

IRRIGA TION

THE GREAT WATER
:: SYSTEM OF THE ::
SALT RIVER VALLEY

*THE HISTORY OF
WATERWAYS IN MARICOPA
:: :: :: :: COUNTY :: :: :: ::*



ISSUED BY J. O. DUNBAR, IMMIGRATION
COMMISSIONER MARICOPA COUNTY,
ARIZONA, MARCH, 1904

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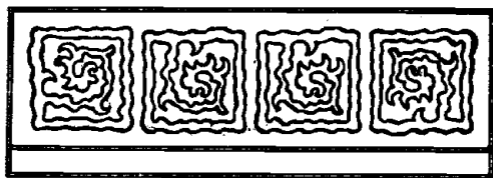
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ISSUED BY J. O. DUNBAR, IMMI-
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Press of The H. H. McNei Co., Phoenix, Ariz.

ILLUSTRATED pamphlets of the
resources of Maricopa County
sent on application.

J. O. DUNBAR,
Immigration Commissioner
Phoenix, Arizona



IRRIGATION

IRRIGATION is the artificial application of water to the soil, and has been practiced by man since the dawn of history. The mighty empires of antiquity, which flourished in Asia and Africa, depended almost entirely upon irrigation for the production of crops. The now desolate Syria, Mesopotamia, Asia Minor and Persia were transformed into the garden spots of the ancient world by elaborate systems of irrigation, and it is estimated that more than two-thirds of the human family have pursued this mode of tilling the soil, from time immemorial, and must continue to do so while present climatic conditions remain.

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Tillage of the soil by means of irrigation possesses many advantages over dependence on the natural rainfall, as water may be applied when needed, and withheld at will. Lands under irrigation yield more abundantly, and produce more uniform crops than those which must look to an uncertain rainfall for moisture, and hence are much sought after, and command the highest prices paid for farming land.

There are abundant evidences that southern Arizona was once densely populated by prehistoric races, but whence they came and whither they went are unsolved mysteries; but the ruins of great cities and massive temples bear mute testimony to their civilization, skill and industry, while the ancient canals which they built, and which may still be traced from the mountain water courses for miles and miles out across the deserts in every direction, reveal to us that they were expert irrigators, and were dependent upon irrigation for sustenance

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in those hidden ages as we are today.

The prehistoric irrigation systems of Arizona were probably among the most ancient in the world, and the waters of her mountain streams have been utilized in the valleys below by each succeeding race inhabiting the country, down to the present time.

The Pima Indians are the earliest irrigators in the Territory of whom we have any authentic record. When Coronado explored this region almost four centuries ago, these people were found farming the lands of the Gila and Salt River Valleys by the aid of primitive irrigating ditches, just as their descendants are doing today.

In other sections irrigation is merely a help to the farmer in the production of his crops, and only serves to increase his harvest; but in southern Arizona it is an absolute necessity, as nothing whatever can be raised without it. Hence those engaged in business in the cities, and in the professions, are equally interested in irrigation with the farmer. There could be

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no settlement in the Salt River Valley if it were not for the canals, and consequently no towns, save those supported by the mines in distant hills.

The canal is the dividing line between the barren desert waste on the one hand, and the luxuriance of a semi-tropic garden on the other. No more bewildering transformation scene of the magicians' art can be imagined than that produced on an Arizona desert by the application of a little water.

Modern irrigation in the Salt River Valley began about the year 1866, when a few hardy pioneers settled along the north banks of Salt River, near the present site of Phoenix, and dug the Griffin and the Swilling ditches, the latter having its head about six miles east of Phoenix, and near the present dam of the Maricopa and Salt River Valley canals. These first canals were community property, each farmer owning one or more shares and working out his assessments for maintenance. But it was

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found that a few failed to perform their proportion of the work, which increased the burdens of the others, and so it was decided a few years later to incorporate, and thus put every stockholder on even footing. The Swilling ditch had been enlarged and extended, one branch running to the north-west and watering the land north of Phoenix, while the other flowed due west through the town and covered the lands toward the river.

The Maricopa Canal Co. and the Salt River Valley Canal Co. were incorporated in 1875 by the stockholders in the Swilling Canal, who transferred their appropriations in the latter ditch to the new companies and received in lieu thereof stock in these companies. The Maricopa Company succeeded to the north branch of the Swilling ditch, and the Salt River Valley Company to the south branch. These canals were enlarged and extended until they reached very nearly to the Agua Fria River. They have continued to maintain a joint dam

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and head as a matter of economy.

A few years later the Grand Canal was built, heading some miles above the other dam, and reclaiming a strip of the desert lying above the Maricopa Canal. In 1886, the Arizona Canal was completed. It has its head in Salt River, twenty-eight miles above Phoenix, at the eastern base of the McDowell Butte, and flows westerly and north-westerly along the base of the mountains forming the northern borders of the valley, for a distance of forty-five miles, to the Agua Fria River, which is the western boundary of the irrigated valley.

Shortly after the completion of the Arizona Canal, the Arizona Improvement Company was organized by eastern and western capitalists, and a controlling interest bought in the four canals, viz.: the Arizona, Grand, Maricopa, and Salt River Valley, and the general management of the entire system was brought under one head, although each corporation remained independent and distinct. The Arizona

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Improvement Company was succeeded in 1899 by the Arizona Water Company, which now dominates the four canals watering the north side, Wm. B. Cleary being the general manager of the system.

This consolidation of conflicting interests has proved a great benefit to the entire valley, as it permitted a more economical distribution of the water, and during the severe drought of the past four years prevented any section of the valley being wholly deprived of water.

The valley on the north side spreads to the west like an open fan, the terminus of the Arizona Canal being almost twenty miles north of Salt River, and it contains about 150,000 acres of irrigable land. The four canals named traverse it in parallel lines on successive levels, rendering the irrigation of the land easy and economical.

The water is delivered from the main canals to the lands to be served through lateral ditches flowing south and west along the section lines, the

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declivity being toward the river, and just sufficient for thorough irrigation. It is doubtful if another irrigated valley of equal extent can be found in the world with so smooth and uniform a surface, and yet possessing a general slope that furnishes perfect drainage and reduces to a minimum the cost of distributing and applying the water to the land. On but a few sections in the entire valley has it been found necessary to employ a leveler. All that is required are low borders or ridges thrown up thirty to fifty feet apart across the field, and the water turned on at the upper side. The irrigator may then sit in the shade and literally irrigate by the clock. This method of flooding the fields is employed for grain and alfalfa, but in the vineyard and orchard trenches are usually dug between the rows and the water permitted to flow through until the soil is thoroughly saturated.

The method of irrigating orchards that has proven most satisfactory, is by a series of deep and wide trenches

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between the rows of trees with gates at each end, so arranged as to impound the water when the ditches are filled, and hold it until it has been taken up by the soil. The surface of the ground is covered with a growth of native grasses, or by a light layer of straw, which protects the earth from the heat of the sun, and retains the moisture which rises from the sub-irrigation, and thus prevents the soil from baking. No cultivation is necessary where this system is practiced, and the results obtained are most satisfactory, both in the growth of the trees and the yield of the fruit.

In many orange groves sour clover is sown broadcast, and permitted to grow and mature on the ground, and the dead grass remains year after year as a protection from the sun, and a fertilizer to the soil. Where this method is pursued the ground is flooded when irrigated, the water flowing under the carpet of grass.

The present system of distributing and applying the water to the land is

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primitive and not economical. Water is bought by the year by the miner's inch, and must be taken by the farmer in regular turn, whether needed or not, as a shortage may occur at any time, when but little water for irrigation can be secured. Hence during the rainy season water is frequently poured on the land to its detriment, and much water is permitted to waste in the public highways.

The Canal Companies on the north side have in contemplation a radical change in the method of distribution of the water, which will probably be put in operation when the storage reservoir is completed, and the supply of water rendered more uniform. Their water right deeds all contain a provision for the delivering of water by the hour for a given sum per cubic foot flow per second. By this system the farmer will pay for what he gets, and only as he needs it, and naturally will practice the strictest economy. It is conservatively estimated that water will perform fully twenty-five per cent

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more service under this system than under the present method. That the normal supply of water is made to perform the service that is required of it under present methods, is due to the intelligent and systematic management of the canal systems, and is highly complimentary to those in charge of this industry. When it is remembered that the aggregate length of the four canals is one hundred miles, and that there are more than four hundred miles of lateral ditches used in the distribution of the water each week, some idea of the magnitude of the undertaking may be gained.

Under all the canals of the Salt River Valley, water is sold and delivered only to those owning or possessing water rights or shares of capital stock in the particular canal serving the lands sought to be irrigated.

South Side Canals

LYING along the south bank of Salt River, and extending some twenty-five miles above Phoenix, is a

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valley somewhat less in extent than that described on the north side, and possessing many of the same characteristics. Five separate canal systems supply the lands with water, the method of distribution being practically the same as that already described.

The canals on the south side, in order down stream, are: the Highland, Consolidated (including the Mesa), Utah, Tempe, and San Francisco. Of these the Tempe is the oldest, having been first operated in 1871. The Utah is next in priority, followed by the Mesa. These are co-operative companies of water users. The Highland is incorporated; the San Francisco is a private ditch owned by the Bartlett-Heard Company. The Consolidated Canal Company was organized for the purpose of enlarging and extending the Mesa Canal System, and to supply lands lying to the east and south of Mesa City. That this work might be successfully and harmoniously carried on, the Mesa Canal

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was leased, and the entire Consolidated System is managed by the new company through Dr. A. J. Chandler. These canal systems supply water to the country surrounding the towns of Tempe, Mesa and Lehi.

Experience has demonstrated the advantages of rotation of water in the seasons of scarcity, and all the canals of the valley have adopted this system.

During the summer time, when the flow of the river is greatly reduced, instead of attempting to deliver to each farmer the few inches of water that he is entitled to continuously, a good irrigating head is run to him for a shorter time at regular intervals. This is much more satisfactory to the farmer, and effects a great saving in water, when every drop is precious.

Litigation

THERE have been many disputes in the valley over the appropriations and distribution of water, as

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in all other irrigating countries, resulting in much litigation in the past. The rights of the various canals were determined by Judge Kibbey in 1890, and a water commissioner appointed to distribute the water daily to the various canal systems. This method is still in vogue, and has been satisfactory to the canal companies, and beneficial to the community, as justice is meted out to all alike, and in extreme low water each canal gets its proportion. It has prevented much vexatious and expensive litigation also.

The Tonto Reservoir

THE storage reservoir which the United States government is now constructing on Salt River, sixty miles east of Phoenix, will be one of the largest of its kind in the world. While the area covered by the reservoir is more than 14,000 acres, and its storage capacity nearly, if not quite,

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1,500,000 acre feet, the total cost will be only about \$3,000,000. Compared with the great Croton Reservoir for New York City, it will have seven times the capacity and will cost but one-third as much.

The dam is across the river where it passes through a deep, narrow gorge or box cañon in the mountains, the walls being of solid rock, and but 200 feet apart at the bed of the river. The foundations will be laid on the bed-rock, which is only 30 feet below the river bed in the deepest place, and the dam will rise 270 feet above this lowest point. It will be 650 feet long at the level of the spill-ways, the thickness at the base being 180 feet and at the crest 20 feet, and it will have a slight curvature up-stream, insuring strength and stability.

It will be built of solid masonry, laid in cement, the stone being quarried from the mountain sides in excavating the spill-ways around the ends of the dam. The cement will be manufactured on the ground from limestone

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and clay, found conveniently near, in inexhaustible quantities, and from which the highest grade of Portland cement can be produced at less than \$3.00 per barrel. A saw-mill has been built some 20 miles above the damsite in the Sierra Ancha Mountains, and is now cutting the lumber to be used in the construction work.

The spill-ways will each be 125 feet wide and 20 deep, and are designed to carry the surplus water away during flood seasons, when the reservoir is full.

Water will be discharged from the reservoir as required through openings near the base of the dam, also through a tunnel on the north side of the cañon, the gates of which will be operated by hydraulic pressure from the crest of the dam. These openings will also be used in times of floods to discharge the surplus water, and for flushing the silt from the reservoir.

The damsite is but a short distance below the confluence of Tonto Creek and Salt River, and the reservoir will

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occupy the valleys of these two streams for a distance of ten and sixteen miles respectively. The widest part will be about two miles, and the depth 225 feet. The drainage basin of the reservoir is approximately 6,000 square miles. Eighteen miles above the damsite a diversion dam will be constructed, which will divert the water from the river bed to the Power Canal. This will follow the south side of the valley above the reservoir level, and the water will be delivered to the power house near the river bed, and immediately below the dam. This canal will have a capacity of 200 cubic feet flow per second, which, with a fall of 250 feet to the turbines, will develop 4,000 horse power.

This power will be used in the construction of the dam, and later will be utilized for pumping water to augment the flow of the river.

The district to be served by this great reservoir is that section of Arizona known as the Salt River Val-

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ley, in Maricopa County, and contains about 250,000 acres of irrigable land.

It begins 28 miles above Phoenix, at the Arizona Canal dam, and is bounded on the north by the Arizona Canal, on the west by the Agua Fria River, on the south by the Pima and Maricopa Indian Reservation, and on the east by the Highland Canal. Within this district it is optional with the land owners whether they will buy reservoir rights or not, and a limited acreage has refused to do so, preferring to depend on the normal flow of the river as heretofore. Somewhat more than 200,000 acres have been signed up at the beginning of 1904. The determining of the maximum amount to be finally included in the reservoir district is left to the Secretary of the Interior.

From the figures given it will be seen that the cost of the reservoir will be approximately \$15.00 per acre, which is to be repaid to the Government in ten annual installments, without interest, beginning with the com-

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pletion of the reservoir which will require three or four years for construction.

The land owners within the district have organized and incorporated The Salt River Valley Water Users' Association, which the Secretary of the Interior has recognized as the representative of the individual land owners, and through which negotiations will be conducted and all assessments collected by the government.

One share of the capital stock of this association is issued to subscribers for each acre of land owned within the district, and such subscription initiates a reservoir right, which is completed by the payment to the government of all assessments levied. Stockholders will be limited to 160 shares.

An acre foot of water means water sufficient to cover an acre of land one foot deep. Lands in the Salt River Valley require about four acre feet per year for the production of crops, al-

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though the amount varies widely with the quality of the soil and the character of the crop. On this basis the reservoir will hold sufficient water to irrigate the present cultivated acreage for three years, or the total acreage signed up for almost two years, without regard to the normal flow of the river or to the water received from the Verde River, which will supplement the stored waters.

In Conclusion

The nine canals mentioned as watering the lands of this famed Salt River Valley, comprise one of the largest and most successful irrigation systems in the world. It is doubtful if the world can produce another of equal extent where so many favorable conditions are combined. In fact there has been but one drawback, and that will soon be removed by the construction of the Tonto Storage Reservoir. At present the flood waters of the

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Salt River flow down to the sea and are lost. For two or three months each summer the normal flow of the river is not sufficient to supply water to all the lands needing it, and summer crops often fail in consequence. Now that the flood waters are to be impounded, and reserved until needed in the valleys below, conditions will be as nearly ideal in the Salt River Valley as man may ever expect to enjoy on earth. The water shed supplying our canals is ample to produce all the water necessary during any ordinary year, being about 13,000 square miles, much of the territory embraced in it being elevated plateaus and mountain ranges where abundant snow falls. The waters which rush down the mountain sides to the plains below carry large quantities of fertilizing material, which continually enriches the soil and renders the use of other fertilizers unnecessary, except in rare cases or for some special crops.

A special committee of the United States Senate reported in 1890 of the

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soil of this valley, that "An analysis shows its fertile qualities to be superior to that of the Nile earth."

And Orange Judd, after a visit to the Salt River Valley, said editorially in the *Prairie Farmer*: "We have seen thousands of acres of growing crops that rival in luxuriance those found in the famed Valley of the Nile, which derives its vivifying liquid, bearing fertilizing elements, from the far-off lands of upper Egypt. This Valley of the Salt River derives its luxuriousness from the mountain ranges of interior Arizona."

