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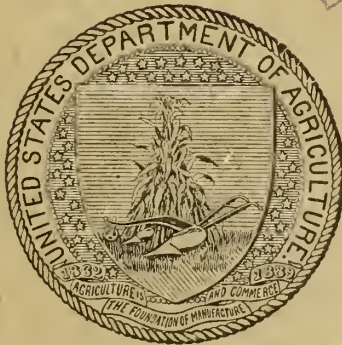
OFFICE OF EXPERIMENT STATIONS—BULLETIN NO. 140.

A. C. TRUE, Director.

ACQUIREMENT OF WATER RIGHTS IN THE
ARKANSAS VALLEY IN COLORADO.

BY

J. S. GREENE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

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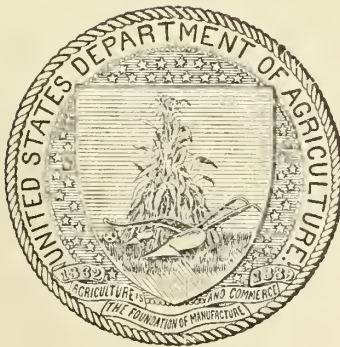
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OFFICE OF EXPERIMENT STATIONS.

A. C. TRUE, Ph. D., *Director.*

E. W. ALLEN, Ph. D., *Assistant Director.*

IRRIGATION INVESTIGATIONS.

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LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,

Washington, D. C., October 5, 1903.

SIR: I have the honor to transmit herewith a report on the acquirement of water rights in the Arkansas Valley in Colorado, prepared by Hon. J. S. Greene under the direction of Prof. Elwood Mead, chief of irrigation investigations of this Office. Its publication as a bulletin of this Office is recommended.

Respectfully,

A. C. TRUE,
Director.

HON. JAMES WILSON,
Secretary of Agriculture.

LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,

OFFICE OF EXPERIMENT STATIONS,

Washington, D. C., October 5, 1903.

SIR: I have the honor to submit herewith a report prepared by Hon. J. S. Greene, ex-State engineer of Colorado, on the acquirement of water rights in the Arkansas Valley in Colorado. It gives the results of Mr. Greene's investigations into the different kinds of water rights recognized in that region and the manner in which they affect the well-being of irrigators. It does not, however, deal wholly with these rights, but describes the physical conditions which affect their value. The subject is presented in such a way as to be of aid to intending settlers in showing them some features of irrigation which should be looked into, and where needed information can be found. While these rights are considered primarily from the standpoint of the farmer, the interests of investors in irrigation works and of the public in the best use of the water supply are also kept in mind.

The importance of the discussion of water contracts arises from the fact that the rights to this river have not been obtained from the public by the farmers directly, but from some company which has built a canal and thus secured title to a part of the stream's flow. The rights of these companies are defined by law, and the rights which they have sold to farmers are, in a measure, determined by law, but to a much larger extent by the conditions imposed in the contracts with the companies or prescribed by the regulations of their by-laws. The water laws of Colorado make water personal property, or give to appropriators such large control over the volume appropriated as to amount in effect to private ownership. This gives to companies holding these rights large latitude in fixing the conditions under which water shall be delivered to irrigators, and makes the influence of these contracts on the well-being of users a much larger factor than has generally been recognized.

Mr. Greene brings to the discussion of these questions a large experience and mature judgment. He has been for many years a prominent irrigation engineer of that State, he has administered the water laws of the State as its State engineer, and is a landowner and irrigator under some of the canals dealt with in this report. He has, therefore, had to deal personally with this question from the standpoints of the investor, the public, and the individual irrigator.

Respectfully,

ELWOOD MEAD, *Chief.*

A. C. TRUE, *Director.*

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ACQUIREMENT OF WATER RIGHTS IN THE ARKANSAS VALLEY IN COLORADO.

INTRODUCTION.

There are differences of opinion as to the comparative importance of the several kinds of irrigation investigation work now being prosecuted. It is generally observable that each investigator lays stress upon the importance of the field he studies. To this general rule the writer is no exception, for he finds himself unwilling to admit that any branch of irrigation is of more importance in connection with the progress and efficiency of an irrigation people, or more worthy of investigation or discussion, than the branch which concerns rights in water, and especially those complex rights emanating from ditch companies known as contract rights. This bulletin is a study of such rights in the Arkansas drainage basin in Colorado. There are nearly twenty million acres in this basin in Colorado. Here and there in the foothills and at higher levels are small tracts upon which can be grown potatoes and grasses and the hardier grains without irrigation, but practically all the plains district, constituting more than 70 per cent of the whole drainage area, requires the artificial application of water in order that the ordinary farm crops may be profitably grown. The available water supply of the valley is not sufficient for the irrigation of its fertile plains. It is only too apparent that under the most favorable conditions of storage and distribution to which we are justified in looking forward, this water supply will never be sufficient for the proper irrigation of even 10 per cent of the valley's area. The recognition of the fact that with the development of the valley the demand for water for irrigation must in time exceed the supply long ago gave to water a speculative value. While there is more than sufficient water in the Arkansas River and most of its tributaries during flood periods, and sufficient water during the ordinary high-water flow of the late spring and early summer to meet the present demands of the lands now under cultivation, there is not enough at other seasons. This condition has given to water a large present value. The fact that the lands in the Arkansas Valley that are capable of being irrigated by means of ditches already constructed are not as yet all cultivated, coupled with the fact that such lands are in process of rapid settlement

and cultivation, accounts in part for the constantly increasing value of water. The growth of population and of industries in the mining districts of Leadville, Cripple Creek, and Victor, in the oil districts of Florence, the coal districts of Canyon and Trinidad, the resorts of Colorado Springs and Manitou, the smelting and steel-producing city of Pueblo, around the sugar factories of Rockyford and Sugar City, and in other less important localities, is further increasing the demand for water for domestic use, and, by stimulating the demand for local and valley-grown agricultural products which require water, is increasing the demands for water for irrigation. The result of the ever-increasing demand for water has been to give to water and water rights a surprising value, so that the stranger within the gates of this typical semihumid valley of western America is amazed at the values placed by the community upon its water supply, water privileges, rights, and franchises—values which are suggestive of a great commerce in water.

The rainfall of the Arkansas Valley in Colorado, while varying from year to year, and while slightly greater in some portions of the district than in others, has a mean annual depth of less than 15 inches, while the depth of water necessary for the production of crops is twice, and, under adverse conditions, even three or more times this mean annual precipitation. The water required in excess of precipitation, while sometimes secured from ground waters, as by artesian wells, is generally taken from surface streams, or, as they are usually called, natural streams, by means of ditches or canals.

Under such conditions land values, while affected by centers of population, lines of transportation, etc., as in other localities, are, in large measure, due to the readiness with which the lands may be irrigated, or to the fact that a water supply can be obtained. Commercial transactions in farming lands are, with comparatively few exceptions, accompanied by commercial transactions relating to water, while commercial transactions relating to water are almost invariably connected with transactions affecting ditches and reservoirs, and, except in rare cases, it is not the water itself, or the water alone, which is sold or is said to be sold, but certain rights and privileges in water are sold and transferred, together with certain other rights and privileges connected with the ditches or canals which are used to divert and carry such water, or the reservoirs in which such water is stored. While in the aggregate there are many sales of lands lying under ditches which are not immediately accompanied by sales or transfers of water rights or ditch interests, yet the cases where settled and cultivated lands are sold without such sales being accompanied by ditch or water right transactions will be found to be comparatively rare. They are so few that practically there may be said to be a commercial transaction in water or water rights every time there is a sale of cultivated lands. These facts show the magnitude of the commerce in water.

These statements, however, give but an incomplete idea of the number and scope of the commercial transactions affecting water. Such transactions frequently occur unaccompanied by land sales. There is commerce in water when ditches or canals are constructed for the carriage or conveyance of water and when reservoirs are constructed for the storage of water, for it is by virtue of such construction and of expenditures therein involved that water rights are initiated. There is commerce in water when ditches or canals are cleaned, repaired, or operated, for expenditures in these ways are necessary for the ripening and maintaining of rights in water previously initiated by the construction of these works. There is commerce in water when ditches are used to carry or convey water for hire. There is commerce in water when ditch or reservoir companies are organized and their stock issued, when their stock is transferred or their bonds placed. Quite numerous, indeed, are the ditch and reservoir interests and water rights which are sold and transferred by and to persons owning no lands affected thereby.

The conditions in the Arkansas Valley are typical of those all through the West. Those who are to settle in that region in the future can not, as a rule, secure a water supply direct from the public. They must buy a right or an interest in a right from some irrigation company. This bulletin is designed primarily to be of service to those who contemplate such purchases.

Rights acquired in this way may be termed secondary rights, since they are not derived directly from the public under the laws governing the acquirement of water rights, but from companies or individuals who have acquired rights or at least initiated them in accordance with the laws, and who in turn dispose of interests in these rights to purchasers under contract. It will be seen that, although the value of a contract right depends to a degree upon the terms of the contract, it depends fully as much on the value of the primary right on which it is based. For this reason a discussion of contract rights must include a discussion of the rights on which they rest. Further, the value of primary rights is governed more by physical conditions than by the terms of the filings made in connection with their acquirement or the terms of the decrees confirming them, hence a discussion of physical conditions is also necessary to an understanding of contract rights. This preliminary discussion will be limited to pointing out the relation of physical conditions and the nature of primary rights to the value of contract rights and to disclosing the sources of information relating to these subjects.

In this connection it may be noted in passing that the relations and correspondences between the laws on the one hand and the comparative efficiency of a people on the other hand, apparent in every social organization, are nowhere more apparent than in irrigation com-

munities. So intimate, indeed, are these relations and correspondences, so responsive is the welfare or distress of the irrigator to the irrigation laws affecting him, and so marked is the influence of irrigators upon the characteristics of their communities that the term "irrigation civilization" has been coined to designate the resulting social conditions. An irrigation civilization, while always unique and distinguishable from other forms of civilization, is not always a satisfactory civilization. To a greater or less extent this is because the water laws affecting that civilization are unsatisfactory, and, going back a step farther, it may be that these irrigation laws are unsatisfactory because their importance in connection with the progress of a people is not fully realized by that people.

WATER RIGHTS IN COLORADO.

What we have termed primary water rights are acquired in Colorado by taking water from its natural source and applying it to some beneficial use. Such a diversion and use of water gives the right to continue the use thus made. There is, however, this limitation on the right to take water in this way: The rights of those who have previously acquired rights must be first supplied. Under this plan the person who first takes water from a stream takes what he needs up to the limit of this right; if there is more water in the stream the one who follows him in time has the next right to take what he is entitled to; if there is water still left in the stream the others having rights may take their supply in the order of the dates of acquiring their rights. If the volume of a stream were uniform from year to year, all rights up to the flow of the stream would be of equal value, and the only feature of importance regarding a right would be the volume of water to which a party was entitled. But the flow of a stream varies from day to day and year to year so that at times it will supply all the canals diverting water from it and at other times only a few of them. At such times the parties are supplied in the order of the dates of their rights, and the date of a right becomes of as much importance as the volume. The volume of a right is of importance to its holder because it determines how much water he may take, but it is of fully as much importance to the holders of later rights because it determines how much water must be in the stream to entitle them to water.

Under the laws of Colorado a river and its tributaries are considered as a whole as regards rights to water. That is, rights to take water from any part of a stream are subject to prior rights to take it from any other part of the stream or its tributaries, except as physical conditions, to be discussed later, make some rights independent of diversions from other parts of the river system.

With the loose method of acquiring rights which has just been described, rights are undefined as to either volume or date, and the determination of these matters has been left to the district courts of the State. For the purpose of adjudicating and enforcing water rights Colorado is divided into water divisions, each division comprising one or more river systems, and each of these divisions is subdivided into districts. Rights in each of these districts are defined independently of rights in the other districts, the court decrees usually giving the volume or quantity of each right and the date of its acquirement. From these district decrees a general table of rights for a whole stream is made up, using the volumes and dates as determined for the districts.

For the distribution of the water of streams in accordance with the decrees there is a superintendent for each water division, who has general charge of the whole stream and determines how much water must be allowed to flow from each district to the next. There is a commissioner for each district who distributes the water within his district, turning down to the one next below the volumes prescribed by the superintendent.

The value of any right therefore depends partly on the size of the canal, on the volume of prior rights, and on physical conditions. There are several sources to which one can turn for information relating to these subjects. The decrees of the district courts, together with the testimony and findings upon which they are based, can be found in the offices of the clerks of the district courts, while the decrees may be found also at the office of the State engineer in the capitol building in Denver, or at the office of the superintendent of irrigation of the Arkansas division, which, while not so fixed by law, is now located in the city of Pueblo. The decrees, however, disclose only facts relating to those ditches whose rights are defined therein. There are a few ditches concerning which such testimony has not been offered, though, as a rule, these unadjudicated ditches are small and unimportant. In some cases the owners of these unadjudicated ditches, as well as the owners of ditches whose rights have been judicially determined, have filed plats and statements relative to their ditches in the office of the State engineer and in the office of the county clerk and recorder of the county in which the heads of their ditches are situated, and in these offices these plats and statements may be examined. But as many of these plats and statements have been filed relative to proposed ditches and reservoirs which were not constructed, and as no filings were made for many works which were constructed, these filings do not afford a complete or accurate record of what has been done. In the office of the superintendent of irrigation are reports of the several water commissioners of his division relative to the ditches of their respective water districts. Copies of these reports are furnished to the State engineer, and such reports, or abstracts, or summaries thereof, are usually pub-

lished by the State engineers, and are to be found in their biennial reports to the governor of Colorado. These reports of the State engineers are usually accompanied by maps of the water districts, and these reports and maps, together with the decrees, are the best sources of information concerning the canals and reservoirs of the several water districts of the division.

Notwithstanding the existence of all these sources of information, there are many facts concerning ditches not obtainable, and, notwithstanding commendable efforts on the part of State engineers and superintendents of irrigation and some of the water commissioners, not a few official statements by water commissioners relative to the ditches and reservoirs of their several districts are misleading and unreliable. On the whole, the investigator of irrigation conditions in the Arkansas Valley can perhaps, in the preliminary stage of his investigations, at least, do no better than avail himself of the information obtainable in the office of Mr. E. R. Chew, superintendent of irrigation of the Arkansas division at Pueblo. Here he will find certified copies of the decrees relating to the ditches and reservoirs in the valley, as well as copies of the several reports above mentioned. The decrees proper are the final awards of the court, which are usually based upon the findings of a referee appointed by the court to take testimony concerning the irrigation works and the utilization of water by means thereof and report his findings to the court. The testimony upon which these findings are based is not disclosed in the decrees, but is usually and perhaps always preserved by the clerks of the district courts, and will be found to yield much valuable information not otherwise obtainable. Included in these findings are usually the names of the ditches, the names of the owners or claimants thereof, the streams from which the ditches divert water, the lengths of the ditches and their widths, depths, and grades, the areas of land irrigated by means of the several ditches, the rates at which water shall be allowed to flow therein, and the dates in accordance with which the rights to water acquired by means of these irrigation works are enjoyed. The decree itself, besides the findings, usually consists of what may be called "general orders" and "special orders." The former are in the nature of comprehensive rules affecting all the rights adjudicated in the decree, or explanatory of the decree, while each of the special orders refers to a single ditch or reservoir.

In some of the decrees stress is laid upon the dimensions and carrying capacities of the ditches and canals, and these capacities are made the basis for determining the volume to which the several canals are entitled, while in nearly all the decrees the volume of rights rests mainly upon the areas of land irrigated by means of the ditches, the courts being only so far concerned with the dimensions and grades of the ditches and canals as to know that they will carry the volumes of

water decreed. Although there is very considerable uniformity in the decrees, there is also no inconsiderable variety. So different, indeed, are the decrees that they can not be abstracted with any considerable degree of completeness under the same headings. One decree will disclose with great completeness and definiteness the areas actually irrigated under the several ditches; another will disclose the areas actually irrigated under some of the ditches and the acreage proposed to be irrigated under other ditches, and omit all reference to the areas actually irrigated or proposed to be irrigated under still other ditches. In some decrees extensions of ditches—mere laterals—are treated as independent ditches, while in other decrees they are not so treated. In some decrees not only the rate of diversion of water, but the time or times during which water may be diverted at the decreed rate are set forth with considerable exactness. In other decrees no mention of the time or times during which water may be diverted into the several canals of the district can be found. In almost all of the decrees the rate of diversion is set forth in cubic feet per second of time. In one decree relating to more than 100 ditches this rate of diversion is not computed or set forth with reference to a single ditch included within the district, and in other decrees this important and, indeed, essential factor of appropriation is set forth in some cases, but not in all.

Although the decrees relating to ditches in the several districts of the Arkansas Valley can not all be abstracted under the same headings, much can be learned concerning the ditches and canals in these water districts by studying the decrees. The statistics relative to ditches found in the decrees frequently conflict with the statistics found in the reports of the water commissioners above referred to. In such cases of conflict it may be difficult to determine what weight to give to the decrees and what weight to give to the reports. It will be observed that the findings upon which the decrees are based rest upon the testimony of the ditch owners, and although it may be remarked with much apparent reason that these owners of ditches are better qualified than others to disclose the facts relative to their ditches, yet it has been frequently claimed that the reverse is true, and that a conclusion resting upon the testimony of the owners of ditches is less apt to be correct than is a conclusion resting upon the testimony of others. Under these circumstances the investigator of irrigation statistics might turn from the findings of the referee and address himself with confidence to the unbiased reports of the several water commissioners of the Arkansas division, were it not for the fact that the majority of such reports are known to be absolutely unreliable, differing not only from the decrees and from general knowledge, but presenting irreconcilable contradictions, such as making the sum of the areas of land planted in crops and irrigated by means of the ditches of a district exceed by some thousands of acres the total area of land which it was at the same time

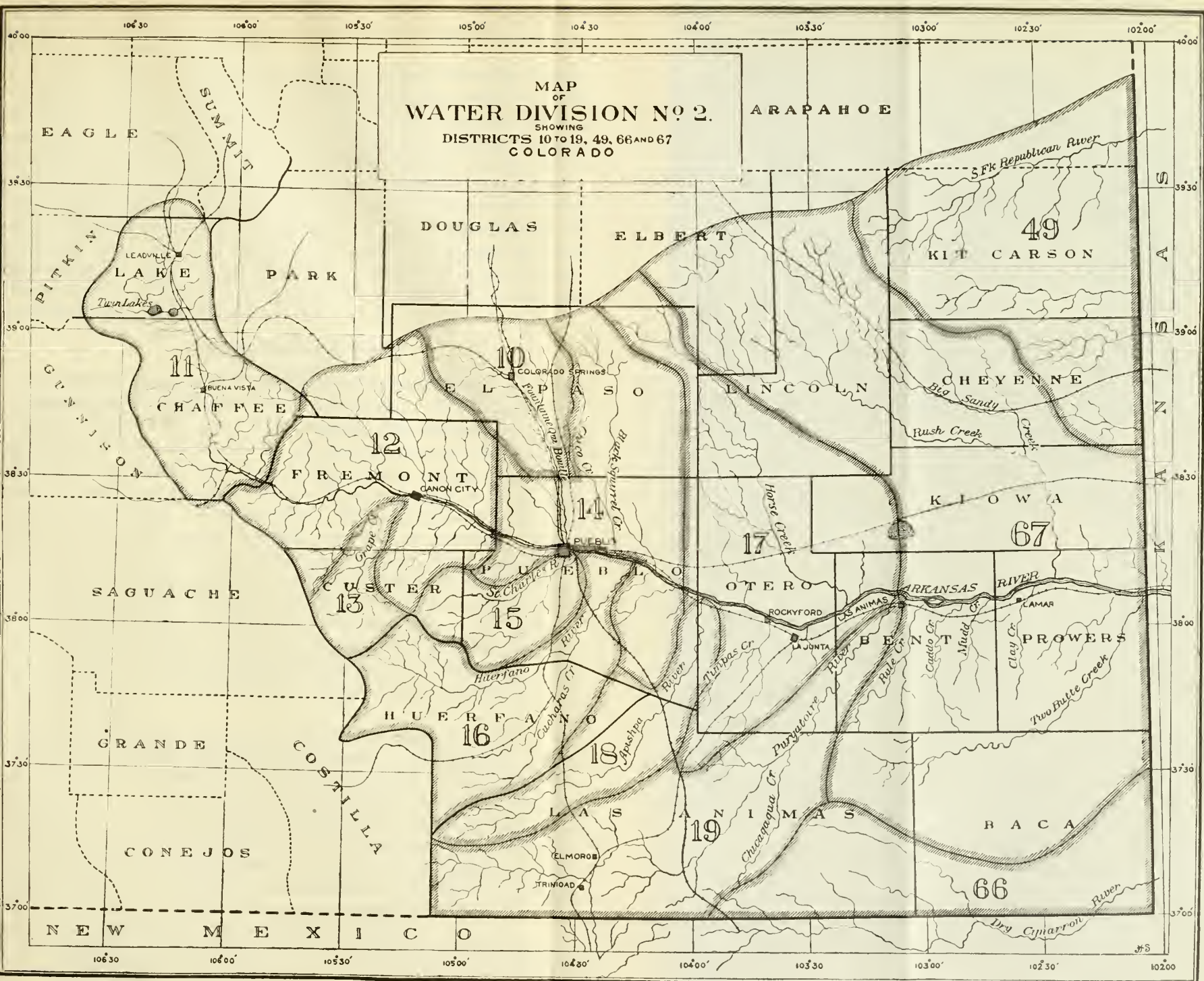
reported as possible to irrigate in such district by means of such irrigation works. Notwithstanding these contradictions in reports and differences between decrees and reports, there is a vast collection of reasonably reliable official information to be had concerning the ditches, canals, and reservoirs of the Arkansas Valley and the lands irrigated by means thereof. Many of the decrees have been prepared with the utmost care, while a number of water commissioners, recognizing the advisability of collecting irrigation data, have been diligent and conscientious in gathering and tabulating such data; and the superintendent of irrigation is always willing to advise as to the credibility of the reports of his several water commissioners.

From the sources of information described above it is not possible to get perfectly accurate or comprehensive information concerning ditches, canals, and reservoirs of the several districts of the Arkansas water division, which are properly involved in a thorough study of rights in the waters of the valley. The writer has utilized some of the sources of information and encountered the difficulties above referred to. It is with the understanding that his statistical estimates are in large part but approximations that he invites attention to the following brief discussions of the Arkansas Valley and the irrigation works therein.

THE ARKANSAS VALLEY.

The 38,720 square miles constituting the Arkansas River drainage basin within the boundaries of Colorado is more than one-fourth of the area of the State. A part of this area—perhaps 6 per cent—drains into the Republican and Cimarron rivers and reaches the Arkansas River beyond the boundaries of the State. The Arkansas River, which rises in the lofty mountains near the center of Colorado, flows southerly for about 100 miles, thence easterly for about 200 miles, and divides this area into two nearly equal portions. The lands of this drainage basin are usually broadly classified as “the mountain district” and “the plains district;” the former comprising something less than one-third and the latter something more than two-thirds of the total area. The lands of the valley are by some more particularly classified as “the high and rocky mountain district,” “the foothills district,” “the mesa district,” and “the plains district.” Clustered around the heads of the Arkansas River and its tributaries and forming the rim of the Arkansas Basin on the west, northwest, and southwest, are the Saguache, Park, Rampart, Sangre de Christo, and Front ranges, in which are peaks from 13,000 to more than 14,000 feet in height. The fall of the country from this rim of ranges to the eastward is at first very rapid. At Pueblo the plains area broadens rapidly, extending both to the north and to the south. From Pueblo eastward the slope is comparatively gentle and offers opportunities for the

MAP OF WATER DIVISION NO. 2. SHOWING DISTRICTS 10 TO 19, 49, 66 AND 67 COLORADO



EAGLE

SUMMIT

PITKIN

LEADVILLE
LAKE

PARK

11
BUENA VISTA
CHAFFEE

DOUGLAS

ELBERT

ARAPAHOE

49

KIT CARSON

10
COLORADO SPRINGS
EL PASO

LINCOLN

CHEYENNE

Big Sandy
Rush Creek

12

FREMONT

CANON CITY

14

PUEBLO

LINCOLN

KIOWA

67

SAGUACHE

CUSTER

15

PUEBLO

OTERO

ARKANSAS RIVER

PROWERS

HUERFANO

16

18

APACHE

19

LAS ANIMAS

BACA

GRANDE

COSTILLA

CONEJOS

EL MORO

TRINIDAD

66

Dry Cimarron River

NEW MEXICO

KANSAS

10630

10600

10530

10500

10430

10400

10330

10300

10230

10200

4000
3930
3900
3830
3800
3730
3700

4000
3930
3900
3830
3800
3730
3700

construction of larger ditches and canals than can be made in the foothills and mountainous districts.

There are sixteen counties lying wholly or in part within the Arkansas drainage basin. Within this drainage basin also, either in whole or in part, are five judicial districts, to the district courts of which is intrusted the power of hearing, adjudicating, and settling questions concerning rights to water. These judicial districts are the third, fourth, fifth, tenth, and eleventh districts of the State of Colorado. Besides the counties and judicial districts mentioned there are within this drainage basin thirteen water districts. These water districts are numbered from 10 to 19, consecutively, and 49, 66, and 67; their boundaries are fixed by law and may be changed from time to time. These districts sometimes extend into two or more counties and into more than one judicial district (see Map, Pl. I).

WATER DISTRICT NO. 10.

This district consists of all lands irrigated from the Fountain and its tributaries within the limits of El Paso County. This is a small but important foothill district. The Fountain still maintains on many maps and in many documents its old historic name of the Fontaine Qui Bouille, so called from the bubbling mineral springs found in its basin at and near Manitou. Above Manitou it receives a few small contributions of clear mountain water. Flowing eastward from Manitou the Fountain passes Colorado City and at Colorado Springs receives from the north an important tributary, Monument Creek. The waters of Monument Creek course southward along the eastern foothills of the Rocky Mountains from the divide separating the South Platte and Arkansas River drainage basins until they mingle with the waters of the Fountain at Colorado Springs, and flow thence southerly in a gradually broadening channel until they are utilized by means of ditches, are lost in the sands of the channel, or reach the Arkansas River at Pueblo.

Manitou, Colorado City, and Colorado Springs, situated in the drainage basin of the Fountain and constituting practically one center of population, are indebted to the clear mountain waters of this district for much of their ever-growing popularity as resorts and residence cities. As the population of these places has grown, necessities for water for municipal purposes have likewise grown, and to supply these necessities encroachments have been made upon waters previously acquired and utilized by individuals for irrigation. Perhaps the highest price paid for water or water rights in the Arkansas Valley has been paid by the city of Colorado Springs.

The statistics relative to the cost of construction, operation, and repairs of ditches in water district No. 10 are far from satisfactory.

In a general way it may be said that the irrigation works of water district No. 10 are inexpensive in construction, maintenance, and operation, except so far as the municipal waterworks are also irrigation works. Because of the smallness of the streams the ditches are comparatively small and short, and the expense of constructing and maintaining them is light, because the streams do not carry much sediment, and because the slopes of the country are great and the ditches can be given greater fall, and consequently be of smaller section to carry a given quantity of water than those constructed on more nearly level land. Head gates, too, are simpler and more easily maintained on small streams than on the larger and shifting stream channels of the plains.

From copies of the decrees, filed in the office of the superintendent of irrigation of the Arkansas division prior to 1902, it is learned that testimony was offered relative to 111 ditches in this district; that one of these ditches was abandoned and that 108 thereof divert water from 13 streams. Some of the ditches in this district are not named in the decrees, while some of the adjudicated ditches have been extended and enlarged since the decrees were issued. It is difficult to estimate the area of land under cultivation in the district, but the total area given in decrees as intended to be irrigated exceeds 24,000 acres. It seems probable, from the reports of commissioners and other sources of information approximate in their nature, that the total area of irrigated lands in the district is about 20,000 acres.

WATER DISTRICT NO. 11.

Water district No. 11 is a mountain district. It includes the drainage basin of the Arkansas River within the limits of the counties of Lake and Chaffee. Within this water district are lands adjacent to Leadville, Granite, Buenavista, Salida, and Poncho Springs. Because of the excellent markets which these places, especially Leadville, afford, the crops raised are of unusual value. The ditches while small are very numerous. Many small parks and valleys, as well as a few large ones, are watered from the Arkansas and its high-altitude tributaries in this district. The report of the State engineer for the year 1889-90 contains a tabulated statement concerning the ditches of this district, made from the copies of decrees which up to that time had been certified to his office. From this statement there were 142 ditches taking water from 42 streams. These, it will be observed, are adjudicated ditches. There are perhaps a few other ditches the rights of the owners of which have been judicially determined, and there are other ditches which have not been included in decrees. Some of these unadjudicated ditches of this district are mentioned in an excellent statistical statement made by Mr. S. K. Sterling, water commissioner, and

published in the State engineer's report last referred to. From this statement we find that there are not less than 180 ditches in the district, the aggregate length of which exceeds 300 miles, the average length being about $1\frac{3}{4}$ miles, the longest ditch given being only 8 miles; and that in the year 1890 14,647 acres were irrigated. From an examination of the decree the writer found that the names of 230 persons, besides unnamed heirs, were given as owners or claimants of the 96 ditches of this district. Several of these names occur in connection with the ownership of two or more ditches, but it seems safe to assume an average of somewhat more than 3 owners to each of the ditches of the district, aggregating about 600 ditch owners, exclusive of stockholders in a few corporations owning ditch interests.

The report of the State engineer of Colorado, above referred to, gives data relative to two adjudicated reservoirs, both of considerable size, in this district. Plats and statements have been filed with reference to other reservoirs and still other ditches, some of which have been constructed and are in operation. Among the notable reservoirs of this district is the Twin Lakes reservoir. The Twin Lakes are two beautiful sheets of mountain water of great depth and surrounded by high mountains some 13 miles southwest of Leadville. They are formed by a moraine across the valley of Lake Creek, one of the chief high altitude tributaries of the Arkansas River. The excellence of this reservoir site was attested by many engineers, including perhaps all of the State engineers of Colorado. It was the opinion of many residents of the Arkansas Valley, who had given the subject consideration, that it should have been utilized for a public reservoir. The State of Colorado initiated rights therein, made investigations preliminary to the construction of a dam across Lake Creek, appropriated money for this preliminary work, and by resolution directed that the State's interests in such reservoir be protected. Notwithstanding such legislative action the Twin Lakes reservoir site was permitted to pass into the control of a private corporation known as the Twin Lakes Reservoir Company. The cost of the impounding and diversion works at Twin Lakes is variously estimated at between \$200,000 and \$250,000.

WATER DISTRICT NO. 12.

Water district No. 12 is immediately below water district No. 11. Nearly all of the lands irrigated in this district are situated in Fremont County. This is the leading fruit district of the Arkansas Valley. Irrigated lands adjacent to Canyon, because of the fact that exceedingly valuable fruit crops may be grown thereon, bring several hundred dollars per acre.

The decree governing the distribution and enjoyment of water in district No. 12 is worthy of special study. Among its satisfactory

features is the careful grouping of nearly all of the ditches and canals of the district with reference to the streams from which they divert water. The number of ditches in the district exceeds 400. Of the ditches of this district 381 divert water from 32 streams. The estimated area to be irrigated by means of 368 of the ditches embraced in the decrees was about 24,000 acres and the decrees disclosed about 535 names of claimants or owners of ditches. The same name not infrequently occurs as the claimant of two or more ditches, but it is probable that the number of persons interested in the adjudicated ditches of this district was, several years ago, not far from 500, exclusive of those persons interested as stockholders in the companies and corporations owning ditch interests in the district. At the time of the issuance of the main decree, the ditches of the district were largely owned by individuals, only some seven or eight companies or corporations appearing as owners or claimants in the decree. During the last few years, however, there have been many land sales and ditch and water-right transfers in district No. 12, and it seems probable that the total number of persons directly interested in the ditches has greatly increased.

WATER DISTRICT NO. 13.

Canyon is near the mouth of Grape Creek, a tributary of the Arkansas River and the main stream of water in district No. 13. The headwaters of Grape Creek are in the mountains which surround the beautiful Wet Mountain Valley. These mountains include the Greenhorn and Sangre de Christo ranges. The latter range raises its highest summits to more than 14,000 feet. From these lofty heights the waters course downward in many small streams, finally gathering into Grape Creek channel and flowing northward through Custer and Fremont counties until they mingle with the waters of the Arkansas River. From the main stream and its chief branches in their lower reaches the larger ditches divert water, irrigating considerable areas. Along the upper reaches of Grape Creek and near the sources of its branches and their subbranches are the smaller ditches, some but little larger than furrows and several a hundred feet or less in length. In this little water district there are as many as 500 ditches, perhaps more, diverting water from more than 80 streams. More than 470 special decrees affecting water rights have been issued; the names of the claimants of these ditches, as set forth in the decrees, exceed 550. Although the same names frequently occur as owners of different ditches the number of different persons directly interested in the ditches of the district can not have been much less than 450 at the time of the issuance of the main body of the decrees several years ago, and doubtless at this time considerably exceeds that number.

The decrees covering the appropriations of water in this district give the length of about 30 per cent of these ditches, the average length being something over three-fifths of a mile, showing that the ditches while numerous are short. The acreage irrigated or proposed to be irrigated by each of these ditches was set forth in the decrees, with possibly one or two exceptions, and aggregated about 26,000 acres. Many of the ditches were constructed for the irrigation of small areas, less than 10 acres; several for the irrigation of 1 acre each. Thirty per cent of the ditches embraced in the decree aggregate 90 miles in length. If these were of average length the length of the adjudicated ditches would be 300 miles; and as there are ditches in the district not embraced in the decree, it would seem quite probable that the aggregate lengths of the ditches in district No. 13, reported by the water commissioner, Mr. L. A. Heineman, of Silvercliff, as 357 miles, was not too great.

WATER DISTRICT NO. 14.

In passing from water district No. 13 to water district No. 14 one leaves the mountains and foothills and enters a district of the plains. The ditches of the plains districts are much larger and longer than are those of the mountains; they carry water to a greater depth and are constructed on lighter grades. Several ditches which divert water from the Arkansas River east of the foothills will each irrigate almost as much land as the total area irrigated by all of the 500 ditches of water district No. 13.

Water district No. 14 consists of all lands irrigated by water taken from that portion of the Arkansas River situated within the boundaries of Pueblo County, and from streams draining into that portion of the Arkansas River, except the St. Charles and Huerfano rivers and their tributaries; and except also that portion of the Fountain embraced in water district No. 10 and streams draining into that portion of the Fountain.

There are 49 adjudicated ditches in this district, besides 7 extensions and enlargements. Twenty divert water from the Fountain and 29 from the Arkansas River. Three taking water from the Arkansas River in Pueblo County may be classed as canals. The Bessemer ditch, which diverts water from the river some 10 miles west of Pueblo and runs easterly along the south side of the Arkansas River, watering lands adjacent to Pueblo, Vineland, and Avondale, is something over 43 miles long and covers some 28,000 acres, to some 18,000 acres of which the waters of this ditch have been applied. The Colorado canal or Bob Creek ditch, as it is locally called, heads on the north bank of the Arkansas River, some 18 miles east of Pueblo, and runs easterly, watering lands situated chiefly in Otero County and adjacent to Olney

Springs, Ordway, and Sugar City. Connected with this ditch are two important reservoirs. In one, Lake Henry, water is stored for the use of the sugar factory at Sugar City, and the water stored in the other, the Twin Lakes reservoir, is discharged into Lake Creek in the county of Lake; following thence the channel of Lake Creek and the Arkansas River, they reach the head of the Colorado canal; at this point they are rediverted from the river and distributed to those persons entitled to the use of this water by virtue of being stockholders in the company controlling the Twin Lakes reservoir. The Rockyford High Line canal heads some 20 miles east of Pueblo and waters land chiefly in Otero County and adjacent to Manzanola, Fowler, and Rockyford. The cost of each of these canals with its laterals was greater than that of all the ditches in either of water districts Nos. 10, 11, 12, or 13.

Water district No. 14 contains many large land holdings, as well as many small ones, and more tenant farmers than the other districts heretofore discussed. We can not gather from the decrees of this district satisfactory information concerning the number of persons owning ditch or water-right interests, because the great majority of these rights accompany the ownership of ditch stock or are involved in water-right contracts concerning which the decrees are silent. The number of claimants of ditch interests disclosed by the decrees is 88, exclusive of heirs not named, including the city of Colorado Springs, the trustees of the Pueblo waterworks, the Pueblo Water Company, the Colorado Coal and Iron Company (whose interests have since passed to various individuals and corporations), the National Land and Improvement Company, and a number of ditch companies.

The referee of this district limited the claims of various ditch owners, with a few exceptions, to 1 cubic foot of water per second for each 50 acres irrigated, and as the decrees aggregated something over 2,100 cubic feet per second it is safe to estimate that the total area of land watered by means of the canals and ditches of the district exceeds 100,000 acres, although it does not follow that all of this acreage is irrigated each year. This district is the home district of the writer. He has watched the irrigation development of this district and believes that the expense involved in the construction and improvement of the works for the irrigation of the hundred thousand or more acres for which water has been decreed in this district, including the laterals and the main structures and their appurtenances, has been about \$25 per acre, aggregating some \$2,500,000. There are a few small reservoirs in the district, the most important of which is Lake Henry, in Otero County; important, not because of its size or the expense involved in its construction, but because of the dependence thereon of the sugar factory of the National Sugar Manufacturing Company at Sugar City for its supply during the winter months. The reservoirs of the district do not add materially to the estimate of cost before

made. This estimate is made with some hesitation because it is exceedingly difficult to determine the cost of constructing the ditches and canals of this district and other districts upon the plains. Some of the ditch companies hesitate to disclose the cost of their works; some decline to do so, and others do not know the cost. It is difficult to classify the numerous items of expense involved in the construction and operation of a large irrigating canal during the first ten years of its life. Our western canals are not built with the same preliminary care and expense as the irrigation canals of Europe, because the rent of money is higher here and the need of an immediate return is greater. There is usually a rush to get water on the land to be irrigated, because this affects the priority of the water right, and the building of a town or factory may depend on the watering of a given acreage in a few months. Often much of the subsequent work is done by a permanent force whose chief duty is to operate the canal, and thus construction work runs into operating work until it is hard to classify the several items of expense. In the case of a few of the large canals, foreclosures took place before their completion, new companies succeeded the original ones, and new owners commenced their account on a new leaf in a new book; so that the writer, in this and other districts, has had to make his estimates from what he learned here and there and from his general knowledge of the cost of such works.

The cost of maintaining and operating the canals of the district varies from year to year; this cost has undoubtedly averaged during the last ten years much more than it will average during the next ten years. The writer is of the opinion that such expenditures are now about \$40,000 a year.

WATER DISTRICT NO. 15.

A small stream called by the Mexican population the Rio San Carlos, but generally known as the St. Charles River, has its source in the Greenhorn Mountains near the western boundaries of the county of Pueblo. The general course of this stream is northeasterly, and such of its waters as are not diverted and utilized by means of ditches find their way into the Arkansas River some 7 miles to the east of the city of Pueblo. The headwater tributaries of the St. Charles are small but numerous, and altogether they collect the waters falling on 150 square miles on the eastern slope of the Greenhorn Mountains. To the east of the foothills the valley of the St. Charles is deep and rather narrow, averaging perhaps half a mile in width, and bounded on either side with sandstone, limestone, and shale bluffs. Water district No. 15 consists of all lands irrigated from ditches or canals taking water from the St. Charles and its tributaries.

Water has been decreed for the irrigation of more than 10,000 acres by means of more than 100 ditches. All the ditches of this district

are small; the only large ditch is now being constructed by the Colorado Fuel and Iron Company. It is a flood-water ditch to be used in connection with Lake Minnequa and other storage reservoirs of the company, for impounding the water needed for the steel works of that company, and for the industrial works connected therewith. One hundred and five of the ditches of the district divert water from 5 streams. The total length of these ditches, as disclosed in the decrees, exceeds 150 miles. There are a few other ditches in the district and a few reservoirs besides the large reservoirs of the Colorado Fuel and Iron Company above referred to. The latter are designed and used chiefly for the storage of water for manufacturing purposes and are not included in the estimate of costs of irrigation works hereinafter made. Probably not more than 150 persons holding ditch and reservoir rights were interested in these ditches when the decree was rendered. With the subdivision of lands, accompanied by a subdivision of ditch and water right interests, the number of persons so interested in ditches in the valley has increased from year to year.

WATER DISTRICT NO. 16.

The high Sangre de Christo Range forms a portion of the western boundary of Huerfano County. Water falling on the eastern slope of this range in Huerfano County runs into the Huerfano River. This stream enters the plains district after coursing around Bald Mountain, the southern terminus of the Greenhorn Range, and runs thence in a broad sandy channel which parallels the St. Charles, reaching the Arkansas River in Pueblo County some 20 miles east of Pueblo. The tributaries of the Huerfano from which ditches are taken number more than 40. Lands irrigated by the waters of the Huerfano and these tributaries constitute water district No. 16. The ditches of this district are numerous and, with few exceptions, small. Many of the ditches have Spanish names and were constructed and are still owned by Mexicans. There are more than 300 ditches in the district and some 20 reservoirs, the storage capacity of the latter being about 5,000 acre-feet. Three hundred and two of the ditches of the district take water from 40 streams and several springs. The aggregate length of these ditches is probably about 538 miles.

The cost of constructing the ditches and reservoirs of this district is probably in excess of \$300,000. The number of names given as owners of 143 ditches of this district was, in 1898, about 317, exclusive of stockholders in a few small ditch companies. Allowing for the repetition of names, as the names of some persons occur as owners of several ditches, this would indicate that there were about 600 persons interested in all of the ditches of this district in 1898, exclusive of stockholders in companies and of persons owning interests in unadjudicated reservoirs. No estimate of the area irrigated can be made from the decrees.

WATER DISTRICT NO. 17.

Water district No. 17 consists of all lands irrigated from the Arkansas River below water district No. 14 and above the mouth of the Purgatory River and from the streams draining into that portion of the Arkansas River, except the Apishapa River and its tributaries. The portion of the Arkansas River below water district No. 14 means below the east line of Pueblo County, which corresponds to the west line of Otero County. District No. 14 itself is not limited by this county boundary line, but extends many miles, and may hereafter be extended many miles farther to the east of the boundary line between the counties of Pueblo and Otero. Otero County is the most important agricultural county of the Arkansas Valley. Its lands are wonderfully fertile and its climate salubrious, but its rapid progress is due largely to the energy of its citizens.

Most of the lands around Rockyford, Lajunta, West Las Animas, Fowler, and Manzanola are in water district No. 17, although some of those adjacent to Rockyford and the towns to the west thereof are in water district No. 14. The district in which these lands are situated, it will be observed, depends upon whether the ditches by means of which they are watered divert water from the Arkansas River to the west or east of the boundary line between the counties of Pueblo and Otero. There are about 20 ditches in this district, the rights of the owners of which have been judicially determined. These ditches aggregate over 300 miles in length and they have supplied water to between 75,000 and 100,000 acres.

WATER DISTRICT NO. 18.

Water district No. 18 consists of all lands irrigated from ditches or canals taking water from the Apishapa and its tributaries. This is a stream running northeasterly through Las Animas County and the extreme southeastern corner of Pueblo County, and tributary to the Arkansas River in the county of Otero. The number of ditches adjudicated in this district was 25, according to the report of the State engineer for the years 1895-96. The amount of water decreed to these ditches, according to this report, was 266.63 cubic feet per second.

WATER DISTRICT NO. 19.

Water district No. 19 consists of land irrigated from canals taking water from the Purgatory and its tributaries. The Purgatory River has its headwaters in the mountains constituting the southwest rim of the Arkansas Valley in the vicinity of Trinidad, situated in the southwest portion of the county of Las Animas. The course of this river is northeasterly and its junction with the Arkansas River, of which it is a tributary, is near the town of West Las Animas.

More than 700 cubic feet of water per second is decreed to the ditches of this district. In the reports of the State engineer for the years 1897, 1898, 1899, and 1900 statistics relative to this district are given. During these years the maximum estimate of the aggregate lengths of these ditches was 237 miles. The maximum estimate of the lands lying under these ditches and capable of being irrigated by means thereof was 40,607 acres, and the minimum estimate 36,960 acres. The greatest area irrigated during these years, according to these reports, was 28,572 in 1897, and the least was 16,139 acres in 1899.

WATER DISTRICTS NOS. 49 AND 66.

Water district No. 49 consists of all lands in the State of Colorado irrigated by water taken from the south fork of the Republican River and the Smoky Hill River and the streams draining into said rivers. Water district No. 66 consists of all lands in the State of Colorado irrigated from the Dry Cimarron and the streams draining into the said river. Both are on the extreme eastern border of Colorado, the former in the northeastern portion and the latter in the southeastern portion of that part of the drainage basin of the Arkansas River lying within the State of Colorado.

WATER DISTRICT NO. 67.

Water district No. 67 "consists of all the lands in the State of Colorado irrigated by water taken from that portion of the Arkansas River below the mouth of the Purgatory River and from streams draining into the said portions of the Arkansas River."

This is an important district, containing some twenty ditches. To these ditches nearly 1,100 cubic feet of water per second has been decreed. The towns of Las Animas, Lamar, Grenada, and Holly are in this district. Many of these ditches are discussed later, where the importance of this district is quite fully set forth in connection with the consideration of the contracts affecting this section of the Arkansas River. In 1900 the water commissioner reported that there were 139,045 acres which could be irrigated by the ditches of water district No. 67, of which 65,844 acres were irrigated in that year.

SUMMARY.

The writer estimates that there are in the Arkansas Valley in Colorado about 1,900 irrigating ditches, certainly more than 1,850, and that their aggregate length, exclusive of laterals, is about 3,200 miles; that the cost of the irrigation works of the valley, the reservoirs, ditches, and laterals is between \$8,000,000 and \$9,000,000; that the area lying under ditches approaches 600,000 acres, and that more than 400,000 acres have been watered by means of these irrigation works.

The number of persons in the valley interested in the irrigation works of the valley as owners, or holders of stock in irrigation companies, or holders of water-right contracts, or water-right deeds, is between 7,000 and 8,000, and the value of these irrigation works and of the the irrigable lands thereunder is between \$25,000,000 and \$30,000,000. The cost of operating and maintaining these irrigation works is perhaps \$150,000 per annum, while some \$50,000 or more is annually expended in improvements. It will be readily seen that large interests and the welfare of a large number of people are dependent upon the efficient execution of wise laws affecting rights in water. This summary also shows the extreme difficulty of getting at the value of a contract right purchased from the owner of one of the 1,900 ditches of the valley, when it is considered that the right of each of these ditches depends to a certain extent on the rights of all the others.

STREAM FLOW AS RELATED TO RIGHTS.

Before proceeding to a more particular review of the decrees of the Arkansas Valley it may perhaps be advisable to discuss briefly the stream flow of the valley. It is the run-off, or water flowing in the streams, which the courts have decreed. The importance of a knowledge of the stream flow is apparent upon a consideration of the fact that the right to take water from a stream can be enjoyed only after all prior conflicting rights have been satisfied. While theoretically this means all prior rights to the streams of the Arkansas Valley drainage area, practically the consideration of many streams may be omitted, so far at least as their ordinary winter flow is concerned. This is true even in the consideration of a right to water from the Arkansas River itself.

Since the conditions on many of the tributaries of the Arkansas River are substantially similar to those on the main stream, an investigation of the decrees governing rights to water from the river will disclose in a general way the conditions on its tributaries. Because of the great fluctuation in the flow of the stream, which varies to an astonishing degree—as, for example, from less than 100 cubic feet per second to more than 28,000 cubic feet per second—the time periods during which all ditches except those entitled to the very earliest rights will receive water vary as the stages of water in the streams vary. In low-water stages only the ditches having the very earliest rights are supplied with water. Then, as the stream flow increases, other ditches with next earlier rights are supplied, and as the flow continues to increase still other ditches are supplied with water until, in times of extraordinary flow, all are supplied. But the later the priority of a ditch the shorter the period during which it can draw water; and as the amount of water a ditch may draw is the

product of the rate at which it may divert water and the time during which it may divert it, it will be seen that the amount of water which may be enjoyed under an appropriation is not determined when the number of cubic feet per second decreed to it is known, but only after the length of time during each year that water will be allotted thereto is determined, or approximately determined, from a knowledge of the stream flow and the demands thereon. Thus the length of time in each year during which a ditch will receive water under the decrees can be determined only roughly for those ditches supplied from the ordinary high-water flow, unless their priority dates are very early, and for those which receive water only during very high water or flood periods the times and consequently the amounts of water they receive are still more difficult to determine. The difficulties attending the determination of the periods during which ditches will receive water under the decrees are further complicated by the fact that a portion of the water which is diverted returns as seepage to the channel of the river.

ARKANSAS RIVER FLOW.

Measurements of the flow of the Arkansas River have been made at Canyon, where the stream leaves the mountains and enters the plains district: at Salida, above, and at Pueblo, 40 miles below Canyon; at Nepesta, Rockyford, and near Lamar, all to the eastward of Pueblo, and at other points. The seepage waters gathering in the channel between Canyon and the State line have also been measured. The records of these measurements are to be found in the publications of the State of Colorado, of the United States Geological Survey, and the Office of Experiment Stations of the Department of Agriculture. The flow records of measurements made at Canyon are quite satisfactory. Those at other points are less so, either because they cover shorter periods, or because the channel is less stable, or because the records do not disclose the full flow of the stream, owing to the carriage of portions of the stream waters in adjacent ditches. The Canyon records show that the mean annual flow of the Arkansas River at that point is in some years more than double what it is in other years. As great a variation between the maximum and minimum mean annual flows may be expected at all points to the east of this point. The mean annual flow at Pueblo when no water is conveyed in artificial channels past the measuring point is about 600,000 acre-feet, which is somewhat greater than the mean annual flow at Canyon. At Nepesta the mean annual flow would under like conditions exceed that at Pueblo, and still farther to the eastward would exceed that at Nepesta. These conditions are occasioned partly by return water from the ditches, but chiefly by the flood waters from the tributaries of the river.

DIVERTIBLE FLOW OF ARKANSAS RIVER.

Perhaps an investigation of the measurement records of the Arkansas River will yield to no two investigators the same conclusions. As the measurements are extended over longer periods and cover more completely the flow of tributary streams and canals, estimates by different men of the mean annual flow will be closer. Having under consideration the flow of the Arkansas River at the several places of measurement, the flow of water in the canals and ditches, the losses from the channel, the re-collection of return and seepage waters in the channel, and other conditions as they have existed for some years, the writer estimates the quantity of water which can be diverted from the Arkansas River in Colorado during years of mean flow at 1,000,000 acre-feet. This is exclusive of several hundred acre-feet per annum necessarily flowing out of the State during periods of high water in the lower reaches of the valley while diverting and storage works are as now constructed. This, it will be observed, is not an estimate of the mean annual flow of the river at any particular points in Colorado. It is an estimate of what may be called the divertible flow of the Arkansas River as distinguished from the flow at any particular point. The writer estimates the minimum and maximum mean annual divertible flow of the river as varying from the mean annual divertible flow by about 50 per cent, with the probability of exceeding this percentage of variation considerably during years of extreme drought or extreme precipitation. The writer further estimates that the mean annual divertible flow of the Arkansas River, expressed for months in terms of the mean flow in cubic feet per second for each month, will be as set forth in the following table:

Mean annual divertible flow of Arkansas River in Colorado.

[Not flow at any particular point.]

	Cubic feet per second.		Cubic feet per second.
January	660	July	2, 250
February	700	August	1, 100
March	800	September	700
April	1, 030	October	690
May	2, 630	November	720
June	4, 370	December	720

The above table shows the mean divertible flow in cubic feet per second for each month. There are periods during the spring months when, for a few hours or days, the flow at certain points may be very great, as in 1894, when it was 30,000 cubic feet per second at Nepesta.

Assuming the divertible flow of the Arkansas River to be as set forth in the above table, it is possible to determine approximately the times, in years of average flow, during which any canal may receive water

from the Arkansas River under its decree; assuming also that the several ditches or canals fed from this stream receive water in accordance with the decrees. An examination of the decrees for comparison with the divertible flow (fig. 1) will disclose, in round numbers, the following results:

Appropriations from the Arkansas River in districts 11, 12, 14, 17, and 67.

[Approximate.]

	Cubic feet per second.
Prior to January 1, 1870	400
Prior to January 1, 1880	600
Prior to January 1, 1890	3,200
Prior to January 1, 1900	5,200

Thus an appropriation of 10 cubic feet per second flowing constantly, with a priority date of January 1, 1870, would receive water

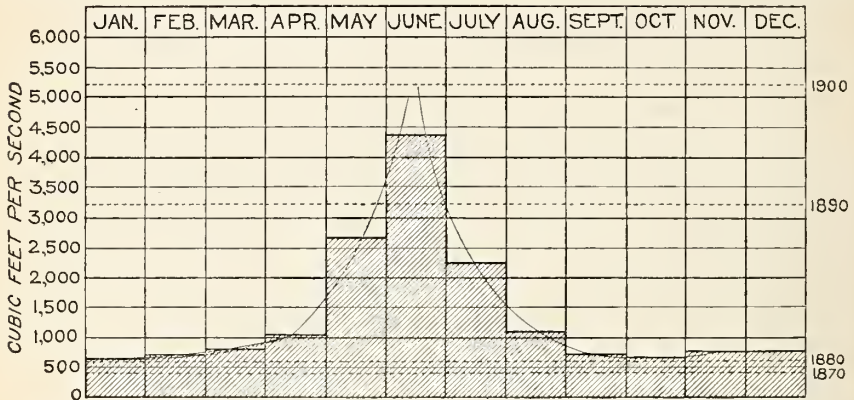


FIG. 1.—Diagram showing the mean divertible flow of the Arkansas River and the stage at which canals having rights of various dates will receive water.

at all times during years of average flow. Such an appropriation with a priority date of January 1, 1880, would also receive water at all times during years of average flow, but during years of minimum flow would be deprived of water part of the time. Such an appropriation with a date of January 1, 1890, would receive water in average years during June and parts of May and July and during flood times in other months. Such an appropriation with a date of January 1, 1900, would receive no water in average years except during a portion of June and flood periods. When ditches with early rights do not demand water, ditches with later rights receive water for longer periods.

It is observed from the above comparisons of the divertible flow of the Arkansas River and decrees to ditches therefrom that, while the

decrees exceed the mean divertible flow of any month for average years, they do not exceed it to the extent commonly supposed.

The foregoing discussion shows that the volume of water to be divided among the ditches of the Arkansas Valley, in accordance with the decreed rights, is variable. An examination of the decrees will show that the volume to which the several ditches are entitled is no more fixed than the stream flow. The principle on which the decrees are usually based is that each ditch is entitled to sufficient water to irrigate a stated area of land. The volume of water considered necessary for this area is usually stated in terms of cubic feet per second, sometimes without limitation as to the time during which this volume may be diverted and sometimes with such limitation. Thus the decree defining rights in district 12 gives to one claimant a certain volume for ten days out of each consecutive thirty-two days, to another a specified volume during the irrigating season, while still another is given the privilege of taking its decreed volume constantly. But the volumes named in the decree are not given as fixed, but seem rather to be estimates of what is necessary to irrigate the areas given, as is shown by the provisos inserted after the volumes are stated, "or so much thereof as shall be necessary," and "such greater quantity as shall be required." In other decrees the dimensions of ditches are given, and they are allotted so much water as they will carry. Although the area irrigated is in most cases the basis used in computing what volume a ditch should be entitled to divert, and the principle on which rights were determined was that the various claimants had a right to sufficient water to continue to irrigate the area which had previously been irrigated, in the actual distribution of water by the irrigation officials of the State the area seems to have been entirely lost sight of, and ditch owners are considered as having rights to the volumes named in their decrees, regardless of what areas they use this water on. This interpretation makes it possible to determine from the decrees more nearly what are the chances of obtaining water under a certain right than it would be if the principle on which the decrees were based were carried out.

CONTRACT WATER RIGHTS.

So far only the acquirement and definition of water rights have been discussed. A brief discussion of the nature of these water rights acquired by appropriation or by purchase is necessary to an understanding of the discussion of the contracts, which follows:

The term "water right," as used in some localities, means something different from what is understood by the term in other localities. In the mountainous districts of the Arkansas Valley, where the ditches are small, a water right usually means an interest in a ditch and the

appropriation enjoyed by means thereof. In the plains district, however, a water right usually means a right in water represented by a contract with a ditch company or by stock in such a company. A farmer who constructs his ditch and by means thereof diverts water from a natural stream which he utilizes in the watering of crops upon his own lands, says that he has a water right. When several farmers unite their efforts and construct a ditch and by means thereof irrigate their lands, they each have a water right; their ditch is sometimes called a community ditch, and their rights community rights. If there are three such farmers, and each of them has constructed one-third of their community ditch, named, let us say, the Three Farmers' ditch, and utilized one-third of the water diverted thereby in irrigating his one-third of the lands, then each has a one-third interest in the right acquired and enjoyed by means of the ditch. If the ditch had been commenced May 1, 1870, and 3 cubic feet of water per second utilized by means thereof, their appropriation would be described as a priority right of May 1, 1870, for 3 cubic feet of water per second. If the interests of these three farmers continued unchanged until the issuance of a decree affecting appropriations of water in their district the decree would allot to the Three Farmers' ditch 3 cubic feet of water per second of time for the use of the owners thereof or those entitled thereto, with a priority date of May 1, 1870, and the names of the three farmers would be given as owners or claimants of the ditch. Each of these three farmers may still be styled an appropriator of water. If these three farmers were to organize a ditch company, say the Three Farmers' Ditch Company, and transfer thereto the Three Farmers' ditch and the rights acquired by means thereof, and the ditch company should issue its stock in payment therefor, one-third of such stock to each of the farmers, the latter are no longer called appropriators of water; their water rights are said to be represented by ditch stock, and the Three Farmers' Ditch Company is said to own the right. If the Three Farmers' Ditch Company on March 1, 1880, commenced an enlargement and extension of its ditch so as to cover the lands of thirty other farmers, and if 30 cubic feet of water per second, in excess of the original 3 cubic feet per second, were utilized by means of the Three Farmers' ditch by these thirty additional farmers, then it would be said that the Three Farmers' Ditch Company owned two appropriations—one for 3 cubic feet of water per second, with a priority date of May 1, 1870, and one for 30 cubic feet of water per second, with a priority date of March 1, 1880. These thirty additional farmers may stand in one of numerous relations to the Three Farmers' Ditch Company. For example: First, they may become stockholders in the company; or, second, they may annually pay the Three Farmers' Ditch Company for the carriage of 30 cubic feet of water per second which they use; or, as the ditch company would prefer to style it, "for the

use of 30 cubic feet of water per second;" or, third, they may enter into an agreement with the company, of a kind other than that involved were they to become stockholders, whereby they acquire some kind out of the many kinds of water rights in vogue. These agreements are generally spoken of as water rights. It will be observed that the nature of the rights in water acquired by the farmers and those claimed by the ditch company changes quite gradually, but in the end quite radically. There is first the single appropriator of water, who diverts water from the natural stream and uses it on his own lands; he owns the ditch and controls the right to water by means of the ditch; upon the issuance of a decree a right is allotted to his ditch and he will claim to own the right; he will tell you that his water right is an appropriation, say of 1 cubic foot per second of the waters of the Arkansas River, with a priority date of January 1, 1875. In a community ditch, such as the Three Farmers' ditch, above described, before the incorporation of the Three Farmers' Ditch Company, the water right of each of the three farmers is said to consist of an undivided one-third interest in an appropriation of 3 cubic feet of water per second, with a priority date of May 1, 1870; they do not each own or control an appropriation, but an interest in an appropriation. It means nearly the same thing perhaps, but it is the beginning of a divergence which later becomes clearly defined. Upon the incorporation of the Three Farmers' Ditch Company, before extension and enlargement as described above, the nature of the rights of the three farmers is not greatly changed, but it is now said that the Three Farmers' Ditch Company owns the appropriation and that each farmer has a water right represented by stock in the ditch company, the nature of which right depends upon the articles of incorporation and by-laws of the company.

The maintenance of his water right by one of the three owners of the Three Farmers' ditch when it was a community ditch required, perhaps, besides the utilization of the water, a few days of his time and the use of his team and scraper in removing the sediment which from time to time is deposited in most ditches. After the incorporation of his ditch company, however, when his water right and interest in the ditch is represented by stock in the company, it may become necessary for him to pay a money assessment for the cleaning of the ditch, and in the event of his inability to do this his stock may be forfeited and his interest in both ditch and water right be lost. The nature of his water right has changed slightly, it is true, but to some extent theoretically he may still be regarded by some as an appropriator of water. But if he wishes to dispose of his water right it is not an appropriation, or an undivided interest in an appropriation, which he transfers, for the company now owns or claims the appropriation,

but a water right represented by shares of stock and limited by the articles of incorporation and the by-laws of the company.

It not infrequently happens that men own land, but are not able to build a ditch for the irrigation thereof. This may have been the case with the 30 farmers for whose benefit the Three Farmers' Ditch Company enlarged and extended its ditch, under an agreement by which each of the 30 farmers bound himself to buy a water right from the ditch company and pay therefor in annual installments. Each of such water rights will be represented by an agreement, or contract, or water deed. Such a water right may be a conditional water right, or may be called a perpetual water right. Such a water-right contract, or water deed, may provide that at some time the farmer may become a part owner in the ditch, or it may not. It may provide for the payment by the farmer of an annual fee for maintaining and operating the ditch after the contract has matured, or before its maturity, or both before and after. It will doubtless provide for a forfeiture of the water right in the event of a default in the specified payments. In any event it will be a very different water right from a right acquired by appropriation. Here the radical difference in the relation to their water rights between a farmer who is an appropriator and a farmer of the contract class is clearly seen. It is the farmer's utilization of the water which matures the right of appropriation, both under the simple ditch, which he constructs and owns, and under the contract system, but in the former case he owned the ditch and controlled the appropriation; under the contract system he ripens and matures this right of appropriation which others own, or claim to own, and, at any rate, control. There is certainly a radical difference between ripening a right which one controls and paying for the privilege of ripening a similar right for another to control. In the meantime the status of the owners of a ditch in relation to the appropriation of water acquired by means of such ditch has also changed. The farmer who controlled his ditch and utilized the water by means thereof enjoyed his right to control his appropriation, partly because he constructed the ditch and partly because he utilized the water. These two steps in the acquisition of a right by appropriation were both important. Certainly the utilization of the water was of no less moment than the diversion thereof. Gradually, however, the rights in an appropriation, resulting from the ownership of the ditch, have become paramount and the extent to which this is true is disclosed in some of the water-right contracts hereinafter discussed. This result is, perhaps, largely due to the laws under which the courts, in place of determining the rights of the several users of water diverted by means of a ditch, determined the appropriation or appropriations of water acquired by means of such ditch and left the real question as to who was entitled to the enjoyment of such rights unsettled, the courts contenting themselves, except in rare instances, with mentioning the

names of the owners or claimants of the ditches. The tendency of this method of adjudicating rights to water seems to have been to magnify the rights of ditch owners at the expense of the rights of the users of water.

Rights derived primarily by appropriation may subsequently be acquired by purchase. Like lesser rights in water, they are transferred by deed and agreements of various kinds, and are sometimes loaned. These transfers of rights in water, considered from the standpoint of duration, may for convenience be classified as temporary or permanent. Temporary transfers of the right to use water such as those for an irrigation season or shorter periods are usually unattended by much formality. Permanent transfers of interests in water are, however, made with much of the same formality accorded land sales. Ditches and interests therein are transferred by deed. Transfers of the rights of the owners of individual or community ditches are frequently made in the deeds by which lands watered from such ditches are transferred. In such deeds it is usual, after describing the lands conveyed, to describe the ditch and to name the stream from which water is drawn.

Sometimes rights obtained by appropriation are transferred from the individual or community ditches through which they were acquired from the State, and thereafter the water which such rights represent is carried in some other ditch. Such transfers are perhaps never made without the consent of all persons interested in the ditch of the grantors. Sometimes also appropriations of water are permanently transferred from a corporation ditch to another ditch, and the ditch of the grantor abandoned or used to carry water under a right having a different date. At times water of an early priority date is exchanged for equivalent water of a later date and a money bonus. The acquisition by a contract-right ditch of an early appropriation from another ditch may largely increase the value of water rights thereunder. Permanent transfers of rights from one ditch to another ditch were formerly made without judicial investigation and sanction; they are now made pursuant to court orders. Temporary transfers between ditches called "loans" are made with less formality than permanent transfers, but are subject to official recognition and are observed by administrative officers charged with the distribution of the water.

The foregoing remarks indicate the nature of appropriations of water and of other rights in water, and will assist in explaining water-right contracts. They afford, also, the grounds for a rough classification of the ditches of the valley. The ditches may be classified with reference to the owners of the water rights, as follows:

(1) Individual or community ditches, or those ditches carrying water for the use of the owners thereof.

(2) Ditches of incorporated ditch companies. The latter may be subdivided into (A) ditches the water rights whereof are represented

by stock. These are the ditches of incorporated ditch companies where the interest of a stockholder in both the ditch and the right to water is represented by stock and varies as the number of shares of stock owned by him; (B) ditches the water rights whereof are represented by contracts. These are ditches carrying water used under and by virtue of contracts between the owners of the ditches and the users of water carried therein; and (C) ditches carrying water for hire. These are quasi-contract ditches, the water being distributed and used under agreements, usually made from year to year, between the owners of the ditches and the users of water at prices fixed by agreement between the parties; in the event of disagreement, by the proper board of county commissioners.

Ditches of Class B may be further subdivided into (a) Class B ditches which will become Class A ditches upon the fulfillment of all the conditions set forth in the agreements; (b) Class B ditches in the agreements relative to which there are no provisions whereby the owners of water rights may eventually become the owners of the ditches.

Ditches of Class C would a few years ago have been subdivided into (c) ditches delivering water to consumers in consideration of an annual carriage fee and (d) ditches delivering water to consumers in consideration of a royalty or bonus in addition to an annual charge for the carriage of water greater than the cost of operating the ditches. Ditches of the latter class (d) have been abolished by statute, but an exhibit of the form of contract used by the owners of such ditches is given.

Eliminating from consideration individual and community ditches, there are left as ditches of incorporated ditch companies less than 3 per cent of the ditches of the Arkansas Valley, but in importance—in their effect upon the welfare of the valley—these incorporated ditches now exceed and are destined to far exceed all unincorporated ditches.

For convenience the Arkansas River is divided into sections. The upper section is above Canyon, the middle section extends from Canyon to the vicinity of Lajunta, while the lower reach extends from the vicinity of Lajunta to the west line of Kansas. Most of the ditches diverting water above Canyon are small. The incorporated ditches which it is proposed to consider are situated east of Canyon, in the plains district of Colorado, where the chief ditches divert water from the river.

CLASS A DITCHES

BESSEMER DITCH.

The most westerly of the large ditches of Class A diverting the waters of the Arkansas River is the Bessemer ditch, belonging to the Bessemer Irrigating Ditch Company. By means of this ditch lands on the south side of the Arkansas River adjacent to the city of Pueblo

are watered. The principal work of constructing this ditch was done in the year 1889. It has been an expensive ditch to construct, being for long distances cut through the bluffs of sandstone, slate, shale, and limestone forming the south escarpment of the Arkansas River. The ditch runs under two stream beds, which in flood times carry water more than 12 feet in depth. It has long flumes, some of which are more than 40 feet in height, and is for three-fourths of a mile in the form of a pipe, which crosses the St. Charles Valley and passes under the St. Charles River. The construction work of this ditch, as that of all large ditches in the valley, has continued long after water was first run therein, and has consisted in replacing flumes by embankments as opportunity afforded through the deposits of sediment and disintegration of rocks, and in the addition from time to time of sand gates or waste gates, by means of which the cost of maintenance and operation is greatly reduced.

The cost of the Bessemer ditch is estimated at about \$550,000. The carrying capacity thereof at the head is something over 400 cubic feet per second. The dirt cross section of the ditch near and above Pueblo is the unusual one wherein the depth of water carried exceeds the bottom width of the ditch, the former being from 7.5 to 8 feet and the latter 5.5 feet. Its several rights February 10, 1902, reported by Mr. C. K. McHarg, the secretary of the company, were as follows:

	Cubic feet per second.
From decree to Bessemer ditch, May 1, 1887	340.0
From decree to I. N. Sater ditch, June 20, 1881	2.0
From decree to Collier ditch, May 4, 1881	14.0
From decree to Cawfield No. 2 ditch, March, 1882	8.0
From decree to Cape Horn Ranch ditch; first, September 18, 1874.	2.0
From decree to Cape Horn Ranch ditch; second, 1876.....	2.5

The Bessemer ditch was originally constructed by the Bessemer Ditch Company, which was succeeded in 1894 by the Bessemer Irrigating Ditch Company. The relations existing between the company and the users of water conveyed in the Bessemer ditch are worthy of special consideration and are given with considerable completeness, because this is a typical Class A company and its articles of incorporation and by-laws are among the best of their kind and will serve not only to disclose the nature, advantages, and disadvantages of a water right represented by stock, but also as guides for certificates of incorporation and by-laws of similar irrigation companies under the laws of Colorado. (See Appendix I, p. 71.) The principal points covered in these articles and by-laws to which attention is especially directed are as follows:

The company supplies water for the use and benefit of its stockholders only. The capital stock of the company was made \$200,000, divided into 20,000 shares of \$10 each, which, when issued, were to be

subject to assessment in amounts adequate to provide for the construction, operation, and maintenance of the irrigation works of the company, the acquisition of rights of way and rights of water, and the liquidation of the debts of the company. The payment of assessments properly levied may be enforced by forfeiture of the stock in default, or as the board of directors may provide. The board of directors have full power to regulate the use of water among the stockholders, not only as to time, but as to the quantity and manner of using water; the water, however, to be divided in such a way as to give to each stockholder such proportion of the water carried in the company's main ditch as the stock owned by him bears to the entire capital stock issued and outstanding. Defaulting stockholders are forever barred from using water from the ditch on the forfeited stock, but they may buy new stock and receive water on it. The directors have power to make such by-laws as may be deemed necessary for the management of the affairs of the company. The superintendent is to apportion and regulate the use of water among the stockholders. Transfers of stock shall only be made upon the books of the company, either in person or by attorney. By-laws may be amended or repealed by a vote of a majority of the board of directors at any regular meeting. One share of stock is issued for each acre of land to be watered, and the number of shares issued now approaches the 20,000 shares into which the capital stock of the company is divided. Each stockholder is expected to own as many acres of land capable of being watered from this ditch as he owns shares of stock in the company.

The company pays no dividends, but each share of its stock must bear, and bear only, its pro rata share of the cost of maintenance, operation, and improvements, incidental expenditures, and cost of additional water appropriations. As a penalty for delinquency in payment of assessments, the water represented by the stock of a delinquent stockholder may be shut off, and in extreme cases his stock may be forfeited. Some penalty is necessary to cover delinquency in the payment of assessments; the welfare of the majority of the stockholders requires this. It is not often necessary to enforce such penalties, and perhaps this company has never gone beyond the shutting off of the water from delinquents. Nevertheless, a water right represented by stock in this company, as in other incorporated companies, is in greater danger of being lost than is a right of appropriation in any individual ditch, the State being more lenient than any ditch company can afford to be.

Occasionally stock has been held by persons in excess of the acreage of land owned by them, but this has usually been a temporary matter, adjusted as soon as it conveniently could be. Occasionally, too, stock has been temporarily transferred to lessees of lands and to landowners not owning water rights for a consideration equaling and sometimes

exceeding the annual maintenance assessment, constituting a sort of limited water right, but this also is usually a temporary matter. Under the regulations of the company the water represented by 100 shares of its stock may be applied to a less acreage than 100 acres, but can not be applied to a larger acreage. Under such regulations the water applied to one tract of land in one year may be applied to another tract the next year, always providing the lands to which it is applied are lands of its stockholders, or that the contemplated change is a temporary one. Assuming that all of the 20,000 shares of the stock of the company were issued—and the issue exceeds 90 per cent—and that the demand for water represented by such stock was constant, the amount of water represented by 100 shares of stock in the company would be $\frac{1}{2} \frac{0}{0} \frac{0}{0} \frac{0}{0}$ or $\frac{1}{2} \frac{1}{0}$ of the water carried in the ditch. To determine the amount of water which the purchaser of 100 shares of stock would receive, he would first make an investigation covering the flow of the stream and the priority dates and determine the quantity of water which the ditch would receive under its several rights. From this total amount he would deduct the losses by evaporation and seepage, and $\frac{1}{2} \frac{1}{0}$ of the balance would be the amount which he would receive. As the point at which he would receive this water under the present system of distributing the waters of this canal would be at the head of the main lateral carrying water to his lands, a further deduction would have to be made for the losses between the main canal and his lands. This loss would vary with the form of the lateral, its length, the quantity of water carried, the character of the soil, and the character of his neighbors using the same lateral as affected by their affinity for water. This stock has never been issued until its full value, \$10 per share, has been paid into the treasury of the company, and has never sold for less than \$10 per share, the price varying from that to more than \$30 per share. In connection with the plan of measuring water, viz., at the heads of the main laterals, it may be remarked that the action of the directors in providing such plan of measurement gives those stockholders whose lands are adjacent to the canal the advantage over those at long distances from the canal because of lateral losses, so that all stockholders do not receive at their lands their pro rata share of the water of the main canal.

The full text of the articles of incorporation and by-laws of the Bessemer Irrigating Ditch Company is given in Appendix I, pages 71-76.

ROCKYFORD GROUP OF DITCHES.

The Bessemer ditch, above described, is in the middle reach of the Arkansas River. There are in this middle section of the river to the east of the Bessemer ditch other ditches falling under Class A, the most important of which are included in what may be called the Rocky-

ford group of ditches. This group includes the Rockyford High Line canal, the Oxford Farmers' ditch, the Catlin ditch, the Otero canal, and the Rockyford ditch.^a

Lands adjacent to Lajunta, Rockyford, Catlin, Fowler, and Manzanola on the south side of the Arkansas River are watered by means of this group of ditches. Some of these lands are among the most highly cultivated of all the Arkansas Valley lands. They have been in course of rapid settlement for some years past, and more especially since the construction of the factory of the American Beet Sugar Company at Rockyford in the year 1900. Perhaps a larger proportion of these lands are held in small tracts—40 acres or less in extent, which are farmed by the owners thereof—than are likewise held and farmed under any other of the large canals of the valley. Even under the ditches composing the Rockyford group, however, the ratio of the area of small tracts worked by the owners thereof to the total cultivated area is far below what it should be, but the conditions here, or at any rate the tendencies here, seem to be comparatively favorable for a high irrigation development, which involves small irrigated tracts intensely cultivated and farmed by the owners thereof, who also have a voice in controlling the ditches and water which they use.

Not all of the ditches of the Rockyford group are of the kind falling under Class A, described above, wherein interests in the ditches and rights to water enjoyed by means thereof are represented by stock in the company owning the ditch. Two of the ditches of this group are Class B ditches, but of the kind which may, upon fulfillment of conditions named in the water-right contracts and water deeds, become Class A ditches. Their organization is discussed under the head of "Class B ditches."

It is this Rockyford district which has spread abroad the fame of the Arkansas Valley in Colorado. The farmers of this district are progressive and prosperous. An investigation of this prosperity and of the causes therefor can not fail to disclose that such prosperity is not due solely to good lands well tilled and watered, but is in no small degree the result of that intellectual development among the leaders of the community which enabled them to appreciate the advantages of united action and led to a combination of efforts resulting in achievements not otherwise obtainable—such as the disposal of vast melon crops under a cooperative plan whereby the usual loss of money and waste of energy accompanying individual efforts to dispose of such a crop are largely eliminated. When the people of a community are, almost without exception, interested in and responsible for the successful operation of large irrigation works, they learn to work together for the common good so far as the care of their irrigation works is con-

^aThe Rockyford ditch should not be confounded with the Rockyford High Line canal in this group.

cerned, and this leads to further community efforts and accounts in part for the rapid progress of irrigation communities, a progress most satisfactorily exemplified by the development under the Rockyford group of ditches.

ROCKYFORD HIGH LINE CANAL.

This canal, one of the Rockyford group of ditches, belongs like the Bessemer ditch, in Class A. It diverts water from the Arkansas River near the mouth of the Huerfano River and just below the most easterly of the lands irrigated by means of the Bessemer ditch. It waters some 25,000 acres of the lands on the south side of the Arkansas River, in the Rockyford district, the owners thereof being entitled to divert for that purpose from the Arkansas River as follows:

	Cubic feet per second.
Under a priority date of January 6, 1890.....	418
Under a priority date of July 1, 1869	16
Under a priority date of June —, 1885	30

The right to 418 cubic feet per second under a priority date of January 6, 1890, was acquired by the construction of the canal and the utilization of the water diverted and used by means thereof. The two earlier rights were acquired by purchase from the Ballow Hill Ditch Company.

The Rockyford High Line canal is the property of the Rockyford Canal, Reservoir, Land, Loan and Trust Company. The objects of this company are to acquire and dispose of lands, to construct or purchase canals and reservoirs, and acquire and dispose of water rights. The capital stock is \$225,000, divided into 2,250 shares of \$100 each. Each share of stock entitles its holder to receive from the company's canal, for domestic purposes and for the irrigation of lands, 0.18 cubic foot of water per second; that is, for each 8 shares of stock 1.44 cubic feet of water per second, this being the amount required to irrigate 80 acres of land. No transfer of water from one tract of land to another is permitted except upon approval of the board of directors. No change can be made in the amount of water represented by each share of the capital stock of the company except by unanimous consent of the stockholders. Each share of stock which is issued and located is subject to an annual pro rata assessment for the maintaining and operating expenses of the company's canal, in an amount to be determined at the regular annual meeting; and a majority of the stockholders have power at a special meeting called for that purpose to levy any special assessment rendered necessary to meet unforeseen contingencies in the operating expenses of the canal. No stockholder who is in arrears in the payment of any regular or special assessment shall receive any water for domestic or irrigation purposes until all such

arrearages have been fully paid. The penalty for delinquency in connection with assessments seems as light as it could well be. The laws of Colorado, however, permit the forfeiture of the stock in the event of nonpayment of assessments.

Although water is distributed to the stockholders at the rate of 0.18 cubic foot per second per share, this is not a determination of the quantity of water to which each stockholder is entitled, for the time during which water is to be distributed to the shareholders at this rate is not set forth, nor can it be definitely determined beforehand what the period may be during which water will be distributed at such rate. Shareholders do not expect to receive water at this rate during all periods of the year. Each stockholder will receive his share of the water carried in the ditch, and the time of diversion will be made as long as the water supply will permit, or as seems best to those controlling the operation of the canal, in connection with which each shareholder has a vote. In effect, each share entitles its holder to a share of whatever water the canal supplies, just as is the case under the Bessemer ditch.

The value of water rights in this canal was enhanced by the purchase of the appropriation of the Ballow Hill Ditch Company. There is more water for stockholders at all seasons of the year because of these early rights purchased, and in periods of scarcity the holding of these early rights will prevent the canal being wholly deprived of water.

The stockholders in this company number some 400. A considerable portion of the land irrigated is held in tracts of 40 acres or less, the average being about 60 acres. The average assessment per share for some years past has been about \$6, of which perhaps \$2, or about 20 cents per acre, has gone into improvements or betterments of the canal and the purchase of rights, while perhaps \$4 per share, or 40 cents per acre, has been absorbed in operating and maintenance expenses. The total cost of the canal, including improvements and betterments, approximates \$350,000.

OXFORD FARMERS' DITCH.

The Oxford Farmers' Ditch Company has a right to 116 cubic feet per second with a priority date of February 26, 1887. Its organization is that of ditches of Class A, above described, wherein stock represents the water right. The canal is small and carries water for domestic purposes and irrigation for use upon lands of the stockholders of the company only.

ROCKYFORD DITCH.

This is the oldest of the Rockyford group of ditches. It parallels the Rockyford High Line canal, diverting water from the Arkansas River at a lower level. It runs through the town of Rockyford,

extending in a southeasterly direction some 7 miles beyond the town. The appropriations of the canal consist of 111.76 cubic feet of water per second with a priority date of May 15, 1874, and 96.54 cubic feet of water per second with a priority date of May 6, 1890.

The Rockyford Canal Company is capitalized for \$8,000 with 800 shares at the par value of \$10 per share, the selling value of which is at this time estimated to be \$150 per share. Enlargements and extensions of the ditch have been paid for by assessments against the capital stock. The area of land irrigated from this canal is about 6,000 acres, the water represented by each share of stock being considered sufficient to supply some 7 or 8 acres. The number of stockholders is less than formerly, and is about 55. This decrease in the number of stockholders is due to the large purchases of stock by the American Beet Sugar Company, which now owns something over 55 per cent of the stock. Tenant farming is carried on under this ditch to a considerable extent, chiefly on the lands of the American Beet Sugar Company. The Rockyford ditch is also one of the ditches defined as Class A.

Each share of stock is subject to an annual pro rata assessment for maintaining and keeping in repair the company's canal and ditches, in an amount to be determined at the regular annual meeting or at special meetings called for the purpose of levying any special assessment, but no such assessment may be made unless the question of making it is first submitted to the stockholders at an annual meeting or special meeting, or unless it is approved and ordered by a majority of the stockholders either in person or by proxy; and whenever any such assessment is approved and ordered, due notice thereof in writing shall be given to each stockholder of the company not participating nor represented at the annual or special meeting ordering the same, by mailing notice to his or her last known post-office address. Should any stockholder be delinquent for thirty days in the payment of any assessment, the board of directors is empowered to declare a forfeiture in accordance with the statute, and the secretary is empowered to sell the forfeited stock at public sale at such time and place as the directors may direct, two weeks' notice of sale having been previously given by advertisement in one of the weekly newspapers in the town of Rockyford, Otero County, Colo.

All lateral gates belonging to the company for the use of the stockholders of the company are put in by the directors at the company's expense and are under the sole control of the board of directors, and all damage to lateral gates committed by any stockholder or water consumer under the ditch of the company is to be made good and paid by the stockholder for whose benefit the lateral gate has been constructed, and the amount of the damage, when ascertained by the board of directors, may be enforced and collected the same as other assessments.

Each holder of capital stock is entitled to receive from the company's canal water in the proportion which the number of shares of stock held by him bears to the total number of shares of the capital stock of the company issued and outstanding. In order that the water may be equitably distributed among the stockholders, the directors and the persons intrusted by them with the management of the ditch are empowered to rotate water among consumers, or to divide the ditch into sections for the distribution of water, or to adopt such other methods as in their judgment may from time to time become necessary to secure to all stockholders their proportionate share of water.

CLASS B DITCHES.

CATLIN DITCH.

This ditch diverts water from the Arkansas River a few miles east of the town of Fowler and runs thence in a southeasterly direction to Timpas Creek east of the town of Rockyford. The extension of this canal for some miles east of Timpas Creek is known as Fairmount extension. The appropriations of the Catlin canal are 248 cubic feet per second, with a priority date of 1884, and 97 cubic feet per second, with a priority date of November 14, 1887. The water rights under the Catlin ditch are acquired and enjoyed under contracts made with the Catlin Consolidated Canal Company, the contracts being followed by water deeds. This is a Class B company which will become a Class A company upon the fulfillment of conditions named in the deeds. The conditions of the deeds are as follows:

One water right represents water for 80 acres and calls for 1.44 cubic feet per second, water to be furnished at this rate during the irrigating season, but not at other times except upon written consent of the company. This water is to be used for irrigating and domestic purposes upon a described tract. The deed is received subject to the decreed priorities of the ditch, in accordance with which the waters of the ditch are to be distributed. No water is to be wasted. Water is to be delivered at the points along the line of land or from the reservoirs determined by the company as most practicable, the manner of withdrawing the water and the regulation of the supply to be at all times determined by the company. The purchaser is to pay for the headworks and weirs and for keeping them in repair; the company is to keep its canal and reservoirs in good condition, and assessments, not to exceed 10 cents per acre per annum, may be levied for the ordinary expenses of maintenance, repairs, and superintendence, payable April 1. The company has a right of way 80 feet wide along its main ditch, and fences made by purchasers across the right of way must be provided with gates when right of way is used for road purposes. The company is not liable for shortage of water due to the fact that its canal can not

carry and distribute a volume of water equal to its estimated capacity, or if the volume proves insufficient from drought or other causes beyond its control, but shall have the right to distribute such diminished flow of water pro rata to holders of water rights. The irrigating season commences April 1 and continues to November 1 of each year. After the irrigating season water is to be conveyed for domestic purposes whenever practicable, subject to the right to repair, enlarge, or extend the canal.

When the company shall have sold and have outstanding and in force a number of water rights equal to the estimated capacity of its ditch to furnish water, and these water rights shall have been paid for, together with interest thereon in full, then the owners of the water rights shall become entitled to be the owners of the company's ditch, and the title to the ditch shall pass to the owners of water rights on the plan following: The company shall appoint five water holders to incorporate the new company, to be composed of all water-right holders. These five persons shall be the directors for the first year and shall organize, make by-laws, and issue to all water-right holders stock in the new company in the proportion that the water rights held by each have to the whole number of water rights outstanding. This new company shall be the owner of the canal and all rights connected with it. The details of this plan are given in Appendix II, page 76, where the full text of these deeds is given.

OTERO CANAL.

The last of the Rockyford group of ditches is the Otero canal, which diverts the waters of the Arkansas River near the town of Fowler, and runs thence in a southeasterly direction, paralleling the other ditches of the Rockyford group and covering some lands in the heart of the Rockyford district not irrigated by other ditches, but extending to and covering lands adjacent to the town of Lajunta. About 60 miles of the canal were built in 1890, the carrying capacity of the canal being estimated at 457.92 cubic feet of water per second. The right of the canal is 123 cubic feet per second, with a priority date of March 3, 1890.

The career of this canal has been a checkered one, caused by the inability of the canal company to keep its agreements with either its bondholders or its water-right purchasers. It was operated by the company until early in the year 1895, when a trustee took charge under a trust deed and operated it until July, 1900, since which time it has been operated by Mr. Albert Smith, receiver. It is now sought to organize an irrigation district under a statute of Colorado approved April 12, 1901, by which this canal shall be purchased and operated. The expense of operating the canal under the receiver in 1901 was 68

cents per acre instead of 15 cents per acre provided for when the company issued its contracts. This fact enables one to weigh more accurately than he otherwise could the value of a water-right contract or water deed under this class of ditches and observe how that excellent plan may be frustrated; and how a greater annual operating charge than that contemplated in the agreement may fall upon a water-right purchaser, and observe how a water right of the kind often called perpetual, except as to the irrigation season limitations, may be jeopardized or lost.

The history of the Otero canal outlined above is perhaps as significant a comment as can be made relative to the fate of a water right in a Class B ditch which it does not pay the promoters to operate.

LAKE CANAL.

This canal is the property of the Laguna Canal Company. It is on the north side of the Arkansas River and is a Class B ditch. It is 20 feet wide on the bottom, with side slopes of 1 to 1, carries water to a depth of 5 feet, and is some 26 miles in length, the carrying capacity being about 500 cubic feet per second and the cost over \$100,000. Some 14 miles from the head of this canal is reservoir No. 1, with a surface area of about 500 acres when full and about 200 acres when the upper 14½ feet of water has been drawn off. The lands watered by this canal are on the north side of the Arkansas River and are tributary to Rockyford and Lajunta. Some 1,800 acres have been watered, a considerable portion of which is State land. There are about 150 families on these lands, some 50 per cent of whom own their land. The company has a right to 155 cubic feet of water per second, with a priority date of September 25, 1889. When the Arkansas River is in flood this canal carries 500 cubic feet of water per second. Ditches having a late priority should be able to carry a larger quantity of water than would be necessary were the priority an early one and water enjoyed by means thereof at all times and seasons. The storage reservoir above mentioned, to a considerable extent, compensates for the lack of an early priority on the part of this canal, the water stored in the reservoir being used at periods when direct diversion from the stream can not be made.

The Laguna Canal Company was organized to purchase from Mr. Henry B. Holbrook the Lake canal, with the reservoir sites, laterals, franchises, and use and dispose of the water conducted through its main canal. The company executes contracts and water deeds with the users of water from the Lake canal system. The features of a Lake canal water right given below are taken from a deed of the Laguna Canal Company to Mr. J. P. Pollack, dated July 25, 1899. The deed, in consideration of \$1,000, conveyed a water right entitling

the purchaser to the perpetual use of water flowing in the canal or from storage reservoirs, at the option of the company, in an amount sufficient for the irrigation of 80 acres, not exceeding in delivery 1 cubic foot per second during the irrigation season, from April 1 to November 1, subject to the following, among other agreements and conditions, viz: That the water shall be used on tracts of land described in the deeds; that no assignment of deed or relocation of water on other lands shall be valid without written consent of the company; that the conveyance of water for domestic purposes shall be made by the company, subject to necessary closing for repairs, enlargement, or extension of its canal; that the purchaser, or those holding under him, shall not permit waste of water, but shall give timely notice of needs; that the point of delivery shall be at lateral head gate in main canal; that the regulating of the supply of water from the main canal or from the storage reservoirs, and the supervision of the head gate, shall be under the control of the company, and that the head gates, flumes, weirs, or other arrangements through which the water shall be drawn from the canal, shall be made and placed in position by the company at the cost of the purchaser, who shall also be liable for the expense of keeping the same in good repair and condition, the payment of all sums, expenses for said purposes, to be enforced in the manner prescribed for enforcing assessments; that the company shall keep and maintain its canal in good order and condition, and sell no more water rights than the estimated capacity of its canal will warrant, and shall have the right to assess each of the water rights it has sold for the expenses of maintaining, repairing, and operating the canal, and for taxes, if any, a sum not to exceed \$25 per annum, payable on March 1 of each year, for the expenses of the previous calendar year and any deficit that may have been occasioned the year prior thereto, this amount to be arrived at by apportioning the actual expenditures and deficit, if any, pro rata among the water rights outstanding at the close of the year for which the assessment is made, and the assessments to be made upon such water rights only. If the purchaser shall fail to pay any or all assessments within 10 days after the service of notice of same by the company, either in person or by letter to him addressed at Lajunta, Colo., then the company shall be authorized to shut off the water from the land described, and to keep the water shut off until the assessments have been paid in full, together with interest at the rate of 1 per cent per month from the date when the assessment was due until paid; and in event of default of payment of assessments for six months the deed may be declared void at the option of the company. In case the canal shall be unable to carry and distribute a volume of water equal to its estimated capacity, either from casual or unforeseen or unavoidable accidents, or because the volume of water in

the natural stream proves insufficient from drought, or the use thereof by those having prior rights thereto, or from any cause beyond the control of the company, then the company shall not be liable in any way for the shortage or deficiency of the supply occasioned by any of such causes. If, by reason of such causes, the supply of water is insufficient to furnish an amount equal to all the water rights outstanding, the company shall have the right to distribute such water as may flow through its canal to the holders of water rights pro rata. The necessary right of way upon which to construct and maintain laterals through which to conduct water from the canal or reservoirs of the company on to lands situated and lying below the lands of purchaser is granted for such purposes.

The Lake canal belongs to Class B, as hereinbefore defined, and is not, so far as disclosed, designed to become the property of users of water. The water right acquired from this company is what is called a perpetual water right, being supposed to represent and entitle the owner to the perpetual use of water from the canal or storage reservoirs of the company. These so-called perpetual rights are subject to the conditions governing the enjoyment of water rights under the laws of Colorado, as well as to the conditions affecting such rights contained in the articles of incorporation of the company or in the water deed itself, and are involved in the ability of the companies selling perpetual water rights to perpetuate themselves and keep their works in operation. The estimated capacity of this canal is greater than its decrees. It has carried water in excess of such decrees during periods of high water, and it is understood contemplates asking for additional decrees. The indefiniteness of the term "carrying capacity," as well as the changeable nature of "perpetual rights," will be considered in general remarks touching these subjects.

COLORADO OR BOB CREEK CANAL.

The head gate of the Colorado or Bob Creek canal is on the north side of the Arkansas River, 18 miles east of Pueblo. By means of this canal water is conveyed many miles to the eastward for the irrigation of lands adjacent to the towns of Olney Springs, Ordway, and Sugar City. This canal has a right to 756.28 cubic feet per second, with a priority date of June 9, 1890, and connected therewith are certain reservoirs which are supplied with water by it, and one, the Twin Lakes reservoir, which supplies the canal.

The Colorado canal, at one time the property of the Colorado Land and Water Company, is now controlled by the Twin Lakes Land and Water Company, and the Twin Lakes Reservoir Company, which owns the Twin Lakes reservoir which supplies water to the canal. The pur-

poses of these companies and their relations to each other are involved in an understanding of the water rights acquired under this canal. The Twin Lakes Land and Water Company was formed to purchase or otherwise acquire agricultural lands, canals, laterals, reservoirs, rights of way, easements, water rights, appropriations of water, and other property, and more especially to acquire the Colorado canal. It was also to buy and sell lands, grain elevators, agricultural implements, and provisions, purchase coal mines, bore for oil and gas, manufacture brick, etc.

The Twin Lakes Reservoir Company was formed in 1897 to acquire the Twin Lakes reservoir site and the rights of storing water therein, to build the works necessary to its operation and conducting the water stored to the place of use, "all for the exclusive use and benefit of the stockholders of the company;" also to acquire the right to carry water through the Colorado or Bob Creek canal, and to maintain and operate such other canals as might be necessary from time to time. The water from Twin Lakes is to be conducted through Lake Creek to the Arkansas, and through that river to the head of the Colorado or Bob Creek canal, and through that canal to the lands of the stockholders of the company; that is, the Twin Lakes Reservoir Company was formed for the purpose, among others, of carrying water in the Bob Creek canal, controlled by the Twin Lakes Land and Water Company. Thus this canal carries water belonging to both companies, and some users of water have rights acquired from both companies.

In 1899 the Twin Lakes Land and Water Company conveyed to the National Beet Sugar Company the first and prior right to the use of water at any time stored in lakes Henry and Meredith, situated under the Bob Creek canal in Otero County, for supplemental use in irrigating lands described in the deed, for domestic uses, and for the operation of a beet-sugar factory to be built by the sugar company; and the water company further agreed not to sell any other water rights in the lakes until after it had been demonstrated that there was a surplus remaining after supplying the needs of the sugar company. This conveyance was made subject to the conditions, among other things, that the water was to be used only for supplemental irrigation and for domestic purposes on 12,206.71 acres in township 21 south, range 57 west, and also for similar uses on 120 acres of additional lands, and for use in operating a beet-sugar factory. The water company reserved the right to distribute the water from the lakes, subject to the rights granted to the sugar company, and to sell any surplus water or water rights after supplying the needs of the sugar company.

Perhaps the most complicated water deed in the Arkansas Valley is that of the Twin Lakes Land and Water Company. The provisions to

which attention is directed are: The Twin Lakes Land and Water Company was the successor in interest of the Colorado Land and Water Company to the Colorado or Bob Creek canal and the undisposed-of water rights therein. The Colorado Land and Water Company had, in June, 1890, conveyed to the Colorado Land and Reservoir Company all the surplus and undisposed-of water which the then capacity of the Colorado canal would supply, reserving expressly, however, the right to the use of water sufficient to irrigate 50,000 acres by direct delivery at the rate of 1.44 cubic feet per second for each 80-acre water right, which is equivalent to 55.55 acres to each cubic foot per second, and 900 cubic feet per second for 50,000 acres. This reserve supply was to be disposed of to purchasers and holders of perpetual water rights, and is what is being disposed of by the Twin Lakes Land and Water Company. The Colorado Land and Water Company conveyed to the Colorado Land and Reservoir Company the right to improve the canal without interfering with the reserved right to deliver and dispose of water sufficient for 50,000 acres; also all its interest in all storage basins and reservoirs under the canal, and all rights to store water to be carried by the canal beyond the first 50,000 acres of water rights reserved; it being understood that all sales of rights and privileges for the use of water by the reservoir company should be subsequent to the rights of the water company to the first and prior use of 900 cubic feet per second for one hundred days' delivery in each irrigating season. The capacity of the canal still vested in the Colorado Land and Water Company after the conveyance to the Colorado Land and Reservoir Company was divided into 833 equal parts, each of which is designated a water right and represents a carrying capacity of 1.08 cubic feet per second for one hundred days during the irrigating season of each year. These are the water rights being sold by the present company, and the water-right purchaser accepts them subject to the conveyance by the Colorado Land and Water Company to the Colorado Land and Reservoir Company. The water represented by a water right is to be used on certain described tracts, shall not be wasted, and is to be delivered at lateral head gate at main canal. The purchaser is to pay for head-works and repairing the same, and pay pro rata expenses for maintenance and operation not exceeding \$16 per 80-acre water right. If the water carried in the canals is insufficient to supply all water rights outstanding, such water as is obtained is to be pro rated, the company not to be liable for shortage resulting from casual, unforeseen, or unavoidable accidents, or drought, or prior claims, or causes beyond the control of the company. The necessary rights of way are granted the company. Water may be located on other lands nearer the head gate of the canal, to which no water right has attached, but without expense or liability to the company.

From the above it will be noticed that while the decreed right of the Colorado canal is 756.28 cubic feet per second, the carrying capacity, though not so declared, is assumed to be 900 cubic feet per second, and that water rights are based upon this assumption, and that the volume of water received will be less if the actual carrying capacity is less than that assumed, or if the canal gets only its decreed volume. It will also be noticed that, although the purposes of the company as stated are, among others, to make appropriations of water, etc., "all for the exclusive use and benefit of the stockholders or shareholders of the company," yet the Colorado or Bob Creek canal does not fall under ditches of Class A, but is a Class B ditch.

A water right under the Colorado canal may also be acquired from the Twin Lakes Reservoir Company. Such a water right may be represented by stock or an agreement by the company to sell stock under certain conditions and after the fulfillment of certain agreements. Under such an agreement in 1902 the Twin Lakes Reservoir Company agreed to sell and transfer to a water-right purchaser — shares of its stock upon the condition that the water represented by such stock should be applied to certain lands under the Colorado canal, for which the purchaser owned water rights in the canal. Under such an agreement each share of stock represented one fifty-thousandth part of the capacity of the Twin Lakes reservoir when completed, and the stock was to be issued only after payment in full therefor and payment of all water assessments pending final payment, and default in deferred payments or interest or assessments would terminate the contract at the option of the company.

LOWER REACH OF THE ARKANSAS RIVER.

The lower reach of the Arkansas River in Colorado extends from the vicinity of Lajunta to the east line of the State. The ditches diverting water from this section of the river and located on the south side thereof may be considered in two groups, viz, the Las Animas group and the Lamar group. The important ditches of the Las Animas group are:

Las Animas group of ditches.

Name of ditch.	Appropriations.	Priority date.
	<i>Cubic feet per second.</i>	
The Jones ditch.....	44.3	Feb. 18, 1890
The Town ditch of West Las Animas.....	38.0	Mar. 7, 1884

The more important ditches of the Lamar group, including the Hyde ditch on the north side of the Arkansas River, are:

Lamar group of ditches.

Name of ditch.	Appropriations.	Priority date.
	<i>Cubic feet per second.</i>	
The Keesee ditch	9.00	Mar. 13, 1871
	4.50	Dec. 31, 1883
The Abe Peterson ditch	6.00	May 31, 1883
The Colorado and Kansas canal	27.77	Apr. 1, 1886
	15.75	Nov. 30, 1875
The Lamar canal	87.84	Dec. 3, 1877
	11.70	Sept. 11, 1889
	184.27	July 16, 1890
The Bed Rock ditch	32.77	Mar. 10, 1889
	26.77	Aug. 12, 1890
The Manville ditch	54.00	Oct. 14, 1890
The Graham ditch	61.00	Aug. 25, 1881
The Hyde ditch	23.44	May 10, 1887

SYSTEM OF THE ARKANSAS VALLEY SUGAR BEET AND IRRIGATED LAND COMPANY.

The more important canals diverting water from the lower reach of the Arkansas River and situated on the north side thereof are the Fort Lyons canal and the several canals which, with the reservoirs supplied by them, constitute the irrigation system of the Arkansas Valley Sugar Beet and Irrigated Land Company.

The Fort Lyons canal, formerly known as the Arkansas River Land, Reservoir, and Canal Company's canal, diverts water from the Arkansas River in the vicinity of Lajunta and runs thence eastward, covering a large area of land in the counties of Bent and Prowers. Its length is about 113 miles. It has two appropriations for direct irrigation, one for 164.64 cubic feet per second, with a priority date of April 15, 1884, and the other for 597.16 cubic feet per second, with a priority date of March 1, 1887. The canal is much larger than required for this volume of water. The waters of the reservoirs known as the King and Price reservoirs are diverted through the Fort Lyons canal, as is also water for storage in the reservoirs included in the irrigation system of the Arkansas Valley Sugar Beet and Irrigated Land Company, the most extensive system of canals and reservoirs in the Arkansas Valley. This system deserves special consideration because of its magnitude and importance and because of the policy of the company controlling the system with reference to the amount of water represented by a water right, and also to the completeness with which water is made appurtenant to lands. The Arkansas Valley Sugar Beet and Irrigated Land Company has succeeded to the lands,

ditches, reservoirs, rights, franchises, privileges, and responsibilities of a number of irrigation and land companies, including the Amity Canal and Reservoir Company, the Amity Canal, Reservoir and Improvement Company, the Amity Land Company, the Great Plains Water Company, and the Great Plains Water and Storage Company. It is contemplated by this company that eventually there will be irrigated by means of its system of canals and reservoirs some 78,900 acres of land. It is not at present contemplated that water stored in the reservoirs of the company will be used on lands irrigated by means of the Buffalo canal. These purposes of the company have necessitated several forms of contracts, including one for ditch and reservoir rights and one for ditch rights exclusive of reservoir rights. This company has initiated a new system of distribution. The quantity of water represented by a water right and allotted to a tract of land under its water deeds and contracts is expressed in acre-feet.^a This company owns or controls the following ditches, canals, reservoirs, water appropriations, and privileges:

(1) A right of way through the Fort Lyons canal from its head gate to Gageby Arroyo, a distance of 42 miles, the estimated carrying capacity of this portion of the Fort Lyons canal being 2,095 cubic feet per second. This right of way is accompanied by a right to divert through the Fort Lyons canal for storage in the reservoirs of the company so much of the carrying capacity of the canal as is not utilized for direct irrigation from this canal. The rate at which water may be diverted through the upper portion of the Fort Lyons canal by this company for storage in the reservoirs of the company seems to be 1,163 cubic feet per second, being the difference between 2,096 cubic feet per second, the estimated capacity of the canal, and 933 cubic feet per second, which it is understood may be utilized by those holding water rights in the Fort Lyons Canal Company.

(2) The Kicking Bird canal, with an estimated carrying capacity of 1,000 cubic feet per second. This canal is some 36 miles in length, extending from Gageby Arroyo to the higher reservoir of the company and conveying the water for storage purposes brought to Gageby Arroyo by the Fort Lyons canal.

(3) The Lone Wolf ditch, some 4 miles in length, with a capacity of 700 cubic feet per second. This is virtually an extension of the Kicking Bird canal for the purpose of supplying the Nee No She reservoir.

(4) The Santanta canal, a supply canal connecting the Kicking Bird canal with the Queen reservoir. Its estimated carrying capacity is 300 cubic feet per second, and its length 12.5 miles.

(5) The Comanche canal, which is an outlet canal from the reservoirs, has a carrying capacity of some 488 cubic feet per second, a length of

^a An acre-foot is 43,560 cubic feet, or sufficient water to cover 1 acre to a depth of 1 foot.

16.78 miles, and empties into Big Sandy Creek about one-half mile above the crossing of that creek by the Amity canal. The Comanche canal is thus used to supplement the Amity canal, but may also be used to supply water to lands above the Amity canal.

(6) The Pawnee canal, with an estimated capacity of 200 cubic feet per second, and a length of 6.34 miles, connecting the Queen reservoir with the Comanche canal.

(7) The Amity canal, which diverts the water of the Arkansas River some 7 miles west of Lamar and runs thence easterly for 110 miles, 30 of which are in the State of Kansas and no longer utilized. The Amity canal has an appropriation of 283.5 cubic feet per second, with a priority date of February 21, 1887.

(8) The Buffalo canal, with an estimated capacity of 192 cubic feet per second and a length of 16.1 miles. This canal has an appropriation of 67.5 cubic feet per second, with a priority date of January 29, 1885.

(9) The Nee Sopah reservoir, with an estimated available capacity of 23,464.5 acre-feet.

(10) The Nee Grondo reservoir, with an estimated available capacity of 57,209 acre-feet.

(11) The Nec No She reservoir, with an estimated available capacity of 60,636.5 acre-feet.

(12) The Nee Skah reservoir, with an estimated available capacity of 23,046.6 acre-feet.

(13) In addition to the above reservoirs already constructed there is the King reservoir, claimed by the company, the construction of which has been delayed pending a judicial determination of the ownership or extent of ownership thereof and storage rights therein. It is estimated that the available storage capacity of this reservoir will be 18,279 acre-feet.

(14) Rights in the Fort Lyons canal, estimated as equivalent to 66.5 cubic feet per second. This company owns large tracts of land under its system of irrigation works, with which and for which its water rights are chiefly sold. The several steps usually taken, and resulting in the acquisition of lands and water rights by a purchaser from this company, consists of an application to purchase, an agreement or contract of sale, a land deed, and a water deed.

The application to purchase describes the lands applied for and states the number of acres which are irrigable and the number not irrigable. It describes the water right, which in general terms is a right to the use of so much water each year as may be necessary to irrigate a given number of acres of land, not to exceed a total delivery during the year of sufficient water to cover the irrigable portion of the land 2 feet deep. It contains a money offer for land and water right, is accompanied by binding money and by an agreement to pay an additional sum upon the delivery of a contract of sale, and to make

deferred payments, with 6 per cent interest, at stated dates. It also contains an agreement to spend a stated amount in buildings for farm purposes within a given period and to put the premises into crops for a stated season, and an agreement that when approved the application shall be a binding contract, and that if applicant fails to sign the contract or to comply with any conditions therein contained or pay the sum agreed to be paid on delivery of contract the application shall be of no further force or effect and the binding money forfeited as liquidated damages.

Following the application is the contract of sale between the company and the applicant for land and water rights. In this contract the company agrees to sell certain described lands, together with a right to the use of water not exceeding a total delivery of 2 acre-feet per annum for the irrigable portion of the lands sold, such right to water to be conveyed by deed.

The contract provides that the purchaser shall pay taxes and assessments lawfully imposed upon the premises and water right and charges on account of maintaining, repairing, and operating the canal and reservoirs of the company, and conform to the provisions of the water deed referred to above. It also fixes the time within which the purchaser is to enter into possession of the premises and expend not less than \$200 in the erection of farm buildings and the season for which the premises must be put into crops.

In the agreement of sale it is provided that no improvements shall be placed upon the premises except as paid for by the purchaser at the time of making the sale, the actual payment for the improvements being an essential part of the consideration, and that the premises are not to be made liable because of failure of purchaser to pay for such improvements. Upon strict compliance by the purchaser with the terms of the contract the company agrees to deliver to the purchaser a deed conveying the premises in fee simple and conveying a water right, subject to certain conditions and reservations, such as the reservation of strips, 30 feet in width, running north and south and east and west through the center of sections, and such as the condition that the premises are subject to roads, highways, ditches, canals, laterals, or other rights of way now existing or hereafter laid out upon them, and that the premises shall be subject to the terms and conditions of the water deed, locating a water right thereon. The contract provides for the reversion to and reinvestment in the company of all rights and interests existing in favor of the purchaser upon the failure of the purchaser strictly and literally to perform all the stipulations and agreements of the contract. No assignment of the contract is valid without the written approval of the company. If the sale of the property is approved by the Mercantile Trust Company, trustee, said trustee will, upon final payment, at the request of the purchaser,

execute and deliver a release deed of the premises if they are under the mortgage of the Arkansas Valley Sugar Beet and Irrigated Land Company. The water deed of this company differs from most water deeds. The especial features of the water deed to which attention is directed are: That the company sells the water right for the use and benefit of certain described lands. Each water right in the Amity canal and reservoirs of the company is a right to so much water taken from the Arkansas River and the reservoirs of the company and delivered from the canal between April 15 and November 1 of each year, as may be necessary to irrigate 40 acres of land, not to exceed a total delivery during that period, at the place of delivery, of sufficient water to cover 40 acres of land $1\frac{1}{2}$ feet in depth, and also an additional amount to be delivered from November 1 to April 15 not to exceed 6 inches in depth. The water is to be delivered and used in accordance with the regulations of the company as now or hereafter adopted. The water right is attached, as part and parcel thereof, to certain described lands belonging to the purchaser, and all persons becoming possessed of said land are deemed to have acquired such right as part and parcel thereof, and said right shall not be transferable to or used on other land. Water is to be delivered from the canal at the head-gate of the lateral ditch supplying the purchaser. The company is not liable for any deficiency of supply to the purchaser if it is unable for any reason or cause not intentional upon its part to carry through its canals for direct delivery or storage sufficient water to utilize the full capacity of the canal and reservoirs. The purchaser is to pay a ratable proportion of the cost of head gates, weirs, etc., for delivering water to him from the canal, and shall in addition pay a maintenance fee which shall not aggregate less than \$5 annually and may be 50 cents per acre, such charges to be liens upon the land. The application to a beneficial use of water from the canal and reservoirs upon the lands described in the water deed shall be deemed an appropriation by the company for its use and benefit. Seepage water developing on lands described shall belong to the company, and may be collected and used by the company. Purchaser grants rights of way over his lands necessary for ditch purposes. When the canal and reservoir system shall, in the judgment of the company, have reached completion, and the capacity having reached such a limit as said company may deem most practicable and expedient, the canal and reservoir system may be turned over to the respective holders of water rights at the option of the company. The manner of turning over such system consists in organizing a new company under the laws of Colorado, deeding thereto the canal and reservoirs without injury to the title of purchasers to their water rights, and issuing of the capital stock of the new company fully paid shares to the owners of water rights, there being one share of stock for each water right in the esti-

mated practical capacity of the system, whether sold or unsold. After transfer, the new company and stockholders are to own and control the canal and reservoirs and the water of the same. All shares in the new company representing water rights unsold are to be issued fully paid and nonassessable to the parent company. Upon demand the new company shall, as fast as water represented by rights unsold at the time of reorganization is made appurtenant to lands, deliver to the parent company, or its assigns, water deeds. (See Appendix III, p. 79.)

Under the Buffalo Creek canal, the contracts and water deeds of the Arkansas Valley Sugar Beet and Irrigated Land Company are quite similar to those under the Amity canal and reservoirs, differing principally in the fact that the reservoirs of the company are not referred to. A water right in the Buffalo Creek canal is a right to so much water taken from the Arkansas River and its tributaries through the head gate of the canal, and delivered from the canal between April 15 and November 1 of each year, as may be necessary, to irrigate 40 acres of land $1\frac{1}{2}$ feet in depth and also an additional amount to be delivered from November 1 to April 15, not to exceed 6 inches in depth. This water is to be delivered and used as summarized in the water deed just discussed. A water right under this irrigation system has not always been expressed in acre-feet, nor has it always meant the same quantity of water or water sufficient for the same acreage of land. At one time prior to the existence of the present company, under the Amity canal and connecting reservoirs, each water right represented 1 cubic foot of water flowing over a weir per second of time between sunrise and sunset. This water was to be delivered between April 15 and November 1. At one time also a water right in the reservoir system, now controlled by this company, was the right to so much water taken from the reservoir between April 15 and November 1, as was necessary to irrigate 80 acres not to exceed a total delivery of sufficient water to cover 80 acres of land 1 foot in depth.

The irrigation system of the Arkansas Valley Sugar Beet and Irrigated Land Company is so large a system that it has been found advisable to form companies for the management of some of the lateral ditches carrying water from one of the main canals. The Swede Lateral Ditch Company, one of these companies, is organized for the purpose of operating what is known as the Swede lateral ditch. Membership in this company is confined to those who are owners of rights to water from the Amity canal, who conduct the water to which they are entitled from the Amity canal through the lateral of this company. Persons now owning or hereafter acquiring rights to water from the Amity canal to be delivered through this lateral may become members and stockholders of this company upon application made to the board of directors, and upon payment of such sum of money as

may be required as their proportionate share of the moneys theretofore expended by the company, which shall be at least equal to all annual assessments theretofore made, with interest thereon at 24 per cent per annum. The board of directors of this company annually elect a superintendent, whose duty it is to attend to the distribution of water, subject to the by-laws and the rules, regulations, and instructions of the board of directors. Subject to the instructions of said board, he has control of the head gates of all subsidiary and distributing laterals, and to regulate the discharge of water through these head gates may place locks upon them, so that each member shall receive the amount of water to which he is entitled. When notified by the secretary that any member is delinquent in the payment of his assessments and when notified by the water company that it refuses to deliver water to any member of this company at the head gate of the lateral, the superintendent shall shut down the head gate of the member and cease to deliver water to him until notified by the secretary of the payment of his assessment, or until notified by the company that it is again delivering water for the use of said member, as the case may be. To facilitate the irrigation of lands, the board of directors is empowered to rotate water among the stockholders of the company or to divide the lateral and the subsidiary and distributing laterals into districts for the better distribution of water, or to adopt such other methods as in their judgment may from time to time tend to secure to stockholders the greatest benefit from the water delivered into the lateral ditch.

In connection with water contracts and water deeds of the Arkansas Valley Sugar Beet and Irrigated Land Company, it is observed:

(1) That among the causes which may diminish the water of water-right purchasers for which the company shall not be liable are the acts of other users of water, in addition to the usual causes of water shortage, such as the demands for prior appropriations and conditions beyond the company's control.

(2) That the ability of the company to supply the 2 acre-feet per acre per annum to its water purchasers is greater the larger the amounts of water it can divert and store and the less the acreage for which it sells water rights; that while the amount of water it can divert and store can not exceed the capacities of the diverting and storage works for carrying and storing water it may be less than such capacities, and that the average number of acre-feet per acre per annum delivered through a period of years is a safer basis for determining the number of water rights to be sold than the estimated practical capacity of the system, unless the words "practical capacity" be interpreted to mean the usual annual delivery or something to that effect.

(3) That the making of water appurtenant to land is likely to prove beneficial among other ways by checking speculations in water rights

and thereby disturbing land values under the system; but may result in the continued cultivation of lands which are less valuable for crops than are other lands to which the water, under another form of deed, might be transferred, and may, as in the case of lands saturated by seepage waters, result in the purchaser losing his water right.

(4) That this company is making a radical departure from the general custom when it provides in its water deeds that the seepage or ground waters shall belong to the company and not to the water-right purchaser upon whose lands they accumulate, and when it provides that the application of water by the purchaser on his own lands shall be deemed an appropriation by the company for its use and benefit.

(5) That while in the new company to which the works are to be turned over at the option of the present company, the water rights sold are to be represented by full-paid shares of the capital stock, and the water rights unsold are to be represented by shares issued full paid and nonassessable to the parent company, it is the intention eventually to place the control and management of the canal and reservoir system free of liens and encumbrances in the hands of purchasers of water.

CLASS C DITCHES, OR THOSE CARRYING WATER FOR HIRE.

The carrying of water for hire is permissible under the laws of Colorado, and in cases of dispute between the owners of ditches carrying or furnishing water for hire and the users of water, as to the reasonableness of the charge for water so carried, the proper board of county commissioners will determine the reasonable fee which is to be paid by the users of water. Ditches carrying water for hire charge more for this service than is required for operating the ditch, making the carriage of water a source of profit. Contract-right ditches charging water users annual fees less than the pro rata cost of operating the ditch are not classed as carriers of water for hire.

There are no ditches in the Arkansas Valley in Colorado operated with the avowed purpose of carrying or furnishing water for hire. There has been, however, an isolated case in the valley, perhaps several, where, because of temporary and unforeseen conditions affecting the operation of a ditch, the county commissioners have determined the reasonable annual charge for water carried or furnished. The most notable example in Colorado of an irrigation company which has operated in this manner is the Northern Colorado Irrigation Company. In times past what is called a bonus was demanded from the users of water in addition to the annual charge for carrying or furnishing water. Such a bonus is also called a royalty and is practically payment for a water right. Such a payment is strenuously opposed by users of water, being regarded by them as a payment for the privilege of annually paying all that is reasonable for water

carried for or furnished to them by ditch companies. Such royalties are now prohibited by a statute known as the anti-royalty law, the effect of the statute being to prevent irrigation companies from carrying water for profit and at the same time selling water rights. In Appendix IV, page 81, is an exhibit of a form of water-right deed which has been used by the company and discloses both the royalty and annual rental features.

SUMMARY.

It remains to consider these water-right contracts briefly, but from a sufficient number of view points to disclose the interest of the general public as well as the attitudes of the contracting parties. The further consideration of the contracts will be from three standpoints:

- (1) That of the investor in irrigation works.
- (2) That of the farmer wanting to secure a water supply.
- (3) That of the general welfare.

WATER-RIGHT CONTRACTS FROM THE STANDPOINT OF INVESTORS IN IRRIGATION WORKS.

From the standpoint of an investor in irrigation works the principal object to be sought is the security and profitableness of the investment, and water-right contracts are drawn with this object in view. Occasionally, when constructors of irrigation works have large land-holdings to be watered from the works, the plan of selling stock which represents an interest in the works and entitles its holder to a share in the water furnished and a voice in the management of the constructing and operating company is satisfactory, but such a plan plainly will not serve the purpose of the investor in irrigation works who is not also largely interested in lands, since as soon as a bare majority of the stock is sold the control of the company will pass to the purchaser of stock, whose object is to secure a water supply as cheaply as possible rather than to render profitable the original investment. Investors require rather some contract under which they may retain control of the works built until they have profitably consummated their enterprise.

The favorite form of contract since the passage of the Colorado anti-royalty bill has been the one under which the company sells a right to receive water from its canal, and the purchaser is obligated to pay, in addition to the price of the right, annual charges intended to be sufficient to cover the running expenses of the canal, but not to exceed that amount. The form of contract which permitted the sale of a water right and also an annual charge to the water user greater than the pro rata cost of the operation being no longer possible, investors are limited to one of several propositions. They are limited to selling water rights with annual pro rata charges not exceeding the pro rata

cost of operation, or to selling water rights and land, deriving a profit from sale of land, or both land and water rights, or to carrying water for hire. The carrying of water for hire is not apt to prove financially profitable, since such construction must precede settlement, and for a number of years at least there would be few to use the water carried, and these few could not pay rates sufficiently high to cover necessary expenditures of the canal company. Then also commissioners are authorized to establish reasonable rates in such cases, and there would always be uncertainty about securing profitable rates.

The sale of water rights, which is now prohibited, has been defended by the builders of irrigation works on the ground that they have been of great service to the community in giving high value to lands which were before valueless, and the only way they can participate in this rise in values which they have created is to sell water rights or lands with water rights attached.

Since the quantity of water received by a ditch under the decrees varies from year to year and from season to season with varying stream conditions and changes with changes in the decrees, it is necessary to provide in contracts that its owners shall not be held liable for failure to deliver water to water-right purchasers when water is not obtainable. The provision for dividing what water the canal furnishes equally among the water-right holders is for the purpose of distributing the losses due to shortage as widely as possible, so that no one will be entirely ruined.

It is necessary to make stringent provisions in contracts relative to rights of way for main ditches and laterals, because the construction of irrigation works has given the values to lands which the owners would claim as damages for such rights if they were not reserved, to the evident disadvantage of other water-right purchasers as well as to the ditch owners.

Builders of canals under contracts now in use are warranted in providing in such contracts that water-right purchasers must take the ditches and rights when they are ready to turn them over, because in the contracts the annual charges for the maintenance and operation of the works are limited to terms which are as low as, if not lower than, is required for those purposes, so that there will be no profit in operating the canal after all water rights are sold; and some indefiniteness relative to the number and extent of water rights, within the capacities of the canals, which are to be sold before the works are turned over to water-right purchasers, is warranted, because no one can forecast the changes in laws, decrees, or irrigation methods which may affect rights in the waters of the streams and the ability of the canals to supply water.

Measuring out water to a water-right purchaser at the head of the main lateral through which he is supplied is justified on the ground that

the farmer is saved the inconvenience of paying in money for work which he can do himself. Then also such an arrangement is conducive to the organization of farmers using water from the same main lateral, which is a preparation for the management of the larger works when they shall be turned over to them.

No ditch has been constructed in the Arkansas Valley in Colorado with the avowed purpose of carrying water for hire. Probably such a ditch, if constructed at this time, would not prove financially profitable for some years, at least, since ditch construction must precede settlement, and for a number of years there would be few to use the water carried, and those few could not pay rates high enough to make the canal pay. Then, again, the county commissioners are authorized to fix rates for water, so that there would always be uncertainty about securing profitable rates.

The provision for shutting off the water supply from those who fail to make the payments required by their contracts is often necessary to the operation of the ditches.

WATER-RIGHT CONTRACTS FROM THE STANDPOINT OF FARMERS WISHING TO SECURE A WATER SUPPLY.

The purchaser of a water right may not want to buy from a canal construction company stock which represents an interest in a canal and its rights to water for the same reason that the company may not want to sell such stock. Until a majority of the stock is in the hands of water users the control of the company will be with the builders of the works, whose interest is to get as much as possible out of the users of water. Immediately a bare majority of the stock is in the hands of farmers the tables will be turned and the investor will be at the mercy of the water users. It may, therefore, be better for both that until the rights are sold and the water is put to use the rights and obligations of both parties be defined by contract, rather than by by-laws which may be changed by the holders of a majority of the stock. There is no doubt that the best final form of organization controlling irrigation works is the stock company, with the stock in the hands of the water users, but during the preliminary stages the rights of all may be better protected by contracts. The contracts which provide for ultimately turning the works over to the users of water are therefore the best from the standpoint of the investor and from that of the farmer. As there are in the Arkansas Valley no companies carrying water for hire, the prospective farmer under the larger ditches is limited to the purchase of a right from a contract company or stock in an irrigation company.

If the prospective purchaser of a water right owns land for the irrigation of which he wishes to secure water, he is of course compelled to get water from the canal which covers his land, and has no choice but

to take it on the terms made by the owners of the canal. If, however, he wishes to get both land and water, he is free to examine the contracts of various canals in the valley and choose the one which promises to most nearly meet his needs. If his investigations are at all thorough they will include the consideration of the quantity of water to be applied to lands and crops of the kinds he desires and of the times during which such application can be made. He may decide that 2 acre-feet of water per acre per annum, applied to each acre at proper times, is sufficient to properly mature his crops. He may conclude that this quantity is ample for his purpose, even during years of minimum precipitation, if measured out to him immediately adjacent to the lands to be irrigated, and yet not be sufficient if measured out to him at the head of the main lateral, a long distance from the lands to be watered; and he may conclude that while this quantity of water per annum, if delivered to him at a sufficient rate of flow—say 1 cubic foot per second—for proper periods would be satisfactory, the same quantity of water, if delivered to him for longer periods but at a very small rate of flow, say 0.1 cubic foot per second, would be far from satisfactory. One-tenth of a cubic foot of water per second he will conclude is too small a flow to spread readily over his land, yet it is about equivalent to 2 acre-feet per acre for 15 acres in five months. If he desires a water right of 2 acre-feet per acre per annum for 15 acres, he will conclude after investigation that if that quantity of water were delivered to him at the rate of 0.1 cubic foot per second, even if measured at his lands, it would not be possible to spread it evenly over his lands so that each acre would receive 2 acre-feet, and that if it were possible to do so it would take practically five months of his time to do it; and he will doubtless conclude that he is very much interested not only in the quantity of water he will receive under his contract, but in the rate and time of delivering it. And the more he considers the advantages of late fall and winter and early spring irrigation, and the necessities for periodical runs of water during the summer months, the more importance he will attach to these features.

If the prospective purchaser then turns to the water-right contracts of the valley in the hope of finding one that will meet his desires he will be disappointed. No contract will do so. And yet under some of the ditches of the Arkansas Valley his necessities will be met, at least for the present. He will fare better than a strict interpretation of the contracts promises. A strict interpretation is, however, all that can be counted upon with certainty for the future.

As to the quantity of water which a water-right holder will receive, a close examination of the contracts will disclose a vanishing tendency. What purports in the opening clauses of the water-right contract to be a perpetual right to the use of a definite flow of water may, before

the concluding clauses have been reached, dwindle into a privilege of occasionally receiving water during half of the year, if several certain, a few reasonably certain, and a number of possible interferences do not prevent. In the opening paragraphs of a contract the company will agree to furnish to the purchaser a definite flow of water for the year or for the irrigating season, but later paragraphs relieve the company of all liability for damages if the water is not furnished because of shortage in the stream from which the water is taken resulting from drought or the use of the water by others having prior rights to it. That is, the decrees affecting a stream are made a part of the contracts of the companies diverting its waters. Under such contracts a company might build a ditch to take water from a stream in which there was no unappropriated water, sell rights to receive water from its canal and still be relieved from any liability for damages, although it could never furnish any water whatever to the purchasers of its rights. It is therefore necessary for the water-right purchaser to go behind the terms of the contract and study the decrees affecting the stream from which he contemplates getting water.

But most canals will get some water, and the contracts usually provide that the company shall divide what it does get among the holders of its rights in proportion to the number of rights held by each. This provision changes the definite volume, which is to be delivered in accordance with the opening paragraph, to a share of whatever water the canal has, and even this share is not definitely fixed in many contracts, but depends on the number of contracts outstanding. The more contracts the less water there will be for each. Most of the companies limit the number of rights they will sell, but this limit is usually the estimated capacity or the estimated carrying capacity of the canal, or the "estimated capacity of the canal to deliver water." A water-right purchaser will not meditate long over this estimated capacity of the company to sell water rights before he concludes it may be a very different thing from the actual capacity of the canal and may be very far from being an accurate expression of the quantity of water carried in the canal, and as he meditates upon this indefinite and possibly expanding limit to the number of water rights a canal company may sell, he sees his contemplated water right rapidly diminishing toward its vanishing point. Companies which have not yet reached this limit may at present be furnishing their patrons a sufficient supply of water, but as more rights are sold, the same supply will have to be divided among a constantly increasing number of parties, and the supply to each will be correspondingly less.

The company apparently obligates itself to deliver a certain quantity of water, while the farmer obligates himself to make certain payments. If the company fails to deliver the water it is relieved from all liability for damages due to shortage of water because of unavoid-

able causes; if the farmer fails to make his payments he is immediately deprived of water, and eventually loses all he has paid on his right, and in some cases his lands, as his canal assessments are made a lien on the lands, even if the cause of his failure to make these payments is the failure of the company to furnish him water.

WATER-RIGHT CONTRACTS FROM THE STANDPOINT OF THE GENERAL WELFARE.

The building of a canal which supplies needed water to lands is a worthy act, and the builders of such a canal merit both financial rewards and expressions of appreciation for their contribution toward the public good. No one denies this, but it is apt to be forgotten in the conflict of interests growing out of the construction of irrigation works. Where a number of men associate themselves for the purpose of building a large canal for the watering of unutilized lands, they are at first hailed as public benefactors. By the time their irrigation works are completed, however, and before their irrigation system is in perfect operation, they have, with few exceptions, fallen from their first high state and become objects of suspicion and attack. The people of the Arkansas Valley are not slow to acknowledge they owe much to the builders of their great canals; nor is it claimed that these canal builders have been fully recompensed for their services to the valley. A moment's consideration will also make it evident that however appreciative of the benefits conferred by the builders of canals the people of Colorado may be, they could not on the one hand give a free rein to such builders as they have done, and on the other hand provide laws under which investments in ditch construction would always prove profitable. Under such a policy the area of the State, large as it is, would hardly suffice for rights of way for ditches that would be built. Certainly all that could have been expected under the constitution of Colorado has been done by legislatures and courts for the owners of ditches. The era of excessive canal construction was a time of speculation in canals and water rights. Some succeeded, some failed. But neither regard for the successful nor sympathy for those who failed should for one moment blur the vision of those who view the great irrigation movement in western America from the standpoint of the general welfare. This movement is in its infancy. We are obligated to foster its growth. If our laws and customs are less conducive to the general welfare than we anticipated, or than is otherwise attainable, we are obligated to change them.

Ditch companies have for some years exercised intermediary functions between the people of Colorado and the water users—the real appropriators of the waters of the public streams; functions not altogether without value perhaps in early stages of irrigation development,

but which, far from being necessary to the welfare of irrigators or to that of the general public, have, on the contrary, been found to require, sooner or later, in other irrigation countries, very careful governmental supervision or complete elimination. The water of natural streams is the property of the public until actually utilized, even though in course of conveyance through ditches and canals, and there is but one charge for water justified by our fundamental laws, namely, a charge for the carriage of water; and there are but two classes of irrigation ditches, if public ditches are eliminated from consideration, which are in harmony with such laws, namely, ditches carrying water for hire, and those ditches carrying water solely for the use of the owners thereof. Into one or the other of these constitutional classes of ditches the writer confidently believes all of the water-right contract ditches of Colorado will eventually gravitate. This tendency, it is believed, is clearly disclosed in the water-right contracts themselves. An examination of the extracts from such contracts will show with reference to many of the water-right contract ditches that they are in a transitory state, and will indicate that such is the opinion even of the framers of such contracts.

The people of the Arkansas Valley in Colorado, who are also students of the irrigation movement, are not so much concerned with the intermediate stage of these water-right contract ditches as with their final stage, and the rapidity of their progress toward the final stage. Whether the companies owning water-right contract ditches sell water rights which they have matured or water rights they have not matured (provided they do not charge for rights in, or the carriage of, water which they can not deliver) is of small consequence compared with their early dissolution and the elimination of such companies and customs from among the irrigation problems.

When these companies are reorganized into the constitutional classes a great disturbing element in the solution of some of our irrigation problems will have passed: the rights of the users of water may then receive the consideration now and heretofore given to the adjustment of the claims of rival ditch companies, and the rights of water users will be clearly seen to emanate from the people and not from such companies, and will be enjoyed to the extent, in the manner, and at the time, and under the conditions which the people, not the ditch companies, impose.

As between the two classes of private ditches included in what have been called constitutional ditches, namely, ditches carrying water for hire and ditches carrying water for the use of the owners thereof solely, there can be no question but that the latter are preferable from the standpoint of the general welfare, and it is to be hoped that the water-right contract ditches of the valley will speedily gravitate into the constitutional classes of ditches.

THE FUTURE OF THE ARKANSAS VALLEY.

The change of our irrigation companies into the constitutional forms above referred to will not alone insure that high irrigation development to which the people of this valley look forward. If our students of irrigation conditions are wise in their conclusion, this looked-for irrigation achievement will be accompanied by many conditions radically different from those now existing.

There will then be no great irrigated land holdings, no great water holdings, with their attendant tenant or wage service, but small irrigated tracts will be farmed by their owners. Much water will then be stored in surface depressions and underground gravels, and ground waters will be more largely utilized than at present. Stream waters will then be rotated as are canal and lateral waters, or be so distributed that each important ditch will receive some water most of the year, as well as the necessary supply during the late spring and early summer months. Water rights will be attached to lands to an extent that will insure the official record of each water right and of the lands to which it appertains. Laws will be enacted which are calculated on the one hand to retard transfers of water rights where no beneficial effects to the community will result, and on the other hand to encourage such transfers in cases where water is not applied with reasonable efficiency. Other laws must be passed to prevent the holding of water unutilized for speculative purposes, even to a severance of water from land to which it is appurtenant, by an official or judicial declaration of forfeiture of rights in such water. The need for an official determination and public record of the rights of water users and the lands to which such rights appertain is even now a pressing one and essential to convenient disclosure in abstracts of rights in water appertaining to lands.

The writer will not attempt to forecast the methods by which the legal and financial obstacles to the attainment of more perfect irrigation conditions may be overcome. There are, however, a few general propositions and facts attendant upon the attainment of the welfare of irrigation communities controlled by the priority right doctrine which merit consideration and to which attention is invited. Among them are the following:

The general welfare is greater, other things being equal, the greater the areas irrigated. The areas irrigated are greater when the stream waters are first applied to the higher lands in the upper reaches of the valley, for then the waters which drain therefrom into the channel may be rediverted and reutilized perhaps many times. Under the priority-of-right doctrine the areas irrigated are less; that is, the stream duty is less than it might otherwise be, for early rights are often enjoyed by ditches in the lower reaches of the streams, involving losses of water in the sands of the channel before such ditches are

supplied, as well as the loss of the reutilization of the waters wasting and seeping therefrom into the channel.

The general welfare, other things being equal, is greater the more valuable the crops. The more valuable crops, as orchards, require water for longer yearly periods than the less valuable, as grasses. At times lands under ditches enjoying early rights and entitled to water during long periods are not well adapted to the culture of the more valuable crops, while under other ditches, with land suitable for such crops, the priority rights are of so late a date as to jeopardize such crops by reason of the short period during which such ditches draw water. Under a strict distribution of water according to priority rights, then, the areas of valuable crops are less than they otherwise might be. The more valuable crops under the several ditches might be saved by distributing to them in times of scarcity the waters of the stream under a system of rotation of stream waters; but this is antagonized by the priority-of-right doctrine and the pro rata distribution clauses of most ditch companies.

Enough has been said to show that the doctrine of priority of appropriation, at least as distorted and encroached upon by legislatures, courts, and ditch companies, is not calculated to secure the most efficient use of water. It is suggested that much which is desired in connection with the economical and efficient use of water, the curtailing of powers assumed by ditch companies, the checking of speculation in water, the recognition of users of water as the true appropriators of water, the preservation of more valuable crops, may be attained without a radical departure from the priority-of-right doctrine under two State policies, the one making water appurtenant to land after the manner above discussed, the other the distribution of the water by the State to the several users thereof under the following conditions, viz: First. The ditch companies to be permitted to charge a reasonable fee for the carriage of water, which is their proper function. Second. The State to receive from users of water certain fees to cover cost of administering the streams, these fees to vary with the stages of water, being greater as the ratio of supply to demand decreases and as the losses in distribution increase, and less as the supply increases or more nearly meets the demand and as the losses in distribution diminish. Third. The water to be distributed by the acre-foot or cubic foot per second per twenty-four hours, measured at the place of utilization. Fourth. The right to receive water in accordance with the priority dates of the several appropriations upon payment of the proper fees, and in amounts necessary for the irrigation of the lands to which the right is appurtenant. Under such a method of distribution the State fees should be so apportioned that in times of scarcity they will induce those enjoying early rights, but with less valuable crops, to postpone the period when they will use water to a less

expensive season: thus, on the one hand, throwing the expense of the distribution of water largely on those who raise the more valuable crops and can best afford to pay it, and, on the other hand, contributing toward the general welfare by encouraging the raising of valuable crops. As an illustration of the practical working of this policy, let it be supposed that A has the earliest right on the stream to water for 10 acres of land in alfalfa, while B, on the same stream, has a late priority date for water for 10 acres of land in orchard, and that the State fee for distributing water is 75 cents per acre-foot on April 15 and 25 cents per acre-foot on May 1, and that B's orchard needs water April 15. A, because of the prior date of his right to water, may upon April 15 demand and receive water at 75 cents per acre-foot, but is likely to postpone the demand for water for his alfalfa until after May 1 because of the saving of 50 cents per acre-foot so effected, and to do this to the entire advantage of B, who can afford to pay the higher rate for water for his more valuable crop, and to the evident increase in general welfare.

In one way or another the people of the Arkansas Valley are disclosing that they are qualified to administer the waters of the valley for the good of the valley. Step by step they are progressing toward the goal, which is a consummation earnestly to be desired and labored for, where the waters of the valley shall be controlled and administered by the people of the valley, subject only to a few broad and general provisions of State and perhaps Federal law. The principle which governs the administration of the public waters should apply to the administration of the public lands of the valley, especially of the forest lands, upon which the permanent flow of water in streams depends. In his moments of optimistic prescience the writer sees the Arkansas Valley in Colorado incorporated as a body politic, sees the representatives of the people controlling their water supply and distributing to themselves public waters, controlling also the forest lands and the public pasture lands, and even the coal, iron, and precious-mineral lands, and applying the revenue properly receivable from public lands and public waters to irrigation development and other forms of industrial development, culminating in a social development unsurpassed in any of the great States of this greatest of Commonwealths.

APPENDICES.

APPENDIX I.

CERTIFICATE OF INCORPORATION AND BY-LAWS OF THE BESSEMER IRRIGATING DITCH COMPANY.

Know all men by these presents, that we, ——, ——, and ——, residents of the State of Colorado, have associated ourselves together as a corporation under the name and style of the Bessemer Irrigating Ditch Company, for the purpose of becoming a body corporate and politic under and by virtue of the laws of the State of Colorado, and in accordance with the provisions of the laws of said State we do hereby make, execute, and acknowledge in duplicate this certificate of our intention so to become a body corporate under and by virtue of said laws.

First. The corporate name of the said corporation shall be the Bessemer Irrigating Ditch Company.

Second. The objects for which our said company is formed and incorporated are: To purchase and acquire all the rights, privileges, franchises, and property of the Bessemer Ditch Company, and to maintain and operate the same, and to construct, acquire, maintain, and operate a ditch or canal for conveying water for domestic and irrigating purposes, all for the exclusive use and benefit of the stockholders of the company in the county of Pueblo and State of Colorado; and to construct, acquire, maintain, and operate lateral or branch irrigating ditches from the said main ditch or canal of the company to such localities in the said county of Pueblo as will enable our company to use or dispose of the water conducted through the said main ditch or canal for the purposes herein set forth; to supply the stockholders of our company, and none others, with water for the purposes above mentioned, and for the purpose of constructing, acquiring, maintaining, and operating of proper reservoirs for the receiving, storing, and distributing the water of said ditch.

Also to pump or otherwise conduct water from said main ditch or canal into any reservoir or reservoirs which may have been or may hereafter be constructed or acquired by the company: *Provided*, That the waters so stored in such reservoir or reservoirs shall likewise be for the sole use and benefit of the stockholders of the said company.

To acquire, by purchase, lease, or otherwise, such amount of real estate as the board of directors of the company may deem expedient or profitable, and to hold, use, and enjoy the same as may be determined upon by such board.

To acquire, hold, and use such premises along the line of our said ditch as may be necessary for the right of way therefor, or in the operation or maintenance thereof, or of said lateral ditches.

To borrow money for the needs of our said work and to issue securities therefor in the name of the company.

To do any or all things that may be incident or conducive to the attainment of the aforesaid objects or any of them, or to the usual power of corporate bodies.

Third. The said company shall exist for the term of twenty (20) years, commencing from the date of the execution of these presents.

Fourth. The capital stock of our company shall be two hundred thousand dollars (\$200,000) divided into twenty thousand (20,000) shares of ten dollars each; and which shall be issued and thereafter subject to assessment in such amounts as shall be adequate to provide for or realize the capital necessary for the constructing, acquiring, maintenance, and repair of said ditches and laterals and reservoirs; for the purchase of rights of way and rights of water therefor, and for providing and raising the necessary means to liquidate all indebtedness of the company, whether principal or interest; and such assessments may be levied upon the holders of the paid-up capital stock of the company in such manner and at such times as may be provided for by the provisions of the statutes of the State of Colorado in such cases made and provided, or in accordance with the by-laws of the company; and the payment of such assessments or any assessments that may be properly levied as provided by law may be enforced by strict forfeiture of the stock in default, or any such other mode or modes as the board of directors may prescribe, or as hereinafter provided.

Fifth. The affairs and management of the affairs of our said company shall be under the control of seven directors; and the names of those who shall as such directors manage the affairs of our company until the expiration of the first year of the corporate existence thereof, and until their successors shall be duly elected, are as follows: ———

Sixth. The officers of our company shall be president, vice-president, secretary and treasurer, and such other officers as the board of directors may by by-law create.

Seventh. The use to which said water, to be conveyed through said main ditch or canal, is to be applied is for domestic purposes and for irrigation of the lands along the line of the said main ditch and laterals thereof which may belong to the stockholders of the company, and not otherwise.

Eighth. The source from which water is to be taken to supply said main ditch or canal and laterals is the Arkansas River, and the head of which main ditch shall be at or about Meadows Station, on the line of the Denver and Rio Grande Railroad, in the said county of Pueblo, and on the south bank of said river; and the line of said ditch shall be in a general easterly direction from the head thereof through the said county of Pueblo to a point east of the Saint Charles River therein; and the line of which ditch shall be more particularly as hereinafter described.

Ninth. * * * (In this article is given the location of the head gate and the sections through which the main ditch runs.)

The total length of said ditch, from the head thereof, as aforesaid, to the lower end of the same, being forty-three (43) miles, more or less, and the whole thereof being in the said county of Pueblo. * * *

Tenth. The general management of the business of the company shall be vested in said board of directors, who shall have full power and authority to do all things necessary to carry into effect the powers specified in these articles and amendments thereto, and in general to manage the property and transact the business of this company in such manner and upon such conditions as they, said board of directors, may deem expedient and beneficial to the best interests of the company; and said board of directors shall have full power and authority to regulate the use of water among said stockholders owning land upon the line of said main ditch or canal and the laterals thereof, not only as to time, but as well as to the quantity of the water which each stockholder may be entitled to, and the manner of using and appropriating said water by said stockholders; such regulations to provide for the use of water ratably by said stockholders. * * * The said board of directors shall likewise have power to declare any share or shares of stock to be forfeited when the holder or holders thereof shall neglect or refuse to make full payment of any calls or assessments which may have been legally levied upon such stock, after notice, as provided

by the by-laws; any such stock when so forfeited by resolution of the board of directors shall divest the defaulting holder or holders thereof of any and all rights and interest, either equitable or legal, in or to the business, property, or franchises of the company, and such defaulting stockholder shall forever thereafter be barred from using or appropriating any water from said ditch, laterals, or reservoirs; * * * and the said board of directors shall have full power to cause other stock to be issued in lieu of such stock so forfeited and cancelled, and shall have power to sell said stock which may be so issued to such landowner along the line of said main ditch or laterals as may purchase the same: *Provided*, That the stock which may be so issued in lieu of such forfeited stock shall not be sold for less than the price to be fixed by a three-fourths vote of the full board of directors; or the said board of directors may in its discretion, without declaring the stock held by such defaulting stockholder or stockholders forfeited as above set forth, after notice as aforesaid, bar and prohibit such defaulting stockholder or stockholders from using or appropriating any water whatsoever from said main ditch, laterals, or reservoirs until such defaulting stockholder or stockholders shall have made full payment and liquidation of the calls or assessments standing against him or them, with such penalties as may be prescribed by the by-laws of the company; and the use or appropriation of any water whatsoever from said main ditch, laterals, or reservoirs by such defaulting stockholder or stockholders, after he or they shall have been notified in writing by said company that he or they are barred from using or appropriating any of such water because of the default in the payment of the calls and assessments aforesaid, shall be deemed and held to be a trespass as against the company, and such defaulting stockholder or stockholders shall be liable accordingly; and the directors in their discretion may forfeit the stock of defaulting stockholders at any time after shutting off water as aforesaid. The said board of directors shall have full power and authority to contract a loan and indebtedness. * * *

Eleventh. Said directors shall have power to make such by-laws as may be deemed necessary and proper for the management, conduct, and control of the affairs, business, and property of the company.

Twelfth. The principal business of our company shall be carried on in the county of Pueblo, and State of Colorado, and the principal office for the transaction of business shall be kept in the city of Pueblo; but an office of the company may be kept at any point without the State of Colorado which the directors of the company may appoint, and meetings of the company and its directors may be held at such office without the State.

The Bessemer Irrigating Ditch Company has adopted certain rules and by-laws limiting and governing the enjoyment of, and in certain ways affecting, the water rights of its stockholders. The following extracts are taken from the by-laws of the Bessemer Irrigating Ditch Company:

BY-LAWS OF THE BESSEMER IRRIGATING DITCH COMPANY.

First. The officers of this company shall consist of a president, vice-president, secretary, and treasurer, who shall be chosen by the directors at their first meeting following the annual meeting of the stockholders in each year. They shall be elected from the board of directors, except the secretary, who may not be a director. Said officers shall hold their respective offices until their successors are appointed and enter upon the duties of their offices.

A majority of the board of directors must be residents of Colorado.

Vacancies among directors may be filled at any meeting of the board of directors by regular ballot. One or more of the offices may be held by the same director: *Provided*, That any officer may be removed by the directors whenever the interests of the company may require.

PRESIDENT.

Second. It shall be the duty of the president to preside at all meetings of the directors, and to sign all bonds, deeds, leases, agreements, or other instruments of writing made or entered into by or on behalf of the corporation; to sign all certificates of stock which shall also be signed by the secretary. The president shall exercise the general supervision of the entire business of the company and the management of every department, and all the property of the company shall be under his control: *Provided*, That it shall be his duty to present to the board of directors at each meeting of the board a report briefly showing the nature of each and every contract or other instrument executed by him since the last meeting; and any and all such bonds, contracts, or other instruments must be approved by the board before they shall become legally binding upon the company.

The president shall have power, with the approval of a majority of the board of directors, of appointment and dismissal of all officers not specially herein provided for, including the superintendent of the company, and shall have authority, subject to the approval or rejection of the board, to fix the salary and compensation of all said officers.

The president is also authorized to sign all orders drawn upon the treasurer for the payment of money, and shall in general perform all acts incident to his office.

VICE-PRESIDENT.

Third. It shall be the duty of the vice-president to perform all such functions as belong to the office of the president in the absence from the State of Colorado of the president, and the board of directors may by vote confer upon him all the authority given to the president.

SECRETARY.

Fourth. It shall be the duty of the secretary to give notice of all meetings of stockholders and of the board of directors. He shall prepare and keep proper books of record and of account of the business of the company, and such other books and records as the board of directors may from time to time prescribe. He shall sign and register all certificates of stock and other documents requiring the signature of the president, and shall attach the corporate seal of the company to all instruments requiring a corporate seal, and perform all such other duties as are incidental to his office; and he shall be the custodian of the corporate seal and of all books, records, and papers belonging to the company.

TREASURER.

Fifth. The treasurer shall be the custodian of the funds of the company until the same be disposed of by order of the board of directors. He may be required to give bond satisfactory to the board of directors. No money shall be paid out by the treasurer except by order of the president, countersigned by the secretary.

SUPERINTENDENT.

Sixth. It shall be the duty of the superintendent to have entire charge of the management and operation of the ditches and other property of the company, under the supervision and control of the president. He shall give his personal attention to maintaining and repairing said ditches and property, employing such assistance in so doing as may be necessary for the purpose. It shall be his especial duty to apportion and regulate the use of water among the stockholders of the company, allowing to each stockholder such proportion of the volume of water carried in the company's main ditch as the stock owned by such stockholder shall bear to the entire capital stock issued and outstanding. Said superintendent shall prepare a complete set of

rules and regulations covering in detail all questions relating to the division and apportioning of water among stockholders, the time and manner of using the same, regulations touching the shutting off of water from defaulting stockholders pursuant to the by-laws or articles of incorporation of the company, and such other matters and things as in the judgment of said superintendent may be necessary or proper to fully embrace and provide for all questions regarding the use and distribution of water among said stockholders.

During the irrigating season in each year the superintendent shall prepare and file with the secretary, on Saturday of each week, a report showing the actual volume of water carried and flowing through the company's ditches during each day of the then present week, measured by the cubic foot per second of time; and said report shall also contain a statement of the quantity of water allotted and used by each and every of the stockholders during said week. It shall likewise be the duty of the superintendent during said irrigating season to prepare and file a written report for the inspection of the board of directors at each and every regular meeting of said board, which report shall set forth fully all matters of interest touching the conditions and maintenance of the ditches and property of the company; and it shall be the duty of the superintendent in said report to specially call the attention of the board to any and all such defects, either in the condition or management of the ditches and property of the company, as may come within the observation, notice, or knowledge of said superintendent.

And the superintendent shall personally attend all regular meetings of the board of directors for the purpose of fully explaining and discussing the matters contained in said reports.

In case of an inadequate supply of water in the ditches of the company for the needs of each and every of the stockholders thereof, arising from any unavoidable or other cause, it shall be the duty of the superintendent to apportion the volume of water actually running in and conducted by the company's ditches pro rata among the stockholders thereof, without favor or discrimination: *Provided*, That in all cases the water so apportioned among said stockholders shall be actually used and applied bona fide by each stockholder for beneficial purposes of irrigating lands; the question of such beneficial use to be determined by the board of directors. And it shall be the duty of the superintendent to prevent the waste or misappropriation of water by any stockholder.

BOARD OF DIRECTORS.

Seventh. The board of directors shall consist of seven members, always including the president, vice-president, and treasurer. It shall be the duty of the board to exercise a general supervision of the affairs of the company. * * *

STOCKHOLDERS.

Eighth. No person shall be eligible to be a stockholder of this company unless he, she, or it is the owner of land so situate as to be susceptible of irrigation from either the main or lateral ditches of the company.

The stock of the company shall be subject to the payment of such assessments as may from time to time be levied by the stockholders, which levy may be made at either a special or regular meeting. The assessments so levied shall be payable within fifteen days after notice of such assessments shall have been given, either personally or by a written notice mailed to such stockholder at his last-known post-office address, and if said assessment is not paid within said fifteen days the said stockholder may be notified, either personally or by written notice mailed as above, that unless he pays said assessment within thirty days the board of directors may in their discretion declare said stock to be forfeited; and the holder of such forfeited stock shall forever after forfeit all rights to the benefits, advantages, and profits to be

derived by reason of holding such stock, in accordance with the provisions of the articles of incorporation, which are hereby made a part of these by-laws. Any transferee of the stock taking such stock after such assessments have been levied shall take such stock subject to said assessments and all notice given in pursuance hereof. The first annual meeting of the stockholders shall be held in the city of Pueblo, and State of Colorado, at such place as may be named in the notice thereof, on the first Monday of October, A. D. 1894; and the regular annual meetings shall thereafter be held on the corresponding first Monday of like month in each succeeding year. * * * Special meetings of the stockholders may be called at any time by the board of directors. * * *

CERTIFICATES OF SHARES.

Ninth. The holders of the capital stock of the company shall be entitled to certificates of shares subscribed for by them, duly signed by the president and countersigned by the secretary. The certificates of stock shall be numbered and registered as they are issued. Transfers of stock shall only be made upon the books of the company either in person or by attorney duly appointed in writing.

CORPORATE SEAL.

Tenth. This company adopts as its corporate seal the name of the company made in circular form. * * *

Eleventh. These by-laws, or any of them, may be altered, amended, or repealed at any regular meeting of the board of directors by a majority of the board.

APPENDIX II.

WATER DEED OF CATLIN CONSOLIDATED CANAL COMPANY.

Know all men by these presents: That The Catlin Consolidated Canal Company (a corporation existing under the laws of the State of Colorado) of the first part, and ——— of the county of Otero and State of Colorado, of the second part, for and in consideration of the sum of two hundred and fifty dollars, paid by the said second party, the receipt whereof is hereby acknowledged by said first party, and in consideration of the mutual covenants and agreements in this deed contained, to be performed and kept by both of said parties, and hereafter specially mentioned, the said first party hereby grants, bargains, sells, and conveys to the said second party, his heirs, and assigns, twenty-five eightieths of one water right; that is to say, the right to the use of the water flowing through the canal of said first party, each water right representing one and forty-four one-hundredths (1.44) cubic feet of water flowing over a weir per second; subject, however, to the following reservations and conditions, to which said party of the second part hereby expressly agrees:

First. Said company to furnish the said water to the second party or assigns continuously during the irrigating season, except as hereinafter provided, and at no other time, unless with consent of company thereto in writing.

Second. Said water shall be used only for irrigating and domestic purposes, on the following-described tract of land, to wit: Lot numbered one of the northeast quarter of section four, in township twenty-three of range fifty-seven.

Third. Said company expressly reserves to itself the right to distribute the water from its said canal, in accordance with such rights and priorities as are or may hereafter be established or decreed, and this deed is received by the party of the second part subject to such priorities.

Fourth. The said second party, his heirs or assigns, shall not permit said water, or any portion thereof, to be furnished as aforesaid, to run waste, but as soon as a suf-

ficient quantity shall have been used for the purposes herein allowed, the second party, his heirs or assigns, shall, in such manner as the first party may prescribe, notify the first party that the said water may be shut off, and shall also give the first party timely notice when the same shall be again needed for the purposes aforesaid; but in no case shall the amount of said water taken or received at any time by said second party, his heirs or assigns, exceed the quantity first herein referred to.

Fifth. The said company shall deliver said water at such point or points along the line of said canal or ditch, or from any of its reservoirs, or either, or all, as it may determine to be most practicable, and the manner of withdrawing and regulating the supply of said water from said company's canal, ditch, or reservoir, shall be prescribed by said company and shall at all times be under its control, as determined and directed by the board of directors of said company. The head gates, flumes, weirs, or other arrangements through which the water hereby sold shall be drawn off from the said company's canal, ditch, or reservoirs, shall be made and placed in position by said company, but at the cost of said second party, who shall also be liable for the expense of keeping the same in good repair and condition; and the said company may collect and enforce the payment of all sums expended for said purposes in the same manner as prescribed for collecting and enforcing assessments.

Sixth. The said first party agrees to keep and maintain said main canal or ditch and any and all of its reservoirs in good order and condition, and in case of accident to the same to repair the injury thereby occasioned as soon as practicable and expedient; and the company shall have a right to assess for the ordinary expenses of maintaining, repairing, and superintending said canal and any and all reservoirs connected therewith, a sum of ten cents per acre per annum, payable on April 1st of the year for which said assessment is made.

Seventh. The said first party to have and the said second party hereby grants to the said first party a right of way across said above-described land of the width of eighty feet (being forty feet on each side of the center of said canal—that is, of the main canal of said first party as now located), and also the right of roadway on the banks of the canal; and in case a fence is constructed by said second party across said roadway, he shall construct and maintain a gateway across said bank when said first party finds it necessary to use said bank as a roadway, in which case said first party shall close said gate when opened by it.

Eighth. It is hereby distinctly understood and agreed by and between the parties hereto that in case the canal of said company shall be unable to carry and distribute a volume of water equal to its estimated capacity, either from casual or unforeseen or unavoidable accident, or if the volume of water proves insufficient from drought or from any other cause beyond the control of said company, the company shall not be liable in any way for the shortness or deficiency of supply occasioned by any of said causes. If, however, by reason of such causes, the supply of water is insufficient to furnish an amount equal to all the water rights outstanding, the said company shall have the right to distribute such water as may flow through said canal to the holders of such water rights pro rata, and for the purpose of so doing may establish and enforce such rules as it may deem necessary or expedient.

Ninth. It is further agreed that the irrigating season shall commence April 1st and continue to November 1st of each and every year, and that thereafter water shall be conveyed for domestic purposes whenever reasonably practicable, subject to the right of said first party to repair, enlarge, or extend said canal.

It is hereby further agreed that when said first party shall have sold and have outstanding and in force a number of water rights equal to the estimated capacity of the company's ditch to furnish water, and said water rights shall have been paid for, together with interest thereon in full, then the owners of said water rights shall become entitled to be the owners of the first party's ditch, and the title to said ditch shall pass to said owners of water rights at the time and on the plan following:

When said water rights shall have been paid for, as aforesaid, and within sixty

days thereafter, at such time as may be fixed by the board of directors of first party, said board of directors of first party shall hold a meeting for the purpose, and thereat designate five persons, who are at that time owners of water rights under said ditch, to be the incorporators of a new company to be incorporated under the laws of the State of Colorado, and which said five persons shall be the directors for the first year; and immediately following the signing and filing of articles of incorporation the directors thereof shall organize, make by-laws, procure a seal, and otherwise proceed as the law directs; and at said time they shall issue to the owners of said water rights, and to each such owner, of the capital stock of the new company, full paid, the same proportion of the whole of said stock as the water right each owner thereof has will bear to the whole amount of water rights sold as aforesaid; and second party hereby agrees to accept and receive the stock of said new company as aforesaid; and when said water rights have been fully paid, as aforesaid, and said five persons shall have been named, as herein provided, by first party, and said five persons notified in writing of that fact, and that said water rights have been fully paid, as aforesaid, then the obligations of this company, said first party, in respect to said ditch and keeping the same in repair, or supplying water through the same, or any other ditch, canal, or reservoir connected therewith, shall cease, and the said new company and the stockholders thereof shall thereafter be the owners and in control of the said ditch and the water of the same.

It is expressly provided, however, that should first party, in exercising its rights in its articles of incorporation set forth, carry on any business therein named—for instance, stock raising, farming, milling, etc.—and should require water for such purposes, that first party will take the same subject to the same restrictions and rules that govern the use of water for others, and that it will also be entitled to its pro rata representation and stock in the new company.

It is further agreed that if said five persons provided to be appointed to incorporate a new company should decline or fail to incorporate said new company as herein contemplated, then first party may within thirty days appoint others for said purpose and to so continue to appoint persons until said company is incorporated as herein provided. And it is further agreed that the said first party will deliver said ditch to said water right owners as aforesaid, and at the same time and manner as aforesaid, free of any debts against the same: *Provided, however,* and this grant is specially subject to the conditions following, that is to say, that inasmuch as said parties so holding water rights are forever exempted from any and all assessments that may be made upon the stockholders of the said company as it now exists for any purpose except that of keeping said ditch in repair, as stated in subdivision 6 of this deed, and inasmuch as an increase of the capital stock of the company as it now exists may become necessary or an assessment of the present stockholders in order to complete the construction of the ditch and reservoir of said company:

Now, therefore, said second party does hereby agree with said first party that this deed, and the right of said second party to vote and have a voice in the management of the company, is subject to the limitation that said second party shall not, by reason of anything in this deed contained, or by reason of any relation he may bear to this company arising out of said water right, be entitled to claim, demand, or receive any part or portion of any moneys arising out of the sale of any stock of said company, should the said company find it necessary to increase its capital stock; and the said second party is to be allowed a voice and vote only as relates to the said company's affairs at the time of executing this deed and necessary to securing to said second party the fullest enjoyment of said second party's water right.

In witness whereof the said the Catlin Consolidated Canal Company has caused its corporate name to be hereunto subscribed by its president and its corporate seal to be hereunto affixed by its secretary this 23d day of December, A. D. 1901.

APPENDIX III.

WATER DEED, AMITY CANAL AND RESERVOIRS.

This indenture, made this — day of —, A. D. 190—, between The Arkansas Valley Sugar Beet and Irrigated Land Company, a corporation organized under the laws of the State of New Jersey, and by compliance with the laws of the State of Colorado entitled to do business therein, hereinafter for brevity called "the company," of the first part, and —, of the county of — and State of —, hereinafter for brevity called "the purchaser," of the second part:

First. The company, in consideration of the sum of — dollars, the receipt of which is hereby acknowledged, and of the faithful performance by the purchaser of the covenants and agreements hereinafter contained, hereby grants, bargains, sells, and conveys to the purchaser — and assigns, for the use and benefit of the lands hereinafter described —, water right in the Amity canal and the reservoirs of the company, each water right being a right to so much water taken from the Arkansas River and the reservoirs of the company and delivered from said canal between April fifteenth and November first of each year, as may be necessary to irrigate forty (40) acres of land, not to exceed a total of delivery during said period at the place of delivery of sufficient water to cover forty (40) acres of land one and one-half feet in depth, and also an additional amount to be delivered from November first to April fifteenth not to exceed six inches in depth, to be delivered and used in accordance with and subject to the conditions and limitations hereinafter set forth, and the rules, regulations, or by-laws now or hereafter adopted by the company.

Second. Said water right — purchased for and — hereby attached as part and parcel thereof to the following described land belonging to the purchaser, to wit: —.

And all persons becoming possessed of said land by purchase or otherwise shall be deemed to have acquired said right as part and parcel thereof, and said right shall not be transferable to or used on other land.

Third. Water shall be delivered from said canal at and through the head gate of the lateral ditch, through which the purchaser may be entitled to carry the same to the land above described, and the company shall have full and absolute control of all head gates, taps, delivery and measuring boxes and weirs through and by means of which the water may be measured and delivered, and in case of any interference or tampering with the same by the purchaser, except with the consent of the company, the company may refuse to deliver water to the purchaser for ten (10) days or may enforce such penalty therefor as may be provided by its rules, regulations, or by-laws.

The company shall not be obliged to deliver water upon land lying above the grade line of the bottom of the canal, nor at any place nor upon any lands where a dam in said canal would be required to effect such delivery.

Fourth. The company is to keep and maintain said canal and reservoirs in good order and condition, and to repair all injuries to the same as soon as practicable. In case the company should for any reason be unable to obtain from the river for direct delivery or storage, or be prevented by any cause not intentional upon its part, including as such all acts of the water commissioner and other officials having charge of the distribution of water from the Arkansas River, from carrying through its canals for direct delivery or storage sufficient water to utilize the full capacity of said canal and reservoirs, or be prevented from delivering the water to which the purchaser may be entitled by any acts of other users of water from said canal, the company shall not be liable for any shortness or deficiency of supply to the purchaser thus occasioned.

Fifth. The head gates, flumes, weirs, and other appliances for delivering said water from said company's canal shall be made and placed in position by the company,

but the cost thereof, and the annual expense of keeping the same in good order and condition, shall be paid by the purchaser, or in case of use of the same by said purchaser and others, then a ratable proportion of said cost and maintenance, and said purchaser shall also pay to said company annually, on or before the first day of April of each year, on account of maintaining, repairing, and superintending said canal and reservoir system, the sum of fifty (50) cents per acre on the lands hereinbefore described, but in no event less than five (5) dollars in the aggregate, which shall be known as a maintenance charge, and all of said charges shall be, and are hereby declared to be, liens upon the land hereinbefore described and enforceable as other like liens; and the said company may, in the event of a failure to pay said charge or charges within ten (10) days after service of notice of same by the said company, which notice may be served upon the purchaser in person or by posting the same upon the lands above described, refuse to deliver water from said canal to the lands herein described until said charges have been paid in full, together with interest at the rate of ten (10) per cent per annum from the date when the same should have been paid.

Sixth. The application to a beneficial use of water from said canal and reservoirs upon the lands described shall be deemed an appropriation by said company for its use and benefit, and this instrument shall constitute the sole right of said purchaser to receive water from said canal or reservoirs.

Seventh. Said purchaser hereby grants a right of way over the above-described lands and over any other lands owned by said purchaser for the canal of said company and for all laterals and distributing ditches necessary to conduct the water therefrom or from the reservoirs of said company to lands that are or may become entitled to water, with roadways upon the banks of same, together with the right to enter upon said lands to survey, locate, and construct said canals, laterals, and ditches, and to care for, maintain, and operate the same, and said purchaser hereby waives any and all claim for loss or damage by reason of breaks, leakage, or overflow of said reservoirs, canals, laterals, or ditches, however caused, either upon the lands above described or upon other lands of said purchaser.

Eighth. All seepage water that may be accumulated by reason of the use of water upon the lands described shall belong to said company, and said company shall have the right to construct over the lands described all necessary ditches for the purpose of intercepting and using said seepage water.

Ninth. It is especially understood that the undertaking of the company is to use all reasonable endeavors to obtain the water to which it may be entitled from the Arkansas River and to employ fair and skillful agents in the superintendence and distribution of the water thus obtained, in accordance with the several deeds to water executed by the company, and that the company may from time to time adopt and enforce rules and regulations providing for rotating or alternating the water obtainable from the river among the several owners of rights to water.

Tenth. It is hereby further expressly stipulated and agreed by and between the parties hereto that when the canal and reservoir system shall in the judgment of the said company have reached completion, and the capacity having reached such a limit as said company may deem most practicable and expedient, said canal and reservoir system may be turned over to the respective holders of water rights, at the option of said company, in the manner following:

A company may be organized under a new name, under and by virtue of the laws of the State of Colorado, having corporate powers to buy and own real estate, to acquire irrigation canals and operate and maintain the same, and all other rights pertinent thereto, hereinafter called the new company, and a deed may be made of the said canal and reservoirs, which deed is to be executed by the said company and to pass the possession and control of the said canal and reservoirs to the new company, but such conveyance shall in no wise impair the title of the purchaser to the

water right or water rights hereby conveyed and made appurtenant to the land above described, and immediately upon the organization of the said new company and the transfer to it of the property aforesaid the directors of the new company shall issue of the capital stock of the said new company full-paid shares to the owners of water rights such a proportion of the whole of the said stock as the water rights each owner thereof has will bear to the whole amount of the water rights in said system, and said purchaser hereby agrees to accept and receive the corresponding stock of said new company, it being understood that there shall be as many shares of capital stock in the new company as there are water rights in the estimated practical capacity of said system at the time when the said conveyance is made to said new company, whether sold or unsold, each share of capital stock to represent one water right. Upon compliance with the foregoing by the said new company, then the obligation of this company in respect to said canal and reservoirs, keeping the same in repair, or supplying water through the same shall cease, and the said new company and the stockholders thereof shall thereafter be the owners and in control of the said canal and reservoirs and the water of the same, and all the shares of the capital stock of the new company representing water rights unsold, if any there be, shall be issued full paid and nonassessable to the company as its property, and each share of stock so issued to the company for unsold water to any lands lying under said canal and reservoirs, and upon demand the new company shall from time to time, as fast as said water is made appurtenant to said lands, make and deliver to said company or its assigns water deeds with like conditions as are contained in the deed for all water rights so located out of said unsold water to be conveyed, it being the intention to put the company and its assigns in the same position and give it the same rights and liabilities with respect to its water as all of the other purchasers of water from the company, and it is understood and agreed that the purpose for which the new company is to be formed is to place the control and management of the canal and reservoir system, free of liens and incumbrances, in the hands of purchasers of water.

Eleventh. The word "purchaser," as used herein, shall include the party or parties of the second part hereto and his, her, or their assigns, successors, and legal representatives, and the lessees and tenants, and each of them.

APPENDIX IV.

ROYALTY CONTRACT OF THE KIND NOW PROHIBITED BY STATUTE.

This indenture and agreement, made and entered into this — day of —, A. D. eighteen hundred and —, by and between the Northern Colorado Irrigation Company, a corporation duly organized under the laws of the State of Colorado, the party of the first part, and —, of the county of — and State of —, the part— of the second part:

Witnesseth, that the said party of the first part, for and in consideration of the sum of — dollars, the receipt of which is hereby acknowledged, and also the conditions and stipulations herein below specified, and in consideration of the annual rental hereafter to be paid, has bargained, sold, assigned, transferred, confirmed, and conveyed, and by these presents does bargain, sell, assign, transfer, confirm, and convey unto the said part— of the second part, — heirs or assigns, the right to receive and use water from the canal of the said party of the first part, for the purpose of

irrigating the following-described land in the county of ——— and State of Colorado, to wit: ———. The right to use said water being under and subject to the following conditions, restrictions, and regulations, that is to say:

First. The second part—, heirs or assigns, shall pay annually, in advance, on or before the first day of May in each year from the date hereof, such a reasonable rental per annum, not less than one dollar and a half per acre, and not more than four dollars per acre, as may be established from year to year, by the first party hereto, according to the situation and locality of the land and all other circumstances proper to be taken into consideration, and upon such conditions, restrictions, and exceptions as are hereinafter provided.

Second. Said water shall be used only to irrigate the land above described, and no other land, and for no other purpose excepting for domestic purposes during the irrigating season, and under no circumstances shall said water or any portion thereof be used for mining, milling, or mechanical power, or for any other purpose not directly connected with or incidental to the purposes first herein mentioned.

Third. The water to be supplied by the first party shall not exceed one cubic foot per second for each fifty-three acres, the water to be measured over a weir or otherwise, or the first party shall have the right to supply only such quantity of water per acre, estimated in cubic feet per second, or otherwise as may be considered by the first party sufficient for the production of good average crops under skillful irrigation.

Fourth. The said second part—, heirs or assigns, shall not permit said water or any portion thereof to be furnished as aforesaid to run waste, but as soon as a sufficient quantity shall have been used for the purposes herein allowed the second part—, heirs or assigns, shall in such manner as the first party may prescribe notify the first party that said water may be shut off, and shall also give the first party timely notice when the same shall be again needed for the purposes aforesaid, but in no case shall the amount of said water taken or received at any time by said second part—, heirs or assigns, exceed the quantity first herein referred to.

Fifth. The said water shall be delivered by the first party into a lateral ditch or subsidiary canal provided by the second part—, and connected with the said first party's main canal, or with a lateral or subsidiary canal of the first party, and the manner of delivering, measuring, and regulating the supply to the second part— shall be prescribed by the said first party, and shall at all times be under its control.

Sixth. It is hereby distinctly understood and agreed by and between the parties hereto, that in case the canal of said company nearest to the land herein described shall be unable to carry and distribute a volume of water equal to its estimated capacity, either from casual or unforeseen or unavoidable accident, or if the volume of water prove insufficient from drought or from any other cause beyond the control of said company, the company shall not be liable in any way for the shortness or deficiency of supply occasioned by any of said causes.

Seventh. It is further agreed that if by reason of any cause the supply of water shall be insufficient to fill and flow through said canal according to its estimated capacity, or if from any other cause as aforesaid beyond the control of said company the supply shall be insufficient to furnish an amount equal to all the water then covered by rents paid for that year, the said company shall have the right to distribute such water as may flow through said canal pro rata, to all persons entitled thereto; and for the purpose of so doing may establish and enforce such rules and regulations as it may deem necessary or expedient.

Eighth. In case of any dispute between the different parties as among themselves to the use of water from the main canals, laterals, or subsidiary canals or ditches of said first party, the same shall be referred to the superintendent of the said first party, and his decision shall be final and binding upon all the parties interested.

Ninth. And the said part— of the second part, for — and — heirs and assigns agree—, in consideration aforesaid, to waive, and hereby do— waive, any and all claims for loss or damage by reason of any leakage, seepage, or overflow from any canals or ditches, or from any reservoirs, lakes, or laterals of said first party, either upon the land aforesaid, or any other tract belonging to —, anything in any statute, law, or custom to the contrary notwithstanding.

Tenth. And the said party of the first part, at all times hereafter, shall have the right to add to and change and modify the foregoing rules and regulations, or any of them, so far as may be reasonably necessary to regulate the delivery and distribution of water, to said part— of the second part, — heirs, or assigns.

And in case the second part— shall fail, neglect, or refuse to take the water and pay the rent therefor in accordance with the foregoing conditions, for any two years in succession, then this indenture and agreement, so far as it may bind said first party, shall become utterly null and void, and all rights and interests hereby created or then existing in favor of the second party, or derived from —, shall utterly cease and determine, and all equitable and legal interests in the premises hereby conveyed shall revert to and revest in said first party, without any declaration of forfeiture, or of any other act of said first party to be performed, and without any right of said second part— of reclamation or compensation for moneys paid, as absolutely, fully, and perfectly as if this indenture and agreement had never been made.

And the said party of the first part shall have the right, upon the failure of the part— of the second part to pay the rent or to comply with any of the stipulations hereinbefore provided, to immediately, or at any time during such failure or default, refuse and cease to supply any water under this agreement. And the said part— of the second part covenant— and agree— that — will surrender unto the said party of the first part all rights or interests hereby created, without delay or hindrance, and no court shall relieve the part— of the second part, — heirs or assigns from a failure to comply strictly and literally with all the conditions and stipulations hereinbefore provided.

And it is further stipulated that no subdivision of the premises herein conveyed shall be valid or binding on the said first party, nor shall said first party be bound or affected by any notice, actual or constructive, by record or otherwise, of any subdivision, unless the same shall be approved in writing by the first party; and it shall be within the power of the first party to refuse to approve any subdivision of the premises.

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LIST OF PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS ON
IRRIGATION—Continued.

- Bul. 124. Report of Irrigation Investigations in Utah, under the direction of Elwood Mead, chief, assisted by R. P. Teele, A. P. Stover, A. F. Doremus, J. D. Stannard, Frank Adams, and G. L. Swendsen. Pp. 336. Price, \$1.10.
- Bul. 130. Egyptian Irrigation. By Clarence T. Johnston. Pp. 100. Price, 30 cents.
- Bul. 131. Plans of structures in use on irrigation canals in the United States, from drawings exhibited by the Office of Experiment Stations at Paris, in 1900, and at Buffalo, in 1901, prepared under the direction of Elwood Mead, chief. Pp. 51. Price, 60 cents.
- *Bul. 133. Report of Irrigation Investigations for 1902, under the direction of Elwood Mead, chief. Pp. 266. Price, 25 cents.
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FARMERS' BULLETINS.

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- Bul. 138. Irrigation in Field and Garden. By E. J. Wickson. Pp. 40.
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