Azul y Puente

The heading is about 3 miles below Abiquiu and the irrigated area was examined on June 20, 1910.

The flow on June 20 was 15.95 cubic feet per second, and the maximum flow was estimated as being 22.50 cubic feet per second.

The irrigated area was estimated at 350 acres. This ditch irrigates some very nice farms. The name shows that it is now the combination of two ditches.

Acequia Quintana and Cordova

The heading of this ditch is just below the heading of the Tierra Azul y Puente ditch.

The diversion works were a dam about 2 or 3 feet high made of cedar brush and cobble stones. This was being raised on the day of examination, June 20, 1910. A layer of brush would be started with the butts upstream, and after 5 or 10 were laid they would be weighted down with heavy cobbles, and then the layer would be extended. Successive layers of brush and cobbles, with sods and gravel made the typical diversion dams of the mountain streams.

There was no water on June 20. The maximum capacity was estimated at 5 cubic feet per second.

Five ranches are irrigated with a combined area of 250 acres.

Acequia Abiquiu or Capia

The heading of this is on the south side of the Rio Chama and near Abiquiu.

This is probably of prehistoricage as Abiquiu was formerly an Indian pueblo, and is at the present time mostly composed of mixed bloods.

The diversion works were a mud wing dam.

The flow on June 20 was 4.14 cubic feet per second, and

the maximum capacity was estimated at 9.00 cubic feet per second. The ditch is 3 miles long and irrigates about 350 acres.

Ranch of T. D. Burns

This is located on the Canon de Chama Grant and there was no irrigation this year, according to one informant, but according to another there were 600 acres. The former is correct. All irrigation previously had been done by a steam pumping plant. It was learned that it was not very large. Taking all information, which was quite conflicting, it is possible that there was about 600 acres under the pumping plant.

This is a hay ranch and the location of the ditch is shown on the topographic map.

Caprino Pino and Antonio J. Delgado

These two men each have a small ranch of 10 or 12 acres which they irrigate from springs in the vicinity of the T. D. Burns ranch. Their exact location is not known.

Private, (4)

Four small ranches in the vicinity of the mouth of the Gallina River. The acreage was not learned for a certainty, but is probably about 4 acres each.

Hart Ranch

This ranch of 20 acres is near the mouth of Rio Cebolla. It was not definitely determined whether it was irrigated from the Rio Chama or Rio Cebolla.

Irrigation near El Vado

There is a small valley near El Vado. There is a saw mill here which was formerly in operation, but it is now idle. The Rio Chama runs through deep canyons both above and below this valley. There are three ditches which irrigate the lands, and all are on the west side of the river.

The lowest one is one which irrigates hay and pasture land belonging to the lumber company, and it has a maximum capacity of 1 cubic foot per second and irrigates 60 acres.

The next above is a community ditch and was flowing 1.5 cubic feet per second and had a maximum capacity of 2.0 cubic feet per second on June 23, 1910. About 135 acres were being irrigated.

The upper ditch is private and was carrying .25 of a cubic foot per second, and had a maximum capacity of 1.00 cubic feet per second and irrigates 5 acres.

There are, therefore, 5 ditches with a combined capacity of 4 cubic feet which irrigate 200 acres.

The crops are native hay, oats and wheat in the main.

The value of the land is not very great, probably not being over $25.00 per acre.

The water supply is always sufficient and there is no additional lands that could be irrigated without prohibitive expense.

OJO CALIENTE CREEK

This is a tributary of the Rio Chama. It is formed by the confluence of the Rios Petaca and Vallecitos. It empties into the Rio Chama about 6 miles from its mouth.

Irrigation is practiced upon the upper part of this stream in the vicinity of the Post Office at Caliente. In the spring when the snows are melting a great volume of water passes down the stream in a short period. The summer storms produce a torrential flow, but generally from June to the end of the summer the flow is not sufficient for the area attempted to be irrigated.

The altitude of the area irrigated is about 6500 feet above sea level. There is some snow in winter. The annual precipitation is probably 14 or 15 inches, but the estimate is obtained by interpolation.

The methods of irrigation are crude, and the products mostly grain and forage. Fruit should do well under scientific cultivation, but the haul to the railroad would be a hindrance.

There is considerable land below the hot springs which might be irrigated if storage were provided. It is known that there are reservoirs on the Rio Vallecitos, and also on Ojo Caliente Creek. If these were constructed, it is probable that a fine mesa about 5 miles below the springs could be partly irrigated. These reservoirs are mentioned under "Reservoirs".

Under the present conditions practically all products are consumed locally. The forage and grain is fed to a large number of sheep during the winter.

On June 14 there was about .50 of a cubic foot of water about 6 miles from the Rio Chama. At the same date there was 2.00

cubic feet per second at Ojo Caliente. No water was running into Rio Chama. The creek bed at the lower end is wide and very sandy and great dunes have been formed on the east side of the creek.

A number of abandoned ranches were noticed below Ojo Caliente, due to a shortage of water caused by increased usage near the source.

No separate description of the ditches is given. They will be found tabulated.

The area of land that might be irrigated if reservoirs were built will be estimated at 5000 acres.

RIO PETACA

This is the east branch of Ojo Caliente Creek. It rises in the high mountains near Good Hope and flows in a southerly direction. Its drainage area is largely wooded and is at a high altitude. The irrigated lands lie in a series of very small valleys, between which are deep canyons.

The valleys are cultivated principally by Americans and Mexicans. In addition to this the Americans are cattle raisers while the Mexicans have large herds of goats. Forage is the principal crop, which is fed to the stock. The few products are consumed locally. The altitude ranging from 6500 to 8300, permits but few crops unless scientific farming is practiced.

Reservoir sites were not particularly looked for, but it is possible that some would be found. As the fall of the valleys is from 40 to 50 feet to the mile, the cost of development, both of the lands and the reservoirs, would probably be too expensive.

The following is a description of the irrigated parcels, with their acreage:

From the mouth of the creek to the first canyon above 10 acres are irrigated in a crude manner. At the Mexican plaza of Servilleta, altitude 6750, about 30 acres are irrigated. The next settlement above Servilleta has about 30 acres irrigated. The crops are mostly wheat, oats and corn. At the plaza of Petaca about 80 acres are irrigated below the settlement, and 150 acres above to Las Cables. In the Las Tusus valley about 240 acres are irrigated. This is at an altitude of about 8300 and native hay and oats are the principal crops.

There might be a good dam site at the lower end of this valley, and if there was there should be a good reservoir site. There are about 20 acres of native hay and oats irrigated on the west branch of Rio Petaca. This is probably at an altitude of 8500. No more irrigation is practical on the Rio Petaca. The irrigable area is small; the cost of storage would be high and the value of the crops is small.

RIO VALLECITOS

This is a typical mountain stream, rising in the high mountains near Good Hope and flowing in a southerly direction, until its confluence with the Rio Petaca, forms Ojo Caliente Creek. The drainage area is mostly at a high altitude and is mostly forested. The topographic formation is a series of mesas intercepted by canyons. The snow fall is considerable and the ground storage of water is considerable. The higher parts of this creek were visited on June 16, and the soil was in places quite moist from winter snows, supplemented with spring rains.

The irrigated area consists of a series of small valleys separated from each other by deep canyons. The size of each ranch is very small, often consisting of but a few acres. Many have goats, which are grazed upon the public domain and are herded by the children.

The crops are mostly native hay, alfalfa, oats, wheat, corn, potatoes, beans and truck. Fruit is raised to some extent but smudging is not practiced, nor is scientific pruning resorted to. The market for the products is local.

Some reservoir sites have been surveyed by the U. S. Geological Survey, and are reported under "Reservoirs".

All ditches are small and have a capacity of but a few cubic feet per second. The diversion works are nearly always of cobbles or cobbles and gravel, and have to be rebuilt after every great flow. The flow in the spring while the snow is melting is great. Owing to the fact that the drainage area lies at such a uniform altitude, together with the heavily timbered nature of this area, the snow melts in a comparatively short time.

The following are brief descriptions of some of the val-

leys in which irrigation is practided:

The lower valley is near the mouth of the river and extends for 1 1/2 miles along it. It was estimated that 48 acres were irrigated. A few more might be irrigated, but the ground was for the most part quite gravelly.

The next valley above this was at Ancons, below which a dam site was surveyed by the U. S. Geological Survey. This valley and settlement is within the reservoir site. The map made by the U.S.G.S. does not show any settlement here. It was not learned whether this was settled since the survey or not.

There is another small valley of 25 acres below Vallecitos. At Vallecitos it was estimated that 130 acres were irrigated. There is a small Mexican plaza of about 150 people. This is situated at an altitude of about 7400 feet above sea level.

Above Vallecitos is a small valley of about 10 acres.

Still higher up, is a valley called Plaza Cañon, being the uppermost of all these valleys. This is situated at an altitude of about 7900 feet and extends for about 3 miles, and 70 acres are irrigated. Oats, wheat, native hay and potatoes are the main crops. In some places the potatoes can be raised without irrigation.

The entire area irrigated is therefore about 313 acres. No account was kept of the number of ditches. The water supply is sufficient for the present amount of irrigation, but any additional area would be detrimental to those on Ojo Caliente Creek who farm the farthest down.

There is some bench land between Cañon and Vallecitos which might be irrigated, but it is probable that it would be expensive to do so.

There are several reservoir sites, which probably are not feasible unless the value of the lands that can be irrigated is increased.

On June 17, 1910, the flow at a point about 3 miles below Vallecitos was estimated at 8 cubic feet per second, and at the dam site at Ancones at 5 cubic feet per second. It is probable that all the water was at the surface at Ancones.

EL RITO

This is a tributary of the Rio Chama which empties into it from the north about 12 miles from the Rio Grande. It rises in the vicinity of Canjilon Mountain and flows in a southerly direction. The stream is intermittent. It has a great flow in the spring while the snow on the high mesas is melting, and a low flow in the summer when the rains furnish the supply. However, often during the summer showers are precipitated, which make the flow torrential.

The area irrigated is in the vicinity of El Rito. This settlement is about 75 years old and is situated at the upper end of one of the finest bodies of irrigable land on the tributaries of the Rio Grande in New Mexico. The elevation is about 6900 feet above sea level.

The annual precipitation is estimated as best as can be by interpolation, at about 14 or 15 inches.

The principal crops raised in the canyon above El Rito are native hay, and in the vicinity of El Rito, corn, oats, wheat, potatoes, apples and truck. All crops are consumed locally.

The soil is gravelly and of a sandy loam. At the upper end of the valley gravel predominates, while at the lower end the soil is of a sandy loam. The coarser debris as it comes out of the mountains is deposited first.

The flow of this creek was estimated on June 19, 1910, at 10 cubic feet per second. above the head of irrigation. This was supplying several but not all the canals down to and including the Acequia Ladre. It will be noticed that 1 3/4 miles below, at the head of the Acequia Placitas, there was being diverted .25 of a cubic foot per second. Again about 5 1/4 miles below this

where the creek runs through a lava canyon, 1.00 cubic foot per second is diverted. The river bed is dry between. Again about 1 mile farther down another cubic foot per second is diverted at another canyon. This is probably the most favorable example of seepage return. The geological formation at the upper end of the valley is such that there is a great amount of coarse gravel, which permits the percolation of a great amount of water. From testimony it appears that the seepage at the lower end of the valley does not appear in midsummer.

The maximum discharge was estimated from evidences furnished by drift wood to be about 400 cubic feet per second at the head of irrigation.

Acequia Madre de El Rito

The heading of this ditch is on the west side of the creek about 1 mile below El Rito.

The diversion works on June 19th consisted of a temporary dam of brush and cobbles.

The flow on June 19th was according to the following data: 2.5 ft. x 1.0 ft. equals 2.5 square feet, the sectional area, and the velocity being 1.0 foot per second, gives a discharge of 2.5 cubic feet per second. The data for the maximum flow are 3.0 ft. x 1.5 ft. equal 4.5 square feet, the sectional area, and the velocity being estimated at 2.25 feet per second, gives a discharge of 10.25 cubic feet per second. This was diverting all the water in the creek.

The area irrigated was estimated at 600 acres.

It was said that this was over 75 years old.

Iabato Grant Ditch

This ditch was built by the owners of the Iabato Grant about four years ago. Iabato Grant is owned by a company with headquarters in Colorado Springs, Colorado, and it is their intention to provide a supply of water for about 20,000 acres of irrigable land and sell it to settlers.

The heading of this ditch is on the west side of the creek about 1 1/4 miles above El Rito.

The diversion works consisted of a brush and cobble dam. A timber headgate was built; this was 5' x 5' x 2'. The ditch was in a very poor condition owing to silt. It was dry on June 19, 1910. The bottom width when cleaned was probably 10.0 feet, and the depth of water about 1.5. As it had no water right except for flood waters, there was no water in the ditch.

The area irrigated was said to be 50 acres. A larger acreage could be irrigated, but the amount is estimated at 4,000 acres.

Upper Cañon Ditches

There are 15 ditches in the upper canyon. They as a general rule irrigate very small tracts of native hay and potatoes. A few tracts of grain were noticed, but not many. A great number of small ranches had been abandoned in this canyon. These divert as a rule considerable water, and a great amount of it runs back into the stream.

CANYONES CREEK

This is a small intermittent tributary of the Rio Chama. It rises near Abiquiu Peak and flows nearly due north and empties into the Rio Chama about 8 miles above Abiquiu. The discharge in spring while the snow is melting, is large. The creek is in a canyon for most of its length and only one small settlement is located on it, Canyones. This was not visited, but considerable confirmatory information was received from several persons.

There are one large and several small ditches which irrigate in all about 500 acres. The farms are small and the crops all consumed locally. As great numbers of sheep, cattle and goats are grazed on the adjacent ranges in the growing season,, the forage crops are fed to these in winter.

The crops are native hay, alfalfa, corn, oats, wheat, truck and fruit. This is an old settlement.

No reservoirs were known to persons from whom information was received.

RIO PUERCO

This is an intermittent tributary of the Rio Chama. It rises in the San Pedro Mountains in T. 21 N., R. 2 E., and flows in a northeasterly direction. This flows for most of its length in a canyon through a series of mesas. A considerable part of the basin is composed of shales which are easily eroded. Great amounts of mud are therefore transferred by the floods, and hence the name of Puerco.

The entire irrigated area was not visited on this creek. We were informed that there were 2500 acres irrigated, but this is believed to be excessive after an examination of a topographic map and after a comparison was made with other estimates made by the informant. There are probably not over 1,000 acres irrigated. The number of ditches was not learned. There is a ditch named Acequia del Arroyo de Agua, which irrigates 11 ranches in the vicinity of Coyote, P.O.

It was said that there were some good reservoir sites, but it is doubtful.

It is believed that no developments will be made for several years that will influence the present water supply of the Rio Grande.

The principal settlements are about Coyote, P.O. and in the lower valley near the Rio Chama.

Arroyo Seco

This is a tributary of the Rio Puerco which rises near Cerro Pedernal and flows in a northeasterly direction. It is an

intermit ent stream flowing only during the periods of considerable run-off.

There is one ranch owned by Juan de Dios Gallegos which had about 15 acres cultivated on the day of examination, June 20, 1910. There are probably 15,000 acres of land lying on the mesa north of Cerro Pedernal that could be irrigated if any water supply could be provided. This might be in time subjected to dry farming if some well adapted crop could be found, but the present supply is not adequate for 15 acres.

El Rito del Rio Puerco

This is a small intermittent tributary of the Rio Puerco. It rises in the high mesas south of Cerro Pedernal and flows in a northwesterly direction. The flow in spring while the snows are melting is considerable, but this is usually over about June 1st and there is no water till about July 1, when the summer rains begin. At times the showers are so copious that irrigation is not needed.

The information received was that there was but one ranch, and that it was owned by Jose I. Archuletta, and 10 acres were irrigatedd with a ditch which had a capacity of 1 cubic foot per second. It was noticed that considerable land had formerly been cultivated that was now wild.

The plaza of El Rito is a settlement of six or eight houses. Some who live there evidently gain a livlihood by raising sheep or lumbering.

There can be no further development of irrigation for a number of years that would be detrimental to the present water supply of the Rio Grande.

El Rito de Las Sillas

This was not visited and information was not received concerning the same while in the neighborhood, but the topographic map published by the U. S. Geological Survey shows settlements to be located high up in the mountains. Ten houses are shown and the irrigated area is small. From information shown on the map, and from a general knowledge of conditions in this part of the country, it is believed that conditions affecting the flow of the Rio Grande will remain as they are for an indefinite period.

Coyote Creek

This is a tributary of the Rio Puerco. It rises in the high mountains near the center of T. 21 N., R. 3 E., and flows north and empties into the Rio Puerco near the north boundary of T. 22 N., R. 3 E. The drainage area ranges in altitude from 6600 to 10,300.

The main body of irrigable land is in the vicinity of Coyote Plaza, which is near the mouth. The informant gave the name of this plaza as "Plaza del Rito de los Encinos". There is a confusion of names at any rate, and the names will be used as shown on the topographic map published by the U. S. Geological Survey.

There are probably not over 1000 acres irrigated on this creek. The water supply is not sufficient for the area under cultivation. These settlements could not be maintained if it were not for the open range and available fire wood.

The crops are mostly oats, wheat, alfalfa and truck. All products are used locally.

Poleo Creek

This is one of the tributaries of the Rio Fuerco, and is intermittent. It rises in the high mountains in T. 23 N., R. 3 E. and near the mouth it is in a deep canyon, where a few small ranches are irrigated, but probably not more than 80 acres in all. There was a flow of about 3 cubic feet per second on the day of examination, June 22, 1910.

SALITRAL CREEK

This is an intermittent tributary of the Rio Puerco. It rises on San Pedro mountain near the east boundary of T. 22 N., R. 1 E., and empties into the Rio Puerco. in Sec. 5 of T. 22 N., R. 3 E. Its drainage area has an elevation from 6600 feet to 10,000 feet above sea level.

All irrigation is in T. 22 N., R. 2 E., and consists of probably about 200 acres.

This was not visited in 1910. It is known that the maximum irrigable area is cultivated. It is probable that the conditions on this creek affecting the water supply of the Rio Grande will remain as they are for a number of years.

There was no discharge at the mouth of the creek on the day of examination.

GALLINA RIVER

This is one of the intermittent tributaries of the Rio Chama. It rises in the high mountains in T. 23 N., R. 1 E., and flows in a northerly direction for about 15 miles, entering a canyon and for about 10 miles flows east, then emptying into the Rio Chama. The high mountains furnish considerable water. The bad lands composed largely of clay soil, produce a great run-off with a small ground storage. The geological conditions are such that there are a succession of tilted strata.

The altitude of the irrigated area probably ranges from 6,000 feet to 7,500 feet above sea level. Irrigation begins about May 1, but often in June the supply is not sufficient. The summer rains usually begin about July 1, and after that time the precipitation is enough to mature crops. The amount of rainfall at Gallina Plaza is evidently much greater than it is 5 miles below.

The soil is a clay formation. The river is in an earth canyon from 10 to 30 feet deep from the Plaza to the canyon below. The geological formation is all sedimentary.

The growing season is short, owing to the high altitude and cold climate. The crops are oats, potatoes, wheat and truck. No fruit is raised.

As far as could be generally learned, the settlers are squatters on government land. It was understood that no homestead entries had been made, even though the settlements are 20 years old.

The value of the land was said to be about $10.00 per acre. This seems very low, but the crops are scant and not very valuable. Nearly every family has a small herd of goats and some

have sheep. The children herd these animals.

The irrigated area extends from about 3 miles above Gallina to 4 or 5 miles below. There are seven ditches. The ranches are scattered and it is difficult to make a reasonable estimate of the total acreage. There are about 20 ranches having an average of 12 acres each, and one additional tract of 60 acres, making a total of 300 acres. The additional area that is possible of irrigation, if there was sufficient water available, is very great and must be about 2000 acres. It seems possible that some storage reservoirs might be developed on some of the arroyos entering on the west side. These sites were not examined, as at the time there was no map and no one mentioned them.

It is very probable that the present conditions will remain about the same for a number of years, and will have no effect on the present supply of the Rio Grande.

CAPULIN CREEK

This is an intermittent tributary of the Gallina River. Its source is near the southeast corner of T. 23 N., R. 1 E., and its mouth is less than a mile below Gallina.

Irrigation is practiced along it for about 5 miles. The altitude ranges from 7,300 to 8,000 feet above sea level. The ranches are very small and the crops not very valuable, the crops consisting of alfalfa, peas, oats, wheat, potatoes, beans and vegetables. The growing season is short and all the products are used locally. The value of the land is from $10.00 to $20.00 per acre. As far as could be learned, all the settlers are squatters on government land.

It is said that the irrigation season extends from June 15 to July 15. This does not agree with the information obtained at Gallina, but it is believed that such is some times the case. Most people expected the summer rains to supply the moisture after the 1st of July. This seems to be a combination of irrigation and dry farming. The value of the land ranges from $10.00 to $20.00 per acre.

As there are no opportunities for storage so far as could be learned, and all the waters used excepting the flood waters, it is believed that conditions affecting the water supply of the Rio Grande will remain as they are for a long time.

The following are the data for the irrigated lands: 20 ranches of 10 acres each and 1 tract of 70 acres, a total of 270 acres. There are 8 ditches for this area. The extendible area is probably 2000 acres if there was sufficient water.

CEBOLLA CREEK

This is a short intermittent tributary of the Rio Chama. It rises in the high mountains near Canjilon Peak and flows in a westerly direction. The geological formation is mostly made up of upheaved sedimentary strata, which produces a clay soil in the valleys.

Most of the irrigation is in the vicinity of the Mexican plaza of Cebolla, which is situated at an altitude of approximately 7,700 feet above sea level.

This stream is like a great many of the mountain streams having a small drainage area, from the fact that nearly all of the run-off occurs during one month in the spring. The stream is then dry, except for short periods in summer when influenced by heavy rains.

There are 16 ranches comprising 75 acres, which are irrigated by 8 ditches. There is much more good land that could be irrigated if water could be provided. It is not likely that reservoirs of large size could be found. It is believed that some might be built of a few acre-feet capacity which could be filled by supply canals during periods of great run-off.

WILLOW CREEK

This is an intermittent tributary of the Rio Chama which empties into it from the west. It rises west of Chama and flows in a southerly direction and empties into the Rio Chama 3 miles above El Vado.

There is no irrigation upon it. Mr. Frank W. Broad believes that there might be a feasible reservoir site on this creek above the D. & R. G. Ry. It was not examined. From the casual examination made of the creek at two different places, its is probable that water stored in this reservoir would have to be used along the lower end of the stream, as the upper end seemed to be in a mountainous country.

This creek was crossed on June 29 on the wagon road from Horse Lake to Tierra Amarilla. The flow of the creek at this point was about one cubic foot per second. If the Horse Lake reservoir was feasible, most of the stored waters could be used on this creek. On June 23rd, while on the road from El Vado to La Puente, a site was noticed that might be a reservoir, though a survey would be necessary to determine its feasibility. The storage would have to be used along the Rio Chama, as the possible reservoir was at the head of the Rio Chama. As this reservoir site is small and as the lands along the Chama have enough water as a rule, it is probable the entire proposition is not feasible.

LAS NUTRITAS

This is one of the intermittent tributaries of the Rio Chama and rises in the high mountains north of Canjilon Peak and flows in a westerly direction.

The irrigated lands are found in narrow non-contiguous patches along the stream bed for a distance of about 19 miles or a little less. The agricultural conditions are not very favorable. The water supply is insufficient. The soil is mostly a clay and in some places a gumbo. It is not as good as it is about Tierra Amarilla, or at Parkview. The climate however, is better than at Tierra Amarilla.

There are probably 10,000 acres of irrigable land in the valley. It is not believed there is any method by which water could be secured for the entire tract, or even a considerable portion of it. The rumors were that the owners of the Tierra Amarilla Grant contemplated bringing water to this tract by an expensive canal from the Rio Brazos, to irrigate a great portion of it. This is not deemed a feasible proposition when there are from 5,000 to 10,000 acres in the vicinity of Tierra Amarilla and along the Rio Chama that are possible of economical irrigation from the waters of the Rio Brazos, provided the water supply is adequate. Owing to the climate, the growing season is long. The range of hills to the north prevents the cold air from the high peaks descending upon the valley.

The value of the irrigated land was stated to be about $25.00 or $30.00 per acre. The crops are wheat, oats, corn,

potatoes and truck.

There are 40 ditches and 40 ranches, with a total of 200 acres irrigated. The altitude at the upper end of the valley is 7,560 feet above sea level.

RIO BRAZOS

This is a tributary of the Rio Chama. It rises in the high mountains north of Brazos Peak. For about 15 miles it flows at an altitude exceeding 9,500 feet above sea level, breaking out of the high mountains upon the mesa at Fairview through Brazos Canyon. It has a fall of about 2,000 feet in 25 miles. This canyon is one of more than ordinary beauty.

All of the water is used for irrigation. The greater part of the soil is gravelly and the return waters are considerable, as noticed along the edge of the mesa at Parkview. No seepage measurements were made.

Acequia Ojos, or Parkview, and La Puente

The heading of this ditch is on the south side of the Rio Brazos, three miles from Encinada and just below the Acequia Encinada. This ditch is very near the mouth of the Brazos canyon, which is a mighty gorge, 2,000 feet deep in places.

The diversion works of this ditch are a typical brush and cobble dam. This is another ditch that was built without regards to alignment or grade.

The data for the flow on June 25th are as follows: 8.0 feet by 0.8 = 6.4 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 12.8 cubic feet per second. The maximum capacity was estimated at 30 cubic feet per second. To get a reliable estimate on the maximum capacity would be very difficult, as there is no constant section, grade or coefficient of roughness.

The irrigated area was estimated at 1280 acres. With conditions as they are at present, there is no extendible area, as the cost would be very great.

Acequia Ensenada

The heading of this ditch is on the south side of the Rio Brazos about 3 miles above the Plaza of Ensenada, and just a few feet above the heading of the Acequia Los Ojos.

The diversion works consisted of a temporary dam across the creek composed of brush and cobbles. A new dam has to be constructed each spring. This is the highest ditch on the Rio Brazos. This ditch was built in the easiest way possible, with no reference to location or grade; the construction is crude.

This ditch was examined on June 25, 1910, and the following data for the flow on that day were obtained: 8.0 feet x 1.4 = 11.2 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 22.4 cubic feet per second. The maximum capacity was casually estimated at 25 cubic feet per second.

The area irrigated was estimated at 640 acres, and the additional area that might be irrigated at 2,500 acres provided a ditch was properly located and there was sufficient water supply. This body of land lies on a sage brush mesa between Tierra Amarilla and Fairview. The value of such land when irrigated would be $20.00 to $25.00 per acre.

LAS NUTRITAS CREEK

This rises in the high mountains east of Tierra Amarilla and is an intermittent tributary of the Rio Chama. The principal town on this creek is Tierra Amarilla, a small Mexican plaza which is the county seat of Rio Arriba County. The land is about Tierra Amarilla and is all irrigated by the Tierra Amarilla ditch.

The altitude is about 7,400 feet. No records seem to be avalable concerning the precipitation. The nearest station for which data concerning the precipitation are obtainable is at Chama and it is not applicable to this station. According to some, irrigation begins about June 1st, and ceases about August 1st. As a rule the summer rains begin about July 1st and little irrigation is done. The snow fall is great in winter and lays upon the ground for a long time. The ground storage is therefore great. The soil is mainly of gravel and vegetable mould. It is a reasonably good soil.

The crops are mostly oats, wheat, barley, potatoes, truck and alfalfa. Close to the creek some native hay is raised without irrigation. No fruit can be grown on account of the frosts. The value of good land is about $25.00 per acre.

The area irrigated is situated on a sage brush mesa. A part of this could be irrigated from the Rio Brazos, and this is mentioned under that stream.

No reservoirs were examined and it is believed that there are none that are feasible.

Acequia Tierra Amarilla

The heading of this is on the north side of the Las

Nutritas Creek, about 1 1/2 miles east of Tierra Amarilla.

The diversion works consisted of a cobble and brush dam.

The data for the flow on June 26th are, 3.0 feet x 0.5 = 1.5 square feet, the sectional area, and the velocity being 1.5 feet per second, gives a discharge of 2.25 cubic feet per second. The data for the maximum capacity are, 4.0 feet x 1.5, and a velocity of 2.0 per second, gives a discharge of 12.0 cubic feet per second.

CANONES CREEK

This is one of the perennial tributaries of the Rio Chama. It is the next stream north of the Rio Brazos. It rises in the high mountains and flows in a westerly direction and empties into the Rio Chama about 5 miles above the Brazos.

There are two ranches, with a small area cultivated in the valley just below the canyon at the edge of the mountains. Most of the lands irrigated are along the Rio Chama.

The flow of the creek at the head of irrigation was estimated on June 30th as being 12 cubic feet per second, and the discharge into the Rio Chama was estimated at 7 cubic feet per second. Seven ditches were noticed with a combined capacity of 10 cubic feet per second. The upper one irrigates 5 acres of the land of Charles Dagert and the next one 5 acres of the land of Elivario Archuletta. The other 5 ditches irrigate a combined area of 240 acres. The total area irrigated is 250 acres. It is believed that an additional area of a like amount might be irrigated.

The crops are oats and potatoes for the most part. The methods of irrigation are crude. The land is not bedded or bordered. The water is allowed to run over the land. No doubt considerable leaching occurs thereby.

It is very probable that there are no reservoir sites.

RIO CHAMITA
or
LITTLE CHAMA RIVER

This is one of the perennial tributaries of the Rio Chama and rises on the southwest side of Chama Peak. It empties into the Chama a short distance below Chama station on the D. & R. G. R.R.

This was visited near the mouth on June 30th. It was estimated that 5 cubic feet per second were flowing. Two small ranches of 10 acres each were irrigated from water out of this creek. As far as could be learned there were no other irrigated ranches on this creek.

RIO TRUCHAS

This is a very small creek. Irrigation is carried on on a great mesa situated on the south side of the creek. The aneroid registered 7,850 at the Las Truchas plaza.

Water is diverted from the Capulin branch of the Rio Duemado at a point about 9 miles east of Las Truchas. The water is carried around a ridge in a ditch and is discharged into the bed of the Las Truchas. It is allowed to run down the river bed to about 4 miles east of Las Truchas, where it is diverted. A half mile below another ditch takes out. The Rio Truchas has a small flow of its own.

The soil of the valley is gravelly with considerable leaf mold on the new lands, but where irrigation has been practiced to a considerable extent the vegetable part of the soil is largely leached out. This was nearly all a timbered country before it was settled. In places near the main mountain the gravel is too large for good farming.

The crops are potatoes, peas, wheat, oats, corn and truck. No fruit is grown on account of the climate. But little irrigation is carried on before June 1st, and it probably ceases for the most part by September 1st. This was visited on June 7th and the ditch from the Rio Quemado had been repaired but a few days before.

The water supply is insufficient in midsummer. The snow goes off about July 1st, and if there are not copious rains the crops suffer. A small additional area could be irrigated if there was sufficient water available. There are about 1300 acres irri-

gated. The value of the land is about $25.00 per acre.

Considerable information was obtained from Jose La Luz Barella.

Community Ditch

The heading of the ditch is on the south side of the Rio Truchas, about 4 miles from Las Truchas Plaza. The diversion works consisted of a cobble and brush dam.

The following are the data for the flow on June 7th: 3.0 feet wide, 0.45 deep and a velocity of 2.5 feet per second, giving a discharge of 3.37 cubic feet per second. The data for the maximum capacity are; 3.0 feet wide, 0.6 deep and a velocity of 3.0 feet per second, giving a discharge of 5.4 cubic feet per second. There were irrigated about 600 acres by this ditch.

Community Ditch

The heading of this ditch is on the south side of the Rio Truchas about 3 1/2 miles east of the Las Truchas Plaza.

The diversion works are of brush and cobble.

The following are the data for the flow on June 7, 1910: 4.0 feet wide, 0.6 deep with a velocity of 2.0 feet per second, giving a discharge of 4.8 cubic feet per second. The data for the maximum capacity are: 4.0 feet wide, 0.8 deep with a velocity of 2.5 feet, giving a discharge of 8.0 cubic feet per second.

EMBUDO CREEK

This is formed by the confluence of the Rio Pueblo and the Rio Santa Barbara near the Pueblo of Picuris. It flows in a westerly direction and empties into the Rio Grande. The Rio Trampas enters from the south and is the only tributary of importance.

This is a perennial stream, but the summer flow this year was very small, on August 4th being about 4 cubic feet per second. This was near the mouth and after all ditches had been taken out.

On June 11, 1910, the discharge at the same place was about 100 cubic feet per second, and information was furnished that such was the low water supply. It seems that most people were of the opinion that the discharge was larger than the data bears out. There is irrigation on this creek near Embudo Plaza. Near the Rio Grande two ditches are taken out to irrigate lands along the Rio Grande.

It is believed by some that water could be diverted from this creek and be carried in a flume through the canyon of the Rio Grande and used to irrigate lands in the Espanola valley. This is possible, but it is doubtful if the supply in midsummer would be great enough to justify such an expenditure.

There is a canyon below Embudo, or Dixon post office. It is said that there is a feasible reservoir site in this canyon. This was examined hastily and was not deemed worthy of particular consideration. The dam site is wide and the fall of the valley was estimated to be 50 feet to the mile. The valley is not wide. It is believed that there is no practical reservoir site here.

The lands under the ditches along the Rio Grande are, as a rule, farmed in a very poor way. One fine orchard was seen.

Of all the country examined it is believed that apples grow to greater perfection and in greater quantities than other fruits, considering the adverse farming methods. Some trees which had never been pruned had surprisingly good crops of apples.

Water right application No. 325 is applicable to Embudo Creek. This was made on June 22, 1909, for 250 cubic feet per second, or 17,000 acre feet, which was to irrigate 13,000 acres. The application has not been approved or disapproved. It was made by the La Joya Land, Irrigation & Development Company.

RIO TRAMPAS

This rises in the high mountains about Truchas Peak and flowing in a northwesterly direction, empties into Embudo Creek.

The area irrigated by this creek is on the high mesas lying close to the mountains. The altitude is probably near 7,500 feet. Lands are irrigated in the Trampas valley and in the valley of Ojo Zarco. The post office for the last settlement is Diamonte.

The crops are mostly wheat, oats, corn, peas and truck. The value of the lands is not over $25.00 per acre. The growing season is short.

The area might be extended some if there was more water.

No information has been obtained concerning reservoirs.

Information was received that an agreement was reached whereby Ojo Zarco received 9 cubic feet per second and the settlements on the Rio Trampas 7 cubic feet per second, of the waters of the Rio Trampas.

On the Rio Trampas there are three settlements. The lower settlement is named Vallecitos and has two ditches, each with a capacity of 1 cubic foot per second, irrigating 140 acres. The middle settlement is Trampas. This is a very old settlement. There are three ditches with a combined capacity of 7 cubic feet per second, irrigating an area of 160 acres. The upper settlement is El Valle. This settlement has two ditches, each having a capacity of 3 cubic feet per second, irrigating 200 acres.

The heading to the ditch to the settlements in the valley of the Ojo Zarco is at the upper end of El Valle. This ditch

contours around the ridge and bifurcates on reaching the valley bottom. These two branches are located, one on the north side and one on the south side. The area irrigated was estimated at 400 acres.

OJO ZARCO

This is an intermittent stream with a very small discharge. It is a tributary of the Rio Trampas. The Trampas empties into the Embudo and the Embudo into the Rio Grande.

There is some irrigable land on this creek at an altitude of 7,300 feet. These lands are partially irrigated by a ditch brought from the Rio Trampas. In the early spring a little water might be secured from the Ojo Zarco, but it would amount to little.

Appropriations from this creek will have no effect on the supply of the Rio Grande.

SANTA BARBARA

This stream rises in the high mountains, in the vicinity of Truchas and Jicarilla peaks, flowing in a northwesterly direction and uniting with the Rio Pueblo, forming Embudo Creek. This is the largest stream south of U. S. Mountain on the east side of the Rio Grande. A considerable body of land is irrigated where this stream breaks out of the mountains proper at an elevation of 7500 feet above sea level. There are several old Mexican settlements on this stream. The area irrigated is not so great as it was previous to 1880. The advent of the railroads and the fact that working for wages was more profitable than farming, are among the causes for this reduction in acreage farmed. Every spring a large number of men leave for Montana, Wyoming, Colorado and Idaho, to herd sheep. The majority of them return in the winter.

The ditches have temporary head and diversion works. As the Santa Barbara Tie & Pole Co. utilize this stream for moving its products, all diversion works are annually destroyed.

The crops are alfalfa, oats, wheat, peas, corn and truck. Practically no fruit is raised. The land is worth about $25.00 per acre. The growing season is short. A great amount of water is stored in the sandy and gravelly soil; this is owing to the heavy snowfall in the winter which remains for a long time, and more particularly to the alternate freezing and thawing, accompanied by rains in the spring. This is very different from the conditions found along the Rio Grande in this respect. The slope of these lands is great and considerable water runs off the surface, and as the soil is porous, a great amount comes out again in seepage.

No reservoirs were found and it is very doubtful if there are any, owing to the topography of the country. Consideration would have to be allowed to the distance of reservoir sites on this stream to the irrigable lands.

Acequia del Llano San Juan

This ditch has its heading on the south side of the river at the upper end of the Santa Barbara walley, and in the vicinity of the saw mill of the Santa Barbara Tie & Pole Co.

The diversion works are temporary.

The area irrigated on the Llano of San Juan was estimated at 1400 acres. The ditch then continues farther on, around a ridge and with a capacity of 15 cubic feet per second irrigates 800 acres in the Chimisal valley. This is a valley lying south of the Santa Barbara Valley. The maximum capacity of the acequia del Llano San Juan is 40 cubic feet per second.

Acequia del Llegua

The heading of this ditch is on the north side of the river near the upper end of the valley. This irrigates a great mesa or llano which lies from 100 to 150 feet above the valley of Santa Barbara.

The maximum capacity is about 10 cubic feet per second and the area irrigated is about 500 acres. There are no fences on this irrigated tract. Small corrals keep the stock from roaming except where they are picketed out in the fields.

The value of the land is not great; either wheat or oats is the main crop.

In Santa Barbara or Penasco valley there are six ditches with a combined capacity of 30 cubic feet per second. The area

irrigated is 1500 acres. Some of these ditches are as small as 2 cubic feet per second, while others are of considerable size. Some alfalfa is raised, but grain is the main crop.

It is believed that there are but few opportunities to extend the irrigable area on this creek.

RIO PUEBLO

This is the north branch of Embudo Creek. It rises in the high mountains near Jicarilla Peak and flows in a westerly direction, and uniting with the Rio Santa Barbara forms Embudo Creek.

For a distance of 9 miles from the mouth there are several Mexican and Indian ranches. The Pueblo of Picuris is on the lower part of this creek; it has about 150 people. There is also the plaza of Rio Pueblo.

13 ditches were noted, with a capacity of 600 acres, in the first 9 miles above the mouth. From testimony it was estimated that there were 100 acres more irrigated in the canyon. There is no more land that can be irrigated because of the mountainous topography of the country, but the water supply is such that more could be irrigated. The valley is narrow, in no place attaining a width of a quarter of a mile. The methods of irrigation are crude and much leaching of valuable salts is done by over irrigation.

The main crops are grain and truck.

A ditch is taken out above the forks and carried by a low grade over a divide and the water used in about Chacon, which is on Mora Creek. This is a small ditch and on the day of examination was carrying 1.25 cubic feet. The maximum discharge as obtained from a showing of an additional height of water of .50 of a foot would be about 10.0 cubic feet per second. A discharge of this amount is possible for a very short length of time, as the flow from the high mountains is not great after the melting of the snow. This water is used to supplement the general flow of

streams on the east side of the mountain and no acreage can be estimated.

Two reservoirs of doubtful feasibility have been surveyed by the U. S. Geological Survey, and are described at length under "Reservoirs".

This creek has no more land which could be irrigated because of the topographical surroundings.

AGUAGE DE PETACA

This is an intermittent tributary of the Rio Grande. It rises in the high mountains west of Tres Piedras and flows in a southerly direction. The flow is considerable in early spring while the snow is melting, and at times during the summer when there are very heavy rains, but the greater part of the yeàr it is dry. This was viewed on June 15th and even above Tres Piedras was dry and the last of the snow had but recently melted. I was reliable informed that before the timber about Tres Piedras was cut that there was a perennial flow. The upper end of the drainage area is now scantily timbered and the lower end is in lava rock. This undoubtedly receives a considerable amount of water and thus helps furnish the supply to the various springs along the canyon.

Three water right applications have been made, one on December 8, 1909, for 14.54 acre-feet, one on February 4, 1909, for 1000 acre-feet and another on June 6, 1909, for 1000 acre-feet. The last two have been approved by the Territorial Engineer. No information is at hand concerning their construction. Some evidences were seen of a distribution system, which did not seem to be effective.

It is probable that there will be little development in the future that will seriously affect the present water supply of this stream to the Rio Grande.

TAOS CREEK, or RIO FERNANDO DE TAOS:

This creek rises in the mountains east of Taos. It with its tributaries forms the true Taos Valley. The valley lies at an altitude of about 7,000 feet above sea level.

The area of the watershed contributing to this valley is considerable. This watershed is well timbered and some of it reaches the highest parts of the mountains, where snow remains nearly all the year.

The water supply is considerable in extent, quite reliable, but not nearly sufficient to properly irrigate one-tenth of the irrigable lands found on the Taos mesa. There are probably, all told, about 9,000 acres irrigated, and there are in all about 100,000 acres that might be irrigated. It is believed that with economical administration and scientific application of the present supply, that probably as much as forty per cent in addition to the present acreage might be irrigated. Antiquated methods and jealousies are serious detriments.

This country has been irrigated by the Pueblo Indians from prehistoric times. The Taos tribe probably built the first seven story apartment house in the United States. It is of adobe and is now occupied.

Taos Valley in the 50s and 60s and later was the granary of the west, as wheat from there was transported hundreds of miles to army posts. With the demand for sheep herders in Montana, Idaho, Wyoming and Colorado, many have given up farming and are now working for wages. Eighty left Taos the past spring for the north, where they will spend the summer.

Taos valley and Taos mesa is experiencing a desire for

expansion in irrigation. It might be better said that certain land owners are desirous of disposing of some of their holdings at a considerable profit. Some of the schemes are legitimate are legitimate and would be legitimately executed if the U. S. Reclamation Service would remove its restrictions concerning water rights, while others are to most intents and purposes fraudulent and seek to deprive the present settlers of their water or to sell land with water rights of no value.

The climate is good; it closely resembles that of Illinois or Ohio as to temperature. There is snow in winter. Summer rains temper the heat considerably, as well as being beneficial to growing crops. Apples, peaches and apricots can be grown in places, and probably with more experience the extent of the fruit bearing areas may be enlarged. The soil is generally good. In places on the tops of the alluvial fans there is considerable course gravel. In some places the gravel is too prominent. but as a rule the soil is good. In quite a few places in the creek bottoms over-irrigation has made swamps.

The principal crops are wheat, oats, corn, alfalfa, native hay, peas, beans, potatoes, truck and fruit. Practically all products are consumed locally and thousands of pounds of provisions are annually imported. The forage is fed to sheep and cattle in winter; these are ranged in the mountains during the summer.

Ditch of the Ranchos, Orchard & Land Company

This ditch was constructed in 1909 by the Ranchos, Orchard & Land Company, which owns the Serna Grant. The company has divided its holdings into tracts and is selling them to

people mostly in the middle west.

It was claimed that there were about 1600 acres under irrigation this year, but the slight inspection made on August 3rd did not seem to show more than half this amount, and a great part of it was suffering because of the insufficient water supply.

This ditch has a permanent diversion dam, made of plank. It also has a regulating gate of approved pattern. This is located on Taos Creek near Plaza Abajo. This ditch is about 5 feet wide on the bottom and would carry 2.0 feet of water. The side slopes are 2:1. The grade is very light and the velocity at maximum capacity would hardly exceed 2.0 feet per second. These conditions would give a maximum discharge of 36.0 cubic feet per second, which would be about enough to irrigate the lands owned by this company. There is no water in Taos creek at this point in mid-summer. The ditch is located for a considerable distance through swamp lands, which contribute some by seepage to the supply, but this can never be much, probably not more than 2 cubic feet per second.

This ditch was examined on August 1st at the head, where 1.0 cubic feet per second was flowing. The flow was seriously obstructed by weeds. This was examined again near Las Cordovas on the mesa after the ditch had gotten out of the swamp lands, and the flow was 2.25 cubic feet per second. The gain, therefore, by seepage was 1.25 cubic feet per second.

So far as can be learned, this company has no water right approved by the Territorial Engineer. As it is now, their operations do not appreciably affect the present supply for the Engle

reservoir, but if conditions are so changed that they secure a supply for their lands, it will be detrimental to the present settlers in Taos Valley, or to the supply for the Engle reservoir.

RIO GRANDE DE LOS RANCHOS

I desire to make an especial report on the report of Mr. Homer J. Gault on the Taos Valley.

In a table he gives the following estimate for the minimum flow of the several streams: Arroyo Seco 5 cubic feet per second; Rio Lucero, 15 cu. ft. per second; Pueblo Creek 50 cu. ft. per second; Rio Taos, 10 cu. ft. per second; Rio Chiquito, 7 cu. ft. per second, and the Rio Grande de los Ranchos 50 cu. ft. per second. These were examined during the period of minimum flow with the following results: Arroyo Seco, nothing; Rio Lucero, 19.0 or 20.0 cu. ft.per second; Pueblo Creek, 5.0 cu. ft. per second; Rio Taos, 15.0 cu. ft. per second; Rio Chiquito, 5.0 cu. ft. per second, and Rio Grande de los Ranchos, 8.0 cu. ft. per second, all totaling 45 cu. ft. per second, instead of 137 cu. ft. as estimated by Mr. Homer J. Gault. Mr. Gault's estimate of the maximum capacity of the various streams is believed to be reliable, but the records obtained this summer prove the minimum flow.

El Paso, Texas, April 28, 1910.

Mr. W. H. Reed,

District Engineer.

Dear Sir:

Following your instructions, I have investigated the proposed storage projects in Taos Valley, New Mexico. On April 25, 1910, I visited the sites of the two proposed reservoirs on the Rio Grande del Ranchos, and examined the conditions in the valley. Attached to the accompanying report is a rough sketch map of the Taos Valley showing the location of the proposed reservoirs and main ditch.

Very respectfully,

(Signed) Homer J. Cault.

OST-OFFICE ADDRESS IS .....

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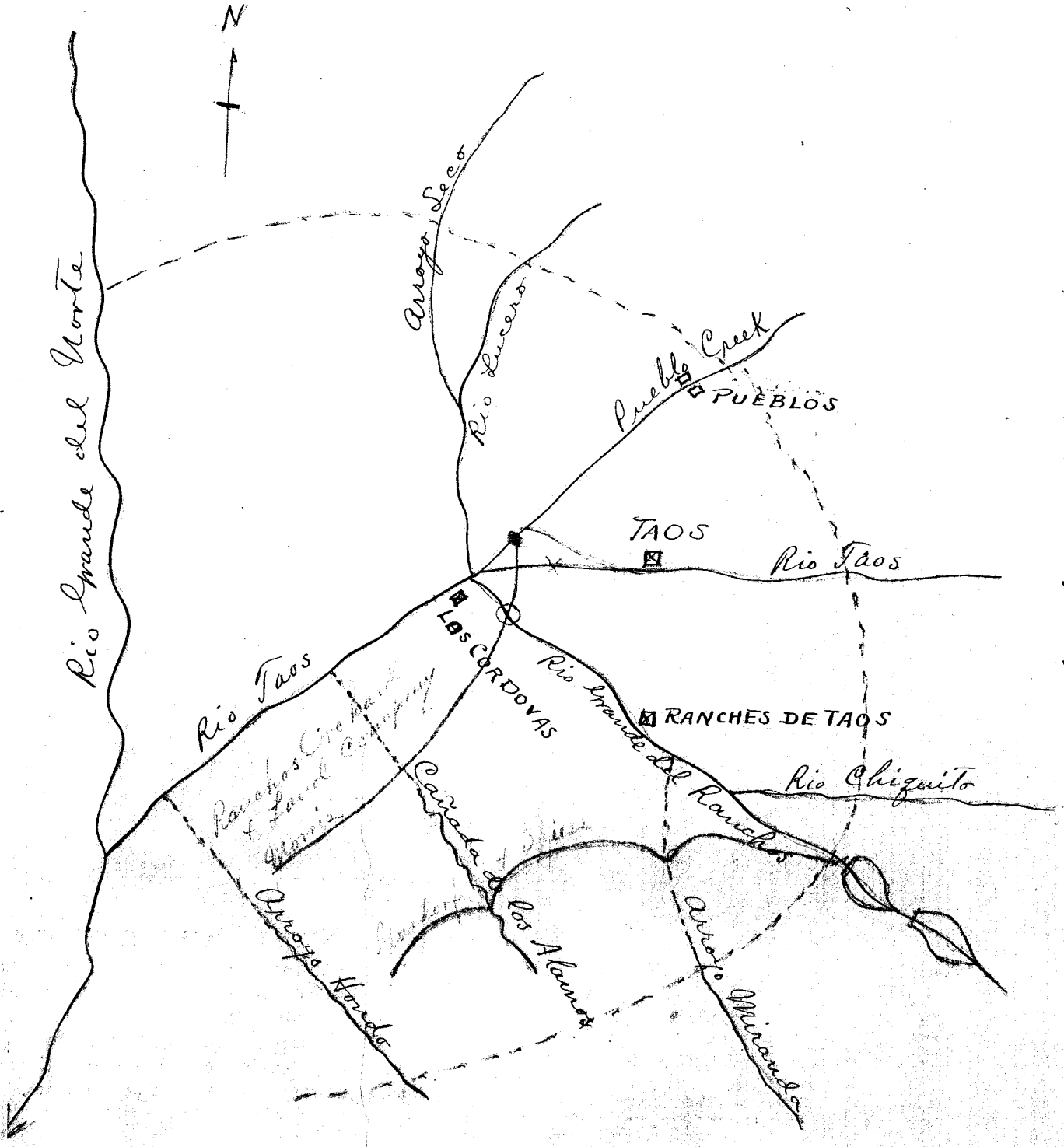
XPRESS ADDRESS IS .....

(Keep the Director informed of addresses by means of the special card.)

DEPARTMENT OF THE INTERIOR

UNITED STATES RECLAMATION SERVICE

....., 190



April 28, 1910.

REPORT ON THE PROPOSED STORAGE AND DIVERSION FOR IRRIGATION, OF THE WATERS OF A BRANCH OF THE RIO TAOS, IN TAOS COUNTY, NEW MEXICO, AS AFFECTING THE WATER SUPPLY FOR THE ENGLE RESERVOIR OF THE RIO GRANDE PROJECT OF THE UNITED STATES RECLAMATION SERVICE.

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On April 29, 1909, an application was made to the Territorial Engineer of New Mexico by Alexander Gusdorf and Manuel Montoya for the storage and diversion of "flood waters" for irrigation, of the Rio Grande del Ranchos, in Taos County, New Mexico, to the extent of 4240 acre-feet per annum. On June 2, 1909, another similar application was made by Chas. A. Spiess for storage and diversion from the same stream of "flood waters" to the extent of 3854 acre-feet per annum. As these applications conflict with the appropriations of the Reclamation Service of the waters of the Rio Grande and its tributaries for the Rio Grande Project, dated January 23, 1906, and April 1908, and as the quantity of water claimed in each case is in excess of the allowable quantity indicated in a Recommendation of the Secretary of the Interior dated April 25, 1907, referring to such appropriations, the Territorial Engineer referred the two above mentioned applications to the Secretary of the Interior, resulting in the present investigation and report.

A general description of the Taos Valley and all its waters is necessary to a clear comprehension of the conditions regarding the Rio Grande del Ranchos.

The Taos Valley lies between the Rio Grande del Norte on the west and the Taos range of mountains on the east. It is

estimated to contain 70,000 acres of irrigable land. The valley is entirely covered by an Indian Grant and six Spanish or Mexican Grants, which have not been subdivided into townships and sections. The soil and climate are suitable for general farming and especially for growing apples and like fruits. About one-sixth of the valley, or 11,500 acres is irrigated. The elevation of the valley is from 6500 to 7000 feet above sea level. The valley is not timbered, but the surrounding mountains are covered with valuable forest.

The only source of water supply for irrigation is the Rio Taos and its tributaries. The Rio Grande del Norte is here in a canyon from 500 to 1000 feet below the irrigable lands, so that its waters cannot be used in Taos Valley. The Rio Taos is a perennial stream entering the Rio Grande del Norte from the east at a point about 12 miles above Embudo. It is called Rio Taos, or Taos Creek, and is formed by the junction at nearly a common point near the Mexican town of Los Cordovas of the four following streams, named in the order of their size beginning with the largest: Pueblo Creek, Rio Grande del Ranchos, Rio Lucero and Rio Taos. The last named is sometimes called Rio Don Fernando. The Rio Grande del Ranchos is sometimes called The Little Rio Grande. The Arroyo Seco is a perennial tributary of Rio Lucero, and the Rio Chiquito a perennial tributary of the Rio Grande del Ranchos.

These streams all have their sources in the Taos range, the highest mountains of New Mexico. Their altitude is from 7,000 to 13,000 feet above sea level, while the higher peaks rise above 14,000 feet. The snowfall on these mountains is heavy and some of it remains throughout the summer. The water supply of the six above named tributaries of Rio Taos is constant but not uniform,

being greatest in May and June, and least in September and October. Rains in the fall cause floods of short duration. The minimum flow of each of these streams is probably about one-eleventh of its maximum flow. These streams have not been gaged. Their flow is approximately as estimated in the following table:

	Maximum Cu. Ft. per Sec.	Minimum Cu. Ft. per Sec.	
Arroyo Seco	55	5	
Rio Lucero	164	15	
Pueblo Creek	547	50	
Rio Taos (little)	110	10	
Rio Chiquito	77	7	
Rio Grande del Ranchos	547	50	
Total, Rio Taos	1500	137	

Ditches are taken out of all of these streams and the irrigating systems are somewhat interlaced. Water may be carried from any one of these streams to almost any part of the valley. Occasionally in seasons of low water it is all diverted for irrigation. At such times the Rio Taos is said to deliver at its junction with the Rio Grande del Norte 15 or 20 second-feet of water from springs and seepage along its course of about eight miles from the junction of its tributaries to the Rio Grande.

There are three tibutaries of the Taos whose waters do not reach the Taos except in floods from rains, the perennial flow in their upper courses sinking in the sand in their lower courses. These are Arroyo Hondo, Cañada de los Alamos, and Arroyo Miranda. These arroyos have their heads in U. S. Mountain, where the snowfall is not as great as in the Taos Range.

Storage reservoirs in these arroyos have recently been allowed by the Territorial Engineer.

The crops now raised in Taos Valley are grain and alfalfa and vegetables. There are very few commercial orchards but many orchards are now being planted. The duty of water per second foot will average about 150 acres when the water is low. It is claimed that orchards require but one acre foot per acre per annum. The use of water by the present methods is excessive and wasteful and often injurious to the land irrigated or to lands below where the drainage accumulates forming swamps. By the economic use of water the acreage irrigated could be doubled without additional diversion. The low water flow of all these tributaries has been all appropriated for many years, but rights have not been adjudicated, now is there any systematic and comprehensive supervision of diversion. The flood waters, which without storage cannot be used, reach the Rio Grande at rates as high as 1500 cu. ft. per second, and form an important tributary in the Territory. In the absence of gagings no definite or accurate information can be had of the quantity of water delivered annually to the Rio Grande by the Rio Taos, but an approximate and conservative estimate, based on observation and inquiry would be, 175,000 acre feet per annum, after the diversion for irrigation. The most of this contribution occurs when the Rio Grande is at a high stage in May and June, and the loss of water by evaporation and percolation between Rio Taos and Elephant Butte is then proportionately small.

The oldest water right in Taos Valley is that of the Indians of Taos Pueblo. There use of the waters of Pueblo Creek dates from prehistoric time. Most of the Mexican ditches are hundreds of years old, and very few ditches have been taken out

in recent years. There is at present, however, a general activity among the large land owners toward all possible additional appropriation and storage. The foregoing general description of the valley has been given because the two applications here under consideration involve principles equally applicable to all the other streams of the valley, and further in fact, to all the tributaries of the Rio Grande above Elephant Butte.

The applications of Gusdorf and Montoya and that of Speiss are similar, both being for storage on the same stream. The only differences are the priority of the Gusdorf application, and the somewhat larger reservoir capacity. The location of the Gusdorf damsite is about three-fourths mile above that of Spiess. The common point of diversion is just below the Spiess dam site. As stated in the Spiess application, they propose to have the diversion and 6.7 miles of main ditch in common.

Mr. P. N. Black of Taos, N. Mex., who made the surveys for both parties, states that in case both applications are allowed, the size of the main ditch would be increased to their combined capacity. The quantity of water claimed in the Gusdorf application is "12 second feet from May to October inclusive, etc.", and that in the Spiess application is "8 second feet from April to September inclusive, etc.", while the capacity of the ditch in each case is 42.7 second feet, from the dimensions and grade given, and their combined capacity 85.4 second feet. Thus their ditch capacity appears to be unnecessarily large. There is, however, a large body of land belonging to other parties, and now without water, which could readily be supplied from this proposed ditch, and this fact may account for the large proposed ditch capacity.

Under the first project Montoya owns 40 acres and Gusdorf, 1660 acres.

The Gusdorf and Spiess projects, being similar, and of nearly the same size, and both on the same stream, must be considered as one in their combined effect on the stream and as to the principles involved. Each party proposes to use twice the capacity of his reservoir each year, making a total of 7,494 acre feet to be diverted. As the unappropriated flood waters of the Rio Grande del Ranchos are estimated to amount to not less than 44,000 acre feet per annum, it is evident that the proposed reservoirs are far too small to control the stream, and further that without competent and strict regulation, it would be possible for the applicants to divert much more than the quantity of water claimed, the combined capacity of their ditches being 5080 acre feet per month, or 30,480 acre feet during the irrigating season. This, of course, would not be entirely possible without sufficient reservoir capacity to completely control the stream, but it would be possible to the extent of the regulation exercised by the proposed reservoirs.

The Territorial Engineer advocates the granting of these claims for three reasons: first, that the quantity of water asked for is small, and that a large portion of it would return to the stream in the form of seepage and springs, and that the Engle Reservoir would not be materially effected: second, because of the larger duty of water per second foot in Taos Valley than under the Rio Grande project: third, because of the strong influence, political and otherwise, of the claimants, which might be used with damaging effect against the Rio Grande Project.

The first two reasons are practically the same as the

arguments advanced by the claimants.

As to the first reason, the quantity claimed, 7494 acre feet per annum, is three-tenths of one percent of the capacity of Engle Reservoir. While this percentage is small, it is to be considered in its effect as establishing a principle to be used as a precedent in the many applications which would follow if these were allowed, and which would, no doubt, in the aggregate considerably reduce the water supply for Engle Reservoir. That a large portion of the water diverted would find its way back to the stream in the form of seepage is doubtful and can not be proven. It is true that some of the water returns to the stream, but the percentage so returning is generally small, varying according to local conditions, and with the ever increasing economy in the use of water for irrigation, the percentage of return water will become continually less.

The second reason, that regarding the duty of water, while true, is not an argument for the cancelation of any part of an existing water right, such as the appropriation for the Rio Grande Project. As compared with the Mesilla Valley the Taos Valley has 50% more rainfall, the irrigating season is three months shorter, and the nature of the soil is less sandy than some portions of the lower valley, so that a certain quantity of water will sufficiently irrigate about twice as many acres of a given crop in Taos Valley as in the Mesilla Valley.

The subject of the influence of the claimants has no place in this report.

In conclusion, this investigation has brought out the following prominent facts:

1. The waters sought to be diverted now reach the Rio Grande and the site of Engle Reservoir with a comparatively small loss on the way.

2. The quantity of water claimed is appreciable and might be largely increased under careless control.

3. Similar conditions exist on other streams in Taos Valley and throughout the Rio Grande drainage, and in consequence, this case is more important by reason of the principle involved than by its effect alone.

RIO GRANDE DE LOS RANCHOS

This is an intermittent tributary of Taos Creek. It is also named Ranchos of Taos Creek. It rises in the high mountains and flows in a westerly direction, and empties into Taos Creek near Las Cordovas.

Some reservoirs have been surveyed on this creek, and they are further mentioned under "Reservoirs" in this report.

The drainage area of this creek being largely forested and largely at a high altitude, and being of considerable size, it follows that the water supply is reasonably constant. If it were not for irrigation from its waters it would be a perennial stream. Irrigation has been practiced upon it for about 300 years.

The crops are mostly hay, grain, peas, potatoes, truck and fruit. Mr. Alexander Gusdorf has a very fine orchard on this creek, from which he has received very good returns. It is believed that considerable additional land would raise fruit in large quantities, and with good flavor, if proper cultivation were practiced.

The land values range from $25.00 to $250.00 per acre.

Any further development of irrigation from waters from this creek will be detrimental to the local irrigation or to the present water supply of the Engle reservoir.

High Line Ditch, South Side

The heading of this ditch is near the lower end of the canyon where the stream leaves the mountains.

The diversion works were not examined, but the gaging was made on August 1 about 600 feet below the heading. The cross section was taken and the velocity determined by current meter. The discharge was 4.15 cubic feet per second. The maximum capacity was reached at a greater height of .40 and it was estimated that the discharge would be 8.0 cubic feet per second.

The area irrigated was estimated at 400 acres.

Acequia Rio Grande

The heading of this ditch is near the canyon on the north side of the creek, and it is the high line ditch of the north side.

This was examined on August 1 and it was gaged about 1000 feet below the heading. The cross section was determined and velocities were acquired by current meter. The discharge was found to be 8.82 cubic feet per second. The maximum capacity is about .40 higher, which would cause the maximum discharge to be about 15 cubic feet per second.

The area irrigated was estimated at 900 acres. The extendible area will not be estimated according to particulat ditches.

RIO CHIQUITO

This is one of the tributaries of the Rio Grande de Los Ranchos. It rises in the high mountains and flowing in a westerly direction, enters upon the plains of a high alluvial fan which it has produced.

As the drainage area is steep and of no great extent, the supply is more intermittent than several other streams contributing to the supply of Taos valley.

The crops seemed to contain more grain than some other sections.

This contributes waters to the Rio Grande only during the spring and during heavy showers in the summer.

From information received there seemed to be a feasible reservoir site of 500 acre-feet capacity. This was not examined but a report had previously been made by Mr. Homer J. Gault upon the proposition, which included this reservoir.

It is believed that any further development of irrigation by waters from this creek would be detrimental to either the supply for the local users or to the Engle reservoir.

Private Ditch

A small ditch was examined on the south side. On August 1st it was flowing about 1 cubic foot per second and the maximum capacity was estimated to be 1.5 cubic feet per second. The area irrigated was 10 acres.

Acequia del Llano

The heading of this ditch is a short distance below where the stream breaks out of the mountains upon the plains.

This was examined on August 1st, 1910, and the velocity

was obtained by the current meter. The discharge was found to be 6.85 cubic feet per second, and therefrom it was estimated that the maximum flow would be 15 cubic feet per second. The area irrigated was estimated at 320 acres; the acreage was in isolated patches at the lower ends of the laterals. The supply is usually insufficient in mid-summer.

Acequia del Troas

The heading of this ditch is on the north side of the Rio Chiquito, and it is the high line canal.

This was examined on August 1, 1910, and as there had been showers the day before on the watershed, there was quite a large amount of water in the creek.

Current meter observations were made for velocity and the discharge was computed to be 5.53 cubic feet per second. The maximum capacity was estimated to be 8.0 cubic feet per second.

The area irrigated was estimated at 160 acres.

Arroyo Seco

This is an intermittent tributary of Taos Creek. It rises in the high mountains and enters upon the Taos mesa near the Rio Lucero. There are two small ranches of about 5 acres each close to the mountain which receive their water from Arroyo Seco.

The waste from the Acequia des Montes, and from the three ditches which take out of the Rio Lucero, furnishes enough water to irrigate in an imperfect manner 480 acres. This is extended along the arroyo for about 4 miles.

No developments can be made in the future that will seriously affect the present supply to the Rio Grande.

THE RIO PUEBLO

This is a perennial tributary of Taos Creek. It rises in the high mountains in the vicinity of Mt. Wheeler. There are two small lakes of about 4 acres capacity at the head which might be readily transformed into small reservoirs by inexpensive dams. The feasible capacity of these would probably not exceed 100 acre-feet.

The drainage area above irrigation is largely timbered and receives considerable snow during the winter.

The Taos Indians have irrigated from this creek from time prehistoric. The data secured concerning this creek was not the most accurate, as the Indians did not allow us to make any current meter observations. They had been instructed by Mr. Wilson of Santa Fe to not allow any one to make any surveys. This was done to prevent any one from having an opportunity to locate any ditches that might take water from the pueblo. The data secured, however, is general and reasonably reliable.

The present low water flow of the creek is all used. It is not probable that any great storage propositions could be developed, as such reservoirs would be on lands owned by the Pueblo of Taos and consequently could hardly be secured. However, any additional development of irrigation would be detrimental to the present irrigators or to the present supply of the Rio Grande.

On August 2nd it was flowing about 5 cubic feet per second above the head of irrigation.

RIO LUCERO

This is an intermittent tributary of the Rio Pueblo. It rises in the high mountains west of Wheeler's Peak and flows in a general westerly direction while in the mountains, but after leaving the mountains it flows down in a southwesterly direction on a singularly steep alluvial fan.

By a decree or an agreement, one-third of the waters of this creek should go to the Pueblo of Taos, one-third to Plaza Abaja, one-third to Plaza Arriba. This information was furnished by Mr. Wilson, of Santa Fe, Special Attorney for the Pueblo Indians.

There are, however, several ditches which irrigate lands on Arroyo Seco and which have evidently been built within the past few years, to judge from their appearance.

A system of rotation is employed in distributing the water in mid-summer; the exact nature of this could not be learned.

Mr. Nambe, who owns lands on the Arroyo Seco, brought suit against the Indians of the Pueblo of Taos to prevent them from using the waters of the Rio Lucero and Rio Pueblo; it was learned that the suit was lost.

Most of the land irrigated is planted to grains.

It is believed that there are no feasible storage reservoirs of any great capacity, and as the summer flow has been used for a long time, it is probable that there can be no changes made that will be detrimental to the present supply of the Rio Grande.

The ditches are listed in the tables.

Acequia Arroyo Seco

The heading of this is on the west side of the creek and near where it comes out of the canyon and starts down the side

of the alluvial fan. It is then taken around the hill into the vicinity of Arroyo Seco, where about 800 acres are irrigated.

Irrigation is greatly supplemented by summer showers near Arroyo Seco. A small amount of this is used along the arroyo.

Current meter observations were made which gave a flow of 9.57 cubic feet per second. This was about one-half of the entire creek, so the low water flow was about 19.0 or 20.0 cubic feet per second.

RIO HONDO

This is a perennial stream, a tributary of the Rio Grande. It is often incorrectly referred to as the Arroyo Hondo. A post office by that name is located upon it.

This creek rises in the high mountains near Wheeler's Peak and flows in a westerly direction. There is no irrigation on the creek while in the mountains, but after leaving them it flows through a series of very narrow valleys. These valleys are considerably lower than the surrounding mesa. The upper valley is probably 250 feet below the mesa.

The water is all used near the lower end of the lower valley. The seepage from this irrigation reappears in the canyon just before it enters the Rio Grande and makes the Rio Hondo a perennial stream.

The crops are good., Alfalfa, grain, peas, beans, fruit and truck are the principal crops. Fruits should be grown to advantage under scientific culture. The crops are all consumed locally.

The Taos Valley Land Company on March 25, 1908, had approved an application for 2.5 cubic feet per second from this creek. On February 9, 1909, an application was filed with the Territorial Engineer for 95 cubic feet per second, but this had not been approved when the records were last examined. The ditch complying with the first application was not constructed in 1910. Another ditch, the Des Montes, was enlarged during the spring of 1910, and from the information obtained it is believed that this ditch was enlarged from a ditch which carried 5 cubic feet per second to one of 20 cubic feet per second. This has brought under the ditch about 1000 acres, but that amount was not being irrigated.

During the past season the people who lived in the lower valley, where irrigation was first practiced, claimed that the additional diversion by the Des Montes ditch caused a shortage of water to them. They were supposed to have two-thirds of the water in the river or creek and were receiving but one-fourth of it. After a visit by a committee of the complainants, the diversion was more equitable.

The altitude of this valley ranges from 6,500 to 7,500 feet. There is considerable snow fall and considerable ground storage. The soil is a mixture of a very fine loam and gravel.

There may be some feasible reservoirs of small capacity, but it is not believed that there are any of importance that would be detrimental to the present supply of the Rio Grande.

It is very probable that in the future various schemes will be employed to get water upon the mesa south of this river. The mesa has a good soil and lies very well for irrigation. This should be included in the Taos valley, more properly named Taos mesa.

On July 27th the flow in the Rio Hondo was measured at the upper end of the upper valley after four ditches had been diverted, and was found to be 5.5 cubic feet per second. The total amount diverted was 18.38 cubic feet. The flow at the head of irrigation, therefore, was 23.88 cubic feet per second. Of this amount 11.50 cubic feet per second were diverted to the Taos mesa, and from this there would be no seepage return to the Rio Hondo. After two additional ditches, with a flow of 2.80 cubic feet per second, had been diverted at the upper end of the middle valley, the flow of the Rio Hondo was found to be 6.75 cubic feet per second. This shows a return of 4.05 cubic feet per second for this valley.

At the upper end of the lower valley after 12.50 cubic feet had been diverted, there were 1.5 cubic feet in the river. The flow was therefore 14.0 cubic feet per second, and the gain in seepage between gagings was 7.25 cubic feet per second. At the lower end of the lower valley there were 2.5 cubic feet per second flowing, which would show a gain by seepage of 1.0 cubic feet. At the gaging station of the U.S. Geological Survey at the mouth of the canyon there was flowing 3.16 cubic feet per second, which would show a gain of only .56 of a cubic foot per second through the deep canyon.

It is therefore evident that 12.88 cubic feet per second was first diverted where the river bed was very full of boulders and coarse gravel, and that subsequent diversions amounting to 17.46 cubic feet per second were made, and that the amount flowing into the Rio Grande was 3.16 cubic feet per second.

The total area irrigated by all these diversions is 561 acres.

The valley is exceptionally well favored for the return of seepage, as the soil is sandy and gravelly to a considerable degree. It is very deep, attaining in places a depth of 250 feet. Seepage on the side of the valley was noticed in one place, but it was of no importance.

ACEQUIA PLAZITA

The heading of this ditch is on the north side of the creek and near the post office.

The diversion works are temporary, consisting of a small dam of cobbles and boulders.

The data for the flow on July 13th were: $\frac{3.0 \text{ feet} + 4.0}{2} \times 0.4$ feet = 1.40 sq. feet, the sectional area, and the velocity was 2.0 feet per second, which gave a discharge of 2.8 cubic feet per second. The data for the maximum capacity are: $\frac{3.0 \text{ feet} + 5.0 \text{ feet}}{2} \times 0.8$ feet = 3.20 square feet, the sectional area, and the velocity being estimated at 2.5 feet per second, gives a discharge of 8.0 cubic feet per second.

The area irrigated was estimated at 50 acres.

ACEQUIA MADRE

The heading of this ditch is on the south side of the creek and near the lower end of the canyon which is about a mile above the post office of Arroyo Hondo. This is an old ditch and after attaining the bench lands, it divides into three branches. The highest and south side being named Acequia del Llano, the next Acequia del Media and the lowest Acequia de la Corrillera. The first mentioned irrigates 160 acres and the other two 190 acres.

The soil is good but in places contains too much coarse gravel.

Grain, alfalfa, truck and fruit are raised. Fruit produces well about every four years. No smudging is practiced. This would greatly increase the production.

The following are the data for the flow on the day of examination, July 13, 1910: $\frac{5.0 \text{ feet} + 7.5 \text{ feet}}{2}$ x .60 feet, equals 3.75 square feet, the sectional area, and the velocity obtained being 1.60 feet per second, gives a discharge of 6.00 cubic feet per second. The data for the maximum flow are as follows: 5.0 $\frac{\text{feet} + 7.5 \text{ feet}}{2}$ x .80 feet, equals 5.00 square feet, the sectional area, and the velocity being estimated at 1.70 feet per second, gives a discharge of 8.50 cubic feet per second.

This was again gaged on July 27 and was cross-sectioned and readings were taken with the current meter for velocity, and the flow was found to be 9.06 cubic feet per second, and the maximum capacity was found to be .60 feet higher than on that date. The maximum height of the water is often difficult to obtain; as estimated the last time is .30 of a foot higher than the first time. The maximum capacity is therefore estimated at 16 cubic ft.

per second.

The area irrigated is about 250 acres.

ACEQUIA TALALLA

This ditch heads in the canyon on the north side of the creek about a mile above the post office of Arroyo Hondo. It irrigates patches to the amount of about 60 acres.

Considerable land that was formerly irrigated is no longer irrigated. The crops were mostly of grain, and as there had been a scarcity of water this year, they were poor. The soil on the lands on the mesa is not very good, as there is considerable gravel.

The data for the flow on July 13 are as follows: $\frac{2.0 \text{ feet} + 3.0 \text{ feet}}{2}$ x .3 feet equal .75 square feet, and the velocity being 1.05 , gives a discharge of .79 cubic feet per second. The data for the maximum flow are as follows: $\frac{2.0 \text{ feet} + 3.5 \text{ feet}}{2}$ x .80 feet equals 2.2 square feet, the sectional area, and the velocity being estimated 2.2 feet per second, gives a discharge of 4.84 cubic feet per second.

This ditch was gaged with the current meter on July 27th, with the following results: The flow on that date was found to be 3.44 cubic feet per second, and as the maximum capacity was estimated to be .30 feet higher, this would make a discharge of 4.75 cubic feet per second. This is close to the estimate made on July 13th.

SMALL COMMUNITY

This ditch heads in the lava canyon, which is at the upper end of the middle valley and is on the south side.

The diversion works consist of a temporary dam of cobbles.

The following are the data for the flow on the day of examination; July 27, 1910: $\frac{1.4 \text{ feet} + 1.8 \text{ feet}}{2}$ x .40 foot equal .64 square feet, the sectional area, and the velocity being estimated at 1.5 cubic feet per second, gives a discharge of .96 cubic feet per second. The data obtained for the flow at the maximum capacity are $\frac{1.4 \text{ feet} + 2.0 \text{ feet}}{2}$ x .60 feet, equal 1.02 sq. feet, the sectional area, and the velocity being estimated at 1.7 makes a discharge of 1.73.

The area irrigated was estimated at 50 acres. No additional acreage could be readily irrigated.

SMALL COMMUNITY

The heading of this ditch is on the north side of the Rio Hondo and at the lava canyon, which is at the upper end of the middle valley

The data for the flow as obtained on July 27, 1910, are as follows: $\frac{1.2 \text{ feet} + 1.8 \text{ feet}}{2}$ x .50 foot equal .75 square feet, the sectional area, and the velocity obtains was 1.5, which makes the discharge 1.12 cubic feet per second. The maximum capacity was estimated to be .20 of a foot higher and the velocity to be 1.60 feet per second, which gives a discharge of 1.68 cubic feet per second.

The area irrigated was estimated at 15 acres.

SMALL COMMUNITY

The heading of this ditch is on the south side of the Rio Hondo. It irrigates land within the valley proper. The heading is in close proximity to three other ditches. The aneroid registered 7600 feet one time and 7700 feet the other time.

The diversion works were of cobbles and gravel.

This was gaged twice, once on July 23rd and again on July 27, 1910. The flow on July 23rd was 1.68 cubic feet per second, and the maximum capacity was estimated at 2.88 cubic feet per second. The velocity was obtained by a float. On July 27th the cross section was obtained and the sectional velocities were taken with the current meter, and the discharge was found to be 2.48 cubic feet per second, which was close to the maximum capacity. It is therefore seen that the maximum capacity is between 2.5 and 3.0 cubic feet per second.

The area irrigated was estimated at 50 acres, which was mostly planted with grain.

ACEQUIA DES MONTES

The heading of this ditch is on the south side of the Rio Hondo near the toll gate. It is below the two ditches which are on the nirth side. The ditch had been widened considerably during the spring of 1910.

Two gagings of this ditch were made; one was made on July 23, 1910. The velocity was obtained by float and the discharge was found to be 6.0 cubic feet per second, and the maximum capacity was estimated to be 15.0 cubic feet per second. On July 27 the gaging was made at a different place, at the first wagon bridge across the ditch, and the cross section was determined and the velocity was found by current meter. The discharge was 11.5 cubic feet per second, and with this as partial data, the maximum discharge was estimated at 20 cubic feet per second. These results are not very close, but with so much of the data for the maximum capacity being estimated, better results could not be obtained.

The area irrigated was estimated at about 1000 acres and this is probably reasonably close, as considerable trouble was taken to get this acreage correct. Most of this is upon the mesa south of the Rio Hondo.

ANDERSON'S MILL DITCH

This is a ditch which is located on the north side of the creek and it has its heading below the Acequia de la Plaza de San Antonio. It was built to operate a small mill, but it has also been turned into an irrigation ditch.

This was examined on July 23, when it was carrying .18 of a cubic foot per second, and again on July 27th, when it was carrying .30 of a cubic foot per second, and the maximum capacity was estimated at 3.0 cubit feet per second each time.

The area irrigated was estimated at 1 acre. This ditch is of small importance.

SAN ANTONIO PLAZA

The heading of this ditch is on the north side of the Rio Hondo near where it leaves the mountains, and a short distance below the toll gate which is for the road to Almosett.

This is an old ditch, as in 1847 or 1848 the people of the plaza were concerned in the insurrention.

The diversion works are temporary, being of cobbles and gravel.

Two different gagings were made of this ditch on two different days. On July 23rd the flow was found to be 3.37 cubic feet per second, and the maximum capacity was estimated to be .45 of a foot higher, and the maximum discharge was estimated at 7.87 cubic feet per second. The velocity was obtained by floats. On July 27, 1910, this was again gaged by float and meter. The following are the data obtained for the flow on that day: $\frac{2.5 \text{ feet} + 3.5 \text{ feet}}{2}$ x .50 foot, equal 1.50 square feet, the sectional area, and the surface velocity of 4 feet was found, and using a coefficient of .80 gave a mean velocity of 3.20 feet per second, which gives a discharge of 4.80 cubic feet per second. At the same place the cross section was taken and current meter observations were made, and the discharge was found to be 4.90 cubic feet per second. This is very close to that obtained by floats. The maximum height of the water was estimated to be .40 higher, and using this is a basis, the maximum discharge would be 9.80 cubic feet per second. This is not as close as it might be, yet with no data that is closely reliable, such variation must be expected.

This is one of the main ditches in the upper valley of the Rio Hondo, and it does not irrigate any lands except those in

the valley proper.

The area irrigated was estimated at 85 acres. A few additional acres might be irrigated, but they would hardly exceed 10.

RIO SAN CHRISTOBAL

This stream is an intermittent tributary of the Rio Grande. It rises in the high mountains and irrigates a very narrow valley in an imperfect way.

This was visited on July 12, 1910, and all the water was being used and there was not enough, yet the crops were not suffering to any considerable extent.

The altitude is about 7200 feet according to the aneroid used.

Native hay is not irrigated, but grain and alfalfa are irrigated twice. Some fruit and truck are grown.

No information was obtained about any reservoir sites.

The total acreage was estimated at 190 acres. There are two main ditches, one on either side of the valley. Near the lower end of the valley is a small ditch which irrigates about 4 acres. There is some land in the vicinity on some mesas that might be irrigated if there was any water, but it is hardly probable that such can be done. It is believed that in the future there can be no development of irrigation that would lessen the present water supply to the Rio Grande.

Lobo Creek

This is an intermittent tributary of the San Christobal Creek. It rises in the high mountains and as it emerges on the top of a great alluvial fan it is diverted into several small ditches and is all used close to the mountains. The total area irrigated was estimated at 150 acres. The crops were grain, alfalfa, beans, fruit and truck. The crops are mostly consumed locally. it

is probable that fruit would do well, judging from the appearance of the young orchards seen.

As this stream seldom contributes any water to the Rio Grande, and that only in a small amount, it is believed that any conditions which may be changed in the future on this creek will have no effect on the supply of the Rio Grande.

Uraca Creek

This is a small creek which rises in the high mountains and sinks on reaching the plains near the south boundary of the Sangre de Cristo Grant. Water probably reaches the Rio Grande only during exceptionally favorable conditions. It irrigates one ranch consisting of about 10 acres. It is believed that there can be no further development that will lessen the present supply of the Rio Grande.

RITO LAMA

This creek rises in the high mountains south of Questa and flows westward over the top of an alluvial fan, and in times of excessive rainfall or very heavy run-off from melting snow, the flow reaches the Rio Grande.

The following information was obtained from Mr. J. H. Luce, who has a ranch on the creek.

There are seven water rights on the creek. Two are for overflow or excess, when such occurs. The five principal ones apply to ranches high up on the alluvial fan or mesa, which the reading of the aneroid showed to be about 8,000 feet above sea level, while the two for seepage are located down near the Rio Grande. The owners of the two ranches down by the Rio Grande were putting in small reservoirs, i.e., reservoirs of about 10 or 15 acres capacity.

The area irrigated near the mountains was 200 acres and that near the Rio Grande 140 acres. There were a number of small ranches totaling 100 acres, near the mountains which were irrigated a little from small streams, but relied mostly on rains.

There was said to be a snowfall from which a depth of two feet remained on the ground for three months in the winter. This should probably be reduced in time to two months.

This was examined on July 12, and an excellent crop of alfalfa hay was being stacked at the ranch of Mr. Luce. Irrigation is not needed after July 1 because of summer rains. Crops of corn, wheat, oats and vegetables were being raised. The crops are largely consumed on the ranches.

The drainage area of this creek above the farming district is small, being somewhere near five square miles.

It is known that the summer flow of the stream never reaches the Rio Grande and that the maximum is not great, and that there are no opportunities for extensive storage, and all this being true, it is believed that any increase of irrigation on this creek cannot noticeably affect the present water supply of the Rio Grande.

This is a perennial tributary of the Rio Grande. It rises east of Wheeler's Peak, the highest peak in New Mexico, being about 13,300 feet in altitude. It drains a large mountain country and produces the most constant flow of any tributary on the east side in New Mexico. Snow was seen on the higher peaks in July.

The course is without the high mountains proper from Questa to the Rio Grande, and for this distance it is in a sort of canyon which near Questa widens out into a small valley, but about 3 or 4 miles below it narrows into a true impassible canyon and continues as such to the Rio Grande.

There are some lands which are irrigated within the mountain area, but they are small in extent.

The total flow of the Red River was found to be 75 cubic feet per second at the head of irrigation in the Questa Valley. It was estimated that the flow at the upper end of the lower canyon was 75 cubic feet per second. As both these measurements were taken on the same day, and within a few hours, it would seem that no loss occurred, even though 475 acres were estimated to be irrigated and about 26 cubic feet were being diverted per second. It would therefore seem that there must be a great amount of seepage from Cabresto Creek, and this must not be denied as the soil is largely of gravel and on Cabresto Creek one cubic foot per second irrigates but 25 acres, where it should irrigate 60 or 80 acres. Assuming that the return waters are one-half from Cabresto Creek, and one half from Red River, the area irrigated per second-foot is about 50 acres, which is about what should be expected.

Nearly all products of irrigation along Red River are consumed locally. Native hay, alfalfa, grain and truck are the principal crops. The area within the mountains produces good wheat, oats and potatoes.

The Red River Land & Water Company through some old rights have secured water rights for water to irrigate 29,000 acres of land near Cerro. In periods of drouth, like the present year, it will be seen that a great amount of land will not have water enough. This water right will seriously interfere with mid-summer irrigation of lands in the vicinity of Albuquerque, as the supply near there was not sufficient this year and will probably not be sufficient in the future.

Red River at times contributes a considerable quantity of silt. The cause of this contribution is singular. There are certain yellow cliffs composed probably of a ryolitic rock. These sluff off a considerable amount of material and when torrential rains occur on this, a mud is formed which runs as a viscid fluid. This at times becomes so thick over the road from Questa to Red River that travel is prohibited. Because of such conditions Red River is transformed from a clear mountain stream to a very muddy and yellow stream in a few minutes. On July 29th there was seen on the road from Questa to Red River a place where 18 inches of mud had been deposited by a flow. There were evidences of greater flows previously.

There is a contemplated proposition to take some of the waters from the Red River drainage to the drainage of the Cimarron. This is contemplated in connection with an old water right.

Some few years previous to 1866 Congress gave a charter

to a mining company to take water from the higher part of the Red River drainage over into the Cimarron drainage, to use for placer mining. This was constructed in 1866 or 1867 and considerable gold was obtained. The ditch was very costly,and according to various reports must have cost near $300,000.Through graft and litigation this ditch was allowed to get out of repair and is now in such condition that it would take a large sum to repair it.

At a pass which was lower than the desired height of the ditch between the two drainage basins, two flumes with a pressure pipe were used to overcome this difficulty. At the present time the flume is nearly destroyed and the pressure pipe is so badly rusted that it would have to be replaced.

The plans of the company which intends to put in a new system, is to repair the old ditch on the Red River side and then take a pressure pipe and run it from the divide across the valley and up on the west slope of Baldy Peak, where the placer ground is located. Another advantage of this would be that any waste water would augment the supply of the Eagles Nest reservoir which is expected to furnish water for lands near Springer.

The newspapers record that the dam for the reservoir is under construction. The ostensible purpose is to store 125,000 acre-feet, but hydrigraphic estimates by the U. S. Geological Survey show that only 20,000 acre-feet are available annually.

The amount of water that could be diverted annually is small, as the divide over which the ditch is to cross was shown to be 9200 feet by the aneroid barometer. The drainage area tributary to this ditch is probably about 10 or 15 square miles and the annual precipitation is over 25 inches per annum, and probably

in places exceeds 36 inches. Applications were made and approved on March 15, 1907, for the following reservoir sites: Crystal, Echo, Wind Gap, Deer Park, South Fork, Great Heart, Snow Bound and one other not named. These have a combined capacity of 815 acre-feet, and were designed to furnish a flow in midsummer. Melting snow would probably furnish a constant supply until midsummer. It is the intention to divert about 30 cubic feet per second. It is estimated that with the present knowledge of conditions and with the contemplated storage, if this proposition were completed that from 4,000 to 5,000 acre-feet would be diverted from the Rio Grande and that such would be detrimental to the present supply.

Red River Canal

The heading of this ditch is on the north side of Red River about one mile east of Questa. The diversion works are temporary, being on the day of examination, July 11, 1910, of cobbles, brush and gravel. The ditch was in reasonably good condition near the head, but for a distance it was located in a wagon road and was consequently not in good condition.

The data for the flow on July 11 are as follows: 5.0 ft. plus 6.0 ft. / 2 x 1.3 ft. equal 7.15 square feet, the sectional area, and the velocity having been ascertained by floats to be 1.8 feet per second, gives a discharge of 12.87 cubic feet per second. The data for the maximum flow are as follows: 5.0 ft. plus 7.0 ft. / 2 x 1.8 ft. equal 10.8 square feet, the sectional area, and the velocity being 2.2 feet per second, gives a discharge of 23.76 cubic feet per second.

The area irrigated by the ditch is not known. There are some small ditches which take out of Red River, which irrigate small

areas. The total area irrigated from the Red River is about 475 acres, and practically all is irrigated by this ditch.

The crops are native hay, alfalfa, grain, fruit and truck. The products are consumed locally.

The value of the land ranges from about $20.00 to $75.00, with $50.00 about the average.

CABRESTO CREEK

This is a perennial tributary of Red River. It rises in the high mountains near Latir Peak and flowing in a general southwesterly direction, empties into Red River near Questa.

The Cabresto Lake Irrigation Co. of Questa has made a filing and had approved a water right on this creek. A certificate of construction has also been issued.

This is a prosperous community, with a good soil and good climatic conditions and a constant water supply. Some of the irrigated lands are in the valley floor and some of them are on a mesa. The methods of farming are not good at all. Too much water is used.

The crops are native hay, alfalfa, grain, some fruit and truck. The markets are all local. The forage crops are used in feeding during the winter the sheep and cattle which range in the mountains during the summer.

The flow of the creek was measured at the mouth of the canyon on July 11, 1910, and was found to be 22.5 cubic feet per second. It was estimated that 500 acres were being actually irrigated. About 1.5 cubic feet per second were flowing into Red River. Therefore, during the dryest part of the season 21 cubic feet per second were being used to irrigate 500 acres. A considerable part of the valley floor was swampy because of supersaturation with irrigation waters. This should be a good fruit country with scientific culture. It is very probable that no additional diversions will ever be made that will interfere with the present water supply of the Rio Grande.

The Red River ditch is peculiar, in that when there is

sufficient water in this creek it is taken therefrom, but when it is low it is taken from Red River.

The mesa is composed largely of gravel and it is believed that water percolates into it very readily. The land in the valley has a great amount of rich alluvium underlaid by coarse gravel. These conditions account for a considerable amount of the return waters, which will be described under Red River. Over irrigation is generally practiced.

Acequia de la Plazita

The heading of this ditch is on the north side of the creek a short distance below that of the Acequia del Llano. The diversion works consist of a temporary dam diagonally across the stream, composed of boulders, gravel, etc.

Part of the irrigated area is upon the mesa and part of it is in the valley proper.

The following are the data for the flow on July 11, the day of examination: $\frac{7.0 \text{ ft. plus } 8.0 \text{ ft.}}{2}$ x .40 ft. equals 3.0 square feet, the sectional area, and the velocity being 2.25 feet per second, gives a discharge of 6.75 cubic feet per second. The maximum capacity should be according to the following data: $\frac{7.0 \text{ ft. plus } 9.0 \text{ ft.}}{2}$ x 1.0 ft. equals 8.0 square feet, the sectional area, and the velocity being estimated at 2.5 feet per second, gives a discharge of 20.0 cubic feet per second.

No estimate was made of the area irrigated under this ditch, or rather no segregation from the total area was made.

Acequia del Llano

The heading of this ditch is on the north side of the creek and near the mouth of the canyon. It irrigates lands on the Llano. It was difficult to estimate the acreage under this ditch without extensive investigation.

The following are the data for the flow on July 11: $\frac{1.0 \text{ ft. plus } 2.0 \text{ ft.}}{2}$ x 4.0 ft. equals .60 square feet, the sectional area, and the velocity being 2.0 feet per second, gives a discharge of 1.2 cubic feet per second.

LATIR CREEK

This is an intermittent tributary of the Rio Grande which rises in the high mountains about Latir Peak, which is noreast of Cerro. This creek furnishes most of the water for irrigation for the settlements at Cerro. Lieutenant Wheeler's map, made in or previous to 1877, shows this settlement as existing then,and the ditch from Latir Creek.

This was visited on July 9, 1910. It was estimated that 150 acres were irrigated on the creek, and this is less than formerly. This creek with two others furnish water for Cerro. The number of ditches was not noted as the irrigation was in small non-contiguous patches. The people of this creek get use of the water for 48 hours out of the week, when there is not sufficient for all, and the people at Cerro get the use of it during the remainder of the week. I was told that this is according to a court decision.

The crops are wheat, oats, alfalfa, potatoes, fruit and truck. The markets are all local. The forage and grain are used in feeding cattle and sheep in winter.

There are no favorable reservoir sites. The drainage area is small. The run-off is reasonably large in the mountain district, but the total run-off into the Rio Grande is very small as it has a considerable distance to flow on the plains, which absorb a considerable amount. Only the rapid melting snow or heavy summer showers furnish water to the Rio Grande.

The soil on the lower plains is a fine alluvial, but near the top of the alluvial fan it is gravelly. It is not believed that any conditions will be developed which will seriously affect the present contributions to the Rio Grande.

Jaracito Creek

This is a small intermittent tributary of the Latir Creek. It rises in the high mountains about Latir Peak and flows in a westerly direction. It was estimated that there are 30 acres which are irrigated on this creek high up on the alluvial fan, near the mountains. This creek has the use of water 48 hours out of the week, and the balance of the time it goes to the settlements at Cerro.

The crops are wheat, oats, potatoes, alfalfa, fruit and truck.

The value of the land is about $40.00 except for the fruit land, which might be worth $100.00.

The drainage area is small, and the toal amount of run-off received by the Rio Grande is small, and as there are no favorable sites for reservoirs and as a sort of an adjudication has been made, it is believed that the present supply of water for the Engle reservoir cannot be affected.

Rio del Medio

This is an intermittent tributary of Latir Creek, and it is the first one emerging from the mountains below Jaracito Creek. This is nearly east of Cerro.

About 20 acres are farmed on the highest part of the alluvial fan. The crops are wheat, oats, potatoes and alfalfa, which produce good yields. Fruit, melons and truck are also grown. The products are all consumed locally. The value of the land probably ranges from $40.00 to $75.00 per acre.

By a court decision given about 20 years ago, I was told the people of this creek are allowed the use of the water for 48

hours out of the week, while the remainder of the time it goes to the settlements at Cerro.

It is believed that there are no feasible reservoir sites as the grade of the stream while within the mountains is precipitous. The drainage area is small and even if the run-off within the mountain district is great, this is largely absorbed and evaporated while flowing on the plains before it reaches the Rio Grande. Only the rapid evaporation of snow or heavy summer showers furnish a flow to the Rio Grande. It is believed that there can be no development of irrigation on this creek that would be detrimental to the water supply of the Rio Grande to an extent worthy of consideration.

C E R R O

This is a Mexican settlement located on the plains north of Red River, and the water supply is received from three creeks, viz., Rio del Medio, Jaracito Creek and Latir Creek.

According to information received from Mr. L. B. Montoyo of Cerro, settlement was made at Cerro in 1852. The land is sectionized and is nearly all patented. A company which has had an application approved by the Territorial Engineer, contemplates taking water out of Red River and irrigating 29,000 acres of Territorial lands near here.

A ditch has been constructed in such manner that the water from these three creeks can be turned into it. This was examined on July 9, 1910, and a rough estimate was made of its capacity. It was estimated that it would carry from 25 to 35 cubic feet per second. As the cross section and grade varies greatly, and as there was no water in the ditch, this estimate is probably

subject to considerable errors. The area irrigated was estimated at 800 acres. The crops were mostly grain, i.e., oats and wheat, but corn, alfalfa, melons and truck were raised. Nearly all were consumed locally. The soil is very good.

The additional area that might be irrigated by the three creeks which furnish water for Cerro is probably 50,000 acres, if a supply could be obtained, but such cannot be done. As it is now very little water is contributed to the Rio Grande even in times of the rapid melting of snow or heavy summer showers.

Information was secured while at Cerro that a water right application was approved for the settlement. This may have been a misunderstanding, but it was difficult to get correct information as the settlers are suspicious that their rights were going to be infringed upon by the company which is going to irrigate 29,000 acres with water from Red River.

On February 18, 1908, an application of Cerro Las Associon, Cerro, N. M., was approved by the Territorial Engineer, to divert from Latir Creek in Section 23, T. 30 N., R. 13 E., 45 cubic feet per second to irrigate 3,000 acres. It was believed that this was an application to cover old rights; if it is not, it is an unfair grant, as Latir Creek and its tributaries do not at the present time supply sufficient water for the 1,000 acres which are cultivated. Any further appropriations would be much more detrimental to the settlers.

It is believed that there are no feasible reservoirs on Latir Creek or its tributaries, that the total amount of water contributed to the Rio Grande is not great, as the flow only occurs at times when the snow melts rapidly or during heavy summer showers,

and that there can be no further development of irrigation that would be seriously detrimental to the present supply for the Engle reservoir.

COSTILLA CREEK

This is an intermittent tributary of the Rio Grande. It rises in the high mountains about Costilla Peak in New Mexico, flowing northwesterly enters Colorado, flowing southwesterly it again enters New Mexico, emptying into the Rio Grande.

The main body of irrigated land is located near Costilla, in the vicinity where the creek debauches on the plains. This settlement is said to have been made previous to 1852. Two years to that date and subsequent Ferdinand Myers bought out various water rights on this creek. The statement is now made by his heirs that these rights included all water rights. These heirs have sold their rights to the Costilla Estates Development Co. Legal proceeding are being carried on to regain the water which is now and has been for several years used by various ditches. Particular efforts are being made to dispossess the squatters at Pina of their water. This settlement was made during 1873 and 1874. The Costilla Estates Development Co. will use this water on lands to be brought under irrigation and then sold. This will be further described in the report of Mr. James A. French.

It is believed the entire flow of this creek is to be diverted into storage reservoirs in Colorado. Impounding reservoirs will also be built at the heads of this stream for use both in Colorado and New Mexico.

The soil near Costilla is not very good; being located on the highest part of an alluvial fan, there is much coarse gravel. Water sinks rapidly.

The principal crops are grain, potatoes and alfalfa. Beans, corn and truck are grown. The markets are mostly local. Two crops of alfalfa are raised; the first is irrigated twice and

the second once. Grain is irrigated three times and beans and corn once.

The average value of lands was said to be about $50.00 per acre.

The altitude about Costilla is probably 7800, and that about Pina 8100.

The summer showers, generally beneficial, were not so this summer owing to the drouth.

Several reservoir sites have been surveyed on this creek.

Acequia del Plaza Medio

The heading of this ditch is on the south side of the creek and at the upper plaza and near the Post Office.

This was examined on July 8, 1910, and was carring .75 of a cubic foot per second. The following are the data for the maximum capacity: $\frac{3.5 \text{ ft. plus } 5.0 \text{ ft.}}{2}$ x 1.0 ft. equals 4.25 square feet, and the velocity being 2.0 feet per sectond, the discharge is 8.50 cubic feet per second.

The area irrigated was estimated at 125 acres.

Acequia del Plaza

The heading of this ditch is on the south side of the creek below Acequia de Piedras and above Acequia del Plaza Media.

The data for the flow on the day of examination, July 8, are as follows: $\frac{2.0 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x .40 ft. equals 1.0 square feet, the sectional area, and the velocity being estimated by floats to be 1.5 ft. per second, gives a discharge of 1.5 cubic feet per second. The data for the maximum capacity are as follows; $\frac{2.0 \text{ ft. plus } 3.0 \text{ ft.}}{2}$ x 1.0 ft. equals 2.5 square ft., the sectional

area, and the velocity being estimated at 2.0 cubic feet per second, gives a discharge of 5.0 cubic feet per second.

The area irrigated was estimated at 100 acres.

Acequia de las Piedras

The heading of this ditch is on the south side of the creek and about 3/4 of a mile above the Post Office.

This was examined on July 8, 1910, and the following are the data for the flow: $\frac{4.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x .90 ft. equals 4.5 square feet, the sectional area, and the velocity being estimated at 2.0 feet per second according to float measurement, gives a discharge of 9.0 cubic feet per second. The data for the maximum capacity are: $\frac{4.0 \text{ ft. plus } 7.0 \text{ ft.}}{2}$ x 1.5 ft., equals 8.25 square feet, and the mean velocity being estimated at 2.2 feet per second, gives a discharge of 18.50 cubic feet per second.

The area irrigated was estimated at 500 acres.

Acequia Cerrito

The heading of this ditch is on the south side of the creek and above Acequia de las Piedras.

The ditch was examined on July 8/and the following data for flow on that day was secured; $\frac{3.0 \text{ ft. plus } 4.5 \text{ ft.}}{2}$ x .70 ft. equals 2.62 square feet, the sectional area, and the velocity being estimated at 1.5 gives a discharge of 3.93 cubic feet per second. The data for the maximum capacity are as follows: $\frac{3.0 \text{ ft. plus } 5.0 \text{ ft.}}{2}$ x 1.1 ft. equals 4.4 square feet, the sectional area, and the velocity being estimated at 2.0 feet per second, gives a discharge of 8.8 cubic feet per second.

The area irrigated was estimated at 300 acres.

ACEQUIA MADRE

The heading of this ditch is on the north side of the creek. It is an old ditch. The lands irrigated are on the north side of the creek, some of them being in New Mexico and some in Colorado.

The following are the data for the flow on the date of examination: $\frac{5.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x .90 ft. equals 4.95 square feet, the sectional area, and the velocity was estimated with floats at 2.9 feet per second, which gave a discharge of 14.35 cubic feet per second. The data for the maximum capacity are as follows: $\frac{5.0 \text{ ft. plus } 6.0 \text{ ft.}}{2}$ x 1.5 ft. equals 8.25 square feet, the sectional area, and the velocity was estimated at 3.5 feet per second, which would give a discharge of 28.87 cubic feet per second.

The area irrigated was estimated at 1100 acres.

Ute Creek

This is a perennial tributary of the Costilla Creek and empties into it near the settlement of Pina. The main body of irrigable land is located near Pina and was estimated at 160 acres. The ditches were all small, but were not examined. There were said to be 7 of them. There are also some settlements about 7 miles from Pina, but they are of no great importance, according to the information received. The irrigation area might be estimated at 20 acres. Nearly all the water is used in midsummer.

There were no good reservoir sites. There are probably no chances of extending the irrigable area.

RIO SAN ANTONIO

This is an intermittent tributary of the Rio Conejos, rising in New Mexico and flowing in a general northeasterly direction, and emptying into it near its mouth. The river is in a canyon for most of its length in New Mexico, and therefore has but little irrigable land along it. After crossing the New Mexico line its course is on the plains of the great San Luis Valley. The area in New Mexico will be described in this report, but that which is in Colorado will be described in the report of Mr. James a. French, Engineer U.S.R.S.

Nearly all irrigation in New Mexico is confined to native hay, grain and potatoes. The soil is good, being as a rule a rich alluvium. The growing season is short, as all the area irrigated is within the confines of the mountain districts and mostly within the timbered area. It is probable that the irrigating season extends from about June 1 to August 1.

One possible reservoir site was noticed, but a survey would have to be made to determine its feasibility. This will be further described under "reservoirs".

The value of land will probably range from about $20.00 to $50.00 per acre.

The annual precipitation at Alamosa is about 13 inches. It is probable that the annual precipitation in the mountains is about 16 inches.

There are ten or fifteen thousand acres that could be irrigated in New Mexico from this river if a sufficient supply of water could be obtained. The lands would be to the north, east and south of San Antonio mountain, but no such supply could ever

be developed.

A grade was noticed which, from information unofficially received, had been constructed by the D. & R. G. R.R. upon which to was intended to lay a wooden pipe, but this was not done. This pipe was to carry water from the Rio San Antonio to the station at Palmilla.

Private

On north side of creek about 7 miles from the state line. Maximum capacity .50 cubic foot per second. No water in the creek on July 4, 1910, or in the ditch. Would irrigate about 5 acres.

Private

On south side of the river about 1 1/2 miles below the Forest Ranger Station. Maximum capacity 2.50 cubic feet per second. Area irrigated 45 acres. Nearly all hay land.

Private

About 1 mile below the Forest Ranger Station and on the south side of the creek, and has a maximum capacity of .50 cubic of a foot per second. The area irrigates is 5 acres and is meadow land.

Private

On the north side of the river and the heading is about 3/4 of a mile below the Forest Ranger's Station. The maximum capacity is the same as the flow on the day of examination, which was July 6. Data for flow: $\frac{2.0 \text{ ft. plus } 3.5 \text{ ft.}}{2}$ x 0.5 ft. equals 1.37 square feet, the sectional area, and the velocity being .80 cubic feet per second gives a discharge of 1.10 cubic feet per second. About 5 acres of land irrigated. The value of the land irrigated is about $30.00 or $40.00.

Private

The heading is on the north side of river and a short distance below the Forest Ranger's Station. The discharge was .10 cubic foot per second on July 6, and the maximum capacity was estimated at .20 cubic foot per second. 1 acre was irrigated.

Private

The heading is about 3/4 of a mile above the Forest Ranger's Station, which is in Sec. 1, T. 30 N., R. 7 E. The maximum capacity is .50 of a cubic foot per second and the area irrigated was estimated at 10 acres.

Information was received from the Forest Ranger that 260 acres were irrigated above the last mentioned ditch. A report had been made shortly before which required this information, so it was considered perfectly trustworthy. The number and capacity of ditches was not learned.

RIO LOS PINOS

This is an intermittent tributary of the Rio San Antonio. It rises in the high mountains in Colorado and flows into New Mexico, and then flows into the Rio San Antonio just close to the New Mexico-Colorado line.

The several ditches are described. Near the Colorado line and in Colorado the waste of water is very noticeable. A considerable amount was noticed to be standing in pools while at the end of some of the ditches the crops were drying up.

There are several reservoir sites on this drainage, which will be described by Mr. James A. French in his report.

The flow of the river at the mouth of Las Nutrias Creek on July 2nd was 5 cubic feet per second, and on July 6th the flow had ceased at a point about a mile below the Forest Ranger's Station. There was no water on either of these dates at the State line. This is an intermittent stream with a large flow when the snow is melting in the spring.

Acequia los Pinos

The heading of this ditch is in New Mexico on the north side of the creek, near the State line.

The data for the flow on July 4 are as follows:

5.0 ft. x 1.0 ft. x 1.5 ft. equals 7.5 cubic feet per second. The maximum capacity is according to the following data; 5.0 ft. x 1.5 ft. x 1.7 ft. equal 12.75 cubic ft. per second.

The area irrigated in New Mexico was estimated at 10 acres.

The ditch will be similarly reported upon by Mr. James A. French concerning the data for Colorado.

Mr. Fred Ortiz, of Ortiz, Colorado, said that lands were irrigated every eight days, while another said that lands were irrigated eight times in the year, during the irrigating season. These two reports agree fairly well. Some one said that the irrigating season would extend from 40 to 60 days, or from about May 15 to July 15.

The value of the lands in New Mexico are said to be about $100 per acre, while farther down along the ditches where the water supply was not so good, the value was about $50.00 per acre.

Too much water is used about Ortiz, as it could be seen standing about in pools, and it was used so much that some of the land received its water by sub-irrigation.

The precipitation is probably about 13 inches per annum, as that is the record at Alamosa.

Acequia del Llano

The heading of this ditch is on the north side and about a mile and one half below the Territorial line. This was measured about 1.2 mile below the heading; the examination was made on July 4, 1910.

The data for the flow on this day was as follows: $\frac{8.0 \text{ ft. plus } 12.0 \text{ ft.}}{2}$ x 1.4 ft. gives 14.0 square feet, the sectional area, and the velocity being found to be 1.6 feet per second, gives a discharge of 22.4 cubic feet per second. The data for the maximum flow are as follows: $\frac{8.0 \text{ ft. plus } 14.0 \text{ ft.}}{2}$ x 2.0 ft. equals 22.0 square feet, the sectional area, and the velocity being estimated at 2.0 feet per second, gives a discharge of 44.0 cubic feet per second.

The ditch was found to be in good condition.

30 acres are estimated to be irrigated in New Mexico.

Community

The heading of this ditch is on the south side above La Ancon and irrigates 15 acres on the south side, and crossing in a flume irrigates 5 acres on the north side just at the heading of Del Llano. Maximum capacity 1.0 cubic feet per second.

For the next mile and a half above the ditch previously mentioned, 10 acres are irrigated, the bottom of the canyon being from 200 to 4oo feet wide and mostly used for pasture. Canyon from 4oo to 6oo feet deep.

San Miguel Plaza

This is in the valley about 6 miles above La Acequia del Llano. There are three ditches, two of which are on the south side. On the south side the upper ditch irrigates 4 acres and the lower ditch 12 acres, and the one on the north side irrigates 12 acres. The walls of the canyon are about 800 feet deep. Crops are grain and forage. The irrigable area is not extendible. There are six ranches in all.

Santa Rita

This is a small plaza about 2 or 3 miles above San Miguel. There are said to be two ditches which irrigate about 12 acres each, and there are five ranches in all. This was not visited as it is situated in a deep canyon and no conditions can arise which will in any way influence the present water supply to the Rio Grande.

LAS NUTRIAS CREEK

This is a perennial tributary of the Rio San Antonio, but it is of small capacity and irrigation is limited. The crops are practically all native hay, oats and potatoes. Information was received from reliable authority that such lands were sold for prices ranging from $30.00 to $50.00 per acre.

The lower ditch was located at an altitude of about 8700. It had a capacity of 1 cubic foot per second and irrigated 80 acres.

The next ditch above had a capacity of .50 of a cubic foot per second and irrigated 20 acres.

The upper ditch had a capacity of .25 of a cubic foot per second and irrigated 10 acres.

There was timber on the hillsides. No irrigation is carried on before the middle of June, and it ceases about July 15th.

R E S E R V O I R S

in

NEW MEXICO

on

THE RIO GRANDE AND ITS TRIBUTARIES

RESERVOIRS

The reservoirs in New Mexico, in the drainage basin of the Rio Grande and its tributaries, north of the Elephant Butte, will be treated under five different headings. The first will be the reservoirs surveyed by the U. S. Geological Survey and reported upon in its publications; the second will be the same as above except that no reports are published; the third will be according to the applications filed in the office of the Territorial Engineer at Santa Fe; the fourth will be reservoirs mentioned by Mr. W. W. Follett, Consulting Engineer for the International (Water) Boundary Commission, in a report to this Commission; and the fifth will be the reservoirs examined or concerning which information was received in 1910.

There are 31 reservoirs tabulated which were surveyed by the U. S. Geological Survey and reported upon by them, and there are also 6 other reservoirs which were surveyed by them but for which no report was published. The total storage capacity of all of these is 820,082 acre-feet. Of this amount 664,940 acre-feet are for reservoirs for which a report was published, and 155,142 for reservoirs surveyed but for which no report was published.

There are 19 applications for reservoir sites for irrigation purposes on file in the office of the Territorial Engineer at Santa Fe, New Mexico. Those for which a specific number of acre-feet are applied for, give a total of 191,630 acre-feet, and there are several in which the surplus is required and the specific amount is not given.

Storage rights for 2,050 acre-feet for three power propositions are applied for. Application is made for storage rights for eight reservoirs, which are intended to supply water for

hydraulic mining in the drainage of the Cimarron River.

The reservoirs reported upon by Mr. W. W. Follett are all mentioned in this report under other headings, except one which is recorded as being located at Brazos Lakes and to have a capacity of 20,000 acre-feet. It might be said that such lakes were not known at Sierra Amarilla.

Computations were made of the capacity of eleven of the fifteen reservoirs for which detailed information was not received. The total for these eleven was 71,390 acre-feet. Four others had no data by which computations could be made.

The combined capacity of all the reservoirs mentioned above which have a computed capacity, is 1,105,062 acre-feet.

It is known that some of the reservoirs surveyed by the U. S. Geological Survey, and some for which application has been made by promoters, are not feasible. All the reservoirs probably will not have a capacity of over 1,150,000 acre-feet. To get this amount, a little less than 50,000 acre-feet was added, which is believed will be a reasonable rough estimate.

It seems impossible to make even a rough estimate of the feasible reservoirs on the Rio Grande and its tributaries. So far applications have been made for storage to the amount of 191,630 acre-feet for irrigation, 2,050 acre-feet for power and 810 acre-feet for mining, making a total of 194,490 acre-feet.

RESERVOIRS SURVEYED BY THE U. S. GEOLOGICAL SURVEY AND REPORTED UPON IN THE 12TH ANNUAL REPORT, PART II, AND IN THE 21ST ANNUAL REPORT, PART IV.

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RIO ALAMOSA

Ojo Caliente Reservoir

This is located mostly in the southeast corndr of T. 8 S., R. 8 W., but some of it extends into the three adjoining townships.

This reservoir has been examined, mapped and reported upon by the U. S. Geological Survey. Data on the reservoir and a description of the lands found therein are recorded in the 12th Annual Report of the U. S. Geological Survey, page 202. A topographic map of it is found in the files of the U. S. Reclamation Service in El Paso, Texas, being F 1.

This reservoir was not examined during the summer of 1910, so all data was obtained by testimony or reports.

The reservoir is considered a good one. The dam site is good but no data could be obtained concerning bedrock. The drainage area is large and partly forested. The maximum altitude within the drainage area is about 10,000 feet.

The serious hindrance to the feasibility of this reservoir is that a concrete canal would have to be constructed for 20 miles, more or less, in order that the water might be delivered upon the irrigable lands below Monticello. The river bed is very porous. There is at the dam site a perennial flow of 10 cubic feet per second and this all sinks before the irrigable land is reached. It is also possible that after the construction of the Elephant Butte dam there may not be a sufficient body of irrigable land to justi-

fy such a dam as would have to be constructed to make the project feasible. There is no reliable hydrographic data on this river.

ARROYO SALADO

Cienega Ranch Reservoir

This is located in T. 3 N., R. 5 W.

This reservoir has been examined, mapped and reported upon by the U. S. Geological Survey. Data on the reservoir and a description of the lands found therein are recorded in the 12th Annual Report of U. S. Geological Survey, page 200. A topographic map of it is found in the files of the U. S. Reclamation Service at El Paso, Texas, being F 2.

This was not examined during the summer of 1910.

The reservoir, with a capacity of 63,000 acre-feet, might be filled annually, and might not. To fill it would require a run-off of .15 of a foot, and as there is no hydrographic data to supplement this estimate, there may be reasonable doubt about the supply. The drainage area is largely deforested and at a low altitude.

There is considerable irrigable land east of Sierra Ladrones and the stored waters could also be used on the Rio Grande by diverting it from the Rio Grande at Alamillo Canyon.

The waters are more or less saline.

The discharge was estimated at the mouth on September 22 as being 50 or 75 cubic feet per second, and on September 26 there was no discharge; the former discharge was caused by local showers.

RIO GRANDE

San Felipe

Located above the Pueblo of San Felipe.

This is fully described in the 12th Annual Report of the U. S. Geological Survey, page 191, and in the 21st Annual Report, Part IV, page 275. A topographic map of the same is found in the files of the U. S. Reclamation Service at El Paso, Texas, being F 3.

This was examined in a casual way in 1910 and was not deemed worthy of an extended examination, as the construction of the Elephant Butte dam had been decided upon. Also this reservoir would flood lands that could nearly all be irrigated if proper irrigation systems were constructed. A great amount of legal work would have to be done to get the Indians to relinquish their lands. The examination of the dam site by diamond drill would determine the feasibility of the site, and without such no plans could be made.

Taking everything into consideration, this may at the present time be considered an impracticable site for a dam or for a reservoir.

San Ildefonso

This reservoir is located above White Rock Canyon, mostly on the lands of the San Ildefonso and Santa Clara Indians.

This is described to a considerable extent in the 12th Annual Report of the U. S. Geological Survey, page 175, and a topographic map of it is on file in the office of the U. S. Reclamation Service in El Paso, Texas.

This was examined cursorily in 1910 and was not deemed feasible at the present time, as it would interfere with the Ele-

phant Butte reservoir. Also, the lands to be flooded could nearly all be irrigated if a proper distribution system were constructed.

No reliable data are at hand about the foundation of the proposed dam, and extensive tests would have to be made to determine its character. The construction of this would require a great amount of capital and much litigation, and is probably not feasible at the present time.

Arroyo Colorado

This is located mostly in Sec. 36, T. 6 N., R. 8 W., and in Sec. 31, T. 6 N., R. 7 W., and is a small reservoir. This is described as Reservoir No. 35 in U. S. Geological Survey 12th Annual Report, at page 199, and map is filed in the U. S. Reclamation Office at El Paso, Texas.

No special trip was made in 1910 to visit this. The stream is intermittent, flowing but a very short time in the spring and at other times when there are heavy showers. If the country will produce a run-off of .15 of a foot, the reservoir can be filled.

The proper name for this is "arroyo" instead of "rio".

From all data available, it appears that the water would have to be used at a considerable distance from the reservoir. This should be considered as an impracticable proposition until further investigation demonstrates its feasibility.

The arroyo was seen on September 5th near where it empties into the Rio San Jose and was dry, and had evidently been dry for a long time.

RIO SAN JOSE

El Rito Reservoir

This is situated on the grant to the Pueblo of Laguna. It is described in the 12th Annual Report of the U. S. Geological Survey, page 192. A topographic map is filed in the office of the U. S. Reclamation Service at El Paso, Texas, being F 5.

The site was examined in 1910. The dam site is in a lava canyon and bedrock is probably deep. The principal objection is that the Santa Fe Railroad runs through the lowest parts of the valley and a new location would have to be made, but this is not a prohibitive condition. There is a large body of good land adjoining the reservoir. The water supply would be sufficient if other reservoirs were not used. The deposit of silt would be great, as the water is very muddy. The indications are not very favorable for bedrock at a shallow depth, and it might be that there are alternate layers of clay and lava.

BLUEWATER CREEK

Bluewater Reservoir

This is situated about 9 miles above the town of Bluewater.

The reservoir is described in the 12th Annual Report of the Geological Survey, Part II, page 195. A topographic map is filed in the office of the U. S. Reclamation Service at El Paso, Texas, being F 6.

A company constructed a dam for this reservoir in 1894. This was used intermittently until September 1909, when the dam failed because of unprecedented floods and faulty construction. Considerable damage was done to the area irrigated. The Bluewater Development Company is making no pretentions to rebuild the dam,

but are rather buying back the land which they had previously sold with a water right. The service of the reservoir was not entirely satisfactory before the failure, as it did not supply the farms with sufficient water. A request for information was made, but it was not received.

This is a good reservoir proposition, but the supply for one of a large capacity is variable owing to the small drainage area and the variable precipitation.

This will probably be rebuilt sometime in the future.

Unnamed Reservoir

This is located in Sections 8, 9, 16 and 17, T. 15 N., R. 11 W., and was not examined during the summer of 1910.

This is described in the 12th Annual Report of the U.S. Geological Survey, page 194. A topographic map is filed in the office of the U. S. Reclamation Service at El Paso, Texas, being F 7.

This is on an intermittent stream and there are no hydrographic data. It can probably be filled every year, as a run-off of .05 foot would do so.

The land to be irrigated is near Bluewater. According to information received at Bluewater in 1910, it is probable that this site is owned by the Bluewater Development Company. The information furnished was somewhat indefinite.

AGUA FRIA

Reservoirs "A", "B" and "C".

These are three small reservoirs in T. 10 N., R. 12 W. They are described in the 12th Annual Report of the U.S.

Geological Survey, page 198. A topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 8, F 9 and F 10.

These were not examined in 1910, but are probaly of little value. The waters of this creek never directly reach the San Jose, but are lost in the great lava flow which covers the country below the reservoirs. Any use of waters from these reservoirs would probably not affect the Engle Reservoir. The altitude and isolation make these nearly impracticable.

RIO JEMEZ

Santa Ana Reservoir

This is located on the river near the Rio Grande.

This is described in the 12th Annual Report of the U.S. Geological Survey, page 181. A topographic map is on file in the office of the U. S. Reclamation Service in El Paso, Texas, being F 12.

This was not examined in detail, but was considered doubtful. No information is at hand concerning bedrock. The dam would be quite large for the storage capacity. The water supply would probably be sufficient as it would only require a little over .10 foot run-off to fill the reservoir. The nature of the reservoir is unfavorable, as it is almost a sandy bed. The fall is 15 feet per mile and great quantities of sand would be carried down and find lodgment in the reservoir. Southwest of the reservoir are a great number of shifting sand hills and these would be blown into the reservoir, more or less.

The Pueblo of Santa Ana is at the upper end of the reser-

voir. These Indians formerly farmed the valley in the vicinity of their pueblo, but it is now a sandy waste, being in the spring entirely occupied by the river. However, this is probably the most feasible reservoir on the Rio Jemez.

Other Reservoirs

There are five other reservoir sites on the Rio Jemez which are described in the 18th Annual Report of the U. S. Geological Survey, from pages 177 to 180. There are topographic maps for these on file in the office of the U. S. Reclamation Service in El Paso, Texas, being F 13, F 14, F 15, F 16 and F 17.

None of these were visited in 1910. It is probable that even though some of them are good reservoir sites, with good dam sites, that they might not be feasible under present conditions. The water would have to be used near and below Jemez Pueblo. There is but little irrigable land except that which is owned by Indians and Mexicans, and these could not afford to pay for a more adequate supply.

The most feasible plan to use any of these reservoirs would be to construct several in the high mountains and let the water flow down the river bed to near Zia and then divert it and open up some new land on the mesa south of the Pueblo of Santa Ana. To construct and maintain a ditch to these lands would be difficult, as there is a great amount of wind blown sand to encounter. Taking everything into consideration, it is doubtful if these reservoirs are feasible, and extensive surveys would be needed for absolute proof.

RIO SALADO DE JEMEZ

Ojo Espiritu Santo Reservoir

This is located on the Ojo del Espiritu Santo Grant. A description is found in the 18th Annual Report of the U. S. Geological Survey, page 180. A topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 18.

This reservoir was not examined in 1910.

In the report of the U. S. Geological Survey it is stated that the materials of construction are one mile away. This would be a serious hindrance to economical construction.

The water of course would have to be used about the Pueblo of Zia, as that is the most feasible location. This pueblo sadly needs water. Another objection is, that as the water is salty to a certain degree, continuous use of it might be detrimental. This statement, however, may not be correct, as salt water is used in Salt River Valley, Arizona, with good results.

The report of the U.S. Geological Survey recommends that the water be used on the mesa south of the Rio Jemez. It is doubtful if this is feasible, as a long canal would have to be constructed through sand hills, more or less drifting, and the amount of water which would reach the irrigable lands would be very small. This when combined with the other reservoirs on the Rio Jemez, might make it possible to irrigate the lands on the mesa south of the Rio Jemez. This cannot be counted as a feasible reservoir under the present conditions.

Santa Fe Creek Reservoir

This reservoir was surveyed by the U. S. Geological Survey and a topographic map is on file in the office of the U.S. Reclamation Service in El Paso, Texas. A description can be found in the 12th Annual Report of the U. S. Geological Survey, Part II, page 182.

The reservoir site is described as being 8 miles above Santa Fe. This dam site was therefore seen casually on August 15, 1910. The capacity of the reservoir is shown as 800 acre-feet, and if it were built the water would have to be conducted below Santa Fe in order to be used. This might in times of drouth conflict with the present reservoir built in Santa Fe Canyon. This reservoir furnishes water for the town of Santa Fe. No water right applications for this site have been made in the office of the Territorial Engineer, as three other water rights have been allowed by the Territorial Engineer (See applications 192, 204 and 333). These would very likely take all the water.

RIO CHAMA

A description of three lakes which are in the Rio Chama drainage is given. None of them are directly on the Rio Chama.

Stinking Lake

This is located in the Jicarilla Apache Indian reservation and near the south end.

A description is found in the 12th Annual Report of the U. S. Geological Survey, Part II, page 168. A topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 20.

This was examined in 1910 and not deemed practical.

There is no annual overflow from this lake. There has been no overflow for several years, but within the last 20 years, according to testimony, there has been an overflow.

The geological formation is peculiar. There is unmistakable evidence that this lake at one time had a very great outflow, as a deep canyon is worn in the channel to the Rio Chama. This outflow has been lessened very much, probably due to piracy on the part of streams in the San Juan River drainage, or adjacent tributaries of the Rio Chama. For some such reason there is no longer any water flowing out of the lake and the canyon to the Rio Chama is filling up by the deposit of sediment brought down by the arroyos from the sides.

There are in this canyon three small lakes, ranging from 5 to 15 acres, and these are formed by the alluvial fans from the arroyos and the seepage from Stinking Lake. Even these small lakes do not have any outlet. One of them is about 40 feet lower than the lower alluvial fan.

There is a good dam site for this reservoir, but as the water supply is insufficient, it is not feasible. On the day of examination, June 29, 1910, it would take a ditch nearly one-half mile long and with a maximum cut of 20 feet to drain all water above that height. This would then have to be conducted about 6 or 8 miles to irrigable lands in the vicinity of El Vado. An attempt had been made some years ago to conduct the water from this lake to a ranch in the canyon. A ditch was cut through the alluvial ridge, but the water in the lake has continued to recede since that time.

Boulder Lake

This is located in the Jicarilla Apache Indian Reservation and lies to the north of Stinking Lake.

This is described in the 12th Annual Report of the U.S. Geological Survey, page 166. A topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 21.

This was examined June 29, 1910, and is probably not a feasible site. There was no outflow on the date of examination. The variation in the height, according to the evidences of drift-wood, is about 20 feet. The outlet was not examined, owing to its inaccessibility. A railroad is located in the outlet canyon. The water supply is undoubtedly extremely variable and the waters would have to be used in the vicinity of El Vado along the Chama.

Horse Lake

This is partly in the Jicarilla Indian Reservation, in T. 30 N., R. 1 E.

A description of this is found in the 12th Annual Report

of the U. S. Geological Survey, page 165; a topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 22.

This was examined in 1910, and probably is a feasible reservoir site of small capacity.

There was no outflow on the day of examination, June 29, 1910. Judging from the channel leading away from the lake, the outflow is never great. The lake could be lowered easily for a depth of three or four feet. A dam could be easily constructed. But, if the lake is lowered, it might be that it would not be filled again for sometime. An earthen ridge is the lower boundry. It was not determined whether bedrock is close or not. There was a sort of regulating gate at the lower end of the lake, but the lake was below it. Below the lake is a narrow valley upon which considerable native hay is grown. More of this could be irrigated if water could be used from the lake. This native hay seemed to be irrigated in a haphazard way.

OJO CALIENTE RESERVOIR

This reservoir was surveyed by the U. S. Geological Survey and the data can be found on page 171, Part II, 12th Annual Report of the U. S. Geological Survey. It is described as No. 7. A topographic map is on file in the office of the U. S. Reclamation Service at El Paso, Texas, being F 25.

The data shows that with a dam 80 feet high the capacity would be 1,058.80 acre-feet.

The dam site was examined and the cost of a dam was deemed excessive, but further investigation might show such cost not to be excessive. The stored waters could easily be used below Ojo

Caliente Hot Springs.

Ojo Caliente Creek is a perennial stream here, but as it sinks during the irrigation season 3 or 4 miles below this dam site, the stored waters could be used along Ojo Caliente Creek.

VALLECITOS

Canones Reservoir

This reservoir is located near the small plaza of Ancones.

This is described in the 12th Annual Report of the U. S. Geological Survey, page 169. A topographic map is filed in the office of the U. S. Reclamation Service in El Paso, Texas, being F 23.

This is probably a feasible reservoir, provided the water would be used a short distance below Ojo Caliente. The water would be allowed to run down the stream bed to the point of diversion.

The dam site is of quartzite and very good.

The land within the reservoir site would have to be purchased, as it is occupied. The report of the U. S. Geological Survey records this as being an unoccupied site.

No. 6, U. S. Geological Survey.

This reservoir is but a short distance below the one just mentioned. No proper name for it can be learned.

A description of it is found in the 12th Annual Report of the U. S. Geological Survey, page 170. A topographic map is filed in the office of the Reclamation Service in El Paso, Texas, being F 24.

The dam site is in a quartzite formation and is good. The reservoir site is good and could probably be filled each year.

There were two deserted cabins in the reservoir on the day of examination, June 17th.

The lands that could be irrigated are situated below Ojo Caliente.

On June 16 the flow of the river at this site was estimated at 5 cubic feet per second.

El Rito de La Chama

There is a reservoir site on Arroyo Seco on a tributary of this creek. This was examined June 19, 1910. It is described in the 12th Annual Report of the U. S. Geological Survey, Part II, page 169. A topographic map was made by the U. S. Geological Survey and this is on file in the office of the U. S. Reclamation Service at El Paso, Texas, being F 26.

The lands under this reservoir were withdrawn after the survey by the U. S. Geological Survey. It is not known if these were ever restored for entry.

This is now claimed by a company which owns the Lobato Grant and which they expect to use as a part of their project. There is an application in the office of the Territorial Engineer; it is No. 18 and was approved on December 15, 1906. This is further described under the heading of Applications in the office of the Territorial Engineer.

This site has been used twice before, once by a Mormon colony which built a masonry dam, which washed out; the construction was faulty. The other was a rock-fill crib which proved a failure. About 1905 a service tunnel was started for the reservoir; about 150 feet were excavated at both the upper and lower ends of this tunnel; work was stopped and 100 feet remain to be excavated.

There is a fall of nearly 100 feet near the dam site. The lower end of the tunnel is therefore nearly 100 feet above the valley.

The geological formation is very good, being a hard quartzite. The dam site is excellent, being very narrow.

With a capacity of 3,000 acre-feet, the supply for the reservoir may be considered doubtful, as it would take a run-off of .50 foot to fill the reservoir. On June 19 there was a flow of about .25 cubic foot per second at the dam site, and this all sank in a short distance. It is intended to convey the stored waters down the bed of Arroyo Seco and use them near El Rito.

The construction of this reservoir would lessen the supply to the Rio Grande Reservoir nearly to the amount of water stored.

RIO HONDO

The U. S. Geological Survey located a reservoir on this river and it is about one mile above the Post Office of Arroyo Hondo. This is described in the 12th Annual Report of the U. S. Geological Survey, page 173. A topographic map of the reservoir and dam site is on file in the office of the U. S. Reclamation Service in El Paso, Texas, being F 27.

This would be located in a lava canyon, and the dam site is very large for the storage capacity. The water should be used on the lands immediately below the dam. The people now owning these lands very likely could not pay for any improvements. The reservoir is small and the lands that might be irrigated are steep and gravelly. A considerable amount of water would be returned. to the Rio Hondo.

RED RIVER

This reservoir is probably located at Red River Post Office. The location cannot be determined definitely from the data at hand.

This is described in the 12th Annual Report of the U. S. Geological Survey, page 173. A topographic map of the reservoir and dam site is on file in the office of the U. S. Reclamation Service in El Paso, Texas, being F 28.

This reservoir was noticed in the examination of the Red River. The data for bedrock is meagre. Red River does not show signs of bedrock. If bedrock could be found at a reasonable depth the construction of the dam would be practical, making a feasible reservoir. Its waters should be used in connection with the project under construction in the vicinity of Cerro, as there is not sufficient water during the summer flow to be relied upon. The precipitation in the drainage area is quite large, amounting to 30 inches in some places. The watershed is well forested.

The lands within the reservoir site are generally in private ownership.

RIO SANTA CRUZ

This is situated near the village of Escondido and on the Cundijo Grant.

This is described in the 12th Annual Report of the U.S. Geological Survey, page 183. A topographic map of the dam site and the reservoir is found on file in the office of the U. S. Reclamation Service in El Paso, Texas, being F 29.

This is a feasible reservoir site if those who would be

benefitted by it could overcome legal complications and finance the enterprise. To build this would destroy the farming area for the town plaza of Escondido. That amount of water used to supplement the summer flow of the Santa Cruz would be of great benefit.

This reservoir was examined on June 6, 1910, and the discharge at that time was about 45 cubic feet per second. This would be much less in summer as the snow had not gone off the mountains.

The drainage area of this reservoir is mostly timbered. The dam site is good, being in a solid porphyritic rock.

RIO PUEBLO DE PICURIS

There is a reservoir site located about a mile above the Pueblo of Picuris. A description is found in the 12th Annual U.S. Geological Survey, page 174. A topographic map is filed in the office of the U.S. Reclamation Service in El Paso, Texas, being F 30.

This site was examined June 9, 1910, and was not considered feasible, as the waters would be used along the Rio Grande in the Espanola Valley. The lands below on the Rio Pueblo and on Embudo have enough water and this could only supplement the water of the Rio Grande.

Pueblo Reservoir

This is located at the upper end of the Embudo Canyon and has a good dam site, and the reservoir site is fairly good, but would flood nearly all the best lands of the Pueblo of Picuris and would thus deprive these Indians of their homes.

This is described in the 12th Annual Report of the U.S.

Geographical Survey, page 175. A topographic map of the dam site and of the reservoir site is on file in the offices of the U.S. Reclamation Service at El Paso, Texas, being F 51.

Any water from this reservoir would be used in the Espanola valley and for that reason might not be feasible.

This is probably not a feasible reservoir site under present conditions.

RESERVOIRS SURVEYED BY THE U. S. GEOLOGICAL SURVEY CONCERNING WHICH NO PUBLISHED REPORT HAS BEEN MADE.

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RIO JEMEZ

There are two reservoirs at the head of this river, one located in Valle San Antonio and the other in the Valle Grande. These were not examined in 1910 and are probably not so feasible as the ones mentioned as surveyed by the U. S. Geological Survey and reported upon in the 12th Annual Report. All waters would have to be used below the Jemez Pueblo.

Natural Dam Reservoir

This is located about a mile or a mile and a half above Jemez Hot Springs. This natural dam is of a calcareous formation. Water comes out on the top of it and the lime is oxidized, and the building up process continued. The dam for this reservoir would have to be quite long. Photographs show the conditions better than can be explained.

Rio de la Vaca

Twp reservoirs were mapped on this river, but neither of them were examined in 1910. It is very probable, judging from the maps, that the dam sites are so poor that the propositions are not feasible.

Rio Cebolla del Rio de la Vaca

This is located high in the mountains and was examined cursorily in 1910. The dam site for this is not good, being too great for the capacity of the reservoir. It is also a long distance to the irrigable lands. This is judged impracticable under the present conditions.

R E S U M E

of the

APPLICATIONS FOR WATER RIGHTS

IN THE OFFICE OF THE TERRITORIAL ENGINEER

at

SANTA FE, NEW MEXICO.

Applications have been filed in the office of the Territorial Engineer at Santa Fe, New Mexico, for a total of 5172.29 second-feet of water. These applications cover nearly all of the tributaries of the Rio Grande, and some apply to the Rio Grande. A few are made to cover old water rights, but most are for new rights.

The maximum capacity of all ditches constructed in 1910 was estimated to be 4024.84 second-feet. It can be seen therefore that an enormous amount of water has been applied for, and if all applications were approved and the propositions constructed, the present supply for the Rio Grande would be entirely lost, as the flow of 3172.29 second-feet for one year would amount to 2,261,160 acre-feet, or about twice the mean annual flow of the Rio Grande. However, it is known that the flow of 3172.29 second-feet as applied for, could not be secured for all the year. It is not believed that any reasonable estimate can be made of the amount that might be used.

Taking into consideration the fact that applications have been made in the office of the Territorial Engineer for water rights for reservoirs which would store more than 194,490 acre-feet, and for water rights for diversions which would divert from several streams more than 3172.29 cubic feet per second, which would equal 2,261,160 acre-feet per annum, it can be conclusively seen that if the various applications were approved, and the propositions carried out, that the present water supply for the Rio Grande reservoir, which is now about 1,122,775 acre-feet per annum, would be entirely lost.

Additional Information

to that

found in the table of water rights, for

which applications have been made in the

office of the Territorial Engineer,

the unit being acre-feet.

Application No. 18

This application was made by G. Hill Howard, and was approved December 15, 1906.

This is what is known as the Arroyo Seco site, near the town of El Rito. This was examined June 19, 1910.

This site was surveyed by the U. S. Geological Survey and a topographic map is on file in the office of the U. S. Reclamation Service at El Paso, Texas, being F 26. A description is found in Part II, page 169 of the 12th Annual Report of the U.S. Geological Survey.

This site has twice before been used as a reservoir site, once by a Mormon colony and another time by a company. The dams failed in both cases, due to faulty construction. A company also started in to drive a service tunnel in the west side of the dam site. This was excavated for about 150 feet at each end and the work was stopped, and 100 feet yet remain to be excavated; this was probably done by G. Hill Howard.

The lands upon which this reservoir is situated were withdrawn from public entry, according to the 12th Annual Report of the U. S. Geological Survey, and it is not known if these were ever restored.

The area of this reservoir is 330 acres, and the report of the U.S. Geological Survey gives a capacity of 3,000 acre-feet. No amount is given in the application as published by the Territorial Engineer.

No work was being done on the dam on the day of examination. Any storage would lessen the supply to the Rio Grande.

Application No. 75

This application was approved March 16, 1908, and this was visited in July 1910 and was partly constructed. It was for a small system of reservoirs which were to irrigate 680 acres.

These reservoirs, or this project, could never appreciably affect the water supply of the Rio Grande.

Application No. ~~34~~ 304

This application was made by Chas. A. Spiess, for 1280 acre-feet from the Rio Grande del Ranchos, and 6.9 second-feet were applied for to irrigate 1280 acres. This is pending before the Territorial Engineer.

This is locally known about Taos as the Corral Viejo reservoir. Its construction would be detrimental to either the supply of the Rio Grande or to the present settlers on the Rio Grande del Ranchos.

It is claimed that the construction of this would help to equalize the flow to the Rio Grande. This cannot be demonstrated.

Application No. 294

No information was obtained concerning this application while in the field in 1910. From its location, however, it is known that this never contributes any to the water supply of the Rio Grande, and any appropriation would not affect the Rio Grande reservoir.

This application was rejected by the Territorial Engineer on February 26, 1910.

Applications 430-455

These applications were made by the Las Bocas Irrigation Company. Application 430 was evidently intended for diversion only, while 435 was intended for storage.

The locations of the sites selected are in what is known as Abo Canyon. This is an intermittent tributary of the Rio Grande, and from the time it emerges from the mountains until it enters the Rio Grande, it is a typical arroyo. It is believed that no such amounts of water could be obtained as are called for in these applications. Application 430 calls for 200 second-feet, and Application 435 for 20,000 acre-feet.

Chas. F. Summis in writing of the Abo Ruins, says that there is an insufficient water supply for the present inhabitants of Abo Canyon.

These applications are pending in the office of the Territorial Engineer.

This project, if constructed, would affect the water supply of the Rio Grande to a slight extent.

Application 78

This application of the Rio Puerco Irrigation Company calls for 12 second-feet and 24,000 acre-feet. This was approved by the Territorial Engineer on July 21, 1908, and the records show an extension of time was granted.

The location of this project is below any present irrigation on the Rio Puerco, and the construction of the same would lessen the water supply nearly to the amount of water stored as very little water would be recovered from seepage.

A part of this project was seen in September 1910, and no work had been done on it.

Application 266

This application has not been approved. It calls for 32,000 acre-feet to irrigate 25,200 acres.

This is located near the mouth of the Rio San Jose, and if constructed would affect the water supply of the Rio Grande to a considerable extent. Most of the water which would be stored would reach the Rio Grande and the Rio Grande Reservoir if it were allowed to flow.

Application 390

The application of Chas. M. Grover for 80 acre-feet of flood waters to irrigate 160 acres, is pending.

This would in no way affect the supply of the Rio Grande.

This was not visited during the season of 1910.

Application 316

The application of Louis D. Lamb for the storage of 550 acre-feet in Ashcroft Canon was rejected January 28, 1910. From testimony received at San Rafael in September 1910, this was rejected because of the objections of the Bluewater Development Co., which claimed that this would lessen the supply for their project. This would be used if the Bluewater Development Company had their project in operation, but as it is now this contributes to the supply of the Rio Grande.

Application 35 and 53

The Bluewater Development Co. has water rights under an old charter. This company constructed a reservoir above Bluewater town, at reservoir site No. 35 as surveyed by the U. S. Geological Survey. The dam for this failed during September 1909. Nothing has been done to rebuild it. The reservoir is described further under reservoir No. 38 of the U. S. Geological Survey list of Reservoirs.

Two applications are recorded, but no detailed information is available.

Application 204

On September 26, 1908, there was an application made for 70,000 acre-feet of water to irrigate 18,000 acres. The survey was tied to the southwest corner of the Cieneguilla Grant. It is therefore presumed that this is a reservoir site examined at Cieneguilla in August 1910 and upon which no work was done. This application was approved May 15, 1909, and an extension of time for construction was granted. The applicants were Pritchard and Reynolds.

The water would be used in the vicinity of La Bajada.

Application 444

This application was made by McGibbon and Bishop for 1000 acre-feet from Santa Cruz Creek, to irrigate 3000 acres. This application is evidently pending. No work was noticed in June or August 1910 which would apply to this project.

Applications 57 and 391

Two applications were made by the Tusus Peak Gold & Copper Co. for water for power purposes. The tables show the

available data. These would not affect the water supply of the Rio Grande to any appreciable extent.

Application 233

The application of Osborn and Rinker for 1000 acre-feet from the Aguage de la Petaca to irrigate 5120 acres was approved April 22, 1909. This is on an intermittent tributary of the Rio Grande, and the approval for 1000 acre-feet is according to the rulings of the Secretary of the Interior. It is believed that ordinarily the major portion of the 1000 acre-feet would not reach the Rio Grande.

Applications 292, 293

The applications of W. J. Preston for two appropriations of water on the Arroyo Hondo were approved January 20, 1910, and considerable construction work was done this year (1910), according to the report of the Territorial Engineer.

These will decrease the water supply of the Rio Grande but little. The major portion of the water to be stored in these reservoirs would not reach the Rio Grande.

Application 21

The application of Hugh F. Duval for the surplus water of the Rio Grande de Taos, was approved November 30, 1906. This evidently was intended for a storage proposition. There was no construction up to the end of 1910.

This would be detrimental to local settlers or to the water supply of the Rio Grande.

Applications 44, 45, 46.

The applications of the Taos Valley Land Company for 1000 acre-feet from the Rio Hondo, the Rio Lucero and the Arroyo Seco were rejected by the Territorial Engineer.

These applications if approved, would work to the detriment of the present settlers on these streams, and to a slight extent to the supply of the Rio Grande.

This company has secured some water rights on the Rios Lucero, Hondo and Arroyo Seco. They have sold some land. There have been some suits brought against the company because of their failing to fulfill contracts. These are further explained under the general descriptions.

Applications 24-25-26-27-28-29-30-31.

The applications of Chas. H. Cosgrove for reservoir sites in the mountains at the head of the Red River, were for mining purposes. It is intended to take this water across the divide to the Canadian River drainage, and use it in hydraulic mining.

Incidentally, this would also supply the deficient supply for the Eagle Nest Reservoir on the Cimarron River.

These are described in more detail under Red River.

Some work has been done on one or two of the sites, but no permanent construction has been attempted.

Application 20

The application of Hugh F. Duval for all waters in Red River to irrigate 15,000 acres, was approved November 30, 1906. The point of diversion was to be 4 miles east of Questa.

This stream was examined in August 1910 and no work had

been done. This will probably not be carried any farther as the Red River Land & Water Company is constructing a project which will take all of the water from the Red River.

Application 23

The application of the New Mexico Irrigated Land Co., of El Rito, New Mexico, for the surplus of El Rito, was approved December 15, 1906.

The field examination in June 1910 failed to show any work being under construction by the company, and two letters sent to El Rito brought no results. One was returned and the other elicited no answer.

Application 106

The application of Chas. W. Wheelon for 40,000 acre-feet to irrigate 1000 acres of land, was rejected. The reservoir was to be 3 miles below Ojo Caliente post office.

This is an extraordinary amount of water for such a small amount of land. No construction had been started up to June 1910.

Application 451

Nothing is known about this application, except what is found in the tables, as the stream was not visited during 1910.

Applications 2-3

The Socorro Company made two applications for water rights from the Rio Grande. One was for 97 cubic feet per second and the other was for 286 cubic feet per second. Some work was done on one of these canals, i.e., the one on the west side of the river, and it was examined in September 1910 and the capacity was estimated at 110.00 cubic feet per second. No construction work was being done. The diversion works were not repaired in the spring of 1910

so no water was used. The company is in financial and legal difficulties.

Application 465

The application of W. P. Sanders, of Magdalena, New Mexico, was for .10 cubic feet per second out of La Jencia. This was not visited, but it is known that this cannot affect the water supply of the Rio Grande.

Application 335.

The application of H. A. Jastro for 112 second-feet from the Rio Puerco is shown as pending before the office of the Territorial Engineer, according to the Second Biennial Report.

The site for contemplated diversion was visited in 1910 and the flow of the Rio Puerco was but 3 second-feet; the Rio Puerco being extremely intermittent in character during the irrigation season, it is believed that storage should be provided for successful irrigation. Any diversion for this project would lessen the amount of water for the Rio Grande Project.

On April 4, 1911, the Territorial Board of Water Commissioners of New Mexico decided that application should be granted, as it was believed that seepage and return waters would amount to a large percentage of the amount diverted. It was also held by the Commission that the Rio Grande reservoir would be benefitted by having the silt retained on the Rio Puerco.

Application 155

This application was made by Liera and Akers for 7.15 cubic feet per second from the Rio Puerco, and was approved Sept. 4, 1908.

The location was examined in a general way in August

1910 and no construction was noticed. I heard about the application, but upon inquiry of one of the parties interested, could get no information.

As it has been found impossible to maintain any wiers near where this ditch is supposed to head, it may be that a wier cannot be maintained at the contemplated location.

Application 196

The application is for 50 second-feet on the Rio San Mateo, and it is proposed to irrigate 6000 acres. This was approved April 5, 1908, but no construction was noticed when examined in 1910. A flow of 50 second-feet can be obtained for but a short time during the irrigating season.

Application 498

This application was made by Simon Bibo for power purposes. The application is still pending. This is located on San Mateo Creek at the Puertocito site.

Application 358

Nothing additional is known concerning this application from what is shown in the tables. The stream is known to be an unimportant intermittent tributary of the Rio Grande.

Application 416

This is an application concerning which very little information was obtained, except that found in the tables. The stream is known to be an intermittent tributary of the Rio Grande.

Application 342

This is an application for which no data has been obtained except that found in the office of the Territorial Engineer.

Application 269

Nothing is known concerning this application except what is found in the tables.

Application 221

This application of Spader and Sullivan for 7 second-feet to irrigate 480 acres in Las Huertas was approved February 24, 1909.

A trip was not made to examine the conditions on this stream. The settlements at Placitas on this stream are very small, according to the Forest Ranger interviewed.

Application 108

This application was made by W. A. Williams, of Kennedy, New Mexico, for 1.8 second-feet, to irrigate 320 acres, and was approved May 20, 1908.

This was not examined. No irrigation was noticed from the mouth of the Gallisteo to Kennedy, and the information furnished there was, that there was little above Kennedy.

Application 333

This application of J. A. Hughes for 220 second-feet from Santa Fe Creek to irrigate 18,000 acres, was approved January 29, 1910.

There was no work done on this up to August 1, 1910. This project is one of some extent and would irrigate fertile lands in the vicinity of La Bajada, but the water supply would be considered doubtful.

Application 192

The application of Hugh T. Duval for 20 to 200 second-feet out of Arroyo Hondo, was approved November 30, 1906. The cost is given as $70,00. This had not been constructed in 1910

and no work had been done on the Arroyo Hondo in the past 10 years which would amount to over $5,000. This should therefore have elapsed ere this time.

Application 325

The application for the La Joya Land Irrigation and Development Co. for 250 second-feet out of Embudo Creek, if approved would be detrimental to the Rio Grande Project. However, it is known that 250 second-feet cannot be diverted except during a short time during the irrigation season.

This stream was visited in June 1910, when about 100 second-feet were flowing, and again in August, when 4 second-feet were flowing. It is the intention to use this water in the Espanola Valley along the Rio Grande, where there is much good land available.

Application 356

The application of the Ranchos Orchard & Land Co. for 40 second-feet to irrigate 8,000 acres is pending in the office of the Territorial Engineer. The company has, however, constructed a ditch from Taos Creek and was irrigating about 15000 acres in a very unsatisfactory way. The ditch is so constructed that it catches some seepage. In August it was obtaining about 2 cubic feet per second in this way. When there is water in the lower end of Taos Creek, or in the lower end of the Rio Grande de los Ranchos, water can be diverted.

This will interfere with the Rio Grande Project to some extent.

Application 248

The application of the Talpa Valley Water Users & Irriga-
tion Association for 3.37 second-feet to irrigate 4075 acres, also

a storage proposition calling for a storage of 1000 acre-feet. Nothing had been done on this to provide storage to August 1910.

Application 279

This application of Montoyo and Gusdorf for 9 cubic feet per second is intended to be part of quite a large project. Several applications have been made in conjunction with this by other persons interested. Several reservoirs are contemplated and extensive surveys have been made. The promoters claim that money is available for this work if reservoir sites can be secured.

The water supply of the Rio Grande would be lessened if this project were completed.

Applications 125 and 126

These two applications, each for 2 1/2 second-feet, were made by the Taos Valley Land Co. The first was from the Rio Hondo and the second from Arroyo Seco. The character of the applicants can be seen in the statement that 10,000 acres are to be irrigated from Rio Hondo, and 5,000 acres from Arroyo Seco. It is impossible to irrigate such areas with such amounts of water as applied for.

These streams had no such irrigation systems on them when examined in 1910, so it is presumed that they were not constructed.

Application 254

The application of H. F. Robinson for 30 second-feet out of the Rio Lucero has evidently been made to protect the rights of the Indians of the Pueblo of Taos. They have rights to part of the waters of the Rio Lucero by the right of beneficial use. Several persons or companies have lately tried to secure rights which would prove detrimental to the interests of the Indians.

Application 95

The application of the Red River Land & Water Co. for 629 second-feet of water from the Red River is shown in the tables published by the office of the Territorial Engineer, to not have been approved. However, it is known that this company was doing some work preliminary to construction in August 1910, and it is published in the Second Biennial Report of the Territorial Engineer that the project will be completed by January 1, 1912. About 30,000 acres are to be irrigated. The water right is prior to that of the U. S. Reclamation Service. As the low water flow of Red River is about 100 cubic feet per second above Questa, it is therefore necessary for storage to be provided in order that a sufficient water supply might be secured for the project.

Application 119

The application of the Citizens Ditch Company for water to irrigate 800 acres was approved January 22. This was made to cover old rights. The ditch has been constructed since about 1852 or 1854. This was done so a legal right might be obtained, as the people are afraid their rights might be affected by the project of the Red River Lands & Water Company when it is constructed.

Application 76

This application was made to cover a reservoir which has been constructed for a number of years. This was made to have a legal water right before the completion of the project of the Red River Land & Water Company. The reservoir is located at Cabresto Lake.

CABRESTO CREEK

Cabresto Lake

This is situated on Cabresto Creek, an intermittent tributary of Red River. The altitude of the lake is about 8,850 feet.

This was examined on July 11, 1910, and is believed to be a feasible reservoir site. The area of the lake according to Mr. W. M. McKean of Taos, is about 30 acres. At present there is a rock-fill crib dam which is so constructed that it can raise the water about 10 feet. The gates were open and 12 cubic feet per second was flowing out. There was a storage of about 3 feet more in the lake.

The conditions at the dam site are such that a dam could be built to a height of about 70 feet. The bottom width would be about 20 feet and the side slopes about 2 to 1.

Bed rock shows up about 200 feet bwlow the present dam, but if the present dam site were used, it might be that the gravel point on the west side would not be favorable.

From the best maps available, it is estimated that the drainage area is about 5 square miles, and is heavily timbered, except where the bare rock is exposed, and it is estimated that the run-off ought to be about 3,000 acre-feet per annum.

It is believed that the water supply would not justify a dam of a height of 70 feet.

On April 18, 1908, there was approved by the Territorial Engineer, an application of the Cabresto Lake Irrigation Company of Questa, for 22 cubic feet per second or 214.6 acre-feet from Cabresto Creek and Cabresto Lake, to be diverted in Sec. 13, T. 29 N., R. 13 E., which were to irrigate 1,504 acres.

From testimony and from general conditions, it was believed that this was an application made to cover the conditions as they were seen and as had existed for some years. The acreage irrigated was not so great as the application mentioned.

It is believed that 214.6 acre-feet is the capacity of the reservoir with the present dam site, and any storage beyond 1,000 acre-feet would be detrimental to the water supply of the Rio Grande. With the present class of settlers it is probable no considerable extension will be executed.

Application 86

The application of Cerro la Associacion de Mutuo Beneficio Protecto for 43 second-feet to irrigate 3000 acres, was approved February 18, 1908. This application covers ditches which have been in operation most of the time since 1852. This was done in order to get a legal water right previous to the construction of the project of the Red River Land & Water Company.

Application 169

This application is evidently on a small intermittent tributary of the Rio San Antonio. It calls for but 2 second-feet. This was not located during the field season of 1910. It is not known if it is constructed or not, but it would not affect the Rio Grande at any rate.

RESERVOIR SITES MENTIONED BY MR. W. W. FOLLETT, Consulting Engineer for the U. S. (Water) Boundary Commission.

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These reservoirs were not seen and no description will be made of them; they are tabulated.

RESERVOIRS CONCERNING WHICH DETAILED INFORMATION HAS NOT BEEN OBTAINED

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Arroyo Unnamed

Reservoir west of and below the present wagon road from old La Ventana to Cabezon, the road being on the East side of the Rio Puerco.

Examined August 27. A small amount of water flowing in the bottom of the two earth canyons in the valley. The arroyo is not over 200 feet wide at dam site, and the valley nearly one-fourth mile wide. The valley is comparatively steep. It is probable that a dam 25 feet high would store 500 acre-feet. The supply might not be reliable.

The drainage area is 20 square miles, and from 6,400 to 9,000 feet elevation.

Could irrigate lands in valley floor of Rio Puerco.

RESERVOIRS ON RIO PUERCO

Rio Puerco Cañon

All the information received in regard to reservoirs on the Rio Puerco was from testimony.

Was informed by Mr. Eichwald of Cuba, and Mr. Duncan of Cebolla that approximately 6 miles above Cuba there was a dam site in a granite canyon. It is 30 feet wide on the bottom with 1:1 slopes. The height is about 100 feet. The valley above the dam site has quite a steep slope and not over 200 yards wide. Did not examine this, as undoubtedly no one could use it, unless used by the U. S. Reclamation Service.

Supposing that the fall of the valley was 50 feet to one mile, and that the sides of the reservoir sloped 5 to 1, the capacity would be approximately 13,000 acre-feet.

Altitude about 7000 feet above sea level.

Drainage area of 15 square miles.

Naciemento Creek Reservoir

All information was received from Mr. Eichwald and Mr. Duncan. The reservoir site is 4 miles east of Cuba. The dam site is in a granite canyon, the side walls being very precipitous, probably 1/2 to 1 slopes for 150 feet in height. The valley is about one mile long and a quarter of a mile wide.

If all of this is true, this would be a feasible reservoir with a capacity of 10,000 to 20,000 acre-feet. The lands below are all in private ownership. The inhabitants living in that vicinity are not able financially to build the dam. There is an unlimited amount of land upon which the stored water could be used.

The altitude of the drainage area is approximately 7000 to 9500 feet above sea level, and has an area of 15 square miles.

Rito La Jara

Was informed that there was a good reservoir site upon it. Information not extensive and not reliable. Altitude about 6800 feet. Rainfall about 14 - 24 inches.

Brazos Meadows

This is a reservoir site noticed in the Brazos meadows at an altitude of about 9,250 feet above sea level, according to the elevation by aneroid barometer. The location is difficult to

describe, but it is at a large flat which is at the lowest place on the wagon road from Tierra Amarilla to Antonito within the so-called Brazos Meadows. Just a short distance below the dam site, the creek, for which no name could be learned but which drains into the Rio Brazos, drops with a much steeper grade. Near the dam site was located a cowboy's cabin. The dam site is formed by a lava ridge on the west side and an alluvial fan on the east side of the creek, which is caused by an intermittent creek. From observations made with a hand level, it was estimated that if there were a lake created which would be 12 feet deep at the lowest part of the valley at the dam site, that it would make a lake covering 160 acres. The point of greatest height of the dam would be 600 feet from the east abutment, the total length being 900 feet.

On the west side a spillway could be easily constructed in a lava ridge. The flow of the little creek on July 1st was about 3 cubic feet per second. The run-off of the drainage basin tributary to this is probably close to 1500 acre feet per annum.

The reservoir is probably not feasible, as the water would have to be used about Tierra Amarilla, and stored waters would probably cost more than the ultimate value of the land would justify.

The evaporation would be very small, as the altitude is great. The ice about some bog holes was not all melted on the day of examination.

The drainage area is rather heavily covered with grass, or else timbered.

RIO JEMEZ

Small Reservoir Site

This is located about a half mile below the mouth of the branch from Sulphur Springs and but a short distance above the head of a great canyon which has a high gradient. The fall of the valley above is probably 40 feet per mile.

The dam site is not very favorable. The width on the bottom was about 100 feet and the side slopes 3:1. It was believed that the maximum height would be about 50 feet. This probably is impracticable for storage for irrigation, as it is too far distant from any irrigable lands. It would have to be used below the Jemez Pueblo.

Cieneguilla

This is a reasonably well appearing reservoir site. It is mostly located on Santa Fe Creek and in the Cieneguilla Grant. The dam site seemed to be feasible. The intended dam site is of solid basalt and it seemed as if a dam 75 feet high could be constructed. The width of the canyon at the bottom is 40 feet and the slopes are 2:1.

This is further described under Application No. 204 in the office of the Territorial Engineer.

Rio Chama

There is said to be a good reservoir site on the Chama about 10 miles above Chama Station; this is in Colorado. The land within the reservoir is owned by the Banded Peak Land & Mining Company, of which J. H. Knaebel is president. The Denver Athletic Club owns 65,000 acres on the head of the Chama in Colorado.

No information was obtained about the dam site or con-

ditions generally. The waters from this could be used about Plaza Los Brazos and above it.

This is probably not feasible, as the crops are not valuable where the water would be used.

Rio Grande de los Ranchos

Tierra Azul

This is one of the reservoirs surveyed by Mr. Parker H. Black of Taos, who reports a feasible reservoir site with a capacity of 2120 acre-feet which could be filled twice annually.

Application was made for a water right for this reservoir, but it was not approved by the Territorial Engineer.

Arroyo Miranda

A reservoir was surveyed by Mr. Parker H. Black of Taos, who reports a feasible capacity of 905 acre-feet. The water supply is to be diverted from the Rio Grande de los Ranchos.

This arroyo is an intermittent tributary of the Rio Grande de los Ranchos.

Canada de los Alamos

A reservoir was surveyed on this intermittent water course by Mr. Parker H. Black of Taos, New Mexico. It is the intention to fill this with water diverted from the Rio Grande de los Ranchos. The feasible capacity was estimated at 389 acre-feet and the plans involved the filling of this five times annually. It is said that the waters from this arroyo seldom reach the Rio Grande.

RIO CHIQUITO

Prairie Reservoir

A reservoir site has been surveyed on the Rio Chiquito, a branch of the Rio Grande de los Ranchos. It is said to be feasible to a capacity of 500 acre-feet, which could be filled twice per annum, once being from the spring floods, and another time by the floods from the summer rains.

Costilla Creek Reservoir Sites

There are 8 lakes from 3 to 10 acres in area which are located in the high mountains near Latir Creek, that might be made into reservoirs. These reservoirs would hardly be feasible, as they are too far distant from the lands to be irrigated.

Reservoir

This was surveyed by Mr. Connor, an Engineer for the Costilla Estates Development Co., and the following data was received: The location is in Sections 4, 5 and 8, T. 30 N., R. 15 E., The dam is designed to be 130 feet high and have a length on top of 650. The capacity is 20,000 acre-feet.

Reservoir

This was surveyed by Mr Connor, of the Costilla Estates Development Co. It is lpcated in Sections 7, 17 and 18, T. 30 N. R. 15 E. The dam is to be 110 feet high and the capacity of the reservoir was estimated at 9,000 acre-feet. No data was secured as to the nature of the dam sites of this or the previous site.

The water supply is probably sufficient to fill these reservoirs each year.

RIO SAN ANTONIO

This is a reservoir that was examined casually on July 6, 1910. It is situated about 2 miles below the Forest Ranger's station. The dam site is not very good, The width would be 100 feet and the slope on the north side would be 3:1, and on the south side 4:1. The dam site is covered with lava boulders from the lava capping on top of the mesa. It could not be determined if the materials at the dam site are rock or earth. A rough estimate was made that a dam 50 feet high would make a reservoir 1.5 miles long which would impound 4,000 acre-feet of water. It is probable that the stream would not furnish that much water, as it would require a run-off of about .15 of a foot over the drainage area. The waters could be best used in the vicinity of Antonito, but could be used on the mesa about San Antonio Mountain in New Mexico if a diversion dam of some height were built in the canyon.

The canyon in which this is located was estimated as being 135 feet high, but a dam that high would be too large for the water supply.

HYDROGRAPHY OF A PART OF THE RIO GRANDE

The part under consideration extends from Elephant Butte, New Mexico, to Lobatos. It includes the gaging station at Lobatos (State Bridge) situated in Colorado a few miles above the northern New Mexico State line.

The hydrograpy of this part of the river will be discussed in connection with data which has been obtained from four gaging stations.

The upper one is the gaging station at Lobatos. This is near the Colorado-New Mexico line and it is practically at the upper end of the great canyon which extends to Rinconada. The canyon generally maintains a definite width without variation. Here at the gaging station it widens to a small extent; probably not exceeding a half mile at any place. Below the mouth of Embudo Creek it contracts again into a narrow canyon and continues so for a distance of three or four miles. The river then for the next 25 miles passes through the Espanola Valley.

This station has been maintained continuously since 1899 by the U. S. Geological Survey. The drainage area above it is 7,695 square miles.

The next gaging station below Lobatos, was the one at Embudo. This was established in 1889 and maintained until 1903. It was located in the Embudo Canyon, below Embudo Creek.

The records for this station are not complete, being deficient in 1894 and 1896 when for a time during these years some of the gagings are missing and a few months the station was abandoned.

It was maintained by the Geological Survey. The drainage

area at this station of 10,090 square miles.

The next gaging station below Embudo is now at Buckman. This station has been known at times as the Rio Grande gaging station. It has not at all times been located at the same place, but at no time has the location been changed to any great extent.

This was first established in 1895 and was maintained to 1905, when it was discontinued. It was re-established in 1909 and is in operation at present.

This was located in the White Rock Canyon and therefore near the lower end of the Espanola Valley and not many miles distant from the upper end of the Albuquerque Valley.

This station was first maintained by the Geological Survey and is now maintained jointly by the survey and the Territory of New Mexico through the Territorial Engineer.

The lower station is at San Marcial, New Mexico. This is at the upper end of the Engle reservoir.

This station is maintained by the International (Water) Boundary Commission of which Mr. W. W. Follett is the Consulting Engineer. The station was established in 1895 and is in operation to date. The drainage area is 28,067 square miles.

Several graphical hydrographs have been constructed to show the records of these stations. In this, as in all other hydrographs in this report, yellow is used for the records at Lobatos, blue at Embudo, red at Buckman and green at San Marcial. These colors are also used in the legends on the several sheets. The first one is entitled "Monthly flow in acre-feet of the Rio Grande at Lobatos, Embudo, Buckman and San Marcial". It shows all the records available and the years and months to which they apply.

The next hydrograph is entitled, "Hydrograph, Simultaneous Observations, 1899-1903". As these four stations were maintained for a period of five years, the results are compared.

The mean annual flow in this and all other hydrographs in this report is obtained in the following manner: The sum of the means obtained for the flow of each month is used as the mean annual flow. There are several years in which the record is not complete, but having a reliable record for some months and computing according to this method, these incomplete records may be used.

The mean annual flow for this period was 379,825 acre-feet at Lobatos; 540,580 acre-feet at Embudo; 868,000 acre-feet at Buckman and 584,620 acre-feet at San Marcial. It can therefore be seen that the Rio Grande experienced a mean annual increase of 160,755 acre-feet between Lobatos and Embudo; a mean annual increase of 327,420 acre-feet between Embudo and Buckman, and a mean annual decrease of 283,380 acre-feet between Buckman and San Marcial.

The next hydrograph is entitled "Hydrograph, All Data". According to this the records of 12 years for the station at Lobatos, gives a mean annual flow of 640,170 acre-feet; the records for Embudo give a mean annual flow of 763,560 acre-feet; the records for 13 years at Buckman give a flow of 1,153,410 acre-feet and the records at San Marcial give a flow of 1,122,775 acre-feet. According to these figures the Rio Grande experienced a mean annual increase of 123,390 acre-feet between Lobatos and Embudo; a mean annual increase of 389,850 acre-feet between Embudo and Buckman and a mean annual decrease of 30,635 acre-feet between Buckman and San Marcial.

It is believed that this mean annual loss of 30,635 acre-

feet as shown by the gaging stations does not represent the true amount of water lost by use and evaporation. Between these stations, are the Rios Santa Fe, Gallisteo, Jemez, Puerco, and Salado, each make considerable contributions to the water supply. A great many arroyos are likewise sending into the Rio Grande their contributions of water at times. Often floods from these sources are dissipated before they reach the gaging station at San Marcial.

According to the records of these two stations for the years from 1895 to 1905; for the year 1899 there was a loss of 442,510 acre-feet. The greatest loss for any one month also occurred in this year, the month of April. It amounted to 122,340 acre-feet. It cannot be assumed that during 1899 there was no run-off from the tributaries to the Rio Grande.

The drainage area tributary to the Rio Grande between these two stations is approximately 14,000 square miles. In 1905 the discharge of the Rio Grande was 375,000 acre-feet greater at San Marcial than at Buckman. This is therefore a run-off of nearly 27 acre-feet per square mile. But if we assumed that the run-off from the tributaries of the Rio Grande for 1899 was but 1 acre-foot per square mile, there would be 14,000 acre-feet to add to the 442,510, mentioned above, making a total of 456,510 acre-feet. It is therefore believed that the loss by use and evaporation between Buckman and San Marcial for the year 1899 was between 450,000 and 500,000 acre-feet.

The following table shows in round numbers, the greatest loss occurring for each month during the period from 1895 to 1905, between Buckman and San Marcial:

January	14,000 A-feet	July	30,000 A-feet
February	12,000 "	August	35,000 "
March	55,000 "	September	100,000 "
April	122,000 "	October	25,000 "
May	95,000 "	November	30,000 "
June	100,000 "	December	15,000 "

The total for all of these monthly losses is 633,000 acre-feet. This does not represent the mean annual loss. The loss of such a great amount of water in some months was caused by a great amount of water being used for irrigation following a month of inadequate supply. The conditions which caused so great a variation in amount were complex and greatly interdependent. A few will be mentioned. If the run-off at Buckman was very great for a short length of time, not much could be used for irrigation below, but if there was a mean run-off for the entire summer, this could nearly all be used or evaporated before it reached San Marcial.* If there was an early spring, much more water is used while the run-off is great.

For the year 1910 the following months showed a loss according to the data of the gaging stations which were available; March 56,337 acre-feet; April 110,088 acre-feet; May 117,772 acre-feet; June 66,906 acre-feet; July 39 acre-feet; August 14,661 acre-feet and September 8,805 acre-feet. The total is 374,608 acre-feet. But it is known that the loss must have been much more than this. Testimony and the results of observation are, that the flow of Santa Fe Creek and the Rio Gallisteo continued to April 1 and the flow of the Rio Jemez to May 1, and the flow of the Rio Puerco to June 1. These all contributed floods of greater or less magnitude throughout

the summer, intermittently. Observations were made that showed that floods of considerable magnitude had come out of Santa Fe Creek, the Rios Gallisteo and Jemez about August 4th. Also the rains in the Espanola Valley caused a rise in the Rio Grande at Buckman. According to the testimony of the people interviewed at La Joya, none of these floods reached there. It was all used for irrigation or evaporated.

According to all the preceding information, it is believed that the mean annual loss between Buckman and San Marcial is near to 500,000 acre-feet per annum.

The number of acres which are irrigated was estimated to be 35,160. The amount of loss by evaporation must be great, as the river bed has a considerable width.

According to the hydrograph showing all data, the mean annual flow in acre-feet is 389,850 acre-feet greater at Buckman than at Embudo.

Between these stations about 5,000 acres are irrigated. It might be roughly estimated that 20,000 acre-feet are used and evaporated annually between these stations. Adding that to the increase shown by the gaging stations, gives a total increase of 409,850. It is therefore believed that the mean annual contribution of the tributaries is from 400,000 to 410,000 acre-feet per annum.

A rough estimate is made of the contribution of the several streams. This is made from the conditions of the drainage areas as seen in the field in 1910, as no reliable hydrographic data can be secured. It is believed that the Rio Chama contributes about 50% of this run-off, the Rio Santa Cruz about 20%, Pojuaque Creek about 20% and the remaining lesser tributaries about 10%.

The hydrograph showing all data shows a discharge of 123,390 acre-feet more at Embudo than at Lobatos. This is known to be somewhat in error as the records show a loss between the two stations for the months of January and February. This is probably due to incorrect rating tables for gage heights obtained when the channels contain ice.

The main tributaries between these two stations are Costilla Creek, Red River, Rio Hondo, Taos Creek and Embudo Creek. Of these Red River contributes the most, probably not contributing less than 50 cubic feet per second. The Rio Hondo, Taos Creek and Embudo Creek, in the summer of 1910, were contributing during the dry season about 2 cubic feet per second.

The only irrigation between these stations is at Rinconada, and this is insignificant. It is therefore estimated that the contribution of the tributaries between these stations is from 120,000 to 125,000 acre-feet per annum.

Taking all the simultaneous records of Embudo and Buckman which were made during 1895 to 1903, the mean annual flow at the former was 667,455 acre-feet, and at the latter 1,037,330 acre-feet. The increase was therefore 369,875 acre-feet. Comparing this with the mean for all records, 389,850 acre-feet, and the mean for the five years, 189901903, 327,420 acre-feet, shows reasonably consistent results for the three periods.

A hydrograph is constructed showing the result of all simultaneous records at the stations at Buckman and San Marcial. The simultaneous observations were made in 1895 to 1905. The mean annual loss for this period was 100,495 acre-feet.

From all data it is estimated that 640,170 acre-feet are

approximately the mean annual flow from the San Luis Valley into New Mexico; that the Rio Grande has a mean annual increase of 120,000 to 125,000 acre-feet per annum from its tributaries between Lobatos and Embudo; that it has a mean annual increase of 400,000 to 410,000 acre-feet from its tributaries between Embudo and Buckman, and that it has a mean annual decrease of about 470,000 acre-feet from Buckman to San Marcial. The total supplied to the Rio Grande in New Mexico is therefore about 990,000 or 1,005,000 acre-feet per annum.

The loss by use and evaporation is about 20,000 acre-feet in the Espanola Valley, and about 500,000 acre-feet in the upper and lower Albuquerque Valleys, making a total of 520,000 acre-feet.

The mean annual flow of the Rio Grande is shown by the gaging station at San Marcial to be about 1,122,775 acre-feet, and this may be considered as reasonably close to what may be expected for a long period of years.

S U M M A R Y

of a

R E P O R T

on a

HYDROGRAPHIC SURVEY

of the

RIO GRANDE DRAINAGE

in

NEW MEXICO

N O R T H

of

THE RIO GRANDE DAM

It was estimated that there were 110,548 acres of land under actual cultivation, and that there were 576345 acres of land that might be classed as irrigable, but it is known that this amount can never be irrigated because of an insufficient water supply. It is believed that with a very small additional water supply and under scientific cultivation that 200000 acres or about the amount of land under ditch could be irrigated successfully.

The report of Mr. W. W. Follett, gives about 150,000 acres irrigated. However, it is known that a great many of the ditches listed by him have been abandoned. The Rio Gallisteo and the Rio Puerco exhibit noticeable examples of this and it cannot be said of any particular stream that there has been an important increase in the irrigated area.

With the restriction of all reservoirs to a capacity of 1000 acres feet, it is believed that there will be no further developments of irrigation that will be seriously detrimental to the water supply of the Rio Grande Project, except that of the Red River Land and Water Co., in Taos County. This company will irrigate over 29000 acres of land near Cerro. To do this successfully would require about 120000 acre feet per annum but this can not be done unless considerable storage is resorted to as the low water flow of Red River is not sufficient to irrigate so large a tract of land. This may use 100000 acre feet without storage, but is not believed any more than that amount.

The water supply entering New Mexico from the San Luis Valley is about 640170 acre feet per annum. This is increased

123390 acre feet between there and Embudo. There is no irrigation between these places. From Embudo to Buckman, the flow is increased by 350,190 acre feet, and to this should be added about 25,000 acre feet which are used or evaporated in the Española Valley, which lies between these two gaging stations. The mean annual flow at Buckman is 1,113,750 acre feet and the mean annual flow at San Marcial is 1,087,180 acre feet, an annual loss of 15,570 acre feet. But, it is shown by the gaging station that the annual loss has amounted to as much as 450,000 acre feet per annum and it is believed that at times it may become as low as 250,000 acre feet, depending on many relative conditions. It is, therefore, seen that the mean annual contribution to the Rio Grande between Buckman and San Marcial is between 250,000 and 450,000 acre feet per annum.

It is believed that there may be some more lands brought under cultivation in the vicinity of Albuquerque or Belen and that along the Rio Grande itself there will be no decrease in the irrigated area and that upon the completion of the Red River Land and Water Company's Project that the mean annual flow of the Rio Grande at San Marcial will be reduced to at least 1,000,000 acre feet per annum.

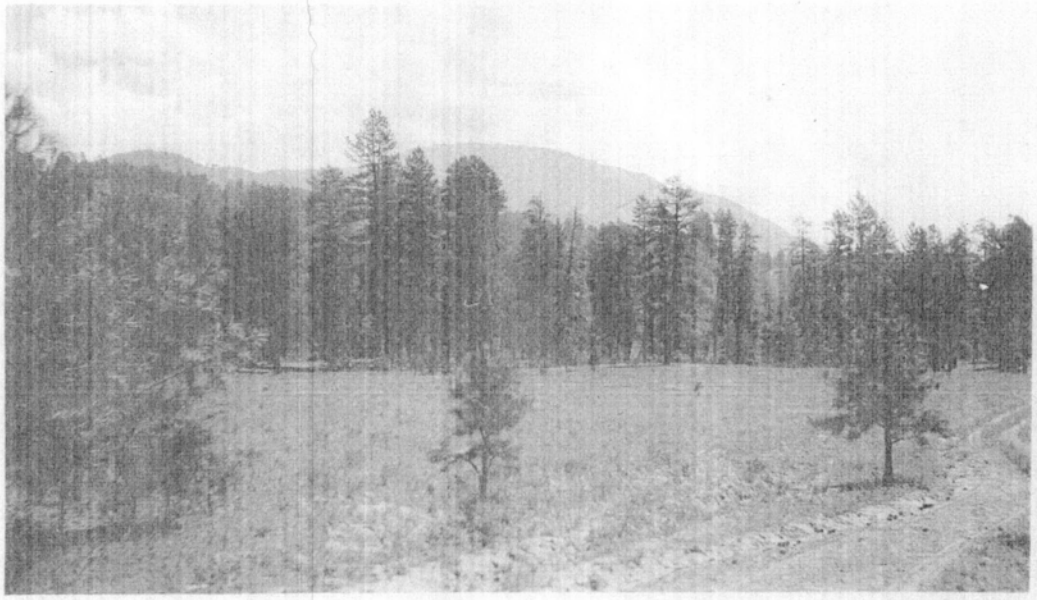
It is found that the capacity of all reservoirs, even including those of doubtful or unreliable estimates, is over 1,144,122 acre feet. The mean annual contribution to the Rio Grande by its tributaries in New Mexico is from 748,580 to 948,580 acre feet. The proposed reservoirs, therefore, have a capacity of from 195,543 to 395,543 acre feet, more than the water supply.

It is believed that no relinquishments of water should be made without further data concerning the supply and that no further relinquishments should be made urtil the Rio Grande Dam is completed and the reservoir full.

Respectfully submitted,

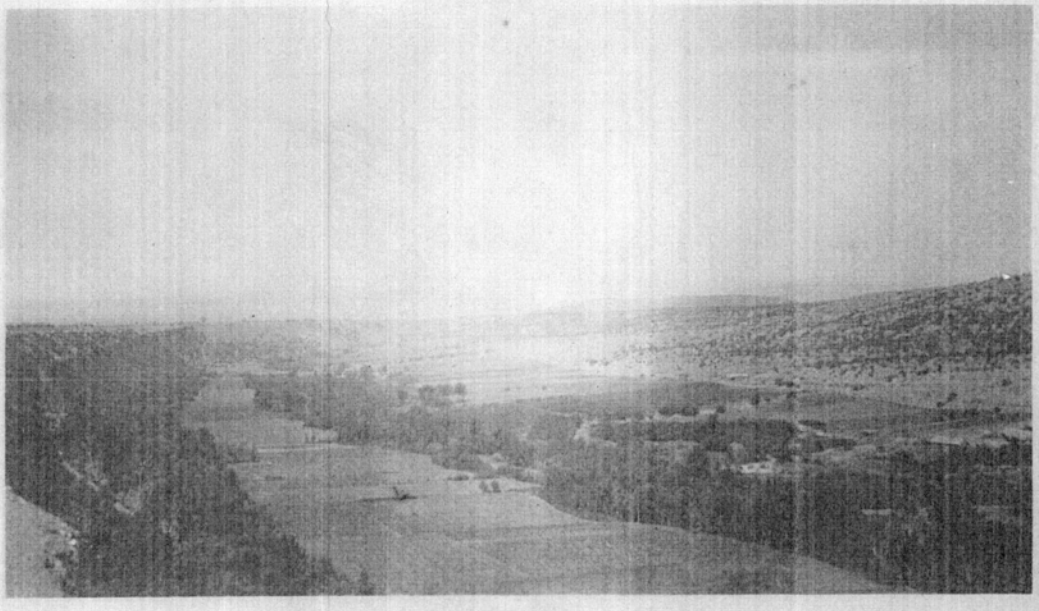
Robert E. Tyce

Junior Engineer.

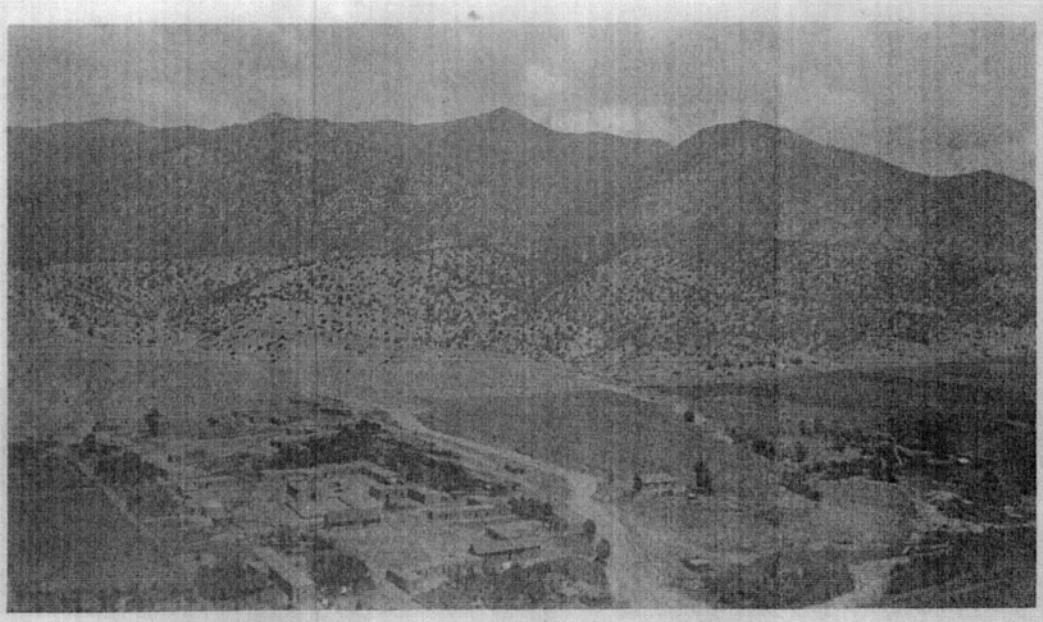


No. 1. The highest peak in the Jemez mountains.

No. 2. Head of the ditch of the Ranchos Orchard and Land Co.

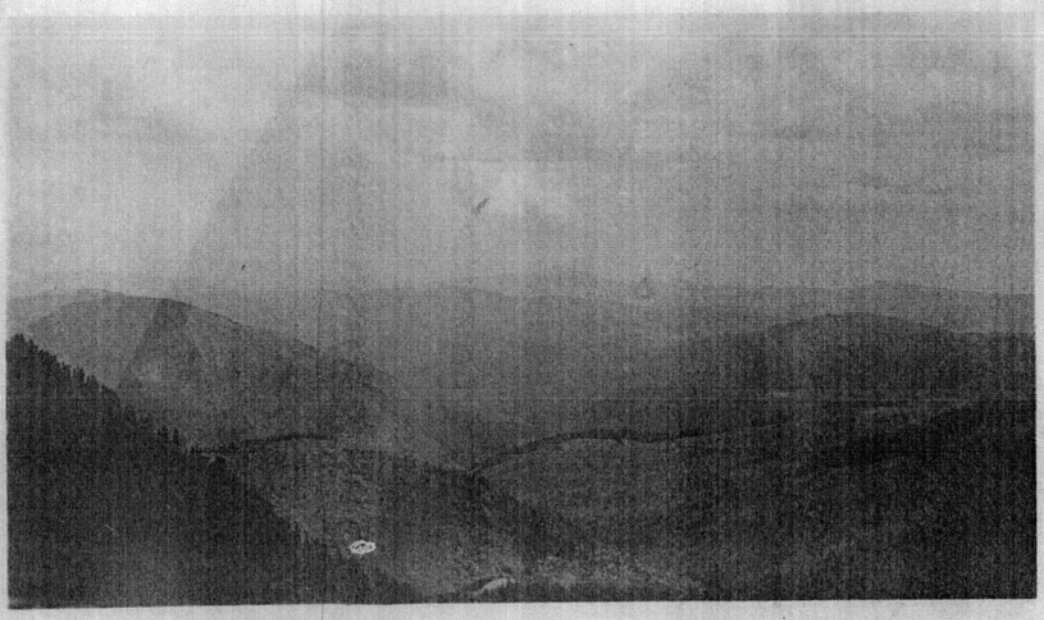


No. 3. The upper settlements on the Arroyo Hondo.



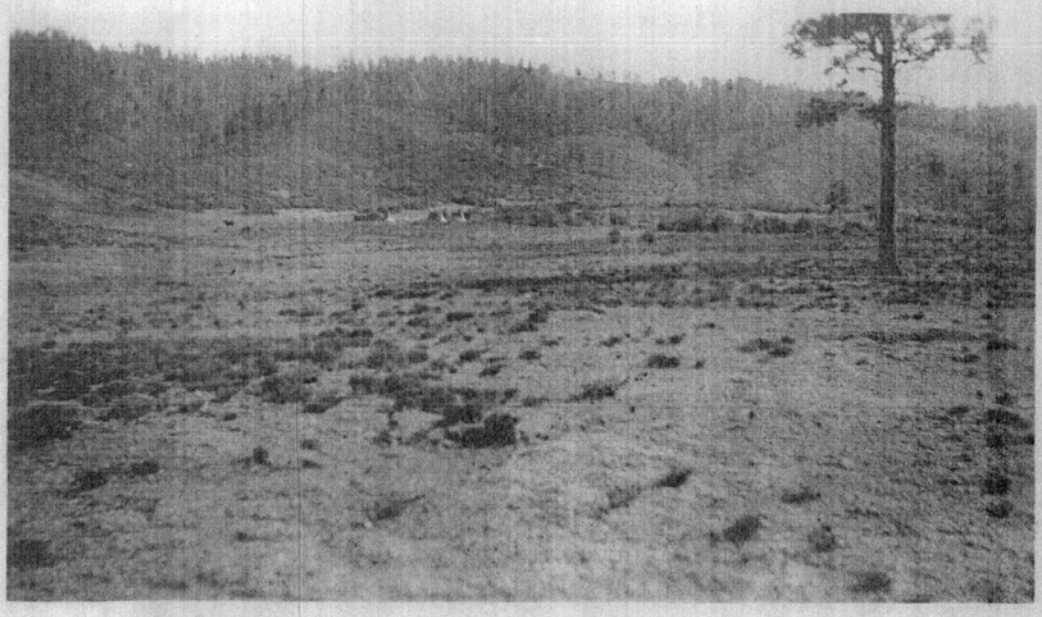
No. 4. Plaza San Antonio. Upper settlements on Arroyo Hondo. Also called Rio Hondo.

No. 5. View of the Reservoir site on Santa Fe Creek at Cieneguilla.

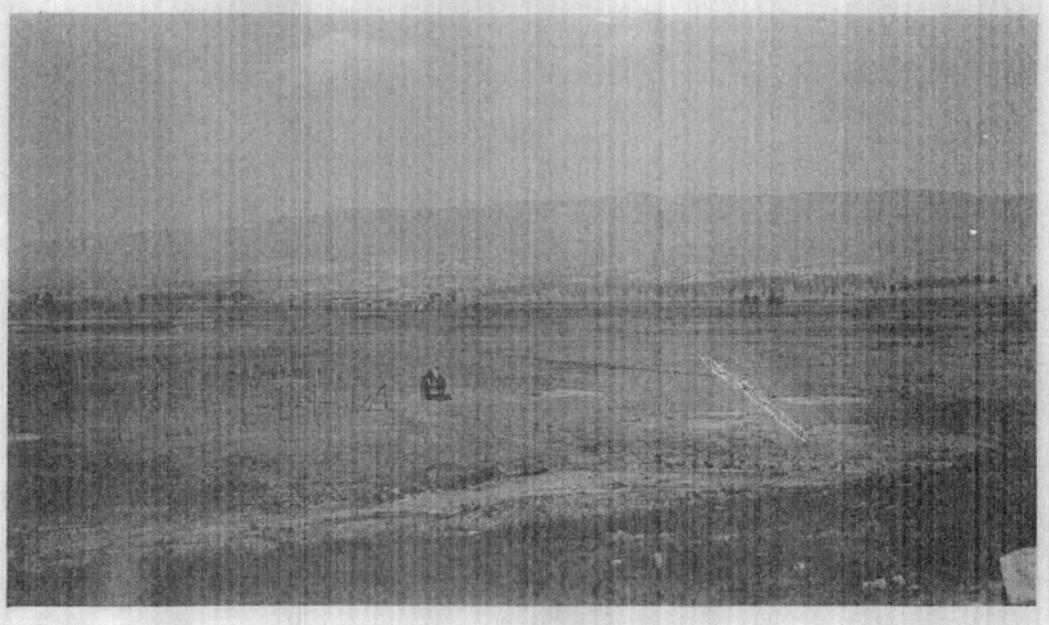


No. 6. The head waters of Red River, a tributary of the Rio Grande. Taken from an altitude of 11,000 ft. One of the Cosgrove Reservoirs at the very bottom of the picture.

No. 7. Terraced lands in Santa Fe Canyon.



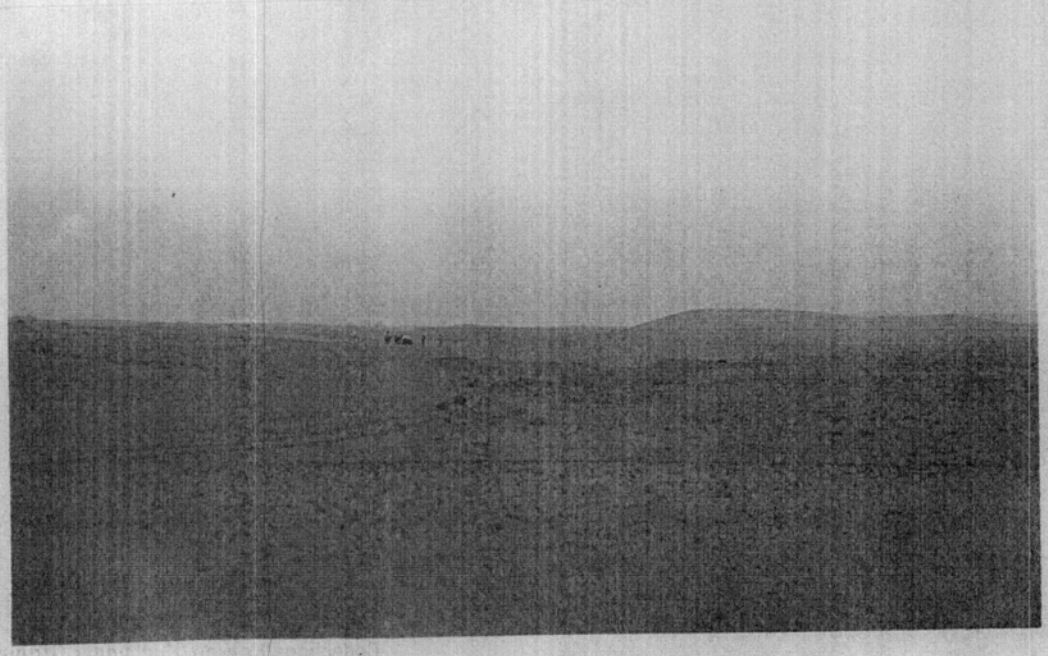
No. 8.



No. 9. Cuba. Near the head of the Rio Puerco.

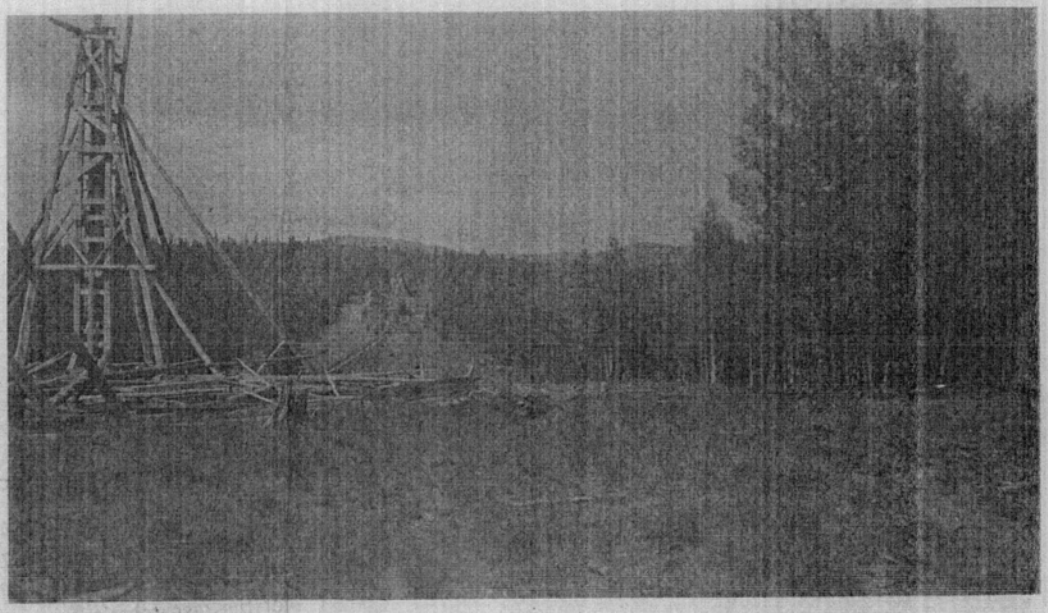
No. 10. Diversion Dam in Jemez River, and acequia Molino leading therefrom.

No. 11. Drifting sand, which would be detrimental to the Santa Ana Reservoir, on the Rio Jemez.



No. 12. Same as above.

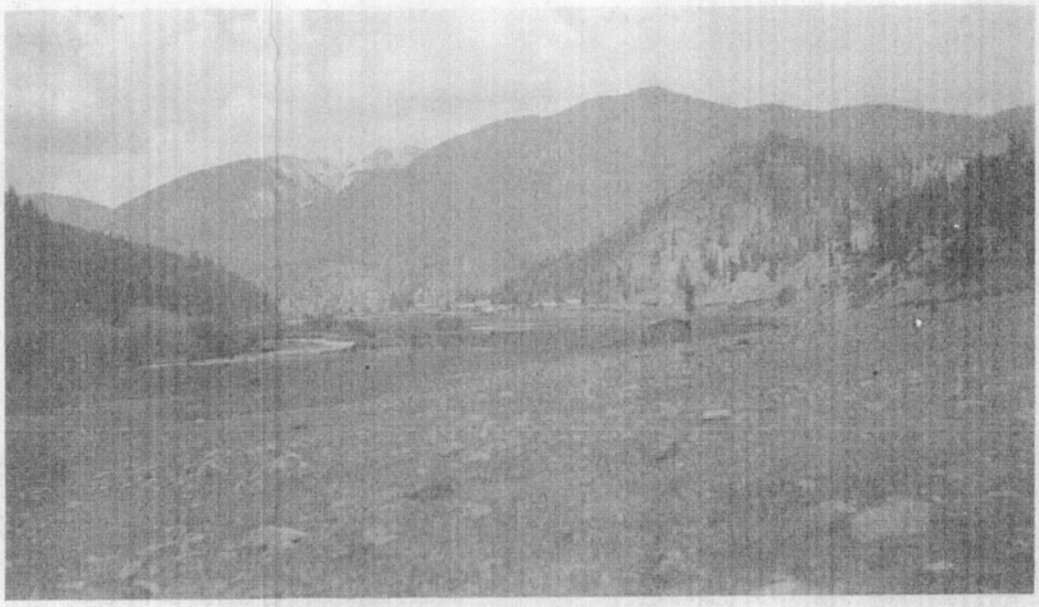
No. 13. The old flume and pressure pipe for the ditch taken out of Red River and used for placer mining near Elizabethtown in the Canadian River drainage.



No. 14. Nearer view of the above.

No. 15. Irrigated lands of the Pueblo of Jemez.

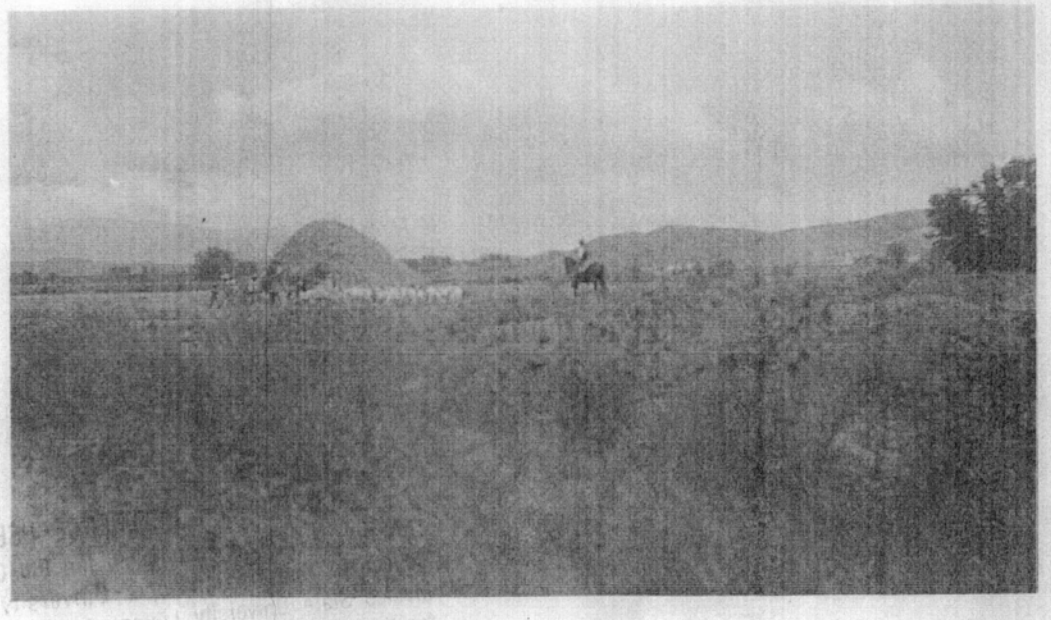
No. 16. Erosion caused by waste ditch on lands of the Pueblo of Jemez.



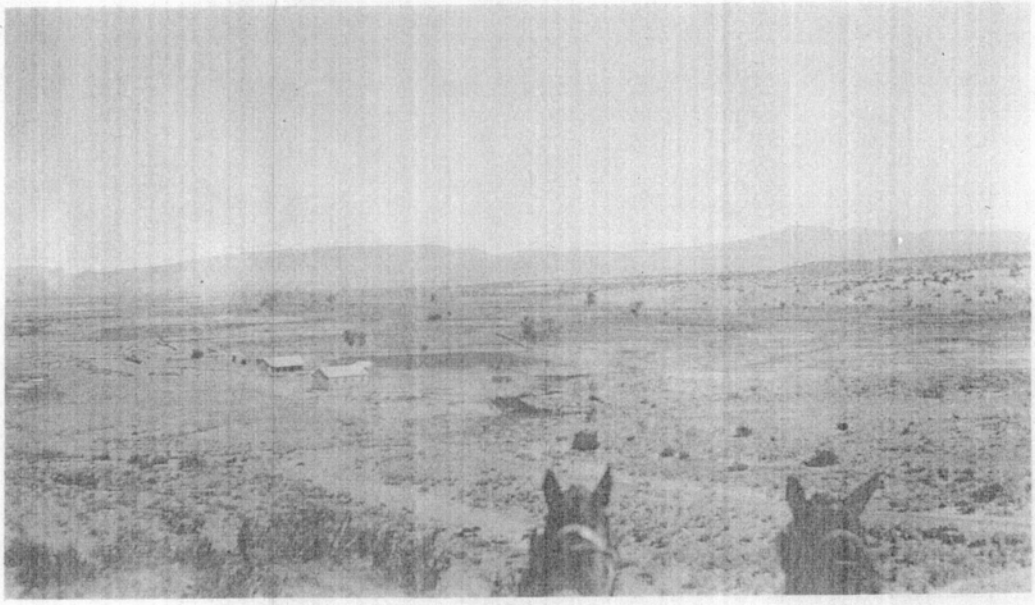
No. 17. Reservoir site on Red River at Red River town, being same as U. S. G. S. No. 9.

No. 18. An Arroyo tributary to Pojuaque Creek, subsiding after a cloudburst. In thirty minutes it rose from no discharge to 600 cu. ft. per second.

No. 19. Bad lands between the Rio Santa Cruz and Pojuaque Creek.

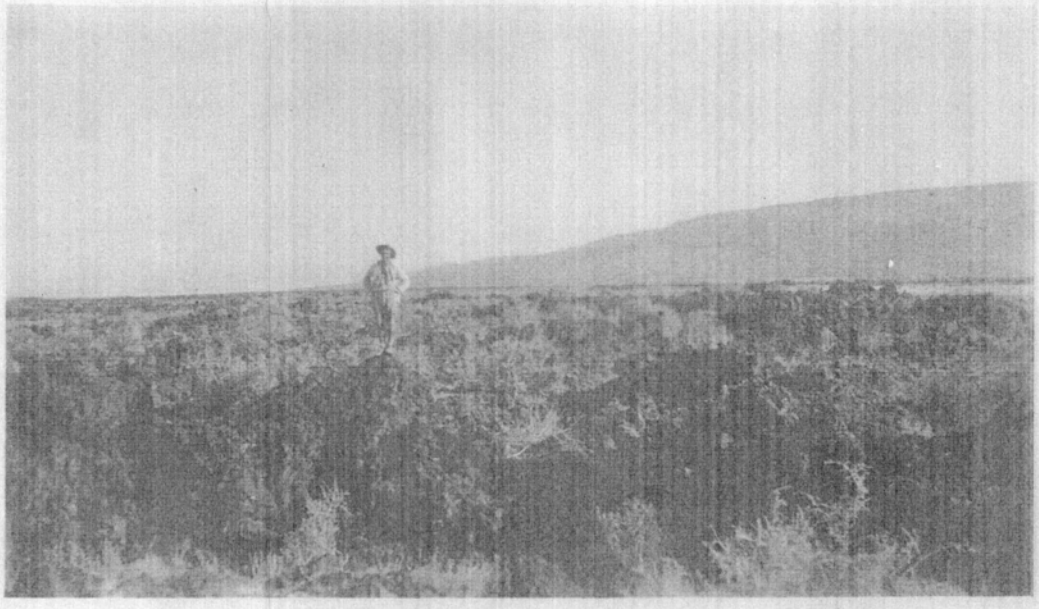


No. 20. Threshing with goats. Santa Cruz, N. Mexico.



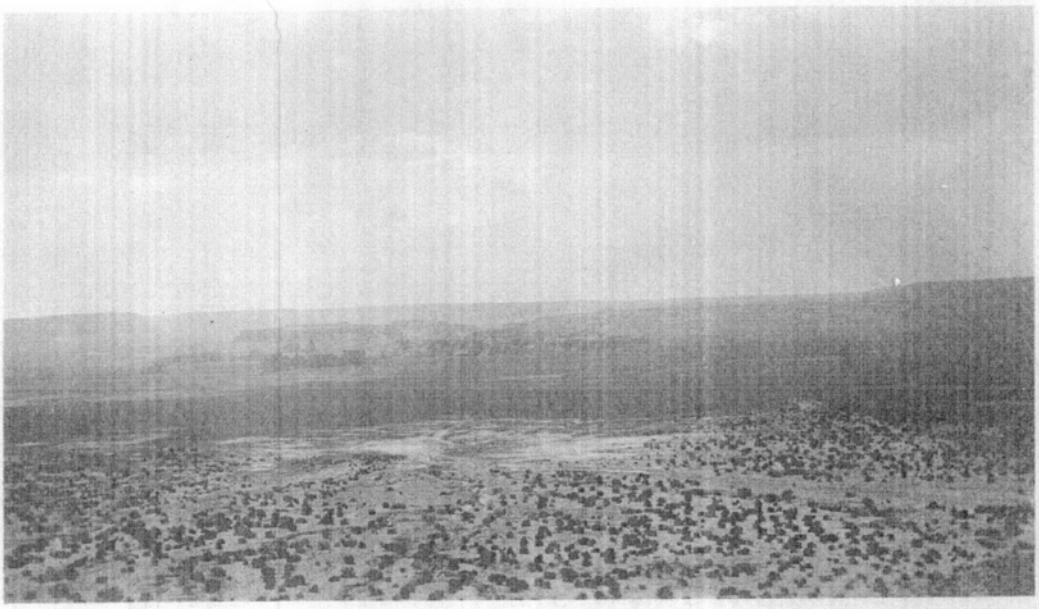
No. 21. Irrigated lands of the Pueblo of Zia. Looking up the Rio Jemez.

No. 22. The canon of the Rio Jemez, at Jemez Hot Springs.

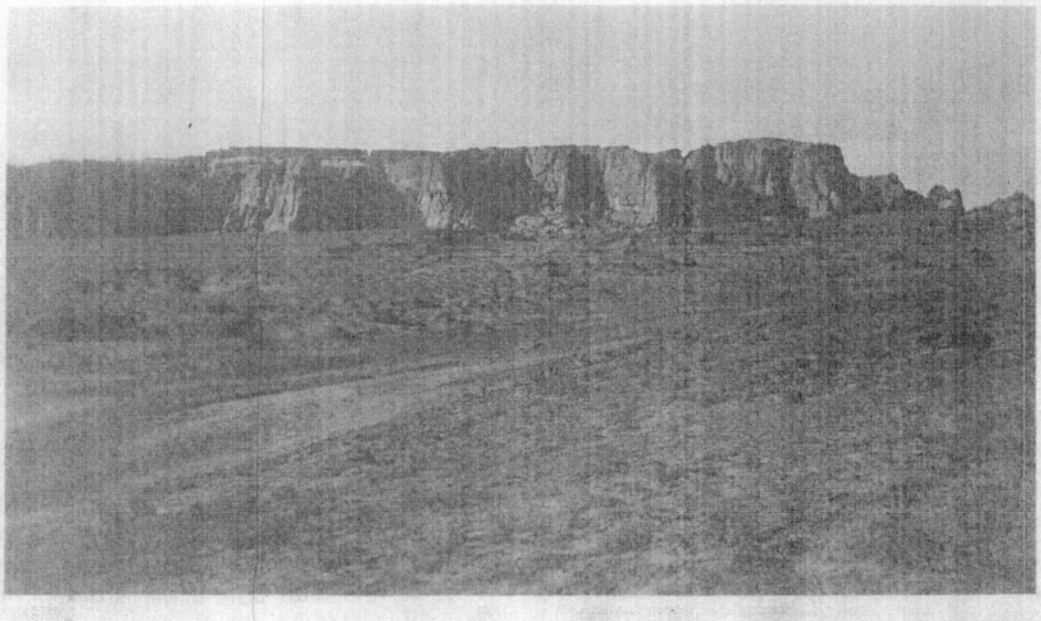


No. 23. Lava flow near Grants.

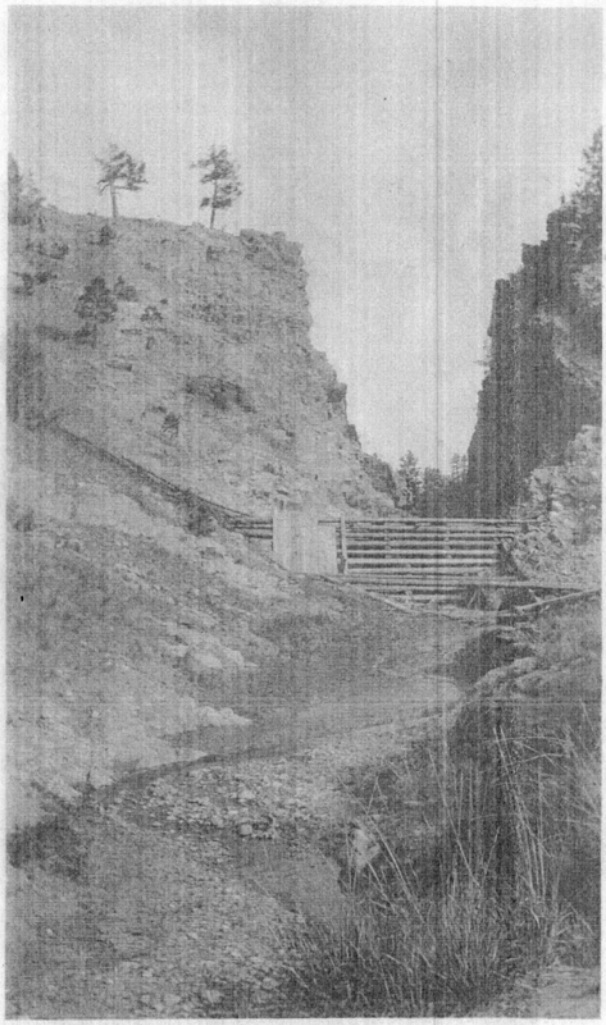
No. 24. Lava flow near McCarthy. Regulators of the flow of the Rio San Jose.

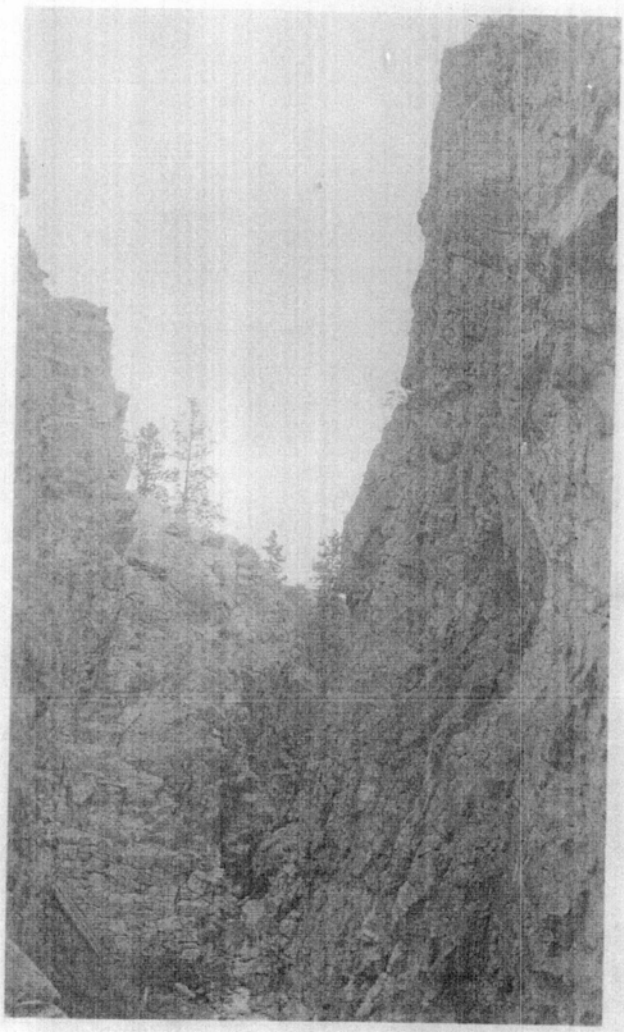


No. 25. The Pueblo of Acoma. The oldest town in the U. S. Seen from the West.



No. 26. Acoma, seen from the North.

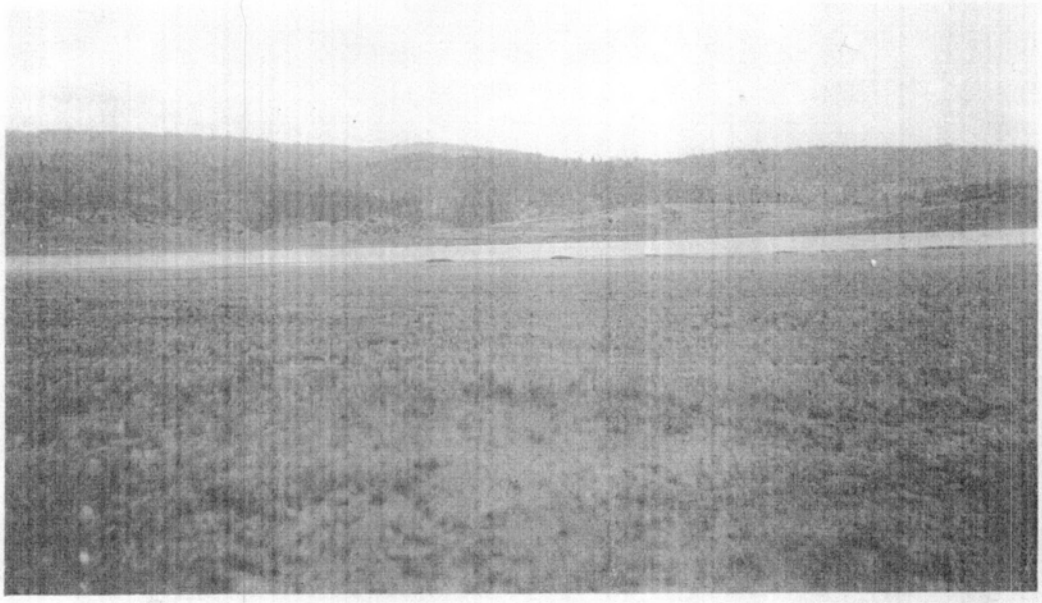




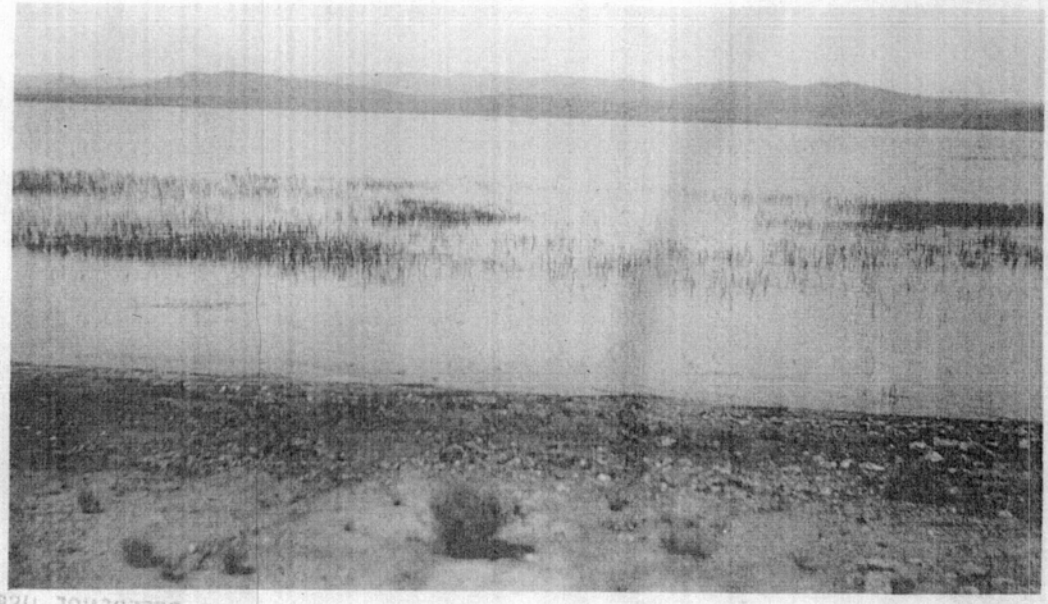
No. 27 and 28. Two views of dam site on Arroyo Seco, a tributary of El Rito.

No. 29. The Valley of Las Nutrias. No water to extend the small irrigable area. Contemplated to be watered from Rio Brazos.

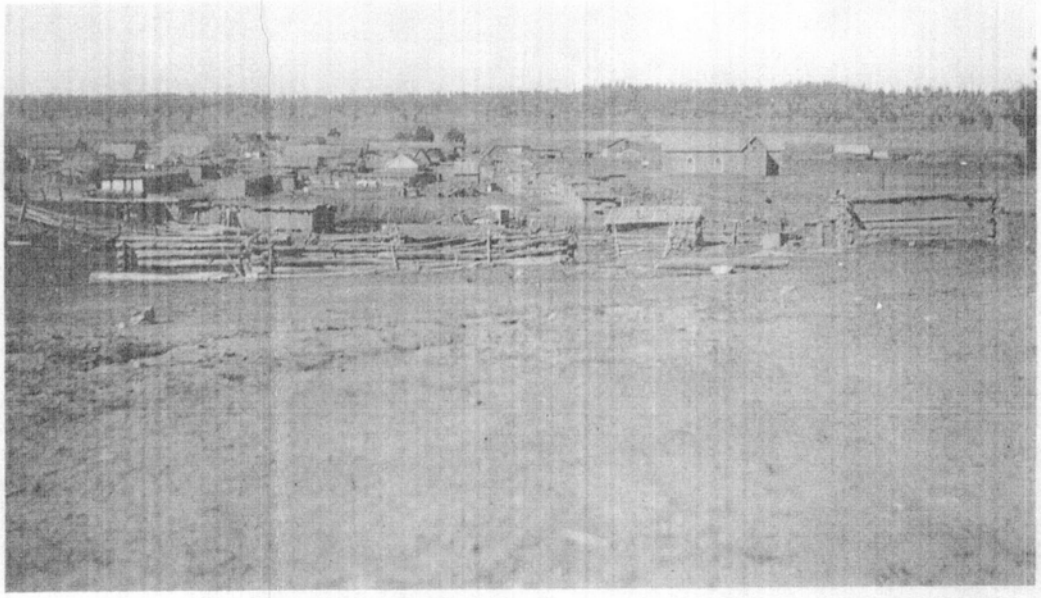
No. 30. Lands near Tierra Amarilla, which could be irrigated from the Rio Brazos.



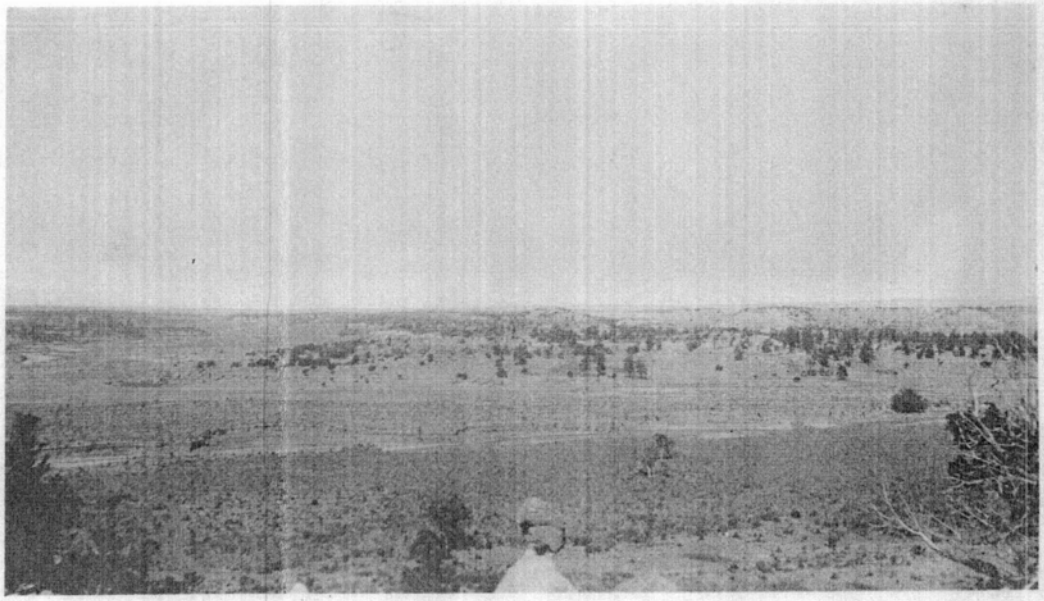
No. 31. Boulder Lake. An impractical Reservoir Site. U.S. G. S. Site No. 2.



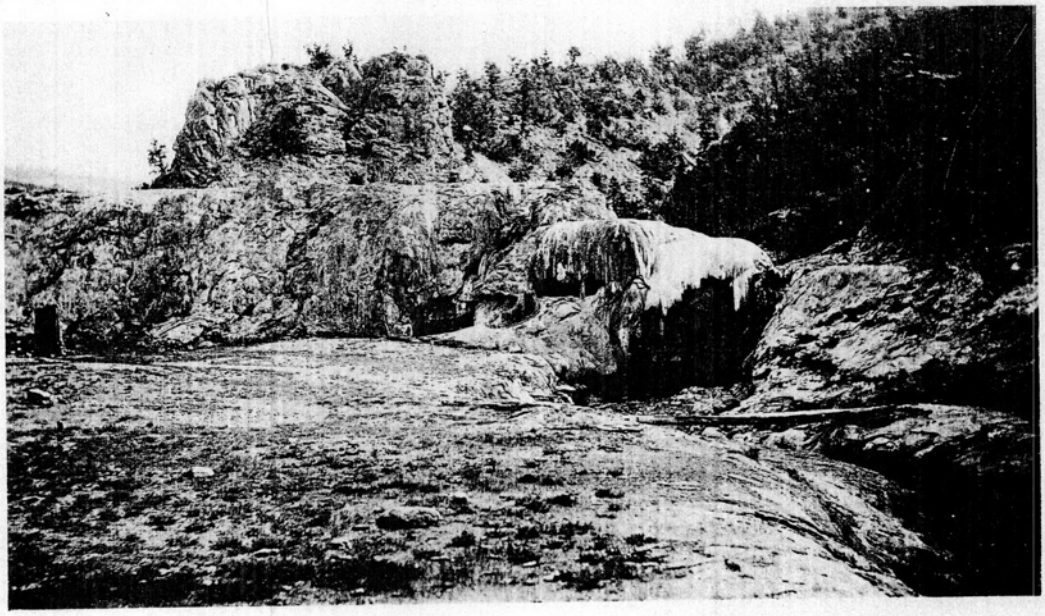
No. 32. Stinking Lake, near the Continental Divide. Impractical as a reservoir. A. S. G. S. Site No. 3.



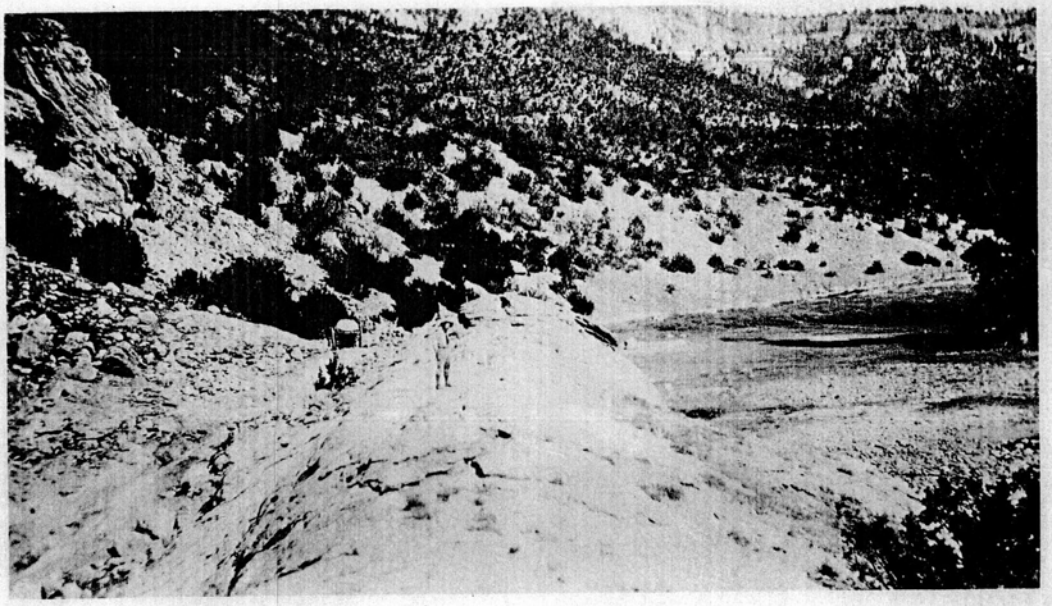
No. 33. Tierra Amarilla, the county seat of Rio Arriba County.



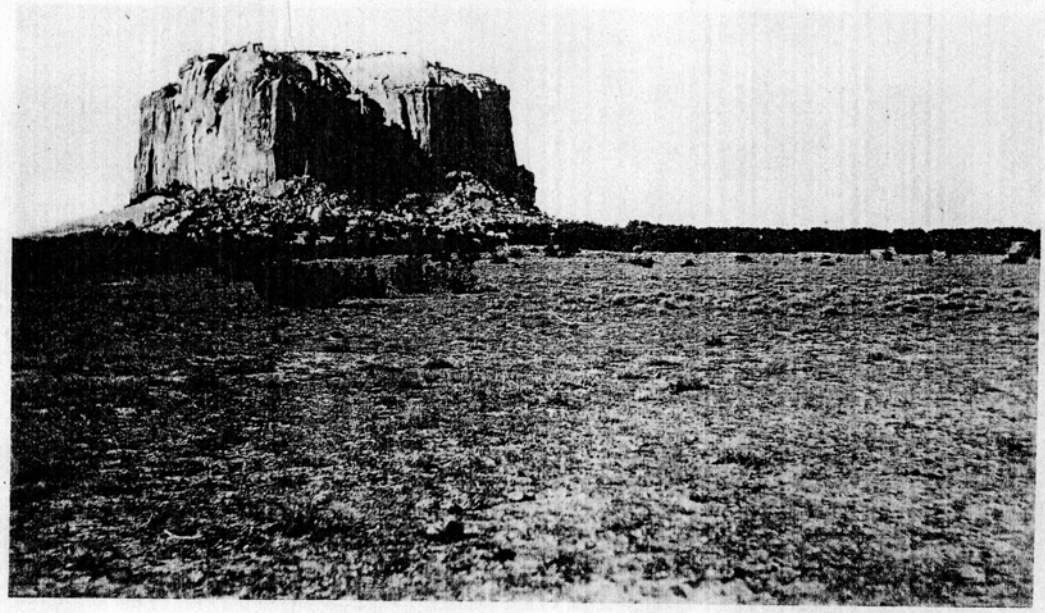
No. 34. The Rio Puerco between Cuba and Cabezon. Earth canon, 15 to 20 feet deep.



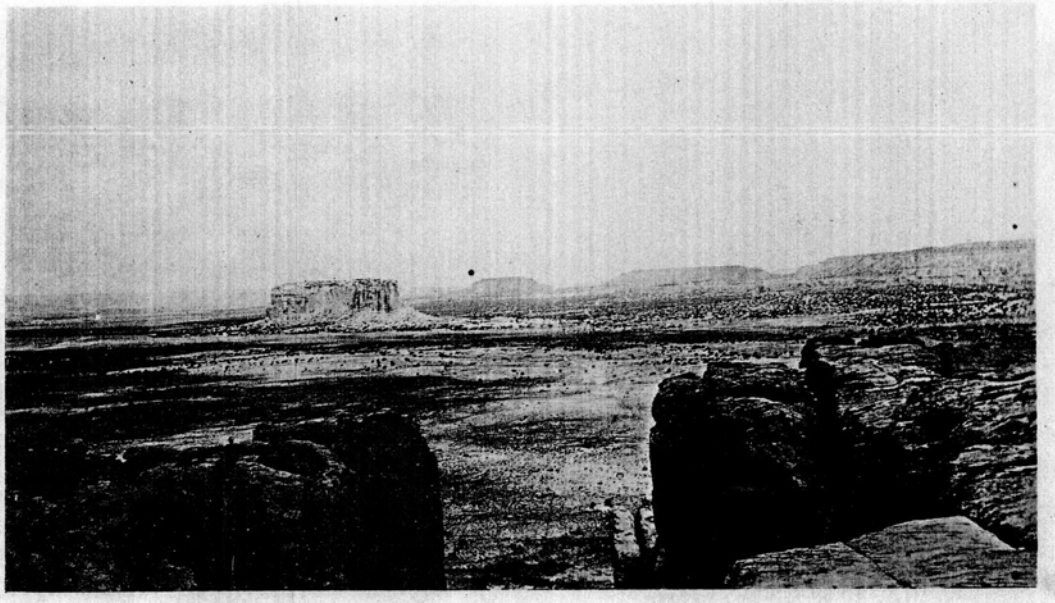
No. 35. View of a natural dam, now building across the Jemez canon by calcareous deposits.



No. 36. Another view of above.

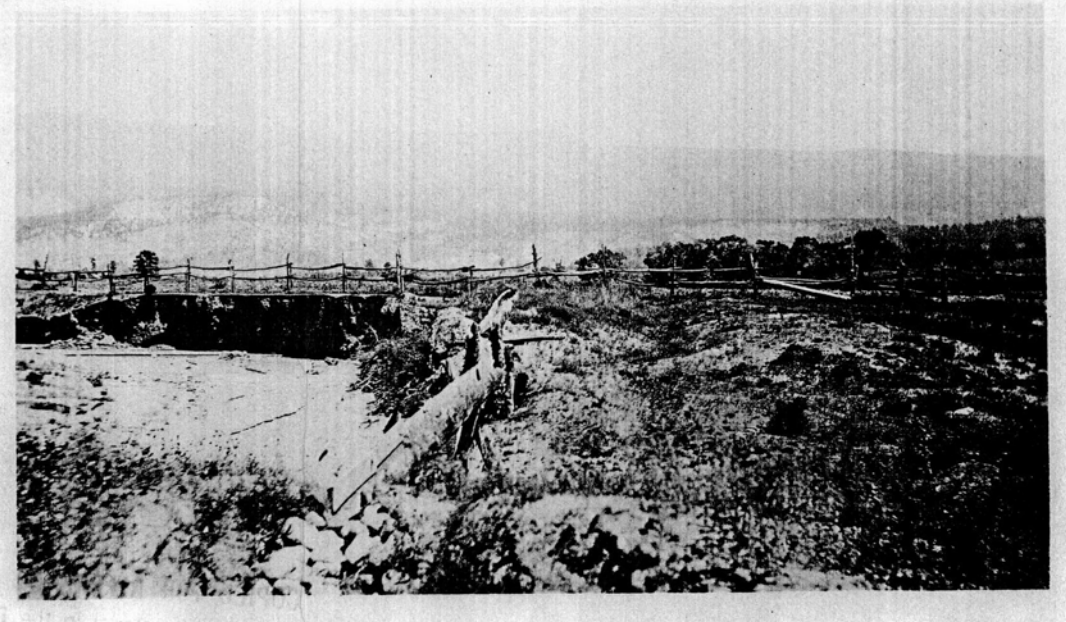


No. 37. The enchanted Mesa.

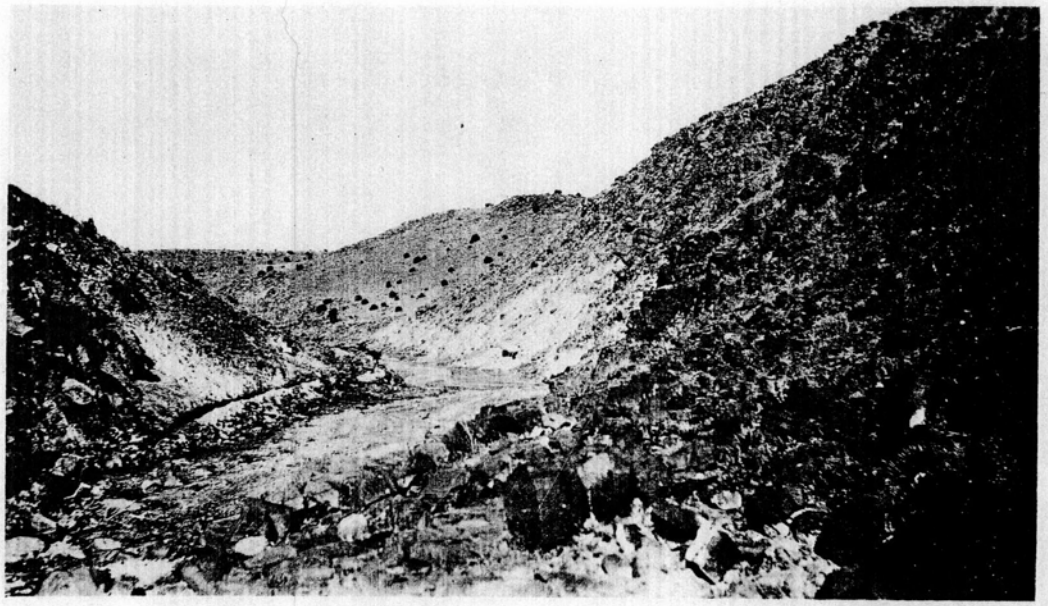


No. 38. The Enchanted Mesa looking East, from the Pueblo of Acoma.

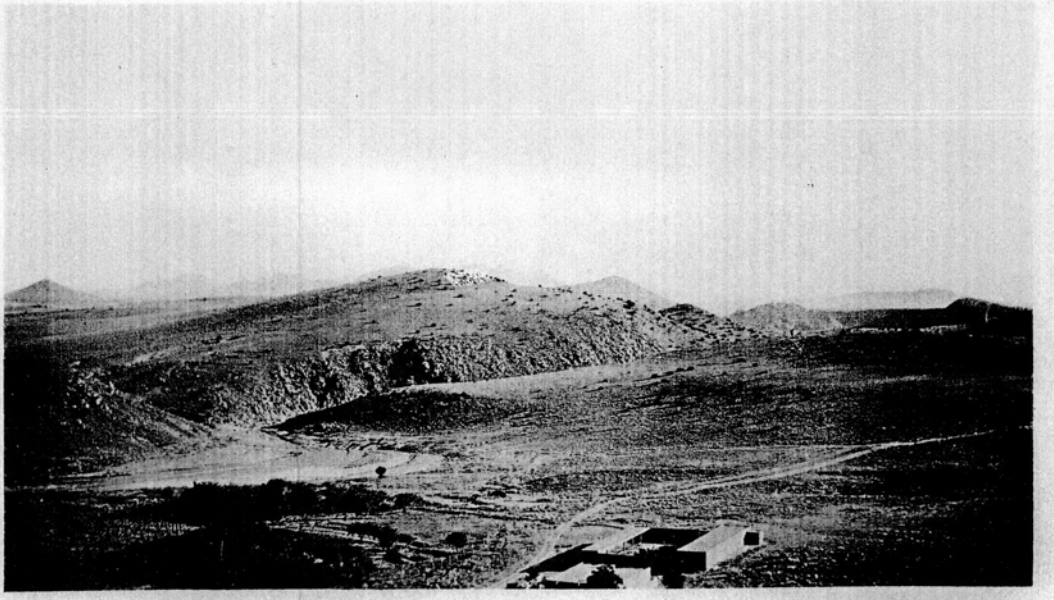
No. 39. Small reservoir site in the high parts of the Jemez mountains, near Chupadero. Impractical No irrigable lands near.



No. 40. Flume for small private ditch near Cuba. Hewn from logs.

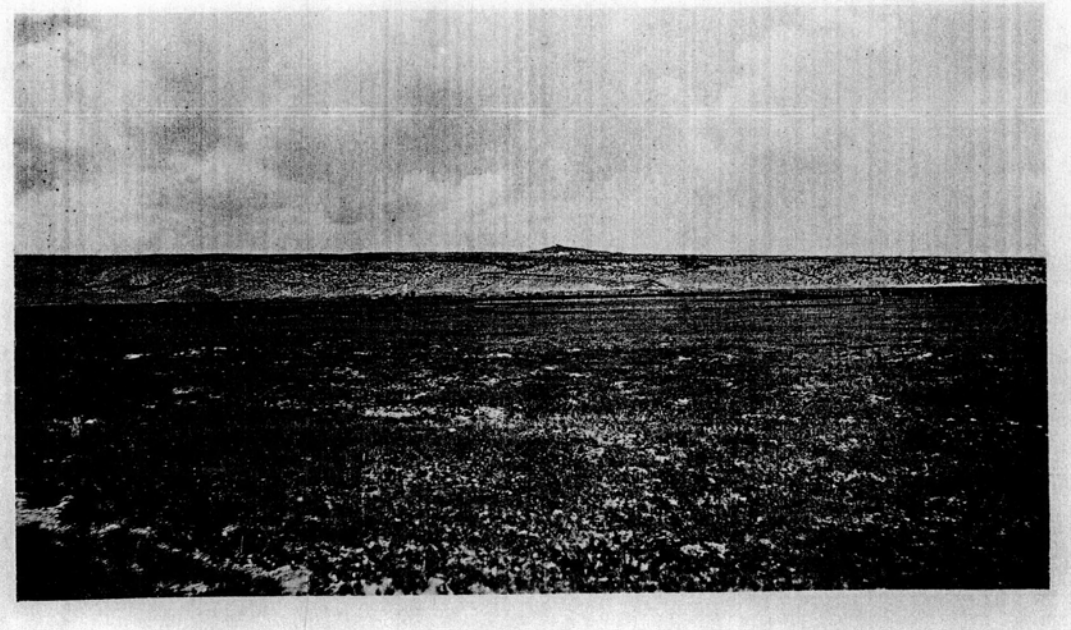


No. 41. Dam Site for the Cieneguilla Reservoir.

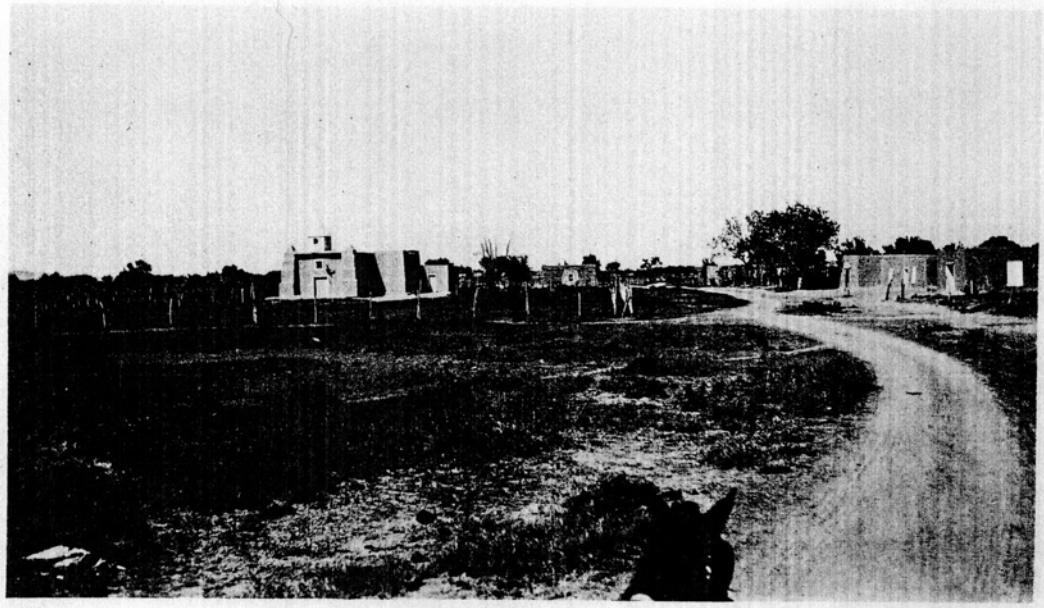


No. 42. General view of the dam site for the Cieneguilla Reservoir.

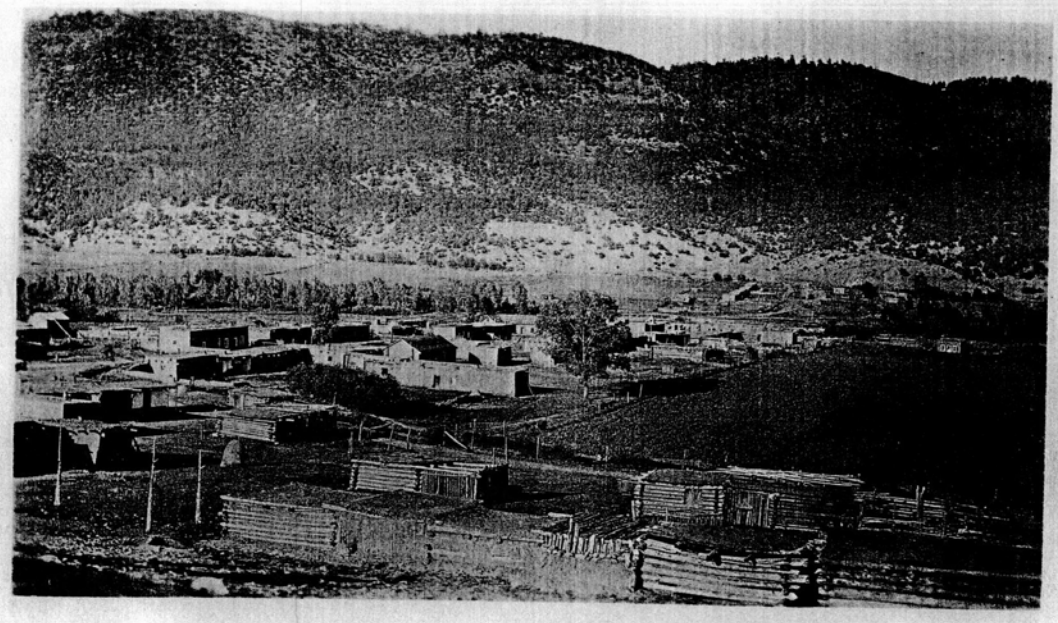
No. 43. Sub irrigated lands from the springs of San Rafael on the East side of the Zuni mountains.



No. 44. A small reservoir fed by springs at Cienega.



No. 45. Salt Grass Lands above Bernalillo, caused by over irrigation.



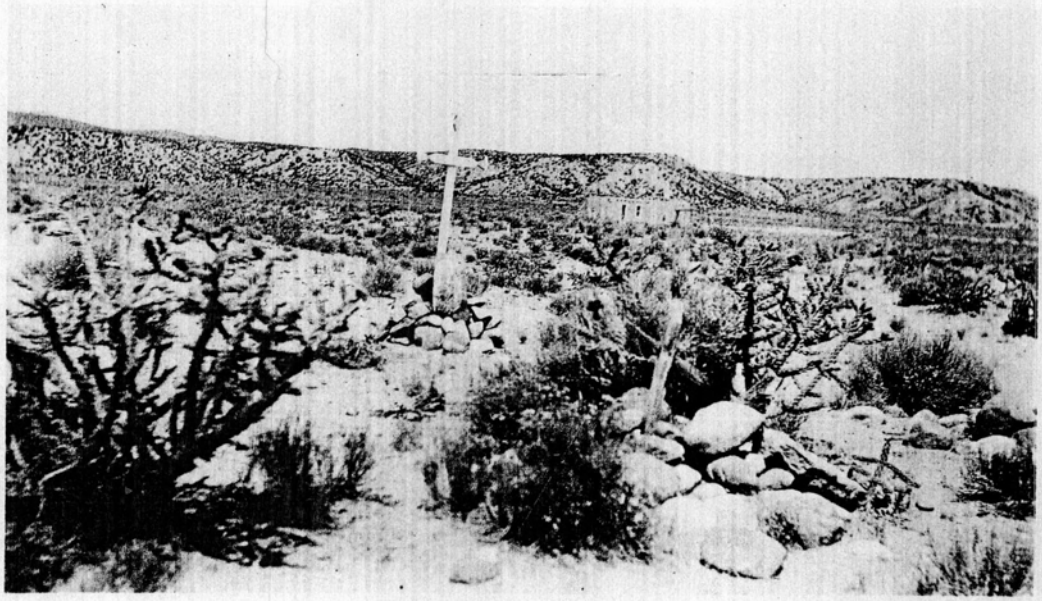
No. 46. Plaza Vallecitso on the Rio Vallecitos.

No. 47. Jicarilla Peak and the upper part of the Rio Santa Barbara.

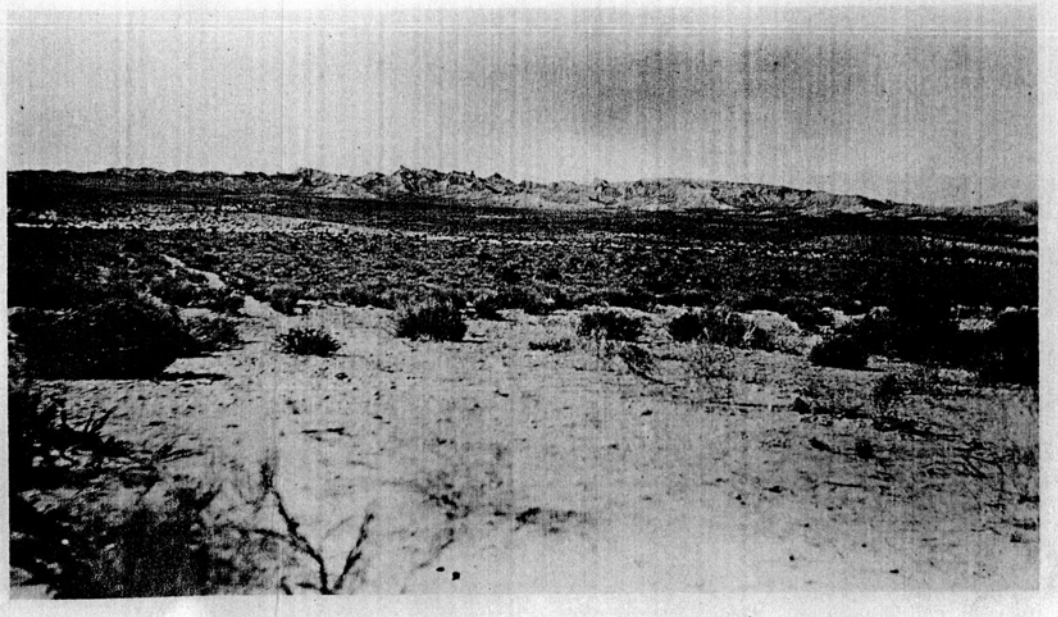
No. 48. Diversion Dam on the Rio Puerco near Cuba. Made of cedar trees typical of Rio Puerco.

No. 49. An Arroyo confined by embankments faced with concrete above Bernalillo.

No. 50. Nambe Falls on Nambe Creek, a tributary of Pojuaque Creek.
Good power opportunities.

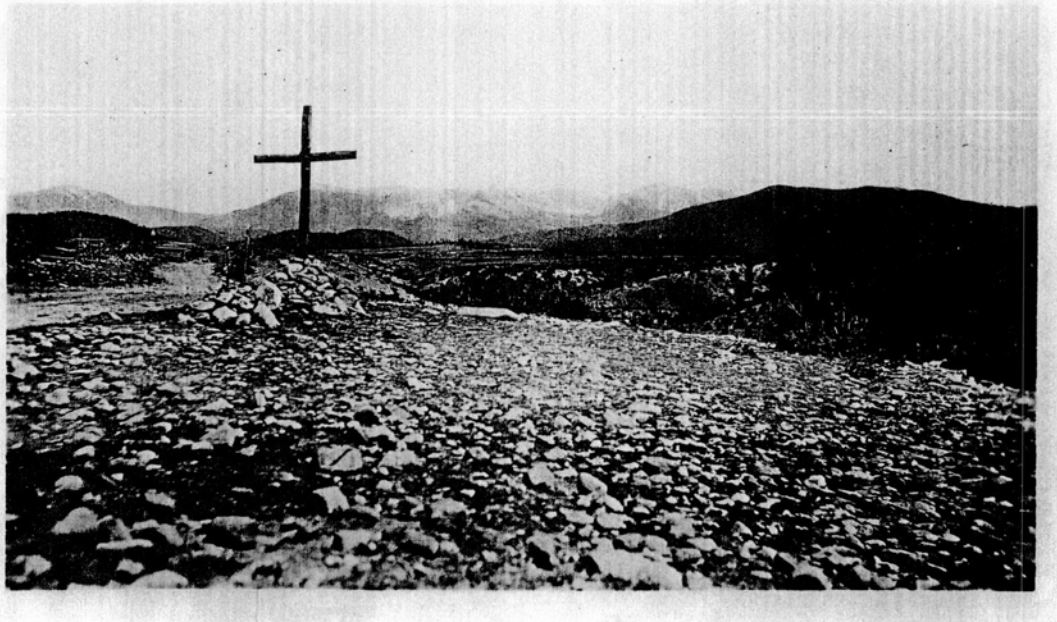


No. 51. The unirrigated portion of the Espanola Valley, above the ditches.



No. 52. The bad lands. East of the Espanola Valley.

No. 53. The Espanola Valley. Rio Grande.



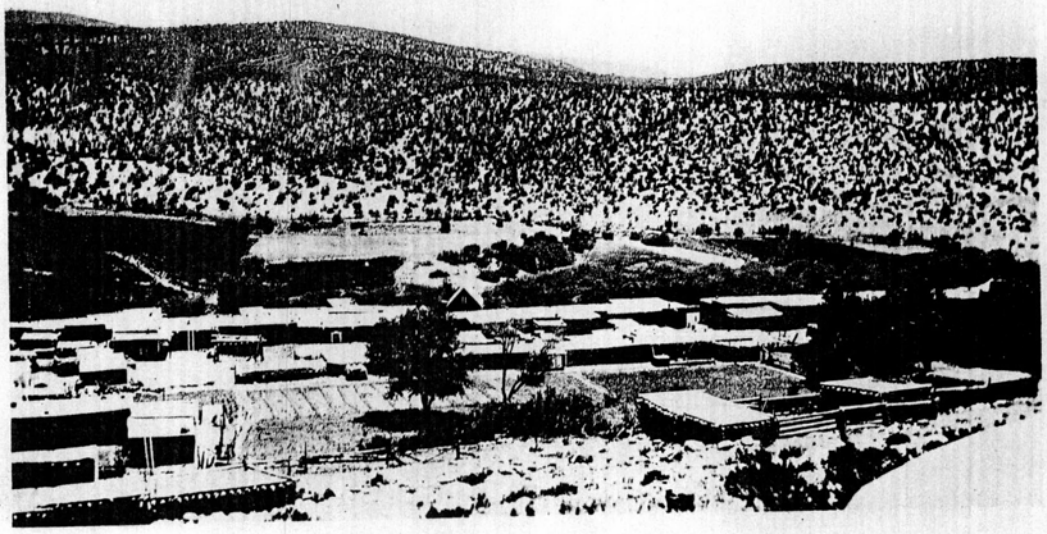
No. 54. The settlements at Truchas and the mountains at the head of the Rio Santa Cruz.

No. 55. Las Tusas Valley.

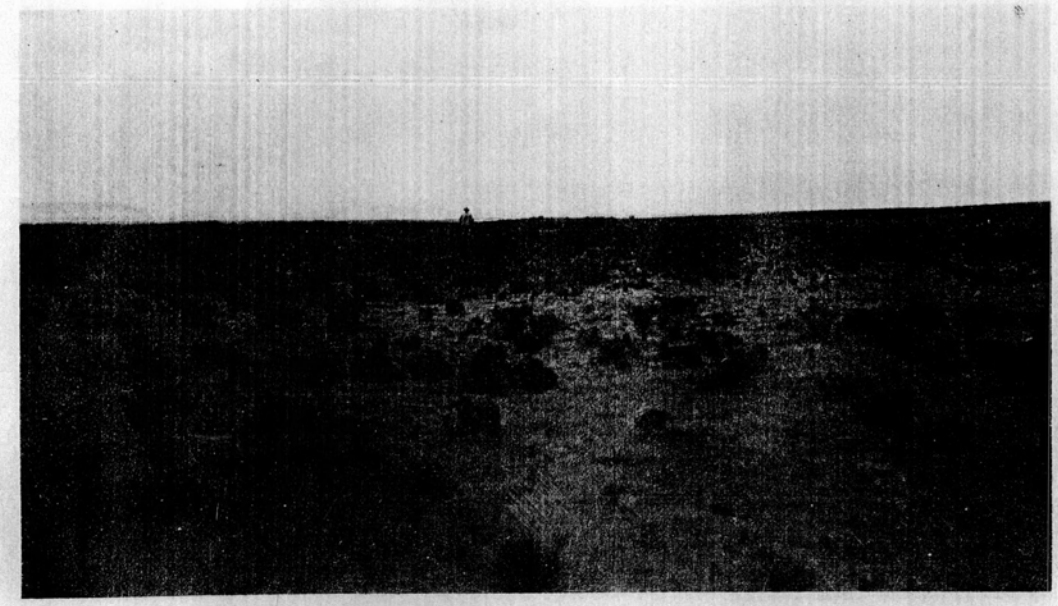
No. 56. Terminal Morain. Arroyo Hondo drainage. Altitude 11,000 approximate.

No. 57. Lake at the head of Arroyo Hondo. No surface outlet. Rock slide to the right.

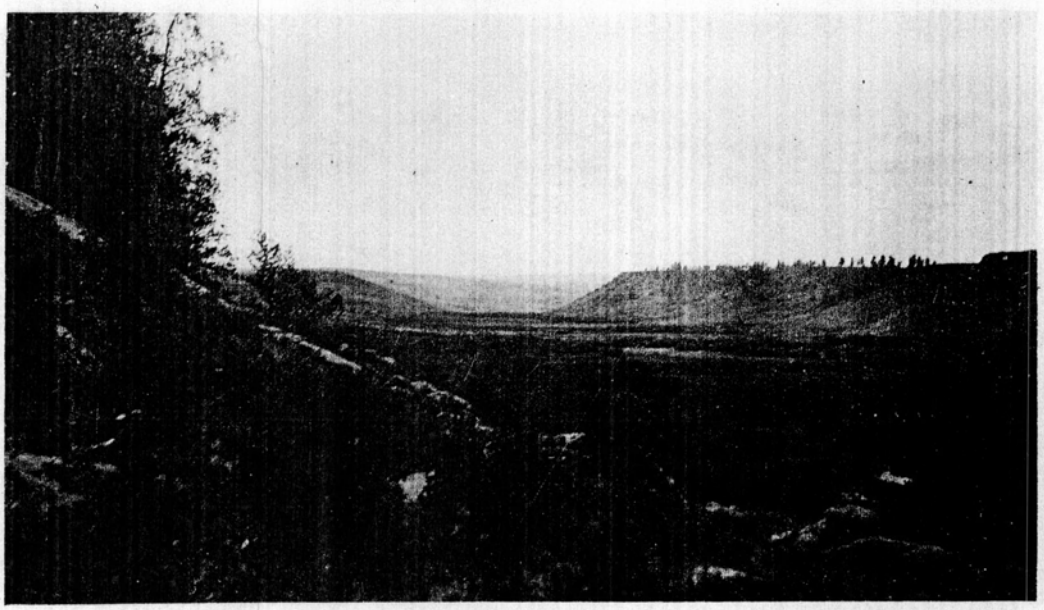
No. 58. Looking South towards U. S. Mountain, from Taos, showing some irrigated lands.



No. 59. Plaza Cordova on the Rio Quemado.



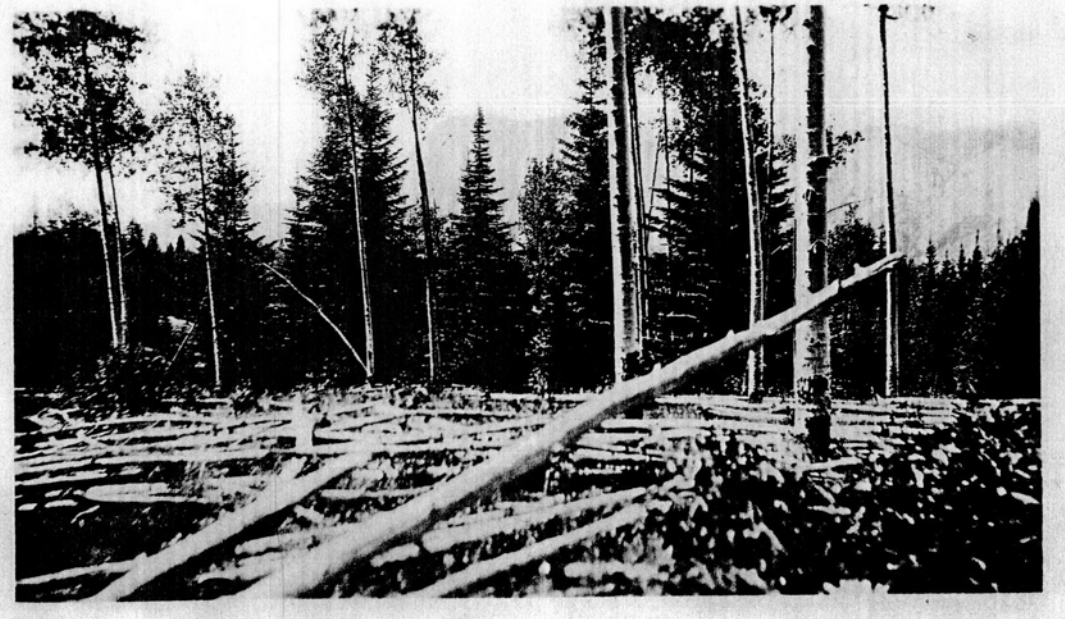
No. 60. The lower end of the San Luis Valley. In New Mexico.
Near Station Palmillo on D. & R. G.



No. 61. The Rio San Antonio. A possible reservoir site below the Forest Rangers' Station.

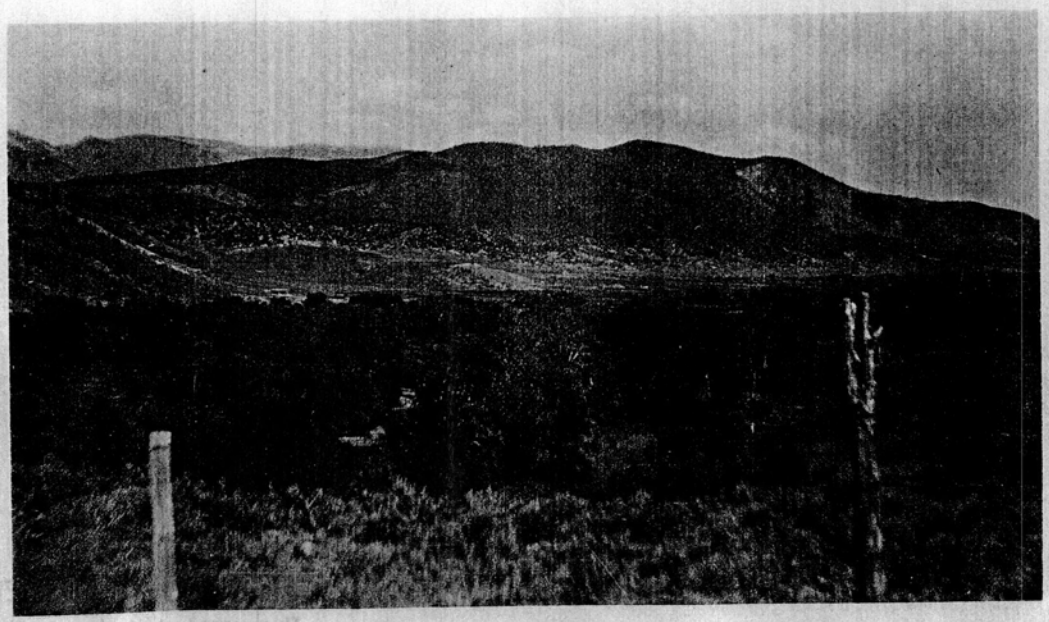
No. 62. Dam site on Rio San Antonio. San Antonio mountain in the distance. Feasibility doubtful.

No. 63. The Rio Grande from the State Bridge, Colorado. Sierra Blanca in the distance.

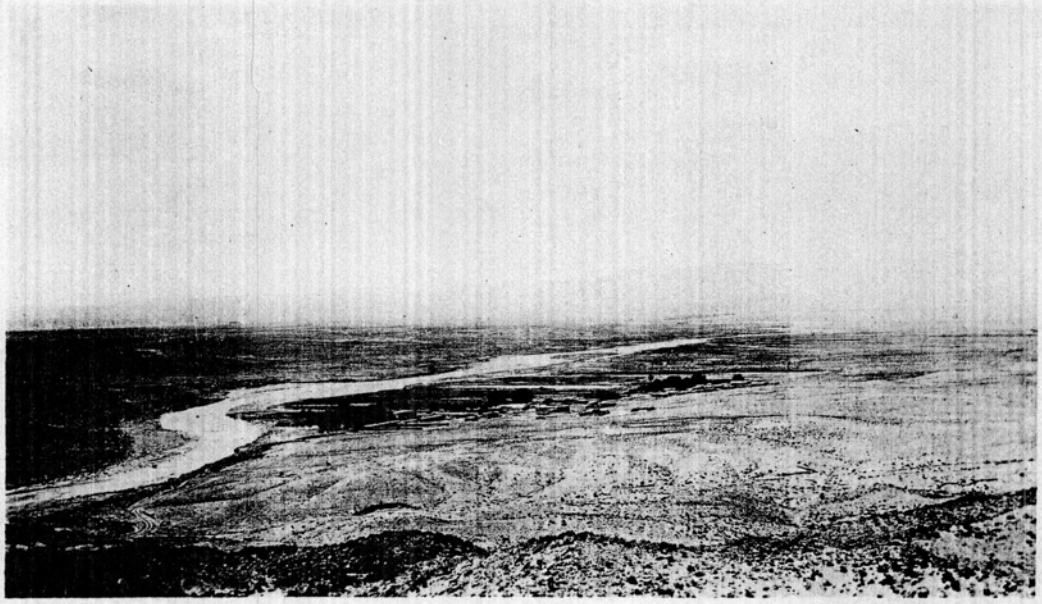


No. 64. The lower part of the Conejos mountains, taken in the drainage of the Rio Brazos.

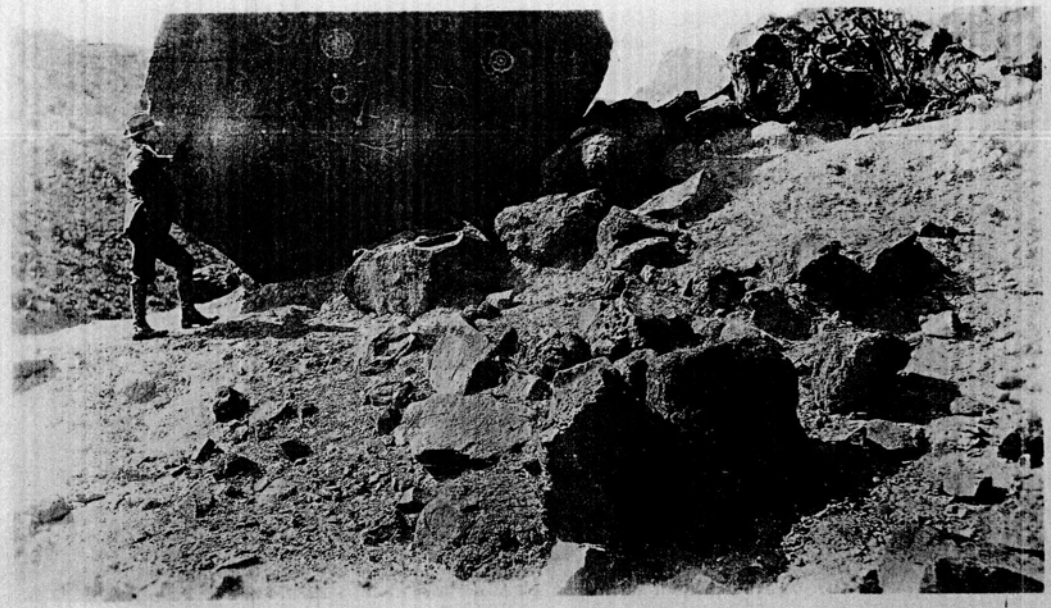
No. 65. Brazos Meadows at the head of the Rio Brazos. Altitude 9,300.



No. 66. The valley of Pina on Costilla Creek. The Costilla Estates Development Company contemplated putting in a reservoir which will flood most of this valley.



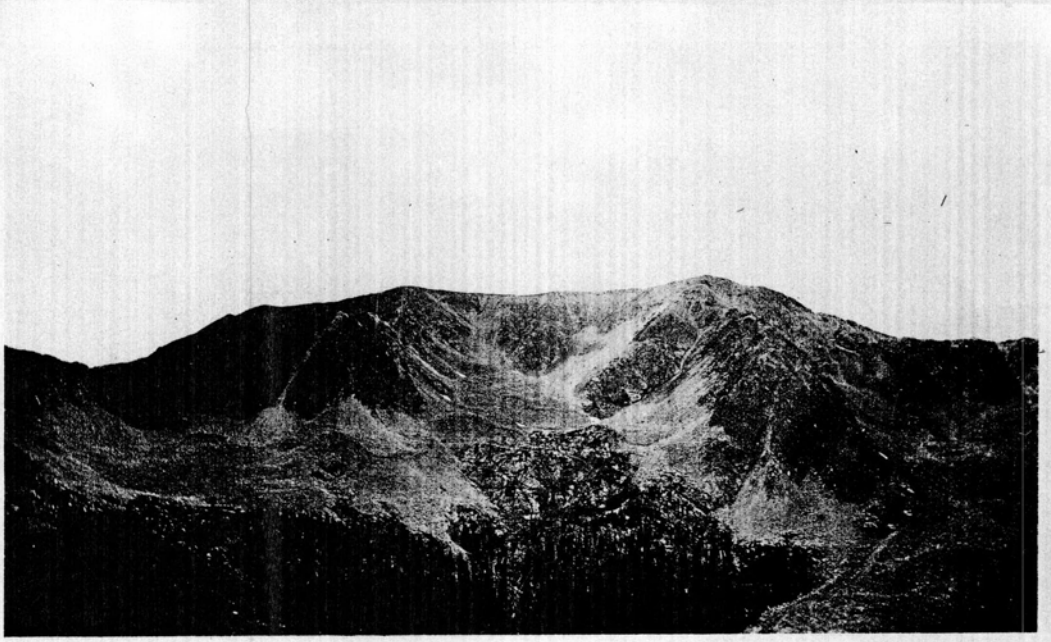
No. 67. The settlement of La Bajada on lower Santa Fe Creek. Large area of unirrigated land and the Jemez mountains also shown.



No. 68. Picture writing. Mouth of Embudo Canon. Rio Grande.

No. 69. Reservoir Site on Rio Vallecitos, near Plaza Ancones.

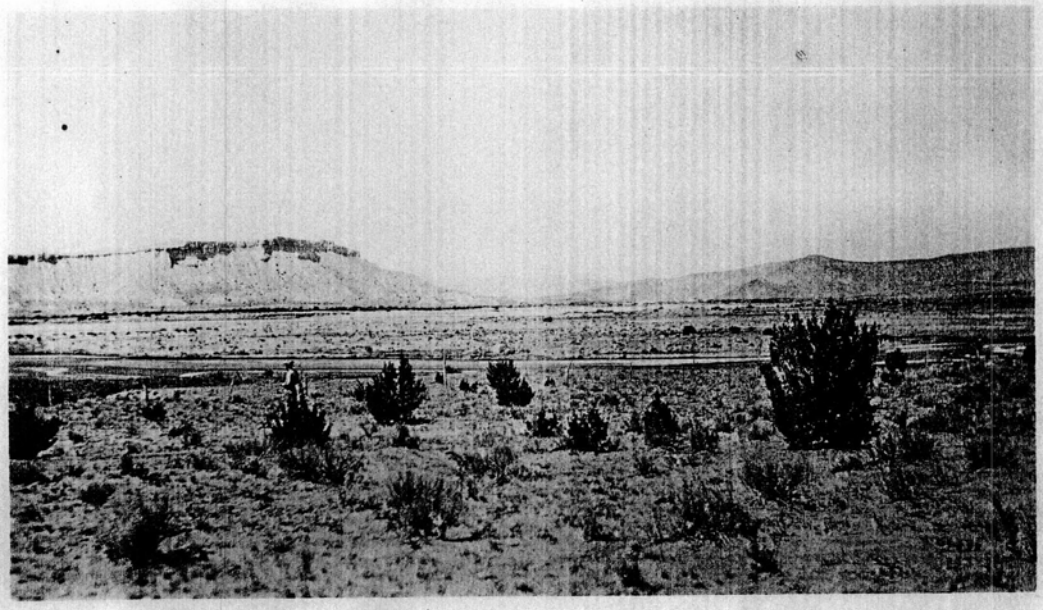
No. 70. Excellent Dam Site on Rio Vallecitos near Plaza Ancones.



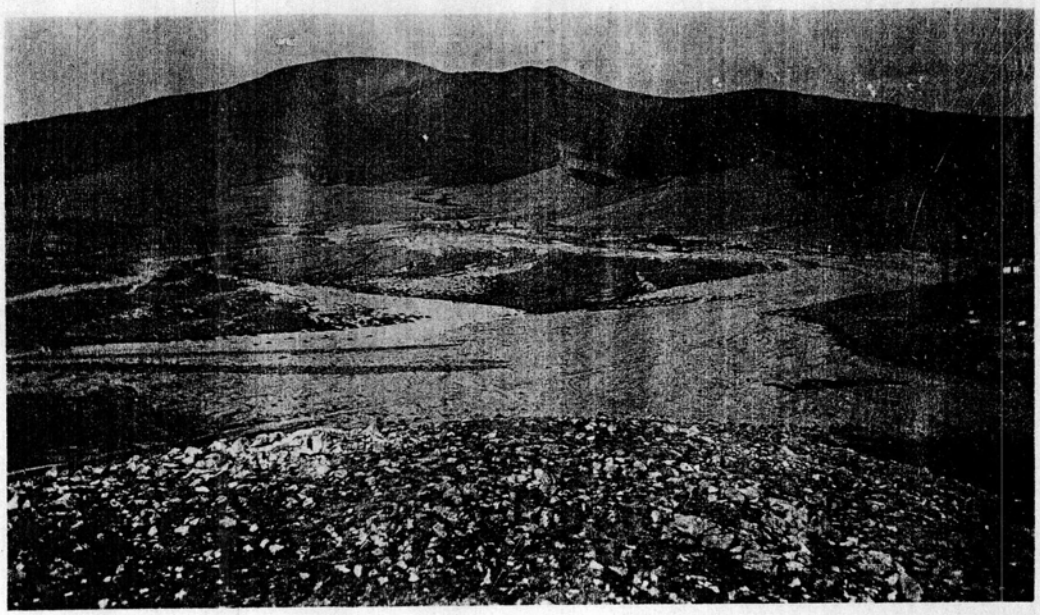
No. 71. Snow on July 24, 1910, in Arroyo Hondo Drainage.

No. 72. Arroyo Hondo and Red River are the only streams of continuous flow entering the Rio Grande from the East within New Mexico.

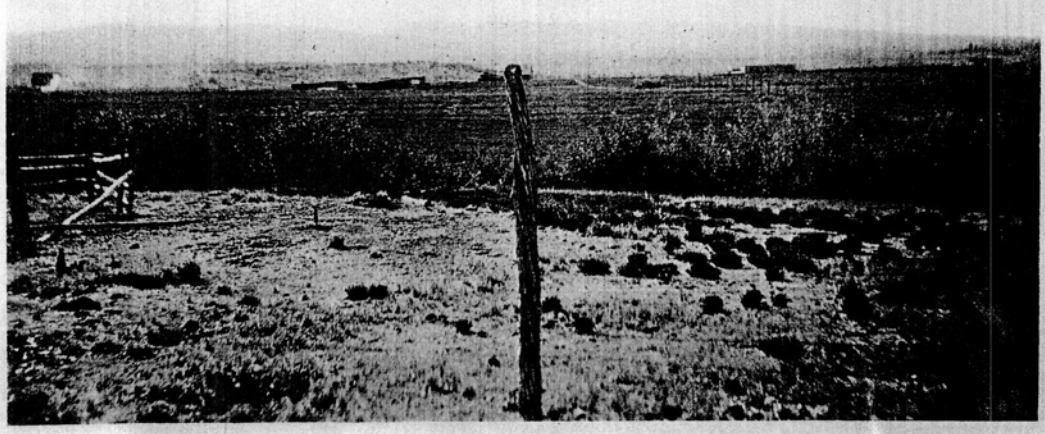
No. 73. A part of the Valleys of Red River and Cabresto Creek, near Questa, N. Mexico.



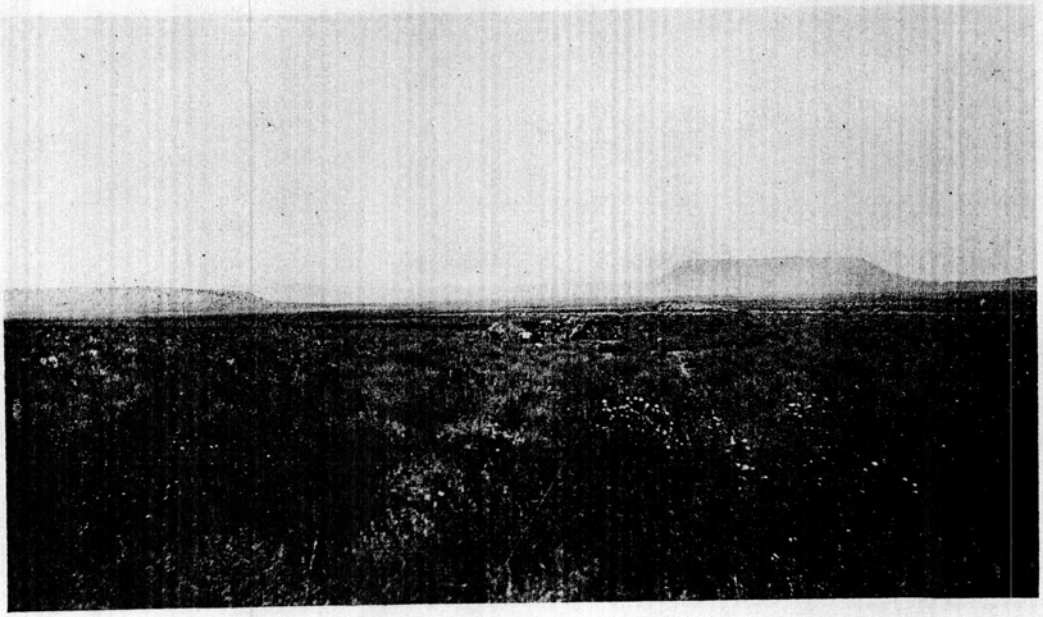
No. 74. Junction of the Arroyo Salado and the Rio Jemez. A small acreage of land could be irrigated if water was stored in the Jemez mountains.



No. 75. Placer mining results at Elizabethtown. Baldy Peak near the center.



No. 76. Irrigated lands near La Puente Rio Chama.



No. 77. Looking up Bluewater Valley from near Bluewater P.O.

Hydrograph of the Rio Grande.

Stations at Buckman and San Marcial

	Mean 1895-1905			Mean-All Data.		
	Buckman	San Marcial		Buckman	San Marcial	
Jan.	30185	30370		30875	36150	
Feb.	33280	30510		33115	38485	
Mar.	66550	53400		77670	65780	
Apr.	173590	133150		184540	141040	
May.	299500	272460		310070	291880	
Jun.	232555	217150		224010	230430	
July.	65270	54250		63360	72540	
Aug.	40275	35190		42695	54475	
Sep.	44755	30740		54395	44215	
Oct.	60080	81560		61935	67700	
Nov.	38630	34190		37765	38460	
Dec.	32725	38330		32980	41590	
	1,117,395	1016,900	-100,495	1,153410	1,122,775	-30,635

Hydrograph

Simultaneous Observrations

1899-1903

Jan.	27550	25400	27990	28210
Feb.	29475	25600	31870	28440
Mar.	23525	39080	57690	30360
Apr.	18675	46180	116240	47080
May	86250	104340	225720	153390
June	158050	168880	213140	187690
July	16640	32560	50660	29510
Aug.	2460	17780	28780	20930
Sept.	3560	17800	36260	25580
Oct.	3740	18300	23680	3360
Nov.	8700	22400	28280	11470
Dec.	19200	22260	27700	18600
	379,825	540,580	868000	584620
		+160755	+327420	-283380

Hydrograph

Embudo - Buckman

All Data

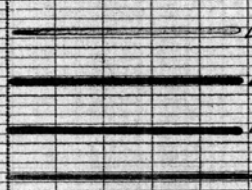
Jan.	27980	30180	
Feb.	27690	33250	
Mar.	44090	66540	
Apr.	92300	169940	
May	195570	299530	——— Embudo.
June	185380	232550	——— Buckman.
July	58200	65260	
Aug	24190	40360	
Sep	20300	44760	
Oct	32600	60020	
Nov	28190	38640	
Dec	27160	32720	
	763560	1,113,750	+350190

1895 - 1903

Jan.	27130	29680	
Feb.	25540	32230	
Mar.	43200	60390	
Apr.	47620	180350	
May	150110	276170	
June	143800	218710	
July.	55460	72110	
Aug.	24330	34590	
Sept.	20050	35550	
Oct.	29290	40180	
Nov	29210	36120	
Dec.	24770	31730	
	620510	1,047,810	+427300

Hydrograph.

All Data.



	12 Years.	15 Years.	13 Years.	16 Years.
Jan.	32020	27980	30875	36150
Feb	35370	27690	33115	38485
Mar	34870	44000	77670	65780
Apr.	47250	92300	184540	141040
May	143250	195570	310070	291880
June	184740	185380	224010	230430
July	48610	58200	63360	72540
Aug	20030	24190	42695	54445
Sept	24410	20300	54395	44275
Oct.	25970	32600	61935	61700
Nov.	18100	28190	37165	38460
Dec.	25550	27160	32980	41590
	640170	763560	1,153,410	1,122,775
		+123,390	+389850	-30,635