

# A Hundred Years of IRRIGATION IN COLORADO

100 Years of Organized and Continuous Irrigation  
1852 --- 1952



PUBLISHED BY  
THE COLORADO WATER CONSERVATION BOARD  
DENVER  
AND  
COLORADO AGRICULTURAL AND MECHANICAL COLLEGE  
FORT COLLINS  
1952

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Committee appointed by Governor Dan Thornton  
to arrange observance of

A HUNDRED YEARS OF IRRIGATION IN COLORADO

Delfino Salazar-----	San Luis
T. C. McPherson-----	San Acacio
Luther E. Bean-----	Alamosa
Clifford H. Stone-----	Denver
M. C. Hinderlider-----	Denver
George J. Bailey-----	Walden
George A. Pughe-----	Craig
A. W. McHendrie-----	Pueblo
James C. Peabody-----	Pueblo
Ted R. Ryan-----	Rocky Ford
John W. Beaty-----	Manzanola
Charles A. Lory-----	Estes Park
Ralph L. Parshall-----	Fort Collins
A. J. Hamman-----	Fort Collins
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Robert Wright-----	Sterling
Glenn G. Saunders-----	Denver
Jean S. Breitenstein-----	Denver
R. J. Tipton-----	Denver
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Frank C. Merriell-----	Grand Junction
Frank Delaney-----	Glenwood Springs
Dan B. Hunter-----	Dove Creek
Ed L. Dutcher-----	Gunnison
James Grafton Rogers-----	Denver
W. E. Morgan-----	Fort Collins

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General Secretary-----	William E. Morgan, President Colorado Agricultural and Mechanical College

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Program Committee:	A. J. Hamman, Chairman Glenn G. Saunders Frank Delaney Dan B. Hunter Stephen H. Hart

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FOREWORD

Charles A. Lory, President Emeritus  
Colorado Agricultural and Mechanical College

Archaeologists find irrigation was practiced in what is now Colorado long before the region was known to the hunters and trappers who roamed the mountain country in the first few decades after Captain Pike's exploration in 1807.

These early irrigators who left traces of their work before the Indians occupied the territory, disappeared and left no history of their times. There are no trustworthy records that the Indians cultivated crops under irrigation in Colorado.

Irrigation, as we know it, was first practiced by two groups of settlers - one of Spanish Americans, racially experienced in irrigation agriculture, who settled in southern Colorado in the Basin of the Rio Grand Del Norte; the other group, Pioneers from the Eastern States and Northern Europe, with no experience in irrigation, who settled in the Basins of the South Platte and Arkansas Rivers.

Spanish Americans were quite helpful to their American neighbors in southern Colorado in growing crops under irrigation, but distance, primitive means of travel and language limitations prevented effective exchange of irrigation experience with the pioneers of northern Colorado.

Spanish American settlers founded the town of San Luis in the Culebra Valley in 1851 - the oldest town in Colorado. They began digging their irrigation ditch the following year, using primitive hand tools and a wooden plow drawn by a yoke of oxen. The quality of their work is shown by the continuous use of this canal for a hundred years.

In due time they made the necessary filing for the appropriation of water to the San Luis Peoples Ditch and for the adjudication of their water right. In 1890 the District Court of Costilla County awarded them Priority No. 1 in Water District 24 of Water Division 3, dated April 10, 1852, with an allotment of 23 cubic feet per second for irrigating 900 acres.

This was the earliest priority in Colorado under the system of water appropriation, adjudication and administration developed largely by American pioneers in irrigation through experience gained in the rush of development in the South Platte River Basin, which began 7 years after the building of the San Luis Peoples Ditch.

Along with developments in canal construction and operation and methods of crop irrigation came difficulties in developing an effective system for the use of the waters of our streams, and administration of this system by the State engineer; the provisions for storage reservoirs, composing conflicting claims for the waters of our Interstate rivers - first through State law suits in the United States Supreme Court, and later through more effective Interstate compacts; the establishing of the right of transmountain diversion of water; the formation of irrigation

districts for financing and operating large irrigation systems; and following the enactment of the National Reclamation Act in 1902, for cooperating with the Bureau of Reclamation in repayment of construction costs.

The 1950 United States Census shows Colorado has 9,258 irrigation enterprises, representing a capital investment of \$161,396,063. These enterprises include 7,713 diversion dams, 16,833 miles of irrigation canals, 1,105 reservoirs with storage capacity of 2,021,343 acre feet, 6,437 wells, and 3,202,911 acres under irrigation.

Colorado also has eleven water development projects completed by the Bureau of Reclamation and the Army Corps of Engineers at a total cost of \$55,771,132. All but two of these projects have been built since 1937. Several others are under construction or in various stages of planning or authorization. One of the largest of these is the Colorado-Big Thompson, which is now nearing completion and which has been in partial operation the past three irrigation seasons. The Conejos unit of the proposed San Luis Valley Project, the Platoro Reservoir, is ready for use. Many more projects must follow before we can say irrigation development is complete.

Interest in irrigation and the conservation and more efficient use of our water resources increased yearly and as we approached the hundredth anniversary of the oldest priority for irrigation, interest and desire among irrigation men for proper observance of Colorado's Irrigation Centennial were strong.

In response to this sentiment, Governor Dan Thornton early in the year (1952) appointed a committee of twenty-seven men, representing all irrigated sections of the State, to arrange for observance of "A Hundred Years of Irrigation in Colorado."

This committee met in Denver February 18, 1952, for organization, appointed committees on program and general arrangements, decided to hold the celebration in Alamosa in cooperation with the Colorado Irrigation Institute April 8 and 9, and in San Luis April 10.

The Committee accepted the invitation of Adams State College to use its facilities for its meeting, also the offer of the State Historical Society to furnish a bronze memorial plaque. Mr. Delfino Salazar offered to build the monument for this plaque on the bank of the San Luis Peoples Ditch.

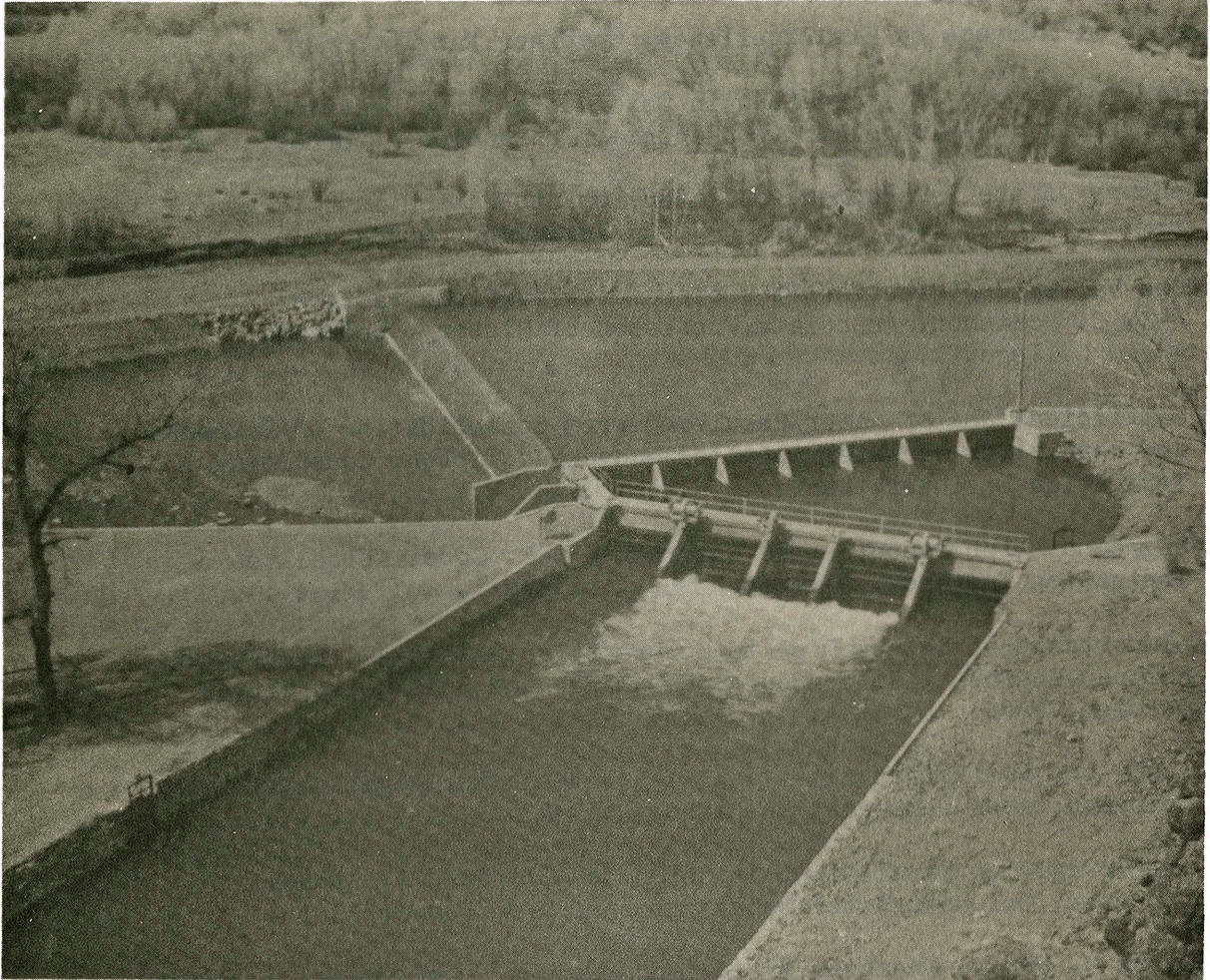
Every one requested to take part on the program by the program committee accepted graciously, and the committee on arrangements had effective support. The Governor's committee is able to publish the Proceedings of the Irrigation Centennial through the generous financial support of Colorado Agricultural and Mechanical College and the Colorado Water Conservation Board, and is grateful for the splendid cooperation of all those taking part in the Centennial Celebration in giving due recognition for the outstanding developments in irrigation agriculture, irrigation structures and their operation, irrigation law, and management of our water resources.

This report includes two papers which were not presented during the sessions at Alamosa or the celebration at San Luis. They are added to round out, just a little, the historical picture of irrigation development in this State.

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Frontispiece



Modern diversion dam and automatically controlled headgates of the Rio Grande Canal at Del Norte, April 12, 1952.

Program of Irrigation Centennial  
at Alamosa

Tuesday, April 8, 1952

10:00 a.m. Call to order by Dr. Charles A. Lory, General Chairman of the Governor's Committee.

Introduction of Mr. Dave Mathias, Deputy State Engineer, Monte Vista, Session Chairman.

Invocation -- Reverend Herbert Melville, Pastor First Presbyterian Church, Monte Vista.

10:20 a.m. Early History of Irrigation in Colorado and the Doctrine of Appropriations--Judge A. W. McHendrie, Pueblo.

11:20 a.m. Development of Water Administration in Colorado--M. C. Hinderlider, State Engineer of Colorado, Denver.

12:20 p.m. Recess for Lunch.

2:00 p.m. Call to Order and Introduction of Fred Christensen, San Luis Valley Pioneer, Session Chairman.

Invocation--

2:20 p.m. Address by His Excellency Governor Dan Thornton.

3:30 p.m. Poudre Valley Contributions to Colorado Irrigation Practice--John C. McKinnon, Associate Professor of History, Colorado Agricultural and Mechanical College, Fort Collins.

4:20 p.m. Adjourn for the Day.

Wednesday, April 9

10:00 a.m. Call to order by General Chairman Lory.

Introduction of President N. William Newsom, Adams State College, Session Chairman.

Invocation--Reverend Joe Medina, Spanish Presbyterian Church, Alamosa.

10:20 a.m. Possibilities of Ditch Consolidations in the Future--Royce J. Tipton, Consulting Engineer, Denver.

11:20 a.m. Underground Water Resources of Colorado--William E. Code, Irrigation Engineer, Colorado Agricultural and Mechanical College, Fort Collins.

12:20 p.m. Recess for Lunch.

2:00 p.m. Call to order by General Chairman Lory.

Introduction of George Corlett, Former Lieutenant Governor and Irrigation Attorney, Monte Vista, Session Chairman.

Invocation--Reverend Donald Grooters, First Methodist Church, Alamosa.

2:20 p.m. Importance of Return Flow to Colorado Irrigators--Ralph L. Parshall, Irrigation Engineer, Retired, Colorado Agricultural and Mechanical College.

3:20 p.m. The 160-Acre Limitation in U. S. Reclamation Law--Jean S. Breitenstein, Attorney to Colorado Water Conservation Board, Denver.

4:20 p.m. Adjourn for Banquet.

#### Banquet

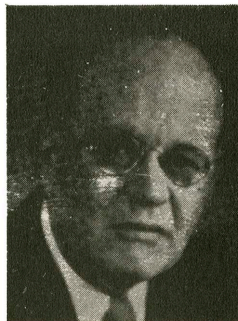
7:00 p.m. Adams State College Cafeteria.  
Toastmaster, William E. Morgan, President, Colorado Agricultural and Mechanical College, Fort Collins.

Invocation, Dr. Ira Richardson, President Emeritus, Adams State College, Alamosa.

Banquet speaker, Judge Clifford H. Stone, Director, Colorado Water Conservation Board, Denver.

Subject--Future Irrigation Developments in Colorado.

#### IN MEMORIAM



Clifford H. Stone, 1886-1952. Known to all, far and wide as "Judge." He served as Director of the Colorado Water Conservation Board from its establishment in 1937 until his death on October 22, 1952. He was instrumental in amicably clearing away every major controversy regarding water flowing from Colorado into neighboring states. He was a martyr to the cause of water development and use, and left a vacancy that may be long in the filling.

Invocation--Reverend J. L. Medina

Emmanuel Presbyterian Church  
Alamosa, Colorado

"Most gracious God, our Heavenly Father, who hast blessed the peoples of the world with the resources of the good earth; accept our thanks, we humbly beseech Thee, for the rich land given unto us for an inheritance.

We thank Thee for Thy favor shown unto our fathers, and for Thy faithfulness continued unto their children. We thank Thee for the vision and the faithfulness of those in the past who have labored diligently to develop and conserve the great resources of our land. We thank Thee for the fields they carved out of the forests and the wastelands, for the ditches they dug to water the dry lands, and bless the people with the fruits of cultivated fields. We thank Thee for the rain and the snow that quench the thirst of the things we plant, and make the grass and the plants grow, to nourish and sustain the birds of the air, the beasts of the fields, and the people of the world.

And today we thank Thee for the stewardship of the land and of the resources of the earth. Awaken us, we pray Thee, to the importance of our stewardship; give us the vision and the wisdom necessary to so use the land, the water and all other resources entrusted into our keeping, that all mankind may come to have a good life; and grant us the love and devotion for this good land of ours that will move us to protect it from the exploitation of the greedy, and from those who would destroy it.

Give us the mind and the spirit of Christ, we beseech Thee, which will enable us to love Thee as the giver of all good and perfect gifts, and make us true and faithful stewards of all Thy blessings.

Send Thy Holy Spirit to guide this gathering, and bless especially the leaders who will guide the thinking of the group. Grant them wisdom that they may be able to pass to others the knowledge they possess on the best uses of irrigation water.

This we ask in the name of Jesus Christ, our Lord and Savior."

Amen

Opening Statement by Chairman Lory

As chairman of Governor Thornton's Committee for planning the celebration of the Centennial of Irrigation in Colorado, I have the honor of calling the meeting to order and giving you a brief outline of the plans of the Committee.

These include four sessions in cooperation with the Irrigation Institute of Colorado Agricultural and Mechanical College and a banquet Wednesday evening here in Alamosa where the splendid facilities of Adams State College were offered the Committee by President N. William Newsom; an all-day meeting in San Luis Thursday, April 10, where as guests of the citizens of the oldest town in Colorado you will take part in a parade, the dedication of the monument on the bank of the San Luis Peoples Ditch, a program at the San Luis Branch of Adams State College and motorcade through the beautiful Culebra Valley. Chairman A. J. Hamman of the Extension Service, Colorado Agricultural and Mechanical College, and his Program Committee have prepared a program which assures your attendance at every session, and he and Luther Bean, local member of the Committee on Arrangements have everything in readiness for our meeting.

The General Committee limited the Institute programs to 2-hour sessions each forenoon and afternoon and ruled out evening sessions, so you have ample time for visiting, reminiscing and planning.

Outstanding leaders in irrigation will preside as chairmen of the four Institute sessions.

The flags of the nations governing the region where irrigation began one hundred years ago in Colorado--Spain, Mexico, and The United States--and the Colorado State flag, are loaned by the Historical Society of Colorado.

Since the Irrigation Centennial Celebration is held during Holy Week, and in growing crops under irrigation where natural rainfall is supplemented with water supplied through human effort, the irrigation farmer is really cooperating with the Lord, therefore, in reverence and thanksgiving, all sessions of the celebration will be opened with prayer.

I now have the pleasure of introducing the Chairman of this session, the son of a pioneer family in the San Luis Valley, an alumnus of Colorado Agricultural and Mechanical College, and Deputy State Engineer, Dave Mathias of Monte Vista.

Summary of Address by Governor Dan Thornton at the San Luis  
Valley Irrigation Centennial Celebration



Ladies and Gentlemen:

For me, it is a singular honor to be able to speak here at Colorado's centennial recognition of irrigation. We usually think of water problems as those of the future, but here in retrospect we pause long enough to look back upon the foresight and judgment of our previous generations and see what we have reaped from their ideas. It is fitting and important that we recognize and compliment our forefathers for starting irrigation here in the San Luis Valley and other sections of the Centennial State. Water is our most important natural resource, and we should feel

Dan Thornton  
grateful to our pioneer ancestors for their vision in recognizing this fact. It is sincerely hoped that our work and our planning of today is as beneficial to our coming generations as this early planning has been to us.

When I learned of the possibility of having this recognition ceremony, I was happy and pleased to appoint the Governor's Committee to make necessary plans for an adequate and eventful celebration. Furthermore, I was especially pleased to include Dr. Lory of Fort Collins because he has had a long and unprecedented career in our State. He and all members of the Committee have worked long and diligently, and I am certain that this celebration will go down in the record books as one of the most historic, colorful, and interesting celebrations in Colorado.

I have a deep and abiding faith for people who work with the soil and Colorado's greatest resource -- water. Irrigation has given the San Luis Valley and other areas of Colorado its prosperity, and we must learn to make use of every drop of water and develop that use for the economic development of the State. We must learn how to better become custodians of our resources and that proper care will assure plenty and provide for future generations. A good measure of our citizenship is how we stack up as custodians of our natural resources, of which water is one.

One of the greatest challenges and responsibility ahead of us, not only in Colorado but the nation, is to think in terms of production and not in terms of destruction. We can look forward to a greater America and better world when all people become affirmative in such thoughts.

We have made use of this great natural resource of water through democratic processes and we need not change our system of government to further develop this resource--we do not need social reforms or any other "ism" for the people to continue to work our problems to make our way of life better in the future.

We do need to develop our knowledge and technics together, particularly in our schools of higher learning, such as Colorado A & M College, where principles of irrigation practice, irrigation laws and similar subjects are taught to our oncoming generations. This is vitally needed because water resources play the greatest role in Colorado prosperity.



1. Toastmaster W. E. Morgan introduces General Chairman, Charles A. Lory.
2. Speaker's table and a corner of the banquet.
3. Another view of the banquet.
4. Upper right—President Morgan, Judge A. W. McHendrie and President Emeritus, Charles A. Lory discuss water development.

The Early History of Irrigation in Colorado,  
and the Doctrine of Appropriation.

Judge A.W. McHendrie  
Irrigation Attorney, Pueblo, Colorado

As a background for a brief discussion of the above subject, permit me to suggest that throughout the world the history of civilization is the history of irrigation.

When primitive man first emerged from savagery, ceased to live a nomadic life, dependent upon the slaughter of animals and upon wild fruits and vegetables, for subsistence, the cultivation and conservation of these vegetable products was the first step in his upward journey. This in turn was based upon the artificial application of water in the irrigation of those crops. This was true because the first attempts along this line were confined to the more salubrious and gentle climates of the semiarid regions. The research and study of prehistoric civilization by students, scholars and archaeologists have definitely established that for centuries before the beginning of recorded history, irrigation of vast areas of land for the support of a large population, was the basis of food production for the major portion of the then inhabitants of the globe. In the valleys of the Nile, the Euphrates and other large streams, irrigation was practiced on a tremendous scale at least 2,000 years before the birth of Christ. In the Valley of the Nile alone, there then existed irrigation systems of canals and reservoirs more extensive, perhaps, than any such systems in operation to-day. It is known that this civilization perished because of some impairment or failure of the water supply; what occasions this failure is wholly a matter of speculation and conjecture.

In any event it is known that the practice of irrigated agriculture was transmitted by the Moors to Spain, and in turn by the Spaniards to the Western hemisphere in their conquest of this continent following its discovery by Columbus. The Spanish conquistadores brought the experience, knowledge and practice of irrigation to the southern portion of North America, although these pioneers found in their first explorations in that region, tribes of Pueblo Indians, the successors of cliffdwellers, depending upon irrigation for the production of a major part of their food.

And particularly connected with the present consideration, the Spaniards constructed and successfully operated irrigation works in what is now the state of New Mexico, many years before the Pilgrim Fathers landed at Plymouth Rock, and the descendants of those hardy and enterprising pioneers in turn brought irrigation to Colorado.

In passing, it might be observed that it is and always has been common knowledge, that the successful growing of crops depends upon the application to those crops, of moisture, either by natural precipitation or by the artificial application of water to fertile lands by means of irrigation. As a convenient yard stick for the land requirements of water supply, some students have divided the land areas into four major

zones, more or less arbitrarily, and of course overlapping and subject to some deviations of climatic conditions. They have divided the regions in which agriculture is the basis of the occupancy of the land, into the arid, semi-arid, sub-humid and humid regions. The arid region is, roughly, that area where the average annual precipitation is less than 10 inches; in that region nothing of food value can be grown without the artificial application of water by irrigation. The semi-arid region consists of those areas in which the average annual precipitation is from 10 to 15 inches; in those areas some food products, such as pasturage for domestic animals, are grown without irrigation, but no substantial or dependable agriculture can be carried on without irrigation. The sub-humid region is that area where the average annual precipitation is from 15 to 20 inches. In those areas many crops can be successfully grown in most years, without irrigation. The humid region consists of that area where the average annual precipitation is above 20 inches. In those areas, in the temperate zone, practically all food crops can be successfully produced with only the natural rain and snow fall. The State of Colorado, insofar as agriculture is a factor, lies within the semi-arid zone.

The history of irrigation in Colorado consists in part of recorded documentary evidence; in part, of the diaries, letters and articles written by early explorers and other contemporary, and usually, temporary, sojourners in this region; also, in part, we have the tales and traditions passed on from generation to generation orally. Depending upon all of these sources of information, we can be reasonably sure that we may draw a fairly accurate picture of the history of irrigation in this State, from which it will be noted that the history of the development and progress of settlement and civilization in Colorado, follows quite closely the world-wide pattern fixed by the first civilized inhabitants of the Orient.

Coming more directly to the subject of this discussion, the first attempt at irrigation within the present confines of Colorado, by civilized peoples, as distinguished from the prehistoric efforts of the original natives thereof, is an effort undertaken in the summer of 1787. In that summer when the founding fathers of constitutional government were struggling in the City of Philadelphia to draft the Constitution of the United States of America, one Juan Bautista de Anza (or Anza), then Governor of the Spanish Province of New Mexico, known as the "Great colonizer," entered into a treaty with the Jupe tribe of Comanché Indians. As a part of that program he sent a group of some 20 Spanish farmers and artisans to initiate with this Indian tribe a colony, known as "San Carlos de Jupes," on the banks of the San Carlos or St. Charles River near its confluence with the Arkansas River, then known as Nepesta, about 8 miles east of the present city of Pueblo. These men, with the help of their Indian collaborators, constructed some twenty houses, broke up and put into cultivation a fairly large tract of land adjacent thereto, and built a ditch taking its water from the river for the irrigation of this tract. Documentary evidence of this colonization project is extant in the archives of early New Mexico. The project, however, was not too successful. The Indians did not take kindly to living in the houses built for them, nor were they enthusiastic over the manual labor involved in the cultivation and irrigation of crops. After

the lapse of a year or two, and the advent into New Mexico of a successor to Governor Anzi, the project was abandoned.

The next attempt at irrigation of which we have reasonably authentic information, was made by the Bent Brothers. Upon the construction of Bent's Fort on the North Bank of the Arkansas River, about midway between the present cities of La Junta and Las Animas, in the year 1832, a ditch was built taking its water from the river for the irrigation of about 40 acres of land lying in a bend of the river and between the Fort and the north bank of the stream. This acreage was plowed and planted to corn, beans, squash and melons, cultivated and irrigated. According to the stories of contemporary occupants of the Fort, the production was quite good, but the harvests were practically a failure. This was due to the fact that the tribes of Indians who congregated and camped near the Fort, during the growing season, either purposely or inadvertently permitted their ponies to invade, graze upon and destroy the growing crops. After a few years the project was abandoned. ✓

The next irrigation enterprise as to which we have fairly reliable information, was begun about the year 1841 at the settlement near the mouth of the Fountain River, by a group of trappers and mountain men, with their Mexican and Indian mates, known as "The Pueblo" - the progenitor of the present City of Pueblo. These men put a considerable acreage into cultivation and irrigated the land by waters taken from the Fountain. They continued this program quite successfully each year until on Christmas Day, 1854, the Fort was attacked by a presumably friendly tribe of Indians, and the inhabitants were practically exterminated.

There is also some contemporary reference to a similar settlement on the banks of the Greenhorn, a tributary of the St. Charles, 30 miles south of the present City of Pueblo, with the irrigation of a considerable tract of land begun in about the year 1841 or '42 and continuing for at least several years.

The next irrigation enterprise as to which we have quite complete record evidence, was that of the construction of the John Hatcher Ditch on the East bank of the Picketwire River or El Rio de Las Animas Perdidas en Purgatorio, about 20 miles down stream from the present City of Trinidad, in September, 1846. This ditch was built by John Hatcher, foreman for the Bent Brothers, for the purpose of growing food for the ox teams engaged in freighting between Bent's Fort and Taos, New Mexico. In April, 1847, water was turned into this ditch for the irrigation of about 60 acres of land planted in corn. In the Fall of that year the Indians raided this ranch, destroyed the crops, and ran Hatcher and his employees out of the country. During the next 15 or 18 years, from time to time, individuals squatted upon this land and farmed or attempted to farm the original 60 acres, with considerable success. Usually, however, they got into difficulties with the Indians, and abandoned the effort. In the early '60s a man by the name of Lewellyng settled upon that land, reopened the ditch, and again put into cultivation the original 60 acres, and continuously occupied the farm and irrigated this acreage for many years. In the year 1881, at the first adjudication proceedings brought in that Water District, the

evidence of the appropriation was submitted to the court by sworn testimony of witnesses familiar with the history of that ditch from its inception. An attempt was made to have a priority awarded to the ditch as of September, 1846, but the trial court held that there was no privity of interest or title between the original appropriator and the then claimant, and accordingly fixed the priority date as of the year 1864. However, the appropriation originally made has been used and still is being used, for the reclamation and use of the 60 acres first put under irrigation by Hatcher.

So far as I have been able to determine from such investigation and research as I have been able to make, the foregoing is a brief outline of the history of irrigation in Colorado down to the date of the construction of the San Luis Peoples' Ditch, the irrigation enterprise, the celebration of the 100th anniversary of which is the occasion for this meeting.

Beginning with the year 1860 and following the gold rush of 1859, a great influx of people familiar with the practice of irrigation in New Mexico for generations, came into Colorado and immediately constructed more or less extensive irrigation works. This was not only true in the valley of the Rio Grande, the Picketwire, the Greenhorn and the Fountain, the three latter being tributaries to the Arkansas River, but to a less extent was also carried on in northern Colorado. The development, however, in southern Colorado, was quite extensive; on the Picketwire, for instance, the average or normal flow of that stream during the irrigation season was completely appropriated by the year 1864.

Subsequently the great irrigation systems on the Platte and its tributaries, the Arkansas and its tributaries and the Rio Grande and its tributaries, were constructed and have continually expanded, and are still expanding, furnishing the foundation and basis for the greater part of the economic wealth and welfare of the State of Colorado.

In the process of this development Colorado was the pioneer in the adoption of what is known as the doctrine of the priority of appropriation for the beneficial use of the waters of the streams; or "first in time, first in right." This was a distinct departure from the common law theory of riparian rights: that is, that the owner or occupant of the lands immediately adjacent to a natural stream was entitled to have that stream continue to flow past his holdings, undiminished in quantity and unimpaired in quality. The riparian right doctrine, of course, was never practically adaptable to the proper and economically feasible diversion, transportation and beneficial use of water for irrigation. The State of California attempted to apply this doctrine in the development of irrigation in that State, but it proved to be a failure, and that State has been more or less continually engaged in controversy and litigation throughout its existence. It now attempts to operate under a hybrid law, based in part on the riparian right doctrine, and in part on the doctrine of priority of appropriation. Their experience emphasizes the wisdom of those leaders and statesmen of the early days of Colorado, who made our laws conform to the necessities of the region, rather than attempting to guide and govern the utilization of a necessary

resource by the control of inapplicable, ancient legal doctrines.

The first recognition by our lawmakers of the fact that in order to make the highest beneficial use of this essential resource, we must depart from or modify the common law, occurred in the first session of our territorial legislature, late in the year 1861. At that session, and under date of November 5 of that year, an act was passed by the legislature in substance providing that the owner or occupant of land in the vicinity of, but not adjacent to, a flowing stream, had the right to construct a ditch over the lands lying between his land and the stream, for the purpose of diverting and using the waters thereof for irrigation. The act further provided that if the construction and operation of the ditch inflicted damage upon the owner of the lands which it traversed, the claimant would have the right to condemn a right of way over these lands, with the amount of damage to be assessed by a commission appointed by a Justice of the Peace.

At succeeding sessions of the Territorial Legislature, between the years 1861 and 1866, various special acts were passed, granting charters to companies engaged in the construction and operation of irrigating ditches. On February 5, 1866, an act was passed, in the nature of special legislation, applicable only to this region. It is a quite unique and interesting law. It provides, in substance, that in the Counties of Costilla and Conejos the citizens thereof engaged in agricultural pursuits are authorized and empowered to hold an election on the first Monday of March in each year, for the purpose of electing superintendents of acequias, to-wit, a superintendent for each and every Acequia Madre in the aforesaid counties. Only those persons in the occupation of lands adjoining the Acequia for farming purposes, were entitled to vote at these elections. The duties of the superintendent so elected are prescribed, which consist of keeping the ditch under his supervision in repair, and to that end he is empowered to call upon each person using water from the ditch to contribute his share of the work necessary to keep the ditch in operation. It also provides for a fine of not less than \$1.00 or more than \$5.00, for any person failing to obey the call of the superintendent.

An interesting provision of this law is that the superintendent shall provide an ample supply of water at all times for the benefit of the users of the ditch; and if he shall fail or neglect to do so, he shall be liable to a fine of not less than \$5.00 nor more than \$50.00; also if he shall wilfully neglect his duty in such manner that damage is done, he shall be liable for such damage, and in addition, to a fine of \$25.00.

It might be observed that said statute has never been directly repealed, and unless it is repealed by implication, as to which there is some doubt, it is still the law of the land.

The provision making the superintendent liable to furnish to each user of water an ample supply at all times suggests an intriguing situation. The enforcement of this statute under present-day conditions would be interesting. I would suggest that water users under every ditch in these two counties proceed to elect a superintendent thereof, and then

hold him liable under this law for furnishing everybody at all times an adequate supply of water. I apprehend that this is one office for which there would be not many candidates.

Of course, the next major step in the development of our irrigation laws, was the adoption of the constitutional provision in 1876, making a part of our organic law the doctrine of priority of appropriation. It has been said by our Supreme Court that this provision of the constitution was merely a recognition of the previous existing custom dictated by the "imperious necessity" of bringing the life giving waters to the thirsty land.

Following the adoption of the Constitution, and in the year 1879, the Legislature passed an act providing a procedure for defining, fixing and establishing the relative rights of appropriators in accordance with the date of each appropriation. This act was very shortly after its passage declared by the Supreme Court unconstitutional in part. In the next session of the Legislature, in 1881, the defects in the act of '79 were remedied. From that date to the present, with modifications and amendments not specially far reaching or drastic, we are capturing, utilizing and developing the water supplies of our State, demanded by expanding agricultural needs.

It will be seen that the inhabitants of Colorado, from the very earliest date of its occupancy, have followed the cycle of the history of civilization. Originally, the prosperity and very existence of those who were living in this arid region, were based upon the production of food by irrigation. Without this foundation the State would have been peopled only by the wandering tribes of nomad savages.

There then followed the great boom of 1858 and '59, created by the discovery of precious minerals. This in time faded into comparative unimportance. This era was followed by the wide-flung range-cattle industry, which in turn gave way to the settlement of homesteads and similar farm uses. We then had a period of growth, based largely upon the development of the great bituminous coal fields, and related industry. Those are no longer of prime importance in the economy of the State. Now, as in the beginning, the creation of taxable wealth, the prosperity and growth of towns and cities, the development of far-flung transportation systems, are all dependent upon the continued spread of agriculture; and that in turn upon the utilization of our water supplies through irrigation systems.

So, these hardy, far-sighted and courageous pioneers who 100 years ago made it their first task to construct the San Luis Peoples' Ditch, builded better than they knew. No shaft of purest marble, no lofty edifice of stone and steel, no tablet of bronze or gold, can constitute a monument to forever commemorate their achievement, comparable with the acequia dug through the desert of sand and sage by the toil and vision of those people whose memory we today honor.

A Century of the Development of Water Administration in Colorado

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In the presentation of this address, I hope you will bear with me in touching upon many items which, more properly, should be presented by an attorney rather than an engineer.

The subject which has been assigned to the speaker however, is inseparably associated with fundamental principles of law and legal procedures upon which the administration of the public waters of our State are based, and with which those who are charged with the administration thereof, must be guided.

Within the time available, it is possible in this presentation to include only some of the more important aspects of this subject and matters relating thereto.

Many years ago, one of the great Associate Justices of the Supreme Court of the United States; namely, Justice Oliver Wendell Holmes, made this statement: "A river is more than an amenity - it is a treasure that offers a necessity of life that must be rationed among those who have power over it."

I have often recalled that statement because it so admirably covers, in a few words, the subject of my talk to you on this occasion; particularly, as it applies to an arid or semi-arid region such as is our State.

The greatest problem with which man has had to contend, has been that of food supplies. This shadow from time immemorial, has laid as a pall upon all nations of the earth, unless it be our own fortunate America. No other people have escaped the ravages of famine, that dread scourge of nations. With the passing of time are we to be less fortunate? Future generations only, can answer this question.

It is of peculiar significance that since advancement comes through incessant urgings, often impelled by necessity, civilization had its awakening in a country plagued with sterility, where the ever present spectre of hunger stalked the footsteps of early man, and stimulated his sluggish mentality into devising artificial means for supplementing his food supplies by correcting nature's deficiencies.

It is also of significance, that civilization made its greatest strides in regions where irrigation is necessary to existence, and advanced or receded, with the growth or decadence of its agricultural activities.

Agriculture by irrigation, antedates recorded history and is probably one of the oldest occupations of civilized man. The time and place of its origin remain unknown.

The early hieroglyphic records of the Pharaohs 2,500 years before Christ, record the great achievements of irrigation which made Egypt the

granary of the civilized world, and the most opulent country of its time, while the earliest chronicle of irrigation along the Euphrates is that of King Hammurabi, one of the greatest monarchs of Babylonian history, and perhaps a contemporary of Abraham. His graven inscriptions record the beneficent effects of irrigation in ancient Chaldea more than 4,000 years ago, in the following lines:

"I have made the canal of Hammurabi a blessing for the people of Shumir and Accad. I have distributed the waters by branch canals over the desert plains. I have made water flow in the dry channels and have given an unfailing supply to the people. I have changed desert plains into well-watered lands. I have given them fertility and plenty and made them the abode of happiness."

The pomp and glory of those people and nations of antiquity whose civilization reached beyond the dawn of history are no more, doubtless due to the decadence of their irrigation institutions.

Hardly less remarkable have been the centuries old civilizations developed in the ancient countries of Persia, India and even South America, and the more modern civilizations of Rome, Athens, and Carthage which depended upon the results of irrigation practices in Italy, Greece, and Northern Africa.

Later civilizations of Egypt and India were saved only by the restoration and extension of former irrigation institutions, while the more modern civilizations of Italy, France and Spain could not survive were it not for intensive agricultural practices made possible by irrigation.

Within the past 300 years, this great civilizing agency has played no small part in reclaiming a large portion of our own continent. As a result of the early settlements of the Spaniards in Mexico which later extended northward into what is now the United States, may yet be seen the beneficent effect of irrigation in that country. Today, our own irrigation practices and institutions developed within the memory of living man, have been the most potent factor in the carving of a mighty empire from a dreary wilderness accounted by one of our former Presidents, "a habitation fit only for roaming Indians and wild beasts."

The changes wrought by irrigation in the western portion of the United States in the last half century have been scarcely less than marvelous. In areas once regarded as forbidding deserts are found the highest priced farm lands on the continent, and great cities have been reared in these former solitudes. The present age has brought a larger and truer conception of the value of the arid west, and of the tremendous part this region is to have in the industrial life and security of our country.

Many of these present are familiar with the history of irrigation institutions and practices in Colorado, and with the marvelous transformations they have brought about. How, from the earliest attempts at reclaiming the narrow strips of bottom lands in this valley and in the

vicinity of Fort Collins and Greeley, the science and art of irrigation practices were extended by the bolder spirits to the reclamation of greater areas of land far-removed from the local source of water supplies; how men of vision later foreseeing the exhaustion of the normal stream flow, conceived and brought about the existence of a great system of storage reservoirs for equalizing stream flows; and finally, as the need for greater supplies became manifest, pierced the mountains with expensive tunnels, and by the use of many miles of great canal systems, supplemented their local supplies by diversions from foreign drainage areas; and when it seemed that individual and corporate ability had been exhausted, the Federal Government was appealed to to construct huge systems of storage and distribution beyond the ability of individuals and corporations to finance. These great accomplishments have not been consummated without hindrances and discouragements, yet have gone forward under conditions, economically both fair and foul, during periods of high mortality to railways, banking institutions, mining and manufacturing industries.

Such have been the transformations wrought within the brief span of a single life.

We, as a young Nation, inherited many of our basic laws from England, our Mother country, which as in most humid regions, recognized the Common law doctrine of riparian ownership which, among other things, provides that one owning land adjacent to, or abutting on a stream, is vested with the right to have the waters thereof flow past his land substantially undiminished in quantity or quality. That he may take therefrom only so much of the water as may be required to meet the needs of his household and livestock; but should he take an additional amount over and above those requirements, he must return the excess amount to the stream before it leaves his land.

Our forefathers realized that such a theory is not applicable to an arid or semi-arid region where the maximum consumptive use of the water is necessary to produce food products and to sustain life. So in framing the Constitution of our State, our forefathers repudiated the Doctrine of riparian ownership as it applies to the use of water, and adopted what is known as the "Doctrine of Appropriation," which is now the recognized law in seventeen of our western States. Thirteen other states have recognized this principle by legislative enactments. Colorado, as I recall, with two or three exceptions, is the only State of the West which has this announced principle written into its constitution.

The Appropriative Doctrine was first announced in 1872 in the case of Yunker vs. Nichols, as reported in the First Colorado Reports of our Supreme Court.

The Territory of Colorado was created by Act of Congress out of lands which were then parts of the States or Territories of Kansas, Nebraska, Utah and New Mexico. Local customs with respect to the use of water which had developed prior to that time involved important questions relative to the rights of different appropriators, both as to quantity and time of use. These differences later resulted in the noted decision of the Territorial Supreme Court, in Yunker vs. Nichols in 1872.

This was the first case in which the Riparian Doctrine which existed in the humid regions of the East, was held to be not applicable to the necessities of an arid region.

The question of Riparian Ownership vs. The Doctrine of Appropriation was definitely decided 10 years later in the case of Coffin vs. The Lefthand Ditch Company, wherein the Supreme Court of Colorado announced the Doctrine of Appropriation as being the only doctrine applicable to this State.

The foregoing provisions of the Constitution which are unique, constitute the basis upon which the irrigation laws, Court decisions and procedure relative to the administration of same, are founded.

In 1879, the Legislature enacted the so-called "Irrigation Statute" to give effect to the aforementioned provisions of our Constitution.

In 1881, the above Act was supplemented by such additional provisions as "experience had demonstrated to be expedient and necessary to the welfare of the agricultural interests and the quiet, orderly and economical distribution of the waters of the State."

Our Supreme Court has held that an appropriation of water is an "Intent to take for some useful purpose, accompanied by some open physical demonstration of the intent." The Court has also held that it is an "Incorporeal hereditament;" that is, "something that may be subject to being inherited."

A water right in this State is also a "usufruct" which means, "the right to use something belonging to another without materially impairing the substance thereof." The Courts have also held that its continued enjoyment is dependent upon reasonably continuous beneficial use thereof. It is a property right, and may be lost through abandonment which, however, is a matter or question of intent that must be proven. In Wyoming and some other western States, the established non-use of water for irrigation and possibly for other beneficial uses, over a given period of years, constitutes abandonment.

In this State, a water right is not necessarily appurtenant or attached to any particular piece of land to which it has been applied.

Under our Constitution, one does not own the water; he merely has the right to take from the source of supply, sufficient water to meet his daily needs within the limit of his decree, and in accordance with the date of priority thereof as established by the Court. Any time he does not need the entire amount of water decreed to his ditch, he must leave the remainder in the stream for the use of others who may be in need of it.

Authority to determine questions of the relative rights of appropriators, is vested exclusively in the several District Courts of our State, which have original jurisdiction over such matters. These adjudication proceedings are not ordinary court proceedings, but are in the nature of what is known as "sui generis," which means "unique or peculiar in itself, or of its own kind."

When the Court finally enters a decree, a certified copy of the same is required to be filed with the State Engineer and with the local water officials within a prescribed period following the entry of the same. These Court decrees are the sole rule and guide which must be followed by the water officials in the administration of the water rights of our State. The water officials may not administer any waters to appropriators whose claims have not been adjudicated by the Courts.

The decrees of the Courts, among other things, fix the points of diversion at the sources of supply, the amount of water in second-feet or acre-feet, the date of priority thereof and the purpose for which the water is decreed.

There are two types of decrees, Absolute and Conditional. An Absolute decree is not subject to attack following a lapse of 2 to 4 years from the date of entry thereof, except for certain specified reasons. A Conditional decree is subject to modification or revocation by the Court at any time prior to becoming absolute.

The water officials must administer conditional decrees as if they were absolute until such time as the District Court has amended, revoked or made them absolute in a further proceeding.

There are two kinds of uses recognized by law. One applies to flowing water decreed for direct application or use, which is measured in cubic feet per second of time; the other applies to water for storage purposes which is measured either in cubic- or acre-feet. Neither of these two kinds of uses may be converted into the other kind without the prior consent of the Court.

Within the past 73 years, many laws relating to the appropriation, use and administration of the waters of our State have been enacted. With few exceptions, the constitutionality of these laws have been litigated and construed by more than four hundred decisions of the Supreme Court of our State. As a result, practically every principle in law designed to control the use of the waters of our State and the administration thereof, has been well established.

The law permits changes in decreed points of diversion, or transfers of water from one ditch to another but such changes must have the prior approval of the Court.

Under our laws, the water is not necessarily attached to the land, but may be transferred from one area to another, which makes for a more efficient use thereof. In times of shortage, water may be rotated between the water users under a ditch. It cannot, however, be rotated between ditches.

The laws permit exchanges to be made between flowing and stored water by which, one may take water to which a senior appropriator is then entitled, by delivering to the senior appropriator an equivalent quantity both in time and in amount.

We also have what is known as the "Loan Statute," which I have felt

is a "phoney" thing. It provides that ditches taking water from the same stream, may exchange with, or loan to another for a limited time, the water to which they may be entitled. Our Supreme Court, however, has held that when a water user has no immediate need for his water, he must leave the same in the stream. It would, therefore, appear that he would have nothing to exchange or loan.

There is also a law relating to the appropriation of the waters of springs, which provides that the owner of the land upon which a spring arises, has the first right to appropriate the waters thereof. Our Supreme Court, however, has held that if the waters of the spring, if left unhindered in their movement, would reach a natural water course, they are a part of the waters thereof, and therefore, may not be taken except in order of priority with all decreed appropriators on the stream to which the spring is tributary, whether by surface flows or as percolating underground water.

Colorado has no laws specifically relating to shallow underground waters, although numerous attempts to enact legislation on this important subject have been made in recent years. Our Supreme Court has held that all waters, whether surface or underground in character, if left unhindered in their movements would eventually reach some water course, are a part of the waters of such water course the moment they start on their transit. There are two laws relating to artesian waters and the use and control thereof which are virtually ineffective for lack of administrative authority.

Under our laws, one may not unduly waste water to the detriment of another appropriator and the water officials are charged with the duty of preventing such waste.

Another important law relates to the use of the natural stream channels of the State, as carriers for transmitting water stored in an upstream reservoir to points downstream, for delivery to ditches or to other reservoirs. This law provides that the owner of the reservoir shall be subject to a penalty to cover losses in transit from the reservoir to point of delivery, which the State Engineer is required to determine.

One of the most important responsibilities of the State Engineer is that of passing upon the adequacy of Plans and Specifications covering the construction of all reservoir dams, the maximum height of which exceed 10 feet, or which will create a reservoir with a surface area in excess of 20 acres. He is also charged with the responsibility of requiring that such dams be maintained in a safe condition, and has authority to limit the stage of storage in a reservoir within limits which he considers to be safe.

There is maintained in the State Engineer's office, an elaborate filing system which includes many thousands of claims of appropriations of water, and Court decrees. Also Plans and Specifications for nearly one thousand, nine hundred reservoir dams, for which a card index system must be currently maintained.

Among other things, the State Engineer is charged with the duty of administering five Inter-state River Compacts, or Treaties with sister States and three decrees of the Supreme Court of the United States, affecting the use of the waters of the State. He is also an ex-officio member of the State Water Conservation Board, the State Planning Commission, the State Irrigation District Commission, the Public Irrigation District Commission, and the State Board of Registration for Professional Engineers and Land Surveyors.

By Act of the Legislature in 1950, he is also charged with the duty of reporting to the Weather Control Commission, the results of all Weather Modification Activities in the State.

It would be difficult if not impossible, to definitely establish the date of the first practice of irrigation in Colorado. The construction of our earliest ditches are almost coincident with the arrival of the first pioneers. There are evidences which are found in the Mesa Verde area, of canals or ditches which were in existence prior to the advent of the white man in Colorado, and which are said to have been built by Indian tribes that occupied the southerly and westerly portions of the State. Since Zebulon Pike, in the history of his expedition into this territory in 1806, makes no mention of either canals or settlements, it may be assumed, that with the exception of canals which may have been constructed in pre-historic times, no irrigation occurred in Colorado prior to 1806.

Present irrigation practices with few exceptions, were initiated immediately following the era of the trappers and fur traders and coincident with the gold rushes of 1858-59. While there is substantial evidence which would indicate that there were instances of the practice of irrigation in a minor way, on the Purgatoire River and Hardscrabble Creek in the Arkansas river basin and on St. Vrain Creek in northern Colorado in the early 1840's, such were of a temporary nature and resulted in no permanent developments.

Although three or four ditches were built in the Arkansas and South Platte River valleys as early as 1859, no fewer than forty ditches were constructed in the San Luis Valley prior to the latter date, by the early Spanish-American emigrants from the Territory of New Mexico.

The ditch which has the earliest priority in this State is the San Luis People's Ditch, the Centennial celebration of which, is the auspicious and happy occasion for this gathering. This ditch was awarded a decree out of Culebra Creek for 21 second-feet and one out of Rito Seco Creek for 2 second-feet, both with dates of priority as of April 10, 1852. It has been asserted however, that work on these ditches was initiated as early as 1849.

When G. H. Heap rode into this Valley on July 4, 1853, he is quoted as having stated that he arrived at a small village in Culebra inhabited by Mexicans where there were "numerous farms" which were skillfully irrigated. In his report of December 25, 1895, to State Engineer Sumner, Francis T. Anderson, Superintendent of Irrigation in San Luis Valley, stated that "for variety of crops and fertility of soil, Water District No. 24, is unexcelled."

As disclosed by the records of the State Engineer's office, the following six ditches, all in Water District No. 24, are the oldest ones in Colorado, the priority dates of which, range from April 10, 1852 to April 1854:

Name of Ditch	Creek	Priority No.	Date	Priority	Amount Decreed
					Second-feet
San Luis People's Ditch	Culebra and Rito Seco	1	April 10,	1852	23.00
San Pedro Ditch	Culebra and Rito Seco	2	April	1852	19.50
Acquia Madre Ditch	Costilla	3	--	1853	22.50
Montez Ditch	Rito Seco	4	August	1853	1.00
Vallejos Ditch	Vallejos	5	March	1854	17.00
Manzanarito Ditch	Costilla	6	April	1854	23.00

I now come to the main subject on which I am supposed to talk; that is, the "History of Administration of the Public Water Supplies of Colorado."

The Legislature in 1879, following the adoption of the Constitution in 1876, realized that there had to be some authority to administer the water decrees of the Courts, so it created a few Water Districts throughout the State and the office of Water Commissioner.

The law provides that a Water District shall consist of all the lands irrigated by the waters diverted from a designated stream. There are now sixty-nine water districts in the State.

From time to time, the Legislature has created Irrigation Divisions, of which there are now seven, each of which includes the drainage basin of a major river system or an integral part thereof.

In 1884, the Legislature created the office of Irrigation Superintendent which name was later changed to that of Irrigation Division Engineer. Each of these officials have supervision over the water commissioners in their respective irrigation divisions.

These division engineers and water commissioners have certain prescribed duties, all of which pertain to the administration of the water decrees in their respective divisions and water districts.

For the proper correlation of the duties and activities of these officials, the Legislature in 1881 created the office of State Engineer, with general authority and supervision over all of the public water supplies of the State and the administration thereof.

There are eleven major stream systems of our State consisting of the Arkansas, Rio Grande, San Juan, Animas, Dolores, Gunnison, Colorado, White, Yampa, North Platte and South Platte Rivers.

The Arkansas River produces an average of 1,150,000 acre-feet of water per year, of which 880,000 acre-feet are actually consumed within the State.

The Rio Grande produces an average of 1,550,000 acre-feet, of which 1,070,000 acre-feet are consumed within the State.

The North Platte River produces an average of 700,000 acre-feet, of which 125,000 acre-feet are consumed within the State.

The South Platte River Produces an average of 1,650,000 acre-feet, of which 1,350,000 acre-feet are consumed within the State.

A minor watershed of the Kansas River produces approximately 200,000 acre-feet, of which about 10,000 acre-feet are consumed in the State.

Colorado River and its many tributaries produce an average of 11,960,000 acre-feet a year or about 70 percent of the total water produced in the State, of which 4,760,000 acre-feet are consumed within the State.

There is a great shortage of water on the Eastern Slope of our State to meet present and future requirements. At the present time, there are thirty transmountain diversion projects, practically all of which divert water out of the Colorado River Basin into the Arkansas, Rio Grande and South Platte River Basins for the purpose of supplementing the water supplies of those basins. The oldest of these transmountain diversions is the Ewing Placer Ditch which diverts water from the Colorado River Basin to the Arkansas River Basin.

The principal transmountain diversion projects consist of the Laramie-Poudre Tunnel, Grand River Ditch, Skyline Ditch, Independence Pass Tunnel and the Moffat and Jones Pass Tunnels owned by the City of Denver.

These transmountain projects divert on the average, about 133,770 acre-feet per year, which is but a fraction of what it will be possible to divert when all the transmountain diversion projects now under construction or consideration have been completed. The largest transmountain diversion project, now nearing completion, is the Colorado-Big Thompson Project which is designed to divert, from the Colorado River into the South Platte River Basin, approximately 300,000 acre-feet of water per year.

The City of Denver is engaged in driving a 23-mile tunnel to divert about 200,000 acre-feet of water per year out of the Colorado River Basin into the South Platte River Basin above Denver.

The Bureau of Reclamation is making studies to determine the feasibility and cost of diverting approximately 500,000 acre-feet of water from the Colorado and Gunnison River basins to the Arkansas River basin to supply present and future needs in that basin.

These projects are, and will be very costly. Their economic justification will depend upon their ability to reimburse the costs thereof not only through the sale of water to the water users but also through the sale of hydro-electric energy.

A law enacted in 1917 prohibits the diversion of water out of Colorado for use in another State. This requirement may be corrected only by

amendments to the present law, by Inter-state Agreements or by decisions of the Supreme Court of the United States. Colorado now has seven (7) Inter-state Compacts covering the use of the waters of the major stream systems of the State. Inter-state uses of the waters of all others are controlled by three decisions of the Supreme Court of the United States.

The present organization of the Division of Water Resources consists of the State Engineer, a principal Deputy State Engineer, three Special Deputies, Seven Division Engineers, one hundred fourteen Water Commissioners and Deputies, a Chief Hydrographer and five hydrographers, two stenographers and an accountant.

The office maintains, in cooperation with the United States Geological Survey and other Federal Agencies, three hundred eight stream-gaging stations throughout the State, practically all of which are equipped with automatic recording devices. In this connection, the hydrographic branch of the office makes many thousands of measurements each year of stream discharges and voluminous computations showing the daily flows thereof. It is also required to calibrate from time to time the measuring devices in thousands of ditches throughout the State. In this connection, the State Engineer is authorized by law to **require** that all canals and ditches, or any other facilities used for diverting water out of the public streams, maintain proper headgates and measuring devices and also automatic recorders, if need be, and for failure to do so, he is authorized to prevent diversions of water by such agencies.

An important improvement in administrative procedure in recent years has resulted largely from the use of the Parshall measuring flume which now has wide recognition and use as the most practical and accurate device for the measurement of water, especially under conditions with which the water officials are confronted. The advent of the automatic recorder and, more recently, means for transmitting currently, records therefrom, to the administrative officials and the management of canals, ditches and reservoirs, has greatly improved the administration of our water supplies and has eliminated many former controversies between water users and the water officials.

Under the Act of 1879, a reservoir was accorded the right to store any unappropriated water not then needed for immediate use for domestic or irrigation purposes. This provision of law was so administered by the water officials until the Supreme Court in the case of Park Reservoir vs. Hinderlider in 1935, held that it violated the superior provisions of the Constitution relating to the Doctrine of Priority of Appropriation and Use.

The law of 1879 and Amendments thereto, authorizing the use of the natural stream channels for conveying stored water to lower points of diversion, provide that the State Engineer shall determine the amount of losses in transit. Due to the many variable conditions which control such losses, this requirement has raised many difficult problems of administration.

Many years ago, the Legislature enacted a law creating an Irrigation and a Storage season. This Act was later referred to the People,

and as a result, was discarded by a large majority. The Supreme Court has held that there is no such thing as an "Irrigation or Storage Season," but that the right to the use of water, whether for direct application or for storage, depends entirely upon the priority dates thereof, regardless of the character of use.

Another important phase of water administration, involves the right to store water decreed for direct use.

In the case of Seven Lakes vs. New Loveland and Greeley Irrigation Company, decided in 1907, the Court held that an appropriation of water for direct irrigation may be temporarily stored for later use so long as the quantity stored, both in time and amount, does not exceed the former uses for direct irrigation.

A later decision of the Supreme Court in Greeley-Loveland Irrigation Company vs. Farmer Pawnee Company, had the effect of reversing the foregoing decision, so that the present law prohibits the storage of water decreed for immediate use.

Another problem which is becoming increasingly important, is that involving the preferential right one may have to make an exchange of water at times when the natural flow of the stream is not sufficient to meet the requirements of all those who may at the same time, desire to avail themselves of this privilege.

In 1944, a suit was filed in the District Court in Water District No. 11, against the water officials which, among other matters, involved the question of evaporation losses from the Sugar Loaf, Twin Lakes and Clear Creek Reservoirs which are located in the Upper Arkansas River Basin. Following weeks of testimony, the Court rendered a decision which required that the owners of these reservoirs be charged with losses due to evaporation from the surfaces thereof, which affected decreed rights senior to those of the reservoirs. The Court directed the State Engineer to determine the amount of such losses monthly, and to release from the reservoirs to the streams, the equivalent quantity of water. The owners of the reservoirs did not elect to appeal the decision to the Supreme Court and hence, the judgment of the trial Court is limited to the three reservoirs in question.

The involved computations to determine the evaporation losses each month requires one day's effort. It is interesting to contemplate the magnitude of the effort and time which would be required should the Legislature enact a law requiring such monthly determinations to be made for the hundreds of other channel reservoirs throughout the State.

The placing of the local water officials under Civil Service has increased the efficiency of administration since it removes them from the pernicious effect of undue influence by those who may be seeking favors. A water official, through lack of a proper understanding of the laws, or of experience, may commit wrongful acts to the injury of the water users, but under no condition must he allow his decisions and actions to be influenced by unwarranted requests, demands, favoritism, or gratuities. Knowledge of the functions and duties of his office and experience and

alertness as to his responsibilities are essential to the efficient administration of his duties, but a keen sense of absolute integrity is the most important essential a water official should possess.

And now, these last words in commendation of the heroic struggles and fortitude of the pioneers whom we are here to honor, I can think of no more appropriate ones than those of Marcus Cato, who 50 years before Christ, said:

"It is from the tillers of the soil that spring the best citizens and the staunchest soldiers; theirs are the enduring rewards which are most grateful and least envied. Such as devote themselves to that pursuit are least of all men given to evil counsels."

These words are as true today as they were in the time of that old Roman philosopher.

In closing, I would leave with you this additional thought so beautifully expressed by the late Henry Grady: "A citizen standing in the doorway of his home, contented upon his own threshold, with his family gathered about him while the evening of a well-spent day closes in scenes that are dearest, he shall save the Republic when the drum tap is futile and the barracks are deserted."



Dan Hunter of Dove Creek, member of the Colorado Water Conservation Board, Judge A. W. McHendrie of Pueblo, State Engineer M. C. Hinderlinder and General Chairman, Charles A. Lory.

Poudre Valley Contributions to Colorado Irrigation Practice

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The first ditch in the Spanish land-grant area of Colorado has now completed its first century of service. The Spanish-Americans who built the People's Ditch can count their irrigation experience, though, by centuries. In the time of Columbus, in Spain, and in our own southwest, irrigation was an ancient institution. The Spanish entered what is now the southwestern part of the United States in 1599, ideally equipped to get the most out of the resources of the area. The climate of Spain is much like our own southwest. The crops and livestock they brought to the new world were well adapted to the area. More important still, they had the law and social organization with which to administer irrigation. Spanish law recognized that water was a utility which all should share. Title to water was held by the municipality, the commune, or the pueblo, as a "common property for domestic use, irrigation, and other purposes." While the use of water was free to all, it was governed by municipal rules, and administered by village officials.

Basic engineering practice was well developed too. It is quite unlikely that the builders of the People's Ditch had to alter it much respecting curves, slopes, embankments, or other detail. Our Anglo-American pioneers in Colorado could have saved themselves money and trouble had they consulted their Spanish-American neighbors, but difference in language and culture, then as now, was an almost insurmountable barrier. We learned most of our engineering by the "trial and error" method, and development of irrigation was therefore slower. Herbert M. Wilson, irrigation engineering specialist for the United States Geological Survey during the 1890's when that was the only federal agency interested in irrigation, wrote in his report of 1892:

"Until about 1882 there can scarcely be said to have been constructed a single irrigation work designed on sound engineering principles." What he said applied only to Anglo-American efforts. He ignored both the European and Spanish-American achievement.

According to men who have made the study of ancient cultures their profession, agriculture and irrigation, developed together. As the last ice age began to recede the rain belt followed it. The climate of the Mediterranean area, north Africa, and the middle East was thus modified. An abundant growth which had provided a relatively easy life began to disappear. Only by the collection of seed and watering of plants could life be maintained. Thus agriculture was born.

However, our Anglo-American forebears had no irrigation in their recorded experiences. Coming as most of them did from the United Kingdom and northern Europe, they had nothing in their past to enable them to cope with the conditions which they found west of the 100th meridian. Water had been so abundant that the laws they brought with them were concerned with getting it to the sea as quickly and unobstructively as possible. The result was that all irrigation in Colorado, except for the acequias built and operated by Spanish Americans, had to be developed empirically.

This was a wasteful process but the adaptability of the Anglo-Americans was great, and in the end the Colorado system that emerged was a very efficient one--more efficient for the intensive use of water than the one which the Spanish had developed. Because the Cache La Poudre Valley was the first intensively irrigated area in the State most of the features of the Colorado system were developed or advocated by its irrigators.

Colorado irrigation, as far as commercial farming is concerned, got its start from the gold rush of 1859. Such men as David K. Wall and "Potato" Clark came out to raise crops for the mining camps, rather than to look for gold. At that time there was only one settlement on the Poudre. Antoine Janis and a few of his French Canadian associates, founded LaPorte in 1844. He became the first permanent settler north of the Arkansas River. Fort Collins was established as a garrison in 1864, and in that year, also, Ben Eaton came to the Valley and began farming on the present site of Windsor. The irrigation in the valley prior to 1870 was relatively insignificant.

The first ditch was taken out of the Poudre in 1860 by G. R. Sander-son. In 1863 he sold his squatter's rights to Joshua Yeager, and it is under the name of the Yeager Ditch that the first priority was granted. The City Ditch of Denver is the only ditch north of the Arkansas which antedated the Yeager Ditch, and that only by 2 months. All together there were thirty-four priorities granted before the establishment of the Union Colony, but the generosity of the court was greater than the facts warranted. Ben Eaton testified 10 years later that there was not a thousand acres under cultivation in the Poudre in 1870 when the construction of Greeley Number Three was begun. The ditches were relatively small and short, irrigating lands on only the first and second bottoms. The chief crop produced was hay. It was thought that the uplands were sterile lands, that they would produce little even with water. Ben Eaton warned the Union Colony that it was senseless to take the ditches up on the bench lands; that the land was so poor that it would fail after a crop or two.

The first major event in the history of irrigation in Colorado was the establishment of the Union Colony at Greeley. This assertion can be justified in several ways. In the first place the Union Colony brought men to the state who were to make a fantastic impression on the institution, and on the practice of, irrigation that is way out of proportion to their numbers. N. C. Meeker, after a trip to Colorado in 1869 invisioned a colony united in purpose and ideals, which would be financially able to build a community without going through the harsh, primitive, backward phases of other frontier settlements. To achieve the unity that was necessary to the success of such an effort, the members of the colony were selected. I quote from N. C. Meeker's circular:

"The persons with whom I would be willing to associate must be temperance men, and ambitious to establish good society, and among as many as fifty, ten should have as much as \$10,000, twenty \$5,000, while others may have from \$200 to \$1,000 or upwards . . . My own plan would be to make the settlement almost wholly in a village. And the lots should be sold that funds may

be obtained for making improvements for the common good-- such as the building of a church, a town hall, a school house, and for the establishment of a library - - - - Whatever professions and occupations enter into the formation of an intelligent, educational, and thrifty community, should be embraced by this colony, and it should be the object to exhibit what is best in modern civilization.

"In particular, should moral and religious sentiments prevail; for without these qualities man is nothing."

What was called the Union Colony was organized on December 24, 1869, at a meeting in Cooper Union, in New York City. The announcement of the projected colony had been made in the papers, and a crowd of interested people was on hand. The meeting was addressed by Meeker and by Horace Greeley, and the organization was perfected. The Locating Committee consisting of N. C. Meeker, R. A. Cameron of Indiana, and a Mr. Fisk of Toledo, was authorized to go west and select a site. The committee came to Colorado in February 1870. They tried to get into the San Luis Valley, but they were blocked out by deep snows. They examined the sites at Colorado Springs, at Platteville and Evans in the Platte Valley, and the Poudre Valley. They selected the Poudre Valley site largely because a large tract was available on which there were no settlers. A few came out in April to begin construction, and most of the men of the colony arrived early in May. Not one man in the group knew anything about irrigation, but many of them had developed an unusual capacity to learn.

Among the men who became prominent in irrigation beside Meeker, were General R. A. Cameron, Max Clark, B. S. LaGrange, Solon and Henry Martin, David Boyd, and E. S. Nettleton. The wisdom and foresight of these men was not always apparent. Mr. Meeker in his Cooper Union speech at the time the Union Colony was formed, said, "The cost of irrigation is perhaps equal to fencing, and is a work that is to be extended from year to year." Horace Greeley, at the same meeting, spoke in the same vein. "A little water goes a great deal farther than people generally suppose. In California they use much more than is necessary."

In the budget \$20,000 was set aside to build four ditches that were to irrigate approximately 110,000 acres of land. Greeley Number Three ditch, coming out of the south side of the Poudre about 6 miles west of Greeley was the first ditch completed. Its purpose was to supply water to the gardens and orchards in the town. It was intended to irrigate 5,000 acres, but it failed to carry sufficient water to irrigate 200 acres. It was enlarged in 1871, 72, and 73 before it carried an adequate supply of water. The estimate of the cost was \$6,333, but the final cost was not less than \$25,000.

Greeley Number Two was a much bigger undertaking. Its head gate came out of the north bank of the Poudre about 6 miles southeast of Fort Collins. It was to irrigate all the farming land north of Greeley. The failure of this ditch to deliver as originally planned, was almost fatal to the colony. About 2,000 acres of crops were put in, in anticipation of the completion of the ditch, but the water was so inadequate that

practically everything was lost. The cost which was estimated at \$9,000, was \$27,000, but enlargements had to be made in 1873, 74, and 77, and the final cost was \$87,000. Altogether, the ditches that were estimated to cost \$20,000, required outlays of \$412,000.

The greater part of the unforeseen costs was for correcting structural deficiencies. The elimination of sharp bends in the ditches was expensive, as was the installation of checks where the slope was too great. A little experience could have saved thousands of dollars, but even by the trial and error method the farmers on Greeley Number Two got their water cheaply. The cost of the completed works was \$350 per 80 acres.

The success of the Greeley colony gave Colorado tremendous publicity. The whole world seemed to be watching the experiment. When the success of irrigation farming on the uplands seemed assured, there was a rush to build big ditches throughout the State. A few attempts were made to imitate the colonization plan: The Chicago colony at Longmont, the Fountain colony at Colorado Springs, the Green City colony in the South Platte, and the Agricultural colony at Fort Collins. Most of the big ditches that followed the Greeley success, were not built by colonists, but by corporations using British capital, however. These ditches were built with two purposes in mind. First a profit could be made from the sale of land. An option would be taken on railroad lands. Without water these lands would bring from \$2.50 to \$4.00 per acre. With water available, the value would skyrocket to \$100 or more. Second, after the land was sold it was confidently expected that the sale of water would give very liberal returns as a permanent investment. Several of the Greeley men became the promoters of new ditches, and the mistakes made on Greeley Number Two were never repeated.

A second contribution of Greeley to Colorado irrigation was in the formulation and promotion of a system of public administration of streams. When Greeley Number Three and Greeley Number Two were constructed there was little water being used above their head gates. However, in 1872 the United States government closed Camp Collins and offered the 3,000 acre military reservation for sale. The Agricultural colony of Fort Collins was formed to buy the reservation and to build ditches with which to supply the surrounding land with water and to develop the town of Fort Collins. R. A. Cameron of the Greeley and Fountain colonies became president of the new enterprise. On the surface it appeared to be just such a colonial effort as Greeley, but in reality it was a mere speculative scheme. It failed to establish a solvent enterprise, but they did build two ditches - Larimer County Canal Number Two in 1872 and Lake Canal in 1873. The early summer of 1874 was very dry. According to the Fort Collins Standard the river was lower than it had been since 1863. There was not enough water in the Poudre to supply both the ditches at Greeley so Number Two was ordered closed 2 days a week to permit water to reach Number Three ditch. The irrigators at Greeley became alarmed because they knew that two large ditches had just been constructed by the Agricultural colony at Fort Collins. These ditches would begin to draw water in the summer of 1874. Who was to have the right to the water when it became scarce? The right to appropriate water had been recognized by law but the idea of prior appropriation had not yet been specifically

expressed by the legislature or tested in the courts. W. C. Meeker spoke for Greeley when, in a Greeley Tribune editorial, he outlined a policy. First the principle of prior appropriation must be recognized. Until it is, capital invested in irrigation cannot be secure, he wrote.

"It looks to us as though it would be much better to consolidate the interests of every ditch owner and to make the river an irrigation canal, subject to such superintendence as is established on our Number Two; for by this means everyone would have his rights, the supply of water would be constant, and all would know what to depend on."

On July 15th, a week after the publication of the Meeker editorial, a meeting of Poudre Valley irrigators was held at the Eaton school. Fort Collins ditches were taking all the water from the river and the Greeley ditches were dry. David Boyd in his History of Greeley and the Union Colony of Colorado has left a highly colored picture of the meeting. Greeley men advocated the principle of prior right at the meeting. Fort Collins men argued for the appointment of a commissioner who would divide the water according to the greatest need, throughout the current season. While no agreement was reached, the meeting ended amicably with the promise on the part of Fort Collins, to let some water down the river, a promise, David Boyd asserts, that they never intended to keep. A heavy rain a few days after the meeting saved the situation for that season, but the irrigators in the Greeley community were firmly united in a determination to secure recognition of the principle of prior right. Less than 2 years later the Colorado Constitutional convention recognized the Greeley position. The committee on irrigation, agriculture, and manufacturing consisted of nine members, two of whom were from Greeley, wrote the constitutional provisions.

"The right to direct the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose . . . ."

The first legislative session was too preoccupied with the organization of state government to attempt to implement the constitutional provisions concerning water. The Greeley irrigators did not relax. They realized that the courts were too slow to offer protection to growing crops. They got new converts from the Fort Collins area when, in 1878, Ben Eaton began construction of the Larimer and Weld ditch. This ditch was to come out of the Poudre at the mouth of the Poudre Canyon and it was designed to irrigate 70,000 acres of land above, and north of all other ditches on the river. It was to have a capacity of 571 second-feet, large enough to take all the Poudre water throughout most of the irrigating season.

In October 1878, J. L. Brush and L. C. Mead, representatives from Weld County, and Silas B. A. Haynes, senator, called a meeting of Weld County irrigators to discuss needed irrigation legislation. A small number of farmers attended, but they included representatives from both the Poudre and St. Vrain. L. C. Mead of the St. Vrain was elected chairman. Quickly the meeting decided that three problems needed legislation.

First, some method of determining prior rights had to be devised. Second, if prior rights were to be meaningful some reasonably exact principle for the measurement of water had to be discovered. Finally a system of stream-flow administration which would authorize and control diversions was needed, if that prior right was to be completely realized.

The convention met in Denver December 5-7, 1878. About fifty-one irrigators were in attendance--all from the South Platte or its tributaries. A few came to oppose any legislative program. L. C. Mead was again elected chairman. David Boyd of Greeley was appointed chairman of the committee on order of business. Three proposals were brought before the convention by the committee. The proposal to divide the State into districts for the administration met vigorous opposition. G. W. Harriman of Bear Creek was reported to have said, "If the people of the Cache La Poudre want legislation let them have a district law and pay for it themselves." When the question of water measurement was under discussion J. Max Clark of Greeley supported the proposal by a reference to the successful measurement of streams in Italy. However, there was a good deal of skepticism about the feasibility of measurement of water, even among the friends of a legislative program. One man, David Barnes of the Big Thompson, suggested that it would be more feasible to measure the snow in the mountains. The convention ended with the chair being authorized to appoint a committee to draft a bill for an irrigation law to be submitted to the legislature. The committee was composed of David Boyd of Greeley, Chairman; J. S. Stange, editor of The Colorado Farmer; Daniel Witter of Boulder, John C. Abbott of Fort Collins, and I. L. Bond of Boulder.

The program this committee recommended to the legislature provided first, for dividing the State into water districts corresponding with the natural drainage basins; second, the appointment by the Governor of a water commissioner in each district whose duty it would be to divide the water on the basis of prior appropriations; third, a plan for securing a record of priorities through referees' hearings in each district. The latter was the most contentiously discussed problem. Dr. Bond wanted water rights based not on diversion but on application to the land. Each parcel of land thus would have the water rights permanently attached to it. Finally, the program provided for the appointment of a state engineer.

The bill was placed in the hands of L. C. Mead who introduced the measure. It was rewritten in committee by Judge H. P. H. Bronwell, one of the few lawyers who were sympathetic with the idea of state administration. The bill faced determined opposition in the legislature. Three times L. R. Rhoads of Fort Collins, who later became one of the leading irrigation attorneys of the State, attempted to kill the bill. However, on February 9, 1879, the bill became law. The act created ten water districts, all but one in the Platte River system, and provided for the appointment of ten water commissioners. It empowered the District courts to appoint referees to determine the priority of rights on each stream. The legislature refused to provide for a State engineer or for gauging stations. To economize, the supervision over irrigation was given to the State Board of Agriculture.

The Poudre, District Number Three, was the first district to request the court to appoint a referee to hear testimony or priorities. H. H. Haynes was appointed referee. Greeley appointed two lawyers to protect their interests by cross examining those claiming priority to the Union Colony. When the testimony was all in the referee made the recommendation to the court but Judge Elliott refused to issue the decree on the grounds that the law was unconstitutional. Later he decided that the law was only defective. While the Supreme Court was reviewing the case, the 3rd Colorado legislature convened and the Act of 1881 was adopted. This law formalized the hearings by which the referee was to prepare the decrees. It also created the office of the State engineer, and provided for the gauging of all streams used for irrigation purposes. Thus the Colorado system came into existence. The men who designed this system had been irrigating only 10 years, yet it worked so well that it has been adopted, with only a few modifications, by the other sixteen western states having irrigation interests.

The Cache La Poudre Valley irrigators made a third important contribution to modern irrigation. They have developed techniques and practices for conserving water that has made the water supply of one small stream effective, far beyond the dreams of any other irrigators--even those people who count their irrigating experience by milleniums. In 1878, Major Powell was authorized by Congress to determine the irrigation potential of the west. He took Utah as an area representative of the eleven western states. By determining the flow of the streams of Utah, and estimating that a second-foot would irrigate a hundred acres, he reported to Congress that 3 percent of the western lands might be subjected to irrigation. Powell's forecast has proved remarkably accurate for the west as a whole. In the Poudre Valley, for every second-foot that flows out of the mouth of the canyon there are now over 400 acres under irrigation. This high efficiency has been achieved by storing water when it is not needed, and by using water high up in the watershed so that the maximum return flow could be achieved.

During the 1860's and 1870's hay and small grains were the chief crops produced under irrigation in Colorado. In the 1880's, alfalfa and potatoes began to be grown on a comparatively large scale. With hay and small grains the flood flow was usually sufficient to give each water user enough to insure a crop. Alfalfa and potatoes, and later, beets, required irrigation over a longer season. By mid-July only a few senior appropriators were entitled to water from the stream. Supplemental supplies of water had to be found if the land of the valley was to be put under more profitable crops.

The first movement in this phase was the development of reservoirs. The first reservoir built in the State to serve as an irrigation supply was built on Coal Creek in Jefferson County in 1859. A dozen or more reservoirs in the State have an earlier priority than any in the Poudre Valley, but they are all of small capacity. In 1882 the building of relatively large reservoirs was begun with the construction of Chambers Lake in the channel of the upper Poudre, and of Windsor Lake reservoir in the lower valley. According to tables prepared by John E. Field, reservoir building in the Poudre reached it peak in the decade of 1880

to 1890. All other districts were a decade or two later. The storing of water for late summer use has done much to increase the productivity of agriculture.

In 1890, Terry Lake reservoir, just north of Fort Collins, was constructed by the Larimer and Weld Canal. Horace G. Clark described the change which that reservoir had made in the lives of farmers living under it, before the Nineteenth Irrigation Congress in Chicago in 1911. Mr. Clark who was a water user of the Larimer and Weld, said:

"I was a farmer under this ditch, and with others, suffered from an insufficient supply of water. We looked with jealous eye on the profitable crops of potatoes grown by our brothers under old Greeley Ditch Number Two . . . . We could not raise potatoes. And we had frequently to irrigate our grain crop when it was too early--when it baked in the ground, turned the grain yellow, and cut the yield down one-third--for fear we would make no crop at all for lack of water later on. About one crop of alfalfa--the first--and a half crop the second cut. . . That was our condition under the Eaton Ditch . . . .prior to the advent of Terry Lake."

Another phase of this search for more water with which to develop a higher agriculture was the development of interbasin and transmountain diversion. The Larimer County Ditch was the agency that pioneered in this field. A. A. Edwards, director and secretary of that company, was the man who promoted this development. In 1890 the Larimer County Ditch was started. Since it was the last but one of the major ditches on the river, its stream flow rights were very poor. That same year the company began to build the Grand River Ditch to intersect several tributaries of the Colorado River, and to bring the water over Poudre Pass into the South Fork. In 1891 heavy rains washed out Chambers Lake dam, which the Larimer County Ditch Company had acquired and enlarged. As a result of the damages caused it was thought best to reorganize, so the Water Supply and Storage came into existence. This company completed the Larimer County Ditch and several diversion projects. The "Sky Line" Ditch was begun in 1891 and completed 2 years later. This was an inter-basin project, bringing water from the Laramie River to the Poudre. The new company also completed the Grand River Ditch in 1895. The Sand Creek Ditch diverting from Sand Creek and Deadman Creek into Sheep Creek was built in 1899. The largest of all the diversions, until the Big Thompson, which was constructed and operated by the Laramie-Poudre District was the Laramie-Poudre system. It was begun in 1910 and completed 2 years later. The tunnel through which the water was brought across the dividing mountains had a capacity of 1,500 second-feet. This project provoked Wyoming into bringing a suit against Colorado. The resulting Supreme Court decision in this case limited the amount that could be diverted to a small fraction of the capacity of the system, and has prevented any further diversion projects from the North Platte and Laramie watersheds. These diversions bring into the Poudre watershed about 25,000 acre-feet each season, and it has gone for the most part, not to irrigate new land, but to improve agriculture on land already under irrigation.

A third phase of this search for more water is found in the development of pump irrigation. Until the 1930's this type of irrigation was not important in the Poudre Valley. However, the first well from which water was to be pumped for irrigating purposes, was dug east of Eaton in 1888.

The search for additional water supplies reveals an ingenuity and resourcefulness that is notable. However, the greatest of the conservation measures developed in the Poudre has been the system of exchange of water. The principle behind the exchange of water is very simple. The higher up in the valley that water can be stored and used the more efficient will be its use. Evaporation losses will be at a minimum, and return flow will be at a maximum.

This is the situation that has led to the development of the exchange system. There are four large ditches coming out of the north bank of the Poudre. The Cache La Poudre Ditch, which is the old Greeley Number Two, is the oldest of the large ditches. Its head gate is the farthest down the stream of any of the main ditches. Next is the Larimer and Weld, the Eaton Ditch. Its priority is junior to the Cache La Poudre, but it is senior to the Larimer County and the North Poudre ditches. Its head gate is above the Cache La Poudre, but below the Larimer County and North Poudre. Junior to all the ditches, but the highest on the river, is the North Poudre. Now the Cache La Poudre Ditch Company could insist on getting its decreed water from the direct flow of the river during the late summer, while its three competitors would suffer from lack of an adequate supply. It would be a more convenient and less troublesome way. Instead, a system of water exchanges was developed which has greatly increased the efficiency of irrigation, and stimulated the utilization of all reservoir sites. The North Poudre, for example, has developed reservoirs which are too low to be of service to lands lying under its system. Therefore, to utilize this stored water, the North Poudre releases water to the Larimer County Ditch lying directly below it, and, in turn, the Larimer County releases water from its reservoirs to the Larimer and Weld. Finally, the Larimer and Weld releases water from its reservoirs to the Cache La Poudre, which completes the exchange, by permitting the North Poudre to divert water from the North Fork of the river for use in the Wellington district. This system of exchanges was developed by private agreement. The water commissioner now supervises such exchanges, covers 5 percent toll to cover seepage losses in transit, and keeps a complete record of the amounts exchanged between the several irrigation companies. This development is a great achievement in co-operation and greatly promotes the efficiency of the use of water in the Poudre Valley.

Other contributions have been made from the Poudre Valley. Dr. Law and G. Max Clark were the pioneers interested in water measurement. Ultimately, the problem was satisfactorily solved by another Poudre man, Ralph Parshall. At Colorado A & M, Elwood Mead started the first work in irrigation engineering. His successor at the College, after Mead had gone on to Wyoming, was Louis Carpenter. Under Professor Carpenter the first experiment station work in irrigated agriculture was undertaken. It was a Greeley man, Delph Carpenter, who became the great exponent of

the compact method of adjusting interstate water conflicts. He helped to negotiate most of the Colorado compacts.

All of these achievements reflect a capacity and an adaptability of which Colorado has a right to be proud. The development of a new set of institutions for the administration of water controls, so quickly and so perfectly, was a major accomplishment. Ordinarily the evolution of our institutions requires centuries. However, I believe that the exchange of water system, reflecting as it does, such high standards of social consciousness, stands forth as the supreme achievement of those pioneers of the Poudre Valley, and of Colorado.

More Efficient Use of Water  
Resulting from Consolidation of Ditches  
and Regulation of Water Supplies

Royce J. Tipton  
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Probably the history of the development of no other part of the country west of the Mississippi River is as replete with the elements of fortitude, ingenuity, and human endeavor as are the annals of those of the irrigation development in Colorado. Beginning with the crude, comparatively small, irrigation systems built by the aborigines in southern Colorado, whose efforts extend into the unrecorded past, the evolution of irrigation in Colorado has passed through numerous well-defined stages of development, the more modern stages of which may be classified as follows: First, the sporadic attempts by the early pioneers to divert water through small ditches for the irrigation of small fields adjacent to the streams for the production of those foodstuffs which found a ready sale in the early mining camps of the State.

Second, the later developments through community effort, such as the Greeley and Fort Collins colonies, whereby larger ditches were laid out and constructed for diverting water from the streams and conveying it to the uplands adjacent thereto, thus covering large areas of land previously considered to be infertile and valueless. These enterprises required much ingenuity, a strong community spirit, and fortitude to overcome almost insurmountable obstacles.

The third phase in the development of irrigation in the State required greater wealth than was available locally. As a result, large sums of out-of-State capital were invested by corporations in enlarging some of the canal systems previously constructed, and in constructing new systems for diverting still larger quantities of water for reclaiming still larger areas of bench lands. Many of these ventures resulted in a loss to the investor, with the result that in succeeding years practically all of these canal systems became the property of the individual water users through the formation of mutual companies.

The fourth phase of development resulted when the basic flows of the streams became over-appropriated. The available water supplies at certain seasons of the year were entirely inadequate to supply the needs of the canals, while at other seasons of the year large quantities of water wasted down the river into adjoining states. To correct this condition, storage reservoirs were constructed to regulate the flow of the streams. As the financing of such developments was beyond the ability of the individual, community effort was again resorted to. Legislation was enacted which provided for the creation of irrigation districts. Other legislation was passed which enabled a community of landowners to issue certificates of indebtedness in the form of bonds for use in financing these larger enterprises.

In 1860 about 35,000 acres of land were irrigated in Colorado. From that time until 1909 development progressed at a fairly rapid rate, the increase in irrigated land averaging over 60,000 acres per year. During the decade from 1909 to 1919, the rate of increase dropped to an average of about 10,000 acres per year and from 1919 to the present the increase has been negligible.

The decline in the rate of irrigation development since 1919 may be attributed to a number of factors, one of which was the occurrence of an agricultural depression in the early 1920's. However, the major factor which, in most of the states about the year 1909, caused the sudden flattening of the curves representing the rate of irrigation development is the fact that, up to that time, development was relatively easy and comparatively inexpensive. The basic water supply was being developed with only nominal storage requirements. The land which was being developed lay contiguous to the streams, or at least in the same basin where the water originated, and was so situated with respect to the water supply that the water could be readily applied through ditches by gravity. Consequently, irrigation works were simple and relatively inexpensive, and the financing of projects was within the ability of individuals, or relatively small groups of individuals.

A new era in water development has commenced which involves the construction of multiple purpose projects to supply new lands with irrigation water and to provide supplemental water supplies for existing irrigated land and, in some cases, to make more useful the water that is already being used. Such projects include not only features for supplying irrigation water but also for generating hydroelectric energy, for flood control, and for other benefits.

The remaining projects to be constructed are so expensive and so involved both from a physical standpoint and from the standpoint of human relations that they are beyond the ability of individual irrigation districts or mutual ditch companies to construct. It is also beyond their ability, acting alone, to resolve many of the human relations problems which must be resolved before such projects can go to construction. Whole river basins or major portions thereof, including the municipalities and all industries that will be benefited by such developments, will be called upon to pay their fair proportion of the costs of such projects. Both the Bureau of Reclamation and the Corps of Engineers are being utilized to investigate such major projects in Colorado, and to prepare plans and specifications and supervise the construction of those which have been authorized for construction by those agencies. The Colorado Water Conservation Board, which was created by special act in 1937, is actively cooperating with the Bureau of Reclamation, the Corps of Engineers and other governmental agencies, as well as State agencies and various local organizations, in planning the water development program for Colorado.

The Water Conservancy District Act of 1937, as amended, enables large areas to organize for the purpose of financing and operating large multiple purpose projects financed by federal funds in Colorado. Such water conservancy districts are over-riding districts, and include with-

in their boundaries all irrigation districts, mutual ditch companies, and all irrigation systems which will benefit from the project. All water-development projects have benefits which extend materially beyond the direct beneficiaries. The Water Conservancy District Act recognized that all property owners within a water conservancy district benefit from the water development for which the district was created, and provides for the imposing of up to a maximum levy of one and one-half mills on the assessed valuation of all property in the district, this levy being in addition to the direct charges made to the water users for the water received by them from the project.

In addition to making new water available by the construction and operation of large multiple purpose projects, there is also an opportunity in the State of Colorado to increase the benefit from the water now being used, by making consolidations of certain ditches and providing that some of the water now being diverted as direct-flow water be regulated by means of some of the multiple purpose reservoirs under construction or being proposed for construction.

The people of the State of Colorado in 1879 and 1881 provided through legislative enactment fundamental laws based upon the doctrine of appropriation necessary for the orderly determination and administration of the relative rights to the use of water. Since that time, much legislation having to do with the acquirement, determination, and administration of the water supplies of the State has been enacted by the General Assembly and applied by the State Supreme Court, the result of which is a comprehensive system of irrigation jurisprudence which has become a model for other states of the West. However, the over-appropriation of many western streams under existing laws impels the search for means to increase crop production by the better use of water. The increasing evidence of unequal application of irrigation water with serious crop losses on some land without commensurate benefits to other land, and the many cases of wasteful, damaging, and excessive use of water, indicates a phase of conservation to which too little attention has been given. The necessity of making more workable extensive projects involving large expenditures of money, brings to the forefront problems of efficient use.

It is believed that the appropriation doctrine was eminently suited to the early development of the irrigated region. It stimulated individual initiative and provided protection to those who had the foresight and stamina to make the first developments along a stream. No doubt the appropriation system, in permitting the free exercise of personal initiative, resulted in a greater development in the major stream basins of Colorado, particularly those on the Eastern Slope, than would have resulted under a planned and regimented development. The system resulted in the development of a greater irrigation area than the basic water supply will support year after year, a fact which has stimulated the construction of large supplemental water projects, such as the Colorado-Big Thompson project, which might never have been constructed if the development within the basins had originally been made under a controlled system.

While in some localities there is need at the present time for some change in the methods of use of appropriated water, it would not be possible or desirable to change the basic underlying principles of the appropriation system. What at times have been alleged to be wasteful practices are not as wasteful as appears on the surface. The early decrees were granted by the courts on the basis of alleged beneficial application of water. At that time neither the courts nor the water users had an adequate conception of the proper duty of water. In Colorado this resulted in decreeing to the original appropriators excess quantities of water. The lands irrigated by the original appropriators lie contiguous to the streams and, in general, consist of, or are underlaid by, a quick draining formation. The application of excess quantities of water to these shoe-string tracts of lands along the stream systems does not result in an unduly high consumption of the water because the water not needed currently for the growth of the crops returns rapidly to the streams and is available for diversion and use by lower irrigators. This process actually has a beneficial effect upon the regimen of the flow of the stream in that it tends to reduce the high flows, and increases the flow during periods when it otherwise would be small.

In practically every stream basin in Colorado, however, where the water supplies have been over-appropriated and where there is need for supplemental supplies, more efficient use could be made of the water if certain consolidations of ditches could be made and, in some cases, if some of the water now being diverted under direct-flow decrees could be regulated and made more usable through the medium of reservoirs. The desirability of changes in the present practice has been recognized for many years but little has been done about it until recently, due chiefly to man's inherent resistance to any change in the order of things which have been long established. Since water rights are in the nature of a property right, it would not be possible or desirable to change the fundamental doctrine and deprive a water user of the benefits he has enjoyed from his water right. However, it must be recognized on the one hand that a water right does not necessarily make water and, on the other hand, that a diversion of water under a right, beyond a certain limit, ceases to be a beneficial use.

It has been suggested that a centralized control over the use of water would result in a more beneficial and efficient use of that water. Such a control exists in Colorado, but it does not provide a complete solution to the problem. The State Engineer of Colorado administers the use of that water which is covered by court decrees. He, theoretically, has the power to limit the use to beneficial use. Actually this has been very difficult to accomplish because of the inability of any one to determine, within those limits necessary for administrative purposes, what constitutes beneficial use. Even the diversion of direct-flow water for winter application has been considered of sufficient benefit to prevent its being curtailed by the Office of the State Engineer. Neither the State Engineer nor any other State entity has the power to bring about the consolidation of ditches, or permit the storing of direct-flow water.

The inefficient use of water varies between wide limits from locality to locality within the State. The majority of the losses result-

ing from such inefficient use are not readily apparent to the water users. This prevents them from visualizing concrete, mutual benefits which would result from certain changes in the uses of water which could be made among users. However, in connection with recently constructed multiple purpose projects, as well as those under construction and those proposed for construction, by much effort in ascertaining the benefits which would be derived by certain changes in uses, by education, and by broad thinking and cooperation on the part of the water users, desirable changes are being brought about in some localities.

Much of the substance of that which I have given above was contained in a talk which I made before the Association of Western State Engineers on October 12, 1942. I should like now to quote from a section of the paper prepared for that talk:

"I wish to give some concrete examples of some situations which exist in Colorado. These are to illustrate some of the points which I have brought out concerning the better use of water that might be brought about by consolidations and storage.

"Exhibits A, B, and C indicate the diversions of water in acre-feet per acre by months in a typical year of three typical ditches in Colorado which irrigate an aggregate of 50,000 acres. These ditches divert from the same side of the river, and the headgates are within a few miles of one another. The ditch covering the land closest to the river, having an early water right, has more than sufficient water at all times. The intermediate ditch has a water right which is junior in character but is not so poor as the upper ditch. From a physical standpoint, it would be easy to consolidate the systems, diverting the water through the upper ditch. Exhibit A indicates the amount of water actually diverted by the senior ditch during a typical year, as compared with the assumed ideal requirement for that year. The water that was diverted in excess of the assumed firm requirements may be noted. Exhibit B represents the diversions of the intermediate ditch. It may be noted that the diversions are somewhat distorted as compared with the ideal demand. This is true to a greater extent with the upper ditch, as is shown by Exhibit C.

"Exhibit D indicates what the diversions would have been in acre-feet per acre had the three water rights been combined and had the water been diverted through the upper ditch and distributed on a pro-rata basis. The improvement may be readily noted. The combined supply of the three ditches results in an almost perfect water supply for the combined acreage. The excess water diverted by the lower ditch does not increase crop production on the acreage under that ditch nearly to the extent that the production would be increased if that water were used to improve the water supply of the two adjacent ditches.

"It must be recognized that the process of bringing about a consolidation of ditches, such as these three, would not be limited to getting an agreement of the water users under the three ditches to consolidate. Before changes in point of diversion could be made to the upper ditch, it would be necessary to

make studies to determine the effect such changes would have on other appropriators. Some adverse effect could be expected because some of the excess water diverted by the senior of the three ditches would not return to the stream if the ditches were combined. The benefits of the consolidation, however, are so apparent that water officials and boards interested in the most efficient use of the waters of the State should investigate fully possibilities such as this one, and be prepared to advise the water users of the area of the proper course to pursue.

"Another example which I have to present involves seven ditches which irrigate 60,000 acres of land by the diversion of direct-flow water and by the application of some reservoir water. A major reservoir is being constructed above these ditches wholly at government expense. Some of the capacity of the reservoir will be used for regulatory purposes and some of it will be used for flood control only. If the water supply diverted by the ditches lying below the reservoir is pooled and this water is regulated by the reservoir and released in accordance with actual requirements, less water throughout the year can be used with much more beneficial results.

"The upper series of hydrographs in Exhibit E shows the diversions as actually made by the ditches for the year 1925 to 1929, those years being a typical series of years. It may be noted that material direct-flow diversions are made during the winter period. October to March inclusive, much of which may be assumed to be of little direct benefit. This is a good example of inefficient use of water through competition under the appropriation system. If the winter diversions were not made as indicated by the direct-flow ditches, that water would be diverted by another ditch system for storage in a system of reservoirs, whose water rights are junior to those of the direct-flow ditches making the winter diversions. While the state officials can limit uses to that which they consider beneficial, it has not been possible to prevent the winter direct-flow diversions since it can not be definitely shown that such diversions are wholly nonbeneficial.

"The second series of hydrographs show the water supply which would result for the ditches below the reservoir if the water were pooled and released in accordance with requirements. It may be noted that the water supply conforms exactly with the assumed ideal, even though the total amount of water diverted is less by about 40,000 acre-feet per year than was formerly diverted. The excess water that was formerly diverted can be made available, if the system outlined goes into effect, for use by upstream water users by exchange. There is no method under existing laws whereby the results described can be brought about. It can be consummated only through the mutual consent and cooperation of the water users whose lands lie below the reservoir."

The ditch diversions represented by the hydrograph shown on Exhibit E represented the combined diversions of the ditches diverting from the Arkansas River in Colorado below the John Martin dam and Caddoa reservoir. John Martin dam had not been constructed at the time I gave my talk in

1942. It has now been constructed, and Caddoa reservoir has been in operation since 1943. Exhibit F represents the diversions by the same ditches shown on Exhibit E for the years 1943 to 1951, inclusive. It may be noted that there is a marked similarity between the pattern of actual diversions since the reservoir went into operation and that which was predicted as shown on the second part of Exhibit E.

The operation of Caddoa reservoir has brought about not only a more efficient use of Arkansas River water in Colorado, but it has also brought about a much better use of the waters of that river in Kansas. The provisions of the Arkansas River Compact between the two states make possible the interstate benefit from the operation of the reservoir.

When the water-use contracts in the Conejos Water Conservancy District are consummated and when the recently completed Platoro reservoir goes into operation for the providing of supplemental water supplies as well as for flood-control purposes, a much more efficient use of the waters of the Conejos River will result. It is estimated that the value of gross crop production within the District will more than double due to the change in type of crops which will be raised because of the more seasonal water supply made available by the operation of the reservoir. In this case again, some of the water which formerly has been diverted as direct-flow water will be stored in the reservoir and released for later use at a time when the water will be of more benefit.

If and when Wagon Wheel Gap reservoir is constructed and goes into operation, and if the owners of canal systems that require supplemental water can be made to realize that they are not surrendering any vested rights if, by mutual agreements with other beneficiaries of the reservoir, direct-flow water is stored for later release, the greatest benefit will result from the operation of the reservoir. If, on the other hand, only so-called "new water" is to be dealt with, the benefit from the reservoir will be negligible.

To bring about the most efficient use of the remaining unconsumed water to which the State of Colorado is entitled, amounting to about 3,215,000 acre-feet, and to bring about more efficient use of the 4,180,000 acre-feet which at the present time is being consumed because of man's activities, there must be continued cooperation of the water users and the public officials, lawyers, and engineers who are directly concerned with the water program of the State.

April 9, 1952.

EXHIBIT A

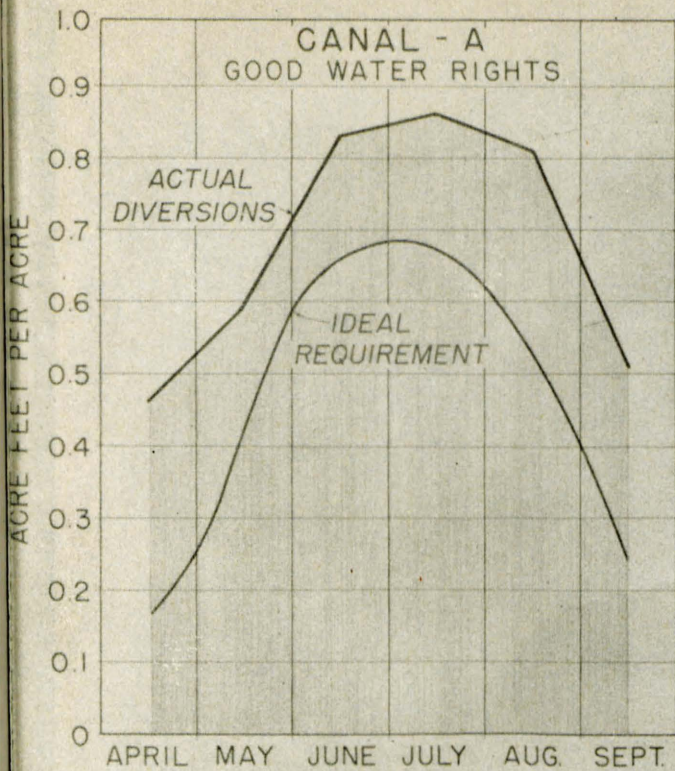


EXHIBIT B

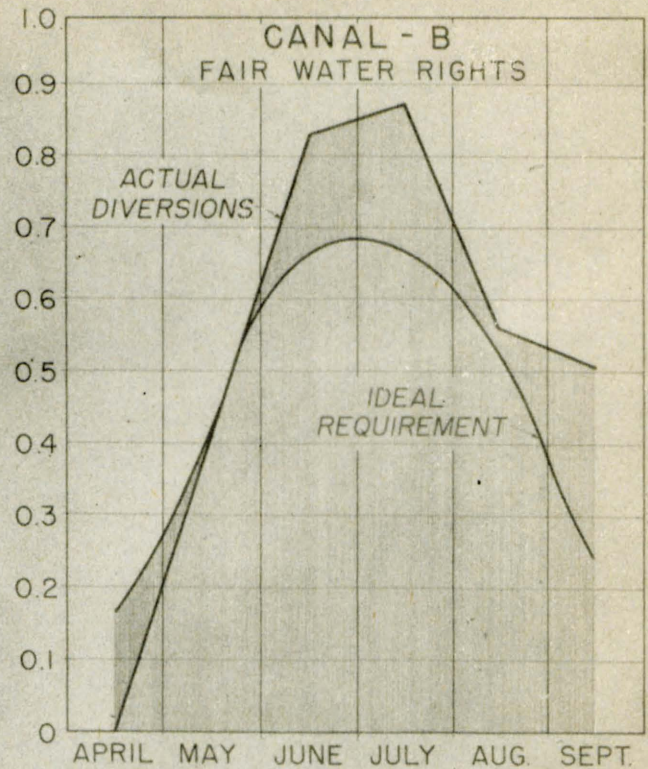


EXHIBIT C

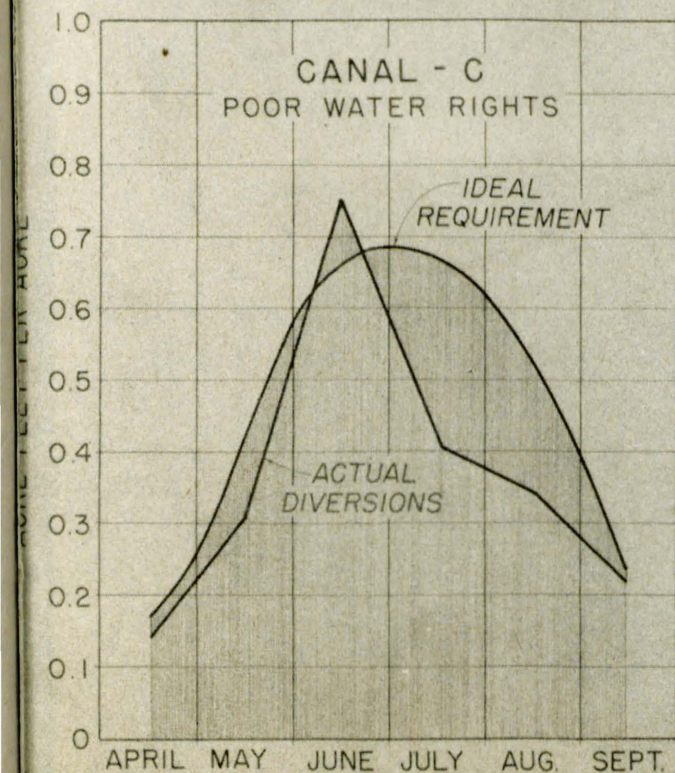
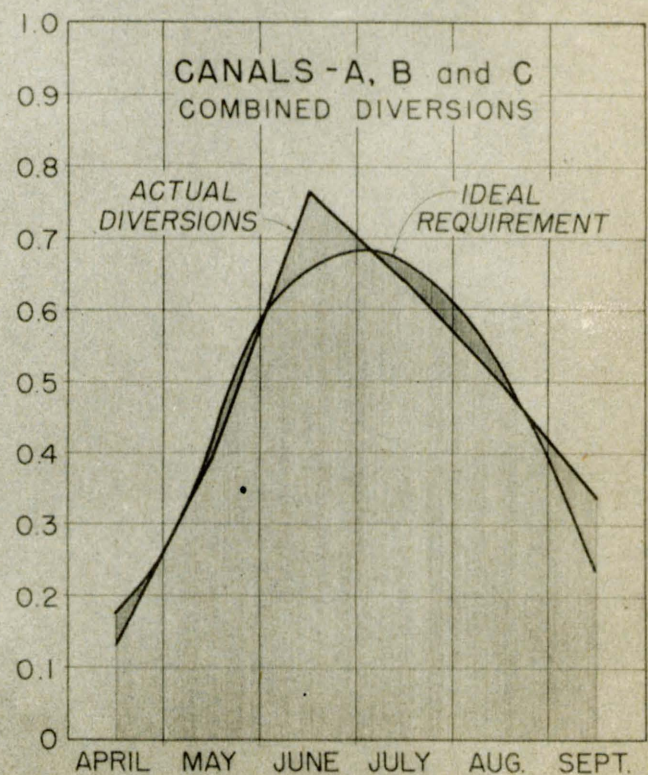
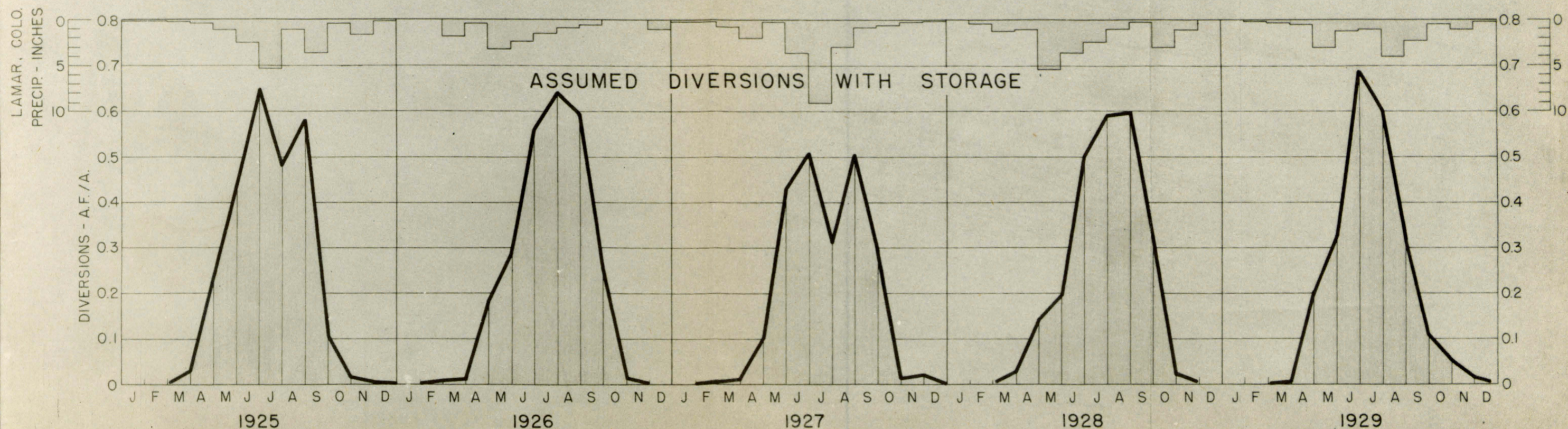
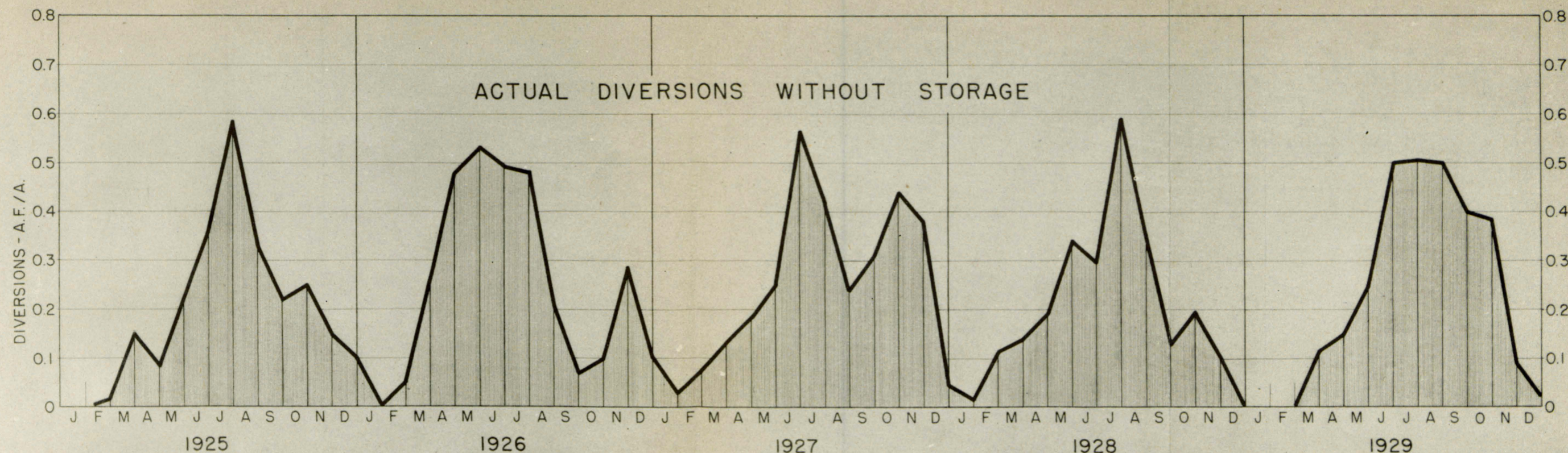
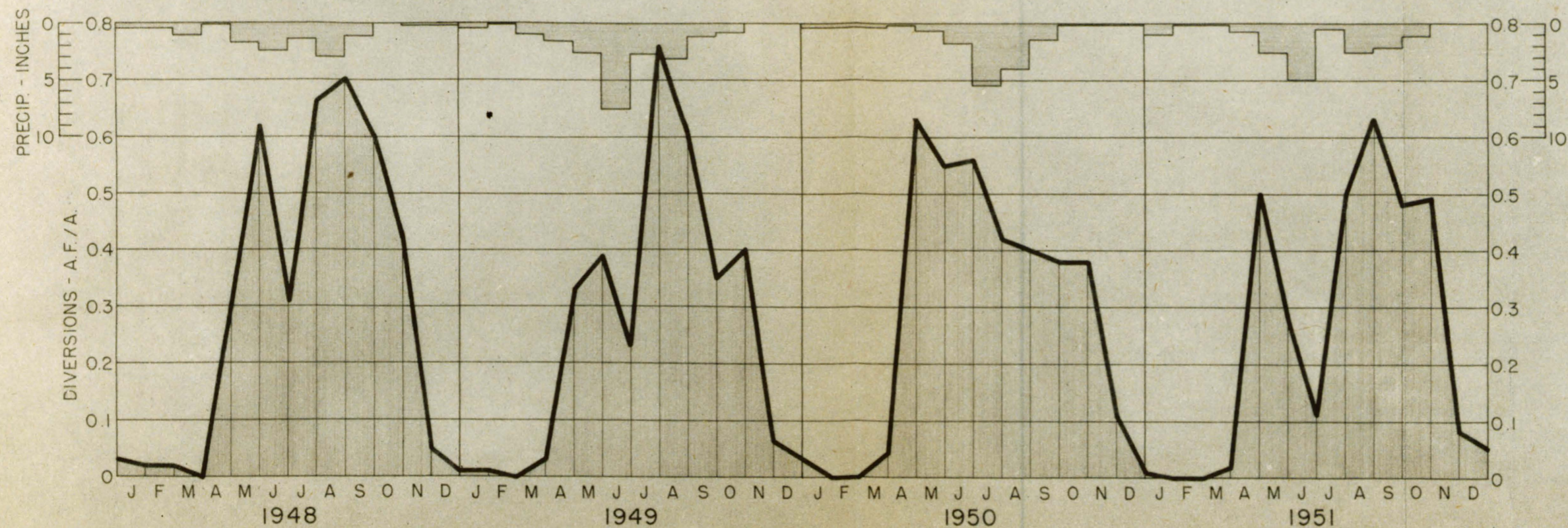
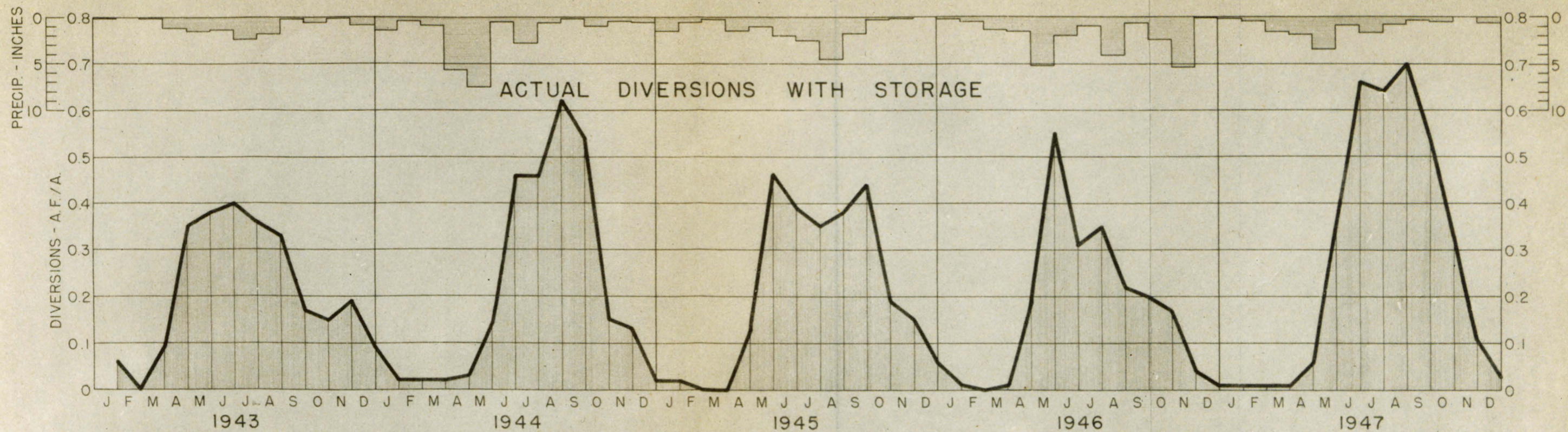


EXHIBIT D







Underground Water Resources of Colorado

W. E. Code

Associate Irrigation Engineer, Colorado A & M College

This setting is a most appropriate one to discuss the subject of ground water. There is probably no place in the State where the people are more conscious of that kind of water than those here in the San Luis Valley. The water shortage of last year resulted in certain crop losses but had it not been for the ready availability of ground water, the financial loss would have been tremendous. Because of the unique method of sub-irrigation employed here, the condition of the water table whether up or down, is always a subject of considerable concern. This situation is rather a puzzle to those in other parts of the State not familiar with sub-irrigation. Many would be greatly alarmed with water standing at 2 feet below the surface. In no other part of the State and in few parts of the United States is there such a means of controlling the height of the water table. But with a short water supply there are times when control can be lost; the irrigation method must then be changed and resort made to the pumps. Last year of course was an outstanding example of use of ground water. The amount of water pumped was at least twice that of any previous year.

There are two main types of ground water occurrence recognized by hydrologists. One is that in which the water is confined by impervious strata and is under pressure --we call it artesian water. Many are of the opinion that artesian wells are only those that flow at the surface but this is not necessarily a criterion. It is only a fortunate circumstance that wells flow. They flow only because the land surface is lower than the pressure head on the confined water. Out on the edges of an artesian basin the pressure may not be sufficient to bring it to the surface but the undersurface conditions may be the same. The other type of occurrence is that of a free water table. The water level in a well in such a formation stands at about where it was first encountered. Ground water of this type is by far of the greater importance.

Artesian conditions of economic importance occur in several parts of the State. I will not take them up in order of importance but rather geographically. In Baca County in the southeast corner of the State the Ground Water Division of the United States Geological Survey in a recent survey found 38 flowing wells. There are numerous artesian wells in Otero County, many of them flow. Such water is particularly valuable to that area because of the poor quality of other water sources. There is a good business around LaJunta in selling this water in tank trucks to farm homes. There is also a small area of flowing wells around Canon City. Although flowing wells are found here and there to the north on the eastern slope, only the Denver area is of real importance. There are many artesian wells in the Denver Basin, some flow, some do not. Before the City of Denver provided an ample water supply to its environs, these wells were of very great importance. They still are of importance but their usefulness has been impaired greatly by a 300-foot drop in pressure head since the first ones drilled before the turn of the century. The weak artesian flows in the Grand Junction and Montrose areas are of considerable importance because

that region is especially devoid of either adequate or potable ground water supplies.

The artesian supply in this valley is by far the most outstanding in the State if not in the nation. According to C. E. Siebenthal of the United States Geological Survey in his report in 1906, there were 3,234 flowing wells here at that time. Professor L. G. Carpenter estimated the number as 2,000 in 1891. Today the number is probably near 7,000. Even in 1891 there were wells 1,000 feet deep, but most of them were under 500 feet. One of the deeper wells flowed about 600 gallons per minute as estimated by Carpenter. About 7 or 8 years ago the drilling of large deep wells for irrigation was begun mainly south of Monte Vista and Alamosa. Although these wells were artesian in character and many flowed, all are being pumped at a high rate. Last year large rotary drilling rigs were moved into the valley and deep well construction took another jump. Some of these new wells in Saguache County are real gushers.

I know it is a touchy subject here and some may be offended but I feel impelled as an engineer and proponent of conservation to express my opinion on this artesian situation. It is a known fact that much water has been wasted in the past and this will be continued in the future. Of this waste some of it has come about through faulty well construction. The casings in some wells were not long enough or properly seated to prevent a blowout or other deterioration, and most wells were permitted to flow continuously to no purpose. Many of the old wells were abandoned when the casing rusted out, and ceased to flow and were replaced with a new one. Such a well will continue to leak into the upper water table forever. Many wells are not being used in a beneficial or efficient manner in my opinion. Some of the soil damage by sodium salts could very well have come from uncontrolled salty wells. Some loss in pressure has been experienced principally in the upper strata and particularly around Alamosa. In 1934 Ray S. Wells, while drilling a well for the City, told me that the pressure in the strata above 600 feet had dropped considerably in his time.

In most situations of artesian supplies, the intake area is remote and the recharge limited. Here, however, the intake is reasonably close at hand and the opportunity for recharge seems unlimited. The surface water coming out of the mountains, before it can be used for irrigation, passes over the exposed edges of the upturned artesian strata. Therefore replenishment has always been regular and substantial.

A good question to ask is how much longer will this great water supply last? As with most things there surely must be a limit. Not a limit that envisions a drying up of a source but one that greatly reduces usefulness of water under pressure. When wells stop flowing the people will have to resort to pumping for their domestic supplies. Most wells in the valley are not large enough in diameter to permit being pumped and therefore if and when such a time comes, new wells will have to be drilled. Such a program will mean much new money spent for water. What will be done about the old wells? I might draw your attention to the Roswell artesian basin in New Mexico. Carelessness in irrigation well construction and casing failures there resulted in a considerable waste of water.

This combined with overdevelopment in the use of water for irrigation caused a serious reduction in pressure. The area of flowing wells grew smaller and smaller, pumping lifts increased, and the situation showed all the signs of continuing deterioration. In the period between 1904 and 1926 the artesian head declined about 200 feet in one area. Invoking control legislation together with a well plugging program has decreased the rate of decline to an almost stabilized condition. Most artesian areas have either suffered very serious loss of pressure or have become of small value.

Passing now from artesian to the free water table type let us examine the occurrence of that kind of ground water in the State. Practically all the important bodies of ground water are east of the Continental Divide. Beginning with the South Platte, from well above Denver to the State line there is a continuous bed of saturated gravel. It lies on shale or sandstone and is from a few feet to nearly 200 feet thick. It is thickest in the vicinity of Fort Morgan. Irrigation wells are scattered throughout its length in a rather narrow belt. The tributaries also contain important water-bearing gravels. The principal ones are the Poudre, Big Thompson, Lone Tree, Box Elder, Kiowa, Bijou and Beaver. One important area, not apparent as a tributary, is Prospect Valley. Here in an old buried stream channel there are about 125 irrigation wells providing most of the water for 14,000 acres.

Along Fountain Creek there are pumping plants rather thinly scattered from Colorado Springs to Pueblo. Development is extensive from Pueblo to LaJunta along the Arkansas and continues to a lesser extent to the State line. Small developments occur in Black Squirrel Creek, Big Sandy above Hugo, Rush Creek, Steels Fork and Horse Creek.

In the areas I have just mentioned, the water-bearing gravels have been laid down rather recently, geologically, by stream action and water tables exist at modest depths. There is a big scope of country in the eastern part of the State drained by the Republican River and its tributaries. It is covered by a formation known geologically as late Tertiary or Ogallala to a depth of several hundred feet. It consists of strata of clay, limestone conglomerate, sand and gravel. Some good wells have been obtained in this formation but ordinarily the water table is in excess of 100 feet below the surface. The stream valleys such as the Frenchman, Arikaree and Republican contain recent gravels with a water table at very moderate depths. Of the approximately 150 wells in this region 30 or 40 are entirely in the Ogallala formation. Although this is a relatively small number of wells judged by the concentration in other areas, it must be remembered that these are wells put down mostly in the last 8 or 10 years.

The rate of growth of irrigation well development in this valley exceeds that of all others. I first became acquainted here in 1928. At that time, to my best knowledge, there was but one pumping plant on an irrigation well in the valley. This plant, 6 miles south of Alamosa, belonged to J. J. Schechter who may be in the audience. While I was here a crops tour had been arranged by A. J. Hamman and Mr. Schechter was agreeable to including a demonstration of his plant as part of the tour. I set

a portable Parshall flume and was measuring water when the rather large group arrived. The visitors seemed quite impressed with Mr. Schechter's novel way of obtaining water.

On this same trip I found Ray Metz assisted by Mr. Maxwell, local manager of the Public Service Company at Monte Vista, valiently struggling to construct an irrigation well on his farm. It seems ridiculous now to look back at what they were attempting to do. They had constructed an 8 by 8 square set 6 feet high. This they were able to get down with a lot of hard work even though the water stood at but 1 foot from the surface. It refused to go any farther than 6 feet, however, so they started driving vertical 2 by 6 planks behind the curb. These would wedge so tightly in driving that only another foot was gained and the job was abandoned at 7 feet. Later in 1934, Mr. Metz had a well driller put down a 63-foot well for him along the Gunbarrel Road.

I think that Mr. Maxey of Monte Vista was about the first irrigation well contractor to start such operations in the valley. He moved over here from Fowler in the Arkansas Valley in 1929. Later other local well drillers got into irrigation well work and by the middle 30's there was a very large drilling program under way. There has been little change in the situation since then. It has grown steadily at a rapid rate. At the present time there are 640 pumps being serviced by the Public Service Company and the R. E. A. and in all it is estimated that there might be between 1,000 and 1,200 plants. Last year the two electric power sources furnished 18,000,000 kilowatt hours of electricity for pumping. That was about one-third of the total electric load for pumping from wells in the entire State. The unusually large power load in 1951 was caused by the extremely low river flow. The prospects for water this year are very good and it is probable that the load will be very much less - perhaps only one-tenth that of 1951. From the standpoint of power suppliers, such great annual fluctuation is highly undesirable.

The water table of course was lowered under the impact of such a pumping draft. From Bureau of Reclamation records I would guess that the water table was 1 or 2 feet lower at the end of the 1951 season than that of the previous year; under such conditions sub-irrigation was impossible. Similar conditions have occurred before, less severe perhaps, but the water table recovered with a return of normal water supplies and that is the important thing. There is no question in my mind that the water table will bounce back this year and you can manipulate it as you wish. It is a mighty wonderful thing to have such an easily accessible alternative water supply to draw upon in emergencies. Its value is exceedingly great.

Most of the pumping in the eastern part of the State is in areas under irrigation from surface stream flow as it is here. In nearly all such cases the water table has recovered from severe drafts in the past. There is always a reasonable assurance under such conditions that replenishment in excess of use will occur in favorable water years. It is a fortuitous situation for those owning farms underlain by gravels in which irrigation wells are possible. They can draw upon such a reservoir which, in many respects is superior to a surface reservoir, whenever they wish.

Not all are so favored. And then there are scattered small areas where the pumping is so light that the effect on the water table is insignificant. Also there are wells adjacent to streams where water flow is frequent enough to replenish any withdrawals.

There are at least two places under canals, however, where the balance between replenishment and pumping draft is very delicate. One of these is near Wellington where pumping has been on the increase for 15 or 20 years and canal water inadequate. The water table recedes over periods of 4 or 5 years at a time and the few favorable years have never brought it back to normal. Prospect Valley is another such place under canals. For a period of 9 years after pumping started in 1932 the water table there kept going down until in some places it was as much as 16 feet lower. Then in 1942 it began to rise and by 1950 had recovered almost completely except at one end of the valley. In 1950 and 1951 it went down again about 6 feet. These delicate balances keep the residents nervous.

There are two places entirely dependent on ground water for irrigation where the downward trend of the water table has been persistent. Along Beaver Creek near Gary the decline started in 1942 and has now amounted to 10 feet. In Bijou Valley, where about 30,000 acres are being irrigated, a similar lowering is taking place which started in 1937. These places get replenishment only from flood flows which have not been sufficient to prevent a constant lowering. Residents in these areas of course are greatly concerned. A third place may be mentioned, one that is beginning to show distress symptoms, is in Box Elder Valley north of Watkins. It is too soon yet to be certain whether the downward trend there is a temporary one or not.

Water tables have fallen in many places due to overpumping. We associate this situation with California and more recently Arizona but there are many other places. The High Plains of Texas is one of them. California has been giving much attention to the artificial sinking of water to halt the decline. Arizona's Salt River Valley and Casa Grande Valley are examples of recent overdrought during a period of extreme drought. In the Casa Grande Valley there has been an annual lowering for over 20 years. It was small at first but lately it has been on the order of 8 feet with a total lowering of about 80 feet. Under recent legislation the area has been declared critical and drilling has been stopped. We have been given a warning that it can happen here in Colorado and we should lend an ear. There are many places where a lowering of even 20 or 30 feet would put the pumps out of business.

I should not omit from this discussion something about the value of ground water to the economy of the State. We have no accurate way of getting at the total amount that is being pumped but we can make some intelligent guesses. There is a clue in the amount of power consumed for irrigation pumping. We know this reasonably close but it does not account for the engine drives. In addition there are the industrial, municipal and domestic uses. An overall state irrigation load of 60,000,000 kilowatt hours is being reached. It takes about 1 kwhr. to raise an acre-foot of water 1 foot at 100 percent efficiency. Let us suppose the average lift to be 60 feet and the overall efficiency 40 percent. These are liberal

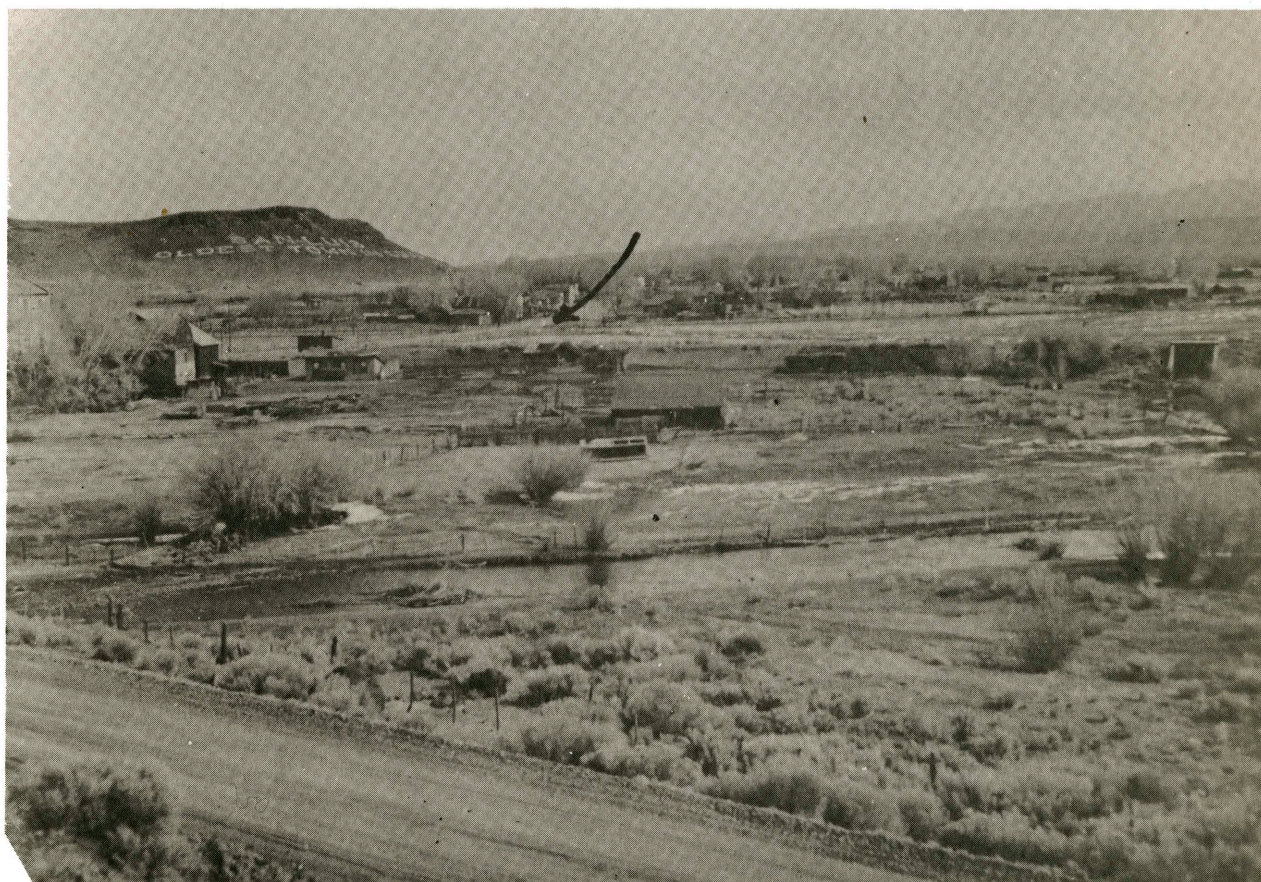
assumptions but even with these we get by calculation a pumpage of 400,000 acre-feet. I know this to be very conservative for in 1940 I found 220,000 acre-feet being pumped in the South Platte Valley. To this must be added a substantial amount pumped with engines. The figure of 400,000 acre-feet agrees very well with the estimate of the President's Water Resources Policy Commission. This commission also places the total use at over 500,000 acre-feet. Thomas, the author of a recent book on the Conservation of Ground Water, has higher estimates. Four hundred-thousand acre-feet is a lot of water and a bit difficult to comprehend so I will try to make some comparisons with which you are familiar. The Rio Grande, Santa Maria, Sanchez, Terrace and Continental Reservoirs have a combined capacity of 243,000 acre-feet or about 60 percent of the water pumped. It will fill Taylor Park reservoir four times and Green Mountain three times. It would be equal to the combined capacities of the seven largest reservoirs in the South Platte system.

With these figures we can gain some idea of the magnitude of this supply; we can begin to realize its worth to our irrigation economy. Consider its tremendous value as a working balance between the wet and dry years. Think of the capital investment in wells and equipment -- possibly \$10,000,000. If electricity is worth 2 cents per kwhr., \$120,000 is being spent annually for that kind of power alone to bring water to the ground surface.

I believe that we can think of ground water as a renewable natural resource. It falls into that category providing it is not used in excess of possible replacement. However we have found places where withdrawals have exceeded replacement and more may and can develop in the future. Possibly to prevent this we can make better use of flood flows in our streams to increase recharge opportunities. Possibly we need legislation to prevent a continually declining water table. This seems to have been the only effective way in dealing with the problem in other states. I am aware that legislation along this line is a highly controversial issue in Colorado where we have no specific ground-water law. It is not wanted by those whose ground-water supply is now seemingly assured but there appears to be a demand for it by those whose supply is threatened. To get around some of the objectives, perhaps control legislation should be invoked only where it is desired. I am of the opinion that this is possible.

I do not believe that much pump water is wasted because it is too costly. It is the free water -- artesian water -- about which we need to be concerned. The opportunities for waste from artesian wells in any such area are much more numerous than with water table wells. There is no question in my mind that such water should not be hoarded but used to the fullest extent. However it should be used beneficially -- not wasted to cause soil-troubles, to contaminate other ground water sources, to evaporate to the atmosphere or to some unrecoverable water source. These losses combine to reduce pressure and reduce its overall usefulness. One of our biggest problems is the prevention of waste from defective wells. These exist in every artesian area. Many such wells have been abandoned and are worthless. It is a puzzle to know what to do with them. Money

spent to correct such defects is not productive for the individual on whose land they occur and further he may in no way be responsible for the condition originally. Perhaps it is in part the State's responsibility to correct such conditions because it has not insisted on proper construction standards in the past. We can take care of the future if we wish to. It is our responsibility to pass on to those who follow us, a resource that is ours to use but not destroy. And to end on the note which has been sounded several times in these meetings and by the governor yesterday -- we do not own this water, nor the land it serves. We are its custodians and have only the right to use it in such a manner that our children will not face an empty inheritance.



The Community of San Luis, oldest town in Colorado. The Culebra river is in the center foreground and the monument on the People's Ditch is at the edge of town, on main street, a little left of center in the upper part of the picture.

(Curved arrow to monument)

The Importance of Return Flow to Colorado Irrigators

R. L. Parshall  
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We are on this occasion commemorating a historic event. One hundred years ago, a colony of settlers established themselves in the fertile valley of the Culebra at San Luis and having had experience in the art of irrigation recognized the necessity and advantage of diverting water into an artificial channel to irrigate the land bordering the north side of this sparkling mountain stream. Spanish laws and customs came with this group of settlers from the South and the simple diversion of water from the Culebra into the People's Ditch established a claim of legal status in accordance with the recognized law of right and procedure, as of April 10, 1852. (Centuries of irrigation in Spain gave these people a background on which to draw.)

Previous speakers on the program of this centennial celebration have reviewed the historical events and the development of the use of water to sustain the settlements of the pioneers. In this development of use of water for irrigation, as guided by the limitations of law and order, related problems of agriculture have appeared requiring the attention of the agricultural scientist and the engineer.

The fundamental principle of Colorado irrigation law is first in use, first in right, but the water must be applied beneficially. Other appropriators follow in time, diverting from a common water supply, and in due course the flow of the stream is insufficient to provide amply for all ditches served by the parent stream. We here recognize the problem of limitation of water supply where the solution, in part, requires the attention of the engineer, agronomist, soil scientist, and others.

Almost from the beginning of irrigated agriculture in our State the menace of water shortage in many areas has been acute. Relief has been found in the storage of excess water during high stages of flood flow together with the impounding of stream flow during periods when the water is not needed for direct irrigation. This reserve water supply later to be used to augment the needs of appropriators having a late right to direct flow water for their lands.

The subject proposed for discussion, as appears on the program, has to do with the all-important question of water supply. In the past many engineers, not thoroughly informed as to the potential water supply of natural streams, have in many cases neglected this limitation. As a result they have helped to create water shortages for the irrigation enterprises. In this picture is found a compensating factor in the phenomenon of return flow or seepage into the stream from adjacent irrigated lands and the contribution from storage reservoirs located within the drainage basin.

In northern Colorado along the various tributaries to the South

Platte River, as well as along the main stream, are to be found many irrigation appropriation rights dating in the early 1860's. Most of these early rights were for small quantities of water to serve limited areas along the bottom lands of the valley. Because of the favorable water supply of the Cache la Poudre River and the fertile lands of the valley, irrigation development was rather rapid and included the construction of comparatively large canals to serve large acreages. These more extensive enterprises were built and lands irrigated prior to 1880.

The first Water Commissioner of the Cache la Poudre was B. S. La Grange, one of the pioneers of the Greeley Colony of 1870. He was one of keen observation and believed that the water supply for irrigation in the Poudre was strengthened by inflow from adjacent irrigated lands along the river. He interested E. S. Nettleton, then State Engineer of Colorado, in this phenomenon of returning water. Measurements of river flow were made by Nettleton, October 12-15, 1885, as a means of showing seepage return. It is believed that these observations were the first made to show return flow to a stream resulting from irrigated lands.

Bulletin No. 180, entitled "Return Waters from Irrigation," by Professor L. G. Carpenter, published by the Colorado Agricultural Experiment Station, 1911, gives the historical account of the first seepage investigations along the Poudre and South Platte. The 1885 observations by Nettleton, assisted by Commissioner La Grange, were conducted by simply closing all the head gates along the river and then comparing the discharge of the Poudre at the mouth of the canon and at a point near Greeley, a distance of 47 miles. A gain of 86 second-feet was found in that distance. Subsequent seepage measurement, between these two river stations, over a period of 25 years indicate a more or less steady gain each year, reaching an inflow of more than 150 second-feet by the end of this period.

The irrigated area along the Poudre Valley had reached an acreage of about 200,000 in 1910 but some of the return flow from the lands near the mouth of the river no doubt reached the South Platte without credit to the Poudre. The average flow of the Poudre at the mouth of the Canyon during July, August, and September, a period when the return flow would be near a maximum, was approximately 530 second-feet. This substantial and sustained additional water supply, in the river, of 150 second-feet is of considerable importance to the water users of this valley.

Experiment Station Bulletin No. 33 published in 1896, gives Prof. Carpenter's conclusions, in part, as follows:

- ✓ "There is a real increase in the volume of the streams as they pass through irrigated areas.
- ✓ The increase is more as the irrigated area is greater.
- ✓ The amount of seepage is slowly, but constantly increasing.
- ✓ It may be expected to increase for some years to come.

On the Poudre River about 30 percent of the water applied in irrigation returns to the river."

These conclusions have since proved to be substantially in line with the findings of later seepage investigations.

These early studies of return flow on the Poudre and South Platte Rivers were extended to other Colorado streams where the findings were more or less in accord with the original investigations. This pioneer work in Colorado has, over the years, been applied to practically all the irrigated areas of our Western States and is now, no doubt, the basis of estimating the water supply in many foreign lands.

The importance of return flow to the irrigator is forcibly brought to our attention in the case of the lower reaches of the South Platte Valley in Colorado. In the beginning this area was sparsely settled and the irrigation supply meager. As late as 1902 the irrigated area in this section of the Platte Valley was about 100,000 acres and was then considered to have the poorest water supply of the whole valley. By 1926, the acreage had increased to about 250,000 acres and the water supply raised to the point of full accommodation of all appropriated irrigation rights along the river. This satisfactory condition resulted wholly from the increased supply due to return flow as concluded from studies made by Ralph I. Meeker.

The large storage reservoirs in the lower South Platte Valley are almost entirely filled with return flow accumulations throughout this section of the stream.

Ivan E. Houk, in his new textbook "Irrigation Engineering," reports the results of a study of return flow records on file in the office of State Engineer Hinderlider. These records cover many years of seepage investigations on the South Platte between Waterton and Julesburg, a distance of about 240 miles. They show the total return flow, exclusive of tributary contributions, amounted to about 700 second-feet in 1891, nearly 900 in 1900, 1,200 in 1908 and nearly 1,500 second-feet in 1910. Because of the stabilization of the irrigated area and the more or less fixed water supply over the last several years, Mr. Houk feels that the return flow to the South Platte is stabilized at about a maximum of 1,000,000 acre-feet per year.

In 1926 the irrigated area along this stretch of the river was approximately 1,000,000 acres and on this basis the return was one acre-foot per acre irrigated. In some areas this ratio is much greater. For the South Platte the return flow is estimated to be about one-third to one-half the annual diversion from the river.

By comparison it is interesting to note the extent of return flow in the North Platte Valley between Whalen Dam in Wyoming and Bridgeport, Nebraska, a distance of 93 miles. R. A. Willis, former chief of the Bureau of Irrigation for the State of Nebraska, reports the results of a return flow study, in Vol. 94, Transactions of the American Society of Civil Engineers covering the years 1925, 1926, and 1927 for this stretch of the North Platte River. The mean annual diversion for

these years was 1,200,000 acre-feet of which about two-thirds was return flow to the river. On this basis, for every three second-feet diverted from the river and applied as irrigation, two second-feet returns for reuse in canals on downstream. The one second-foot unaccounted for is assumed to be consumptive use. Willis concludes that increase in diversion is a major contribution to return flow.

About 1909 the area irrigated in the valley west of Bridgeport approximated 50,000 acres and not until after 1912 did the return flow become perceptible. Additional lands were put under irrigation and by 1919 had reached a total of 233,000 acres in the valley between Whalen and Bridgeport. In 1927 the irrigated area approximated 350,000 acres. Willis found that the mean monthly flow of the river, after the Pathfinder Reservoir began storing flood water in 1910, was about 50 percent less for May and June than the mean prior to that time. For July it was about 30 percent less; August, 95 percent more; September, 225 percent more; and for October, 215 percent more. This increase in river flow during these months being the result of the application of water to irrigated lands between Whalen and North Platte, Nebraska. It is to be noted that the very large increase in the return flow occurs during September and October.

The increased diversions from the river are believed to be the major contribution to the return flow. Most of the water returning to the river is through deep percolation and is designated as "invisible return flow." It is believed that the extent of return flow to the North Platte is the greatest for any of our western streams. Because of this substantial increase in the available water supply for irrigation the stability of agriculture in this valley is definitely assured.

During recent years many western streams that provide water for irrigation, have been studied to determine the extent of return flow. The Sacramento River between Red Bluff and Sacramento during July for the years 1924 to 1928 inclusive had an average return flow of 36 percent of the river flow. However, streams having wide valleys and of flat grade may show losses instead of gains in discharge. (The San Luis Valley along the Rio Grande is an example, according to Dr. Wm. P. Headden.)

In the Poudre River Valley, in northern Colorado, during the period of irrigation development, about 1 second-foot was considered to be required per 80 acres of land. At that time the general water table was at a considerable depth and the area irrigated was not large. From 1870 to 1880 the irrigated acreage in the valley was increased to about 15,000 acres and at the time the first return flow measurements were taken in 1885 the total irrigated area had reached about 70,000 acres. The return flow from the mouth of the Canyon to Greeley in 1885 was less than 50 second-feet. The irrigated area in the valley increased with the years and for the period 1906 to 1910 the return flow to the river had increased to more than 200 second-feet during the fall months. This can only be accounted for through the substantial amount of return flow, and reuse of the water supply. (434 acres per second-foot is high efficiency.)

The return flow along the main stream of the South Platte for a distance of about 240 miles, between Waterton and Julesburg, is now more or less established at about 1,000,000 acre-feet annually. The return waters accruing in the several tributary streams would increase greatly the total amount for the entire drainage area of the South Platte. Because of the topography and favorable soil conditions throughout the irrigated areas within this basin, it is estimated that from a third to one-half of the total diversions will appear eventually as return flow to serve water users farther downstream.

Very shortly the principal tributaries to the South Platte will receive an additional supplemental water supply of approximately 300,000 acre-feet annually delivered by the Colorado-Big Thompson Project. It is likely that the bulk of this new water supply will be used on lands of higher elevations. The return flow entering at points farther downstream will be available for reuse on lands at lower elevations and thus tend to maintain and strengthen the water supply beyond. If this premise of the final stabilization of return flow, when the present water supply is augmented by another Poudre River, proves later to be a reasonable assumption, then the total return from this added supply may well exceed one-half the water delivered by the project. It can be expected with confidence that the water supply in the Lower South Platte Valley will be very much increased due to the return flow from irrigated areas upstream as well as inflow from lands along this stretch of the main river.

The phenomenon of the return flow to streams from adjacent irrigated lands and water held in storage reservoirs is somewhat paradoxical in that the more water we use judiciously in the irrigation of our lands the stronger the available water supply in the parent stream to serve yet more land.



R. L. Parshall

The Parshall flume was named for him by those who worked with him on its development.

The 160-Acre Limitation Law

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PREFACE:           After the following paper was given, the San Luis Valley has secured relief from the excess land provisions of the Federal Reclamation Laws. S. 2610, to which reference is made in the paper, was unanimously passed by each House of the Congress and approved by the President on June 27, 1952. This law provides that so far as the San Luis Valley Project is concerned the effective limitation is that no one land owner may receive a greater quantity of project water than that reasonably necessary to irrigate 480 acres of land (Act of June 27, 1952, Public Law 415, 82nd Congress, Chap. 478, Second Session).

Development of the Colorado water resources in recent years has become an enterprise in which the United States, the State, the local community, and the farmers all perform important functions. The participation of the United States has resulted from the high cost of the projects which remain to be built if we are to utilize fully our remaining water supplies. Public rather than private financing is essential. Until some method is provided for state or local financing, we must look to the United States for the funds with which to construct the projects of the future.

Federal financing produces many problems. This is inevitable. If we ask the Federal Government to come into Colorado and build water projects with its own money, we must realize that the Federal Government will have something to say about the construction and operation of such projects. We cannot have our cake and eat it too.

One of the rules which the Congress of the United States has established for Federal reclamation projects is the 160-acre law. The idea of the 160-acre limit undoubtedly goes back to the Preemption Act of 1841 and the Homestead Act of 1862. Its applicability to the fertile lands of the Ohio, Mississippi and Lower Missouri valleys has been tested by time. As the more arid lands farther west were opened for settlement, Congress increased the limit by the Desert Land Act of 1877, and the Stock-Raising Homestead Act of 1916. This latter statute permitted the entry upon 640 acres of lands designated by the Secretary of the Interior as "stock-raising lands." These various laws reflected the national sentiment for disposal of the public domain to settlers, not to speculators, and in tracts suitable in size for family operation.

The 160-acre farm principle was contained in the original 1902 reclamation act and has been restated in several amendatory acts. Of these, section 46 of the Omnibus Adjustment Act (act of May 25, 1925, 44 Stat. 649, 650) is most pertinent. Therein provision is made for contracts between local districts and the United States for the payment of project construction and operation costs and it is stated that:

"\* \* \* Such contract or contracts with irrigation districts hereinbefore referred to shall further provide that all irrigable land held in private ownership by any one owner in excess of one hundred sixty irrigable acres shall be appraised in a manner to be prescribed by the Secretary of the Interior and the sale prices thereof fixed by the Secretary on the basis of its actual bona fide value at the date of the appraisal without reference to the proposed construction of the irrigation works; and that no such excess lands so held shall receive water from any project or division if the owners thereof shall refuse to execute valid recordable contracts for the sale of such lands under terms and conditions satisfactory to the Secretary of the Interior and at prices not to exceed those fixed by the Secretary of the Interior;\* \* \*."

As presently construed by the legal advisors of the Interior Department, this means that a farmer who owns more than 160 acres of irrigable land under a reclamation project cannot receive project water for more than 160 acres unless he signs a recordable contract to sell the excess over 160 acres at a price determined by the Secretary of the Interior. For example, if an owner has 480 acres, he can receive project water for the entire acreage only if he agrees to sell 320 acres at a price fixed by the Secretary.

Various reasons have been assigned for this limitation. One factor was probably the desire to prevent speculation and to assure that the incremental land value, resulting from organization of land, water, and labor into a farm unit will inure to the benefit of the water user whose skill and energy make possible such development. Another was the intent to protect the investment of the United States against the hazards which result from sharp rises in land costs and the attendant increases in the landowner's overhead expenses. In recent years the land limitation provisions have been advanced as an essential part of a social program designed to assure family-unit farms and to prevent corporate farming.

The 160-acre law is of universal application in all of the states wherein the Federal reclamation program operates. It applies equally to the fruit and vegetable raisers of Arizona and California and to the livestock raiser of Colorado. This element of universality is the basic cause of trouble over the 160-acre law.

So far as the family-size farm principle is concerned, it seems self-evident that the desirable acreage must necessarily vary with the different conditions which prevail in the various sections of the United States. Is it fair or logical to apply the same yardstick to the San Luis Valley of Colorado, with its mile and a half altitude and 100-day frost-free season, as is applied to the low-altitude areas of Illinois and Missouri where there is a 180-day frost-free season or to the fertile valleys of the southwestern and Pacific coast states where crops may be grown the year round? In a desert oasis watered

by a reclamation project a 40-acre almond grove may support a baronial estate whereas a 160-acre hay meadow in one of the mountain states would provide only submarginal existence. The simple sensible answer is that in some sections 160 acres is too large an area and in others it is entirely too small.

Testimony given before a Congressional committee several years ago was that on the Conejos Division of the San Luis Valley Project the net farm income of a 160-acre farm, without livestock, was \$930.00 and with livestock was \$1,598.00. At the same hearing there was testimony that on 160 acres in the Central Valley of California devoted to fruit specialty crops the net farm income was \$37,200.00. Under these conditions does it make any sense to apply to the Conejos the same limitation as is applied to the Central Valley?

This problem is not new. Early in the 1930's the Secretary of the Interior ruled that the lands served in the Imperial Valley of California by the All-American Canal were not subject to the 160-acre law because the farmers already owned the water rights and the reclamation project only acted as a facility for the delivery of the water. A comparable situation prevails on the Conejos in Colorado where the stream supply, including all but extreme flood flows, is covered by existing appropriations under Colorado law, and the constructed Platoro Reservoir will only regulate the delivery of that water. But while the Secretary exempted the Imperial District from the 160-acre law, he now says that the Conejos farmers are bound thereby.

In 1938, Congress exempted the Colorado-Big Thompson Project from the operation of land limitation provisions. In justifying this exemption the Commissioner of Reclamation told a Committee of Congress that:

" \* \* \* those are high lands, comparatively high lands - I don't know what the altitude is, but I imagine it is 5,000 or better around Loveland - with a comparatively short growing period. You might be able to drum up some justification for larger holdings on a shorter growing period."

The San Luis Valley lands are a half mile higher in altitude and have a frost-free period only two-thirds that of the Colorado-Big Thompson lands.

In 1940 two Nevada reclamation projects were freed from the land limitation provisions by action of Congress. The sponsors of the legislation told Congress that the projects were located in an area of high altitude and early frost where "a person must have more land than 160 acres in order to farm successfully and carry on livestock feeding operations." In most sections of Colorado similar conditions prevail.

The land limitation provisions have been construed by the Interior Department as permitting the ownership of 320 acres by man and wife in community property states. The Department also has ruled that

in non-community property states the same result can be obtained by the ownership of 160 acres each by the husband and wife. Representatives of the Bureau of Reclamation have pointed out that the law may be avoided by an arrangement whereby tracts up to 160 acres each are held by children, other relatives, or friends. In at least one area a scheme has been devised whereby a corporation split up its holdings into tracts of not more than 160 acres each among its stockholders and then took back leases. These devices are, in truth, methods of avoiding a law which, because of its universality, is unworkable.

While the land limitation provisions are part of the law of the land, the Bureau of Reclamation has been loathe to insist upon complete compliance. In 1946 the Bureau published a pamphlet entitled "Land-ownership Survey on Federal Reclamation Projects." Therein it is conceded that at the time of the survey 4.1 % of the acreage of "Regular Bureau Projects" constituted "known excess land in violation of acreage limitations."

The difficulty which arises from an attempt to limit Colorado farms to 160 acres is well illustrated by the preliminary report on the 1950 census of agriculture prepared by the Bureau of the Census. This shows that the average size farm in Colorado contains 832.7 acres. The acreage varies from a high of 3,733.4 acres in Moffat County to 6.9 acres in the City and County of Denver. A few county figures may be significant, for example:

<u>County</u>	<u>Average size of farm</u>
Alamosa . . . . .	751.1
Saguache . . . . .	1,519.7
Gunnison . . . . .	1,324.1
Montrose . . . . .	432.8
Mesa . . . . .	216.3
Pueblo . . . . .	1,039.5
Otero . . . . .	735.5
Prowers . . . . .	887.8
Larimer . . . . .	430.0
Weld . . . . .	493.5
Morgan . . . . .	548.5
Logan . . . . .	751.4

Although these figures are on total acreage rather than irrigable acreage, they do emphasize the problem which is presented.

At the moment the situation existing in the Conejos Division of the San Luis Valley Project is critical. The Conejos people have been trying for some fifty years to secure a storage reservoir on the Conejos River which will impound the high spring flows and permit their use later in the growing season. After many years of disappointment the Conejos Water Conservancy District and the Bureau of Reclamation agreed upon the construction of the Platoro Dam on the headwaters of the Conejos. The Bureau told the District that construction could not start until a repayment contract was executed and that such contract would have to contain the usual provisions relative to land ownerships in excess of 160 acres.

The District said it would sign the contract if it were approved by the electors but that the repayment contract would in itself mean nothing unless the secondary agreements with the water users were negotiated and signed. This results from the fact that the Conejos flows are overappropriated and no firm supply will be available for storage in Platoro unless the holders of direct-flow rights forbear the use of a portion of those rights during the heavy spring run-off and permit the water to be stored in Platoro. Further, the District told the Bureau that it seriously doubted its ability to secure the secondary agreements with the owners of the essential water rights so long as the project was subject to the land limitation provisions.

The payment contract was signed, and the dam has been built. However, the essential contracts with the owners of the water rights have not been executed. At present the Platoro Dam and Reservoir is inoperative except for flood-control purposes.

The efforts to secure a modification of the land limitation provisions so far as the Conejos Project is concerned may prove a valuable case study to those who are interested in Bureau of Reclamation projects in Colorado. In 1947, pursuant to the advice of its leaders in Congress, Colorado joined with Texas and California in a bill to exempt certain named supplemental water projects in the three states from the land limitation laws. The San Luis Valley Project was one of those included in the bill. Extensive hearings were held by the Committee on Public Lands of the United States Senate. Opposition to the bill was centered on certain California and Texas projects. The Committee made no report on the bill. In 1949 the Colorado senators introduced S. 1385 which pertained only to the San Luis Valley Project. At the committee hearing on this bill a letter dated July 20, 1949, from the Secretary of the Interior, reporting on the bill, was presented. That letter said among other things, that the Conejos Division of the San Luis Valley Project presented "a somewhat unique relationship with established use of water, and irrigation practices not readily adaptable to farm units of 160 irrigable acres, or 320 irrigable acres for man and wife, as permitted by existing law." The bill, which did not remove all limitations but enlarged the permissible ownership in one individual to 480 acres, was passed unanimously by both the Senate and House. The President of the United States then vetoed the bill upon the ground that it violated a "national policy of long-standing."

After the disappointing veto of S. 1385 the solicitor of the Interior Department announced an opinion in a matter involving the Tulare Irrigation District of California. Many lawyers interpreted this opinion as holding that the limitations imposed by the Federal Reclamation laws meant that no land owner could receive a greater quantity of project water than that reasonably required to irrigate 160 acres. If such was the case, the opinion furnished a possible solution of the Conejos problem. Accordingly, the attorney for the District wrote the Secretary of the Interior on February 27, 1950, requesting the application of the so-called Tulare formula to the Conejos. In January, 1952, an adverse ruling was apparently made as the Commissioner of Reclamation wrote his field representatives that the excess land provisions must be met on the Conejos and that they meant a limitation on land rather than water.

The Conejos people again appealed to the Colorado Senators for advice. They recommended that another bill be filed with the hope that, if it be vetoed, enough votes will be available to override the veto. Accordingly, last February, S. 2610 was introduced by Senator Millikin for himself and Senator Johnson. This bill does not remove all limitations but rather restricts the project water which a land owner may receive to that quantity reasonably needed to irrigate 480 acres. The fate of such bill is in doubt. Its passage will ensure the success of the Conejos Project. Its defeat will mean that the Platoro Dam at least for the time being will stand as a monument to a stubborn Washington bureaucracy.

Those interested in Colorado water development should not take the smug attitude that the San Luis Valley must work out the land limitation problem for itself. The same problem will arise on the Fryingpan-Arkansas, the participating projects under the Colorado River Storage Project, the Blue-South Platte, and other projects. You cannot hide it. You cannot escape from it. The idea of avoiding the problem in an authorization bill is, in my opinion, fallacious. It merely postpones the fatal day and opens the door for the charge, which has been most unfairly made in connection with the Conejos, that the farmers have misled and deceived the United States in securing the construction of the project.

There is at the moment one faint ray of hope. The legislative committee of the National Reclamation Association has recommended that the hard and fast 160-acre limitation be removed and that in its stead provision be made for the determination of the maximum acreage which may be held by one owner under each project by a board created to study and pass thereon. I am informed that the legislation which the President's National Water Resources Policy Committee has recommended contains a similar provision. The difference between the two proposals, according to my informant, is in the appointment of members to the Board. Under the NRA plan such appointments would be locally controlled. Under the plan of the President's Committee, the appointments will be controlled by the Secretary of the Interior. This difference might conceivably cause difficulty in Congress. The legislative recommendations of the President's committee have not as yet been given public release.

In conclusion let me say that I believe that speculation in lands to be served by a Federal reclamation project should be prevented. Also I believe in the principle of family-operated farms. On these two points I am in agreement with those who support the existing law. I part company with them when they insist that the 160-acre limit must be applied everywhere that the Bureau of Reclamation operates. A limit which might be reasonable in the rich farm lands of Illinois, Iowa, and Missouri or in the prolific valleys of Arizona and California is entirely unreasonable when applied to Colorado. For a fruit orchard the limit may be too high. For a livestock operation it is too low.

One parting comment. I see no way for Colorado to secure the vast projects, which are essential to its full water development, without federal financing. This means that we cannot overlook the conditions which the United States imposes when it advances the money. The only way to change those conditions is by action of the Congress. If you

believe, as I do, that the 160-acre limitation is unsound when applied to Colorado conditions, then I invite your advice and aid in the attainment of a reasonable modification of the land limitation laws which will retain the basic principles of the existing law but afford a sensible, realistic, flexible limit on acreage.



Three of the ladies who attended the centennial banquet--from left to right: Mrs. Luther Bean of Alamosa, Mrs. T. C. McPherson of San Acacio and Mrs. B. B. Sutherland of near Monte Vista.

--Photo by Dick Biglin  
Western Farm Life

"FUTURE IRRIGATION DEVELOPMENT IN COLORADO"

by  
Clifford H. Stone  
Director, Colorado Water Conservation Board  
Paper Delivered  
at  
Colorado Irrigation Centennial  
April 9, 1952

A discussion of "Future Irrigation Development in Colorado," important as that subject is to our people at the present time, may seem somewhat prosaic in the light of the romantic story of the early beginnings of water development in this State.

A centennial observation, such as the one we observe on this occasion, must emphasize historical aspects of the event which is celebrated; we look back and turn the "spotlight," as best we may, on those individuals who played an important role in the initiation of great institutions, enduring enterprises and works which time has demonstrated accrued to the happiness and well being of those who came after them. Too often these individuals played their great part unnoticed at the time; the significance of their acts was not realized in their day. This comment may surely be made concerning those hardy and venturesome people who built the first irrigation ditches in Colorado.

It is a far cry from the time the San Luis People's Ditch was built to Colorado's irrigation development of this day. But the locators of that ditch brought with them the Spanish influence which, together with other factors, gave birth in Colorado to the appropriation doctrine of water law. They and settlers in other parts of the State initiated a system of water law which later ripened into a legal basis through the Colorado Constitution and Statutes.

These first water seekers who would nurture crops on arid lands were endowed with but little of the worldly goods; they possessed only crude tools with which to build; and they faced insecurity in a country only partially explored.

If a personal reference may be pardoned, the insecurity and uncertainties which these early irrigators in Colorado faced are shown by the experience of my father who settled in the Cebolla Valley, just across the Continental Divide from the San Luis Valley. He crossed the San Luis Valley in a stage coach nearly thirty years after the San Luis People's Ditch was built. When he was fencing his land, which he had taken up under a placer claim because it had not yet been surveyed, Chief Ouray and a band of his Ute Indians came along. The Chief told him he would have to get off the land which, he said, belonged to the Ute tribe. When the Indians had passed by, my father continued to fence his land, and later, after it had been surveyed, he proved up on it as a homestead. Not long after this encounter with the Indian chief, the Meeker Massacre occurred and the Utes were removed from Colorado to the Uinta Basin in what is now

the State of Utah. N. C. Meeker, then an Indian agent, was killed in the Meeker Massacre. Before going to Meeker, he had played a prominent part in early irrigation ventures of the Greeley Colony in the South Platte Basin in Colorado.

There is some evidence that many years prior to the time my father came to the Cebolla Valley, a small group of Spanish explorers settled for a short time in that Valley and built two or three small irrigation ditches.

These earliest irrigators and those who came to Colorado after them during the next three decades were able to construct by individual effort the ditches which were the least expensive and easiest to build for the irrigation of the land lying nearest the rivers and creeks. Then came a period when farmers banded together through associations and ditch companies to irrigate much larger acreage at higher levels and land removed from the strips which bordered the water courses. This was accomplished by the construction of larger structures, canals and reservoirs and required the expenditure of sums of money beyond the financial ability of the individual land owners. In many instances, the irrigation ventures of this period were highly promotional; and often the available water supply for the land proposed to be irrigated was inadequate. Thus the record indicates that, in many instances, those who had advanced the money for these ventures in irrigation were substantial losers and too often the farmers who relied upon them for a dependable water supply were doomed to bitter disappointment. Nevertheless it was during this period that irrigated acreage had its greatest expansion in Colorado, even though much of it remains to this day without an adequate and dependable water supply.

During the hundred years since the San Luis People's Ditch was built, irrigated acreage has expanded from a few hundred acres in Colorado to about 3,000,000 acres in 1950. From 1930 to 1940 irrigated acreage in Colorado decreased and from 1940 to 1950 there was a decrease of 280,000 acres, even though during that period new irrigation structures were constructed. No doubt, such reduction in irrigated acreage is largely due to the fact that at the present time, and it must be so to a large extent in the future, facilities for use of water must provide a more dependable supply in all years. It is only good planning to devote, as far as practicable, the remaining water supplies of the State to the stabilization of the existing agricultural economy of the State. This decrease, as shown by the last tentative census figures, is also partly due to the fact that in 1950 irrigated acreage in parks, golf courses, cemeteries and similar public areas was excluded.

According to the last tentative census returns, Colorado is the third state of the nation in total irrigated acreage. In the last ten years, the State had dropped from second to third place. California is now first with 6,619,000 acres; Texas, second with 3,148,000 acres; and Colorado, third with 2,941,000 acres. Although the precise figures for 1950 are not now available, the tentative figures show 24,869,000 acres

of land are now irrigated in the seventeen Western arid or semi-arid states, and in the other thirty-one states, there are presently irrigated 1,529,290 acres of land. The total for all of the country is 26,398,200 acres. Of the irrigated acreage in the seventeen Western states, slightly more than 6,000,000 acres of land have been provided by Bureau of Reclamation projects with a new or supplemental water supply.

Irrigation permits a more intensive use of land, and, where water supplies are adequate for a given irrigation system, an assured year-in and year-out high level of production, less influenced by vagaries of season and weather than any other type of agriculture. Only six-tenths of one per cent of the world's land is irrigated, but this irrigated acreage provides a greater diversification than other forms of farming, and thus helps both the economic stability of agricultural areas and the living standards of consumers. For these reasons, irrigation, formerly confined to the arid regions of the West, has steadily been spreading eastward. As an example, take note of the increase in irrigation in these states during the past ten years: New York, 5,900 to 19,200 acres; New Jersey, 8,000 to 28,000 acres; South Carolina, 411 to 6,400 acres; Massachusetts, 2,000 to 18,500 acres; Florida, 132,000 to 363,000 acres; Arkansas, 162,000 to 419,000 acres; and Wisconsin, 2,345 to 9,781 acres. Much of the irrigation outside of the seventeen arid land states is accomplished by pumping underground water supplies. It is interesting to observe, too, that states east of the ninety-eighth meridian encounter legal difficulties when any extensive diversion of water from natural streams is considered. This is because these states embrace the riparian doctrine of water law, as distinguished from the doctrine of prior appropriation which is largely practiced in the Western states.

The Eleventh census (that for 1890 with acreage figures for 1889) was the first to give attention to irrigation. This census report listed the Colorado irrigated land by counties. The irrigated acreage in Colorado during the past one hundred years, as disclosed by the census, may be noted by the following figures: From a few hundred acres in 1852, to 891,000 acres in 1889, 1,611,000 acres in 1899, 3,394,000 acres in 1929, 3,221,000 acres in 1939 and about 2,941,000 acres in 1949.

The year 1902 was the beginning of a new era in irrigation development in the West. Federal reclamation of arid and semi-arid lands, as it is known today, was initiated by the passage of the Reclamation Act of June 17, 1902. The original act and subsequent legislation established this Federal reclamation program for the seventeen Western states. In 1901, President Theodore Roosevelt, in urging initiation of this Federal irrigation program for the West, made a significant statement. It emphasized the need for the program and he pointed out that it should be undertaken in full recognition and application of state water laws. He stated:

"There remain, however, vast areas of public land which can be made available for homestead settlement, but only by reservoirs and mainline canals impracticable for private enterprise. These irrigation works should be built by the National Government. The lands reclaimed by them should be reserved by the Government for actual settlers, and the cost of construction should so far as possible be repaid by the land reclaimed. The distribution of the water, the division of the streams among irrigators, should be left to the settlers themselves in conformity with State laws and without interference with those laws or with vested rights. The policy of the National Government should be to aid irrigation in the several States and Territories in such manner as will enable the people in the local communities to help themselves, and as will stimulate needed reforms in the State laws and regulations governing irrigation."

The early-day concept of Federal irrigation development of the public domain has been expanded over the years by numerous acts of Congress to include supplemental irrigation of private lands, incidental power production, flood control, and relief from detriments to fish and wildlife from reclamation activities in connection with multiple-use projects. Also, it is no longer financed solely from proceeds of the Reclamation Fund.

The authority of the United States to engage in reclamation was sustained in the beginning by Article IV, Section 3 of the Constitution giving Congress power "to dispose of and make needful rules and regulations respecting the territory or other property belonging to the United States." Some reclamation project authorizations, such as the Boulder Canyon Project, were based on the commerce clause of the Federal Constitution. As late as June 5, 1950, the concept of the authority for Federal reclamation was broadened in the important United States Supreme Court case of United States v. Gerlach Livestock Company. While holding that Congress has directed that, in the Federal reclamation program, state-created water rights must be recognized, the Court said:

" . . . Thus the power of Congress to promote the general welfare through large-scale projects for reclamation, irrigation, or other internal improvement, is now as clear and ample as its power to accomplish the same results indirectly through resort to strained interpretation of the power over navigation."  
(Emphasis supplied)

Although the Federal reclamation program does not by any means foreclose irrigation development through private financing, it is realized at this time that, in most instances, the major projects development required to utilize the water resources of the West will have to be accomplished through Federal financing.

In the first thirty-five years of the Federal reclamation program, from 1902 to 1937, only two Federal water development projects were constructed in Colorado. These were the Uncompahgre and the Grand Valley

projects in Western Colorado, the latter including the Orchard Mesa Division. Prior to 1937, except for the Pueblo flood control works which were financed under a district created by state law and without the aid of Federal funds, no flood control projects had been constructed in this State.

The total construction cost of completed Federal water development projects in Colorado, including both reclamation and flood control projects, is \$59,971,132. All of this expenditure, except the amount of \$14,120,800, has been made since 1937.

The estimated cost of Federal water projects now under construction in Colorado amounts to \$192,769,000.

The estimated cost of Federal projects authorized for construction in Colorado, but on which construction has not been started, is \$69,092,700.

The Federal water development projects which have been completed in the State are the Uncompahgre, Grand Valley, which includes the Orchard Mesa Division, John Martin Dam and Reservoir, Pine River, Fruitgrowers, Montezuma, Stillwater, Mancos, Cherry Creek, Templeton Gap and the Conejos Unit of the San Luis Valley Project.

Federal water development projects now under construction in Colorado are the Colorado-Big Thompson and the Paonia.

Federal projects authorized for construction in Colorado, on which construction has not been started, are the Narrows, Morrison, Trinidad, extension of the Pueblo flood control works and the South Platte flood control project.

Of the projects just mentioned, the John Martin, Cherry Creek, Templeton Gap, Morrison, Trinidad, Pueblo and South Platte will provide only flood control benefits. The others are Bureau of Reclamation projects and will serve irrigation, flood control and power production purposes. Many of these reclamation projects are multiple-use in character.

A report on the proposed Blue-South Platte project has been made available to project sponsors and the Colorado Water Conservation Board. Litigation now pending in the courts is delaying consideration of State comments on this project.

Authorization by Congress is presently being sought for the Fryingpan-Arkansas Project, the Colorado River Storage Project and Participating Projects and the Collbran Project. The Fryingpan-Arkansas Project will divert an estimated 70,000 acre-feet of water from the Fryingpan Basin of the Colorado River for use in the Arkansas Basin. This project was approved by the Colorado Water Conservation Board after a Policy and Review Committee, appointed by the Board, had worked out operating principles satisfactory to both Eastern and Western Colorado. The Collbran Project, located near

Grand Junction, Colorado, will provide supplemental irrigation in the Plateau Valley, domestic water supplies for Grand Junction and the surrounding area, and a relatively small amount of hydroelectric energy. This project has definite defense relationships because of the great need for domestic and municipal water supplies in the Grand Junction area to meet demands created by the atomic energy activities and uranium ore production in that section of the State.

The Colorado River Storage Project and Participating Projects is a plan for the comprehensive development of the entire Upper Colorado River Basin. It is a great basin-wide undertaking and will require many years to complete. The States of Colorado, New Mexico, Utah and Wyoming are primarily concerned with, and will be benefited by, this proposed development. The report of the Bureau of Reclamation on this project has been favorably commented upon by all the affected states, including the States of Arizona, California and Nevada in the Lower Colorado River Basin. The report on this project is now on the desk of the Secretary of the Interior and every effort is being made to have it transmitted by the Secretary to the Bureau of the Budget. The Upper Colorado River Commission, of which Colorado is a member State, has approved a draft of legislation to authorize this great project. The Colorado River Storage Project is of great concern to all of the people of the State, both West and East of the Continental Divide. It will provide hold-over storage to enable Colorado, New Mexico, Utah and Wyoming to meet their obligations under the Colorado River Compact to make deliveries of water at Lee Ferry in the Lower Colorado River Basin and, at the same time, enable the Upper Basin to make full use of the 7,500,000 acre-feet of water a year allocated by the Compact to that basin. Without this hold-over storage, it is estimated that the Upper Basin will lose the use of from 1,300,000 to 1,600,000 acre-feet of the water a year. Since Colorado, under the Upper Colorado River Basin Compact, is entitled to 51.75 per cent of Upper Basin water, the loss of this 1,300,000 to 1,600,000 acre-feet of water would be a serious blow to the future development of the State.

At the present time, a matter of great concern to Colorado and its present and future water users is that of securing adequate surveys and investigations for water development. It is recognized now that in order to formulate plans for the utilization of Colorado's remaining water supplies, basin investigations are of primary concern. The Colorado River is virtually Colorado's last "water hole" for its principal future development through the utilization of the water resource. The entire State is concerned with the completion, at as early a day as possible, of surveys and investigations in that part of the basin which lies in Colorado.

The sources of six major rivers are found in Colorado and there lie in Colorado portions of four major river basins. Because of this geographical situation and the origins of so many major rivers in this State, the utilization of surface water supplies has created many interstate water problems. Under the principle of equitable apportionment of the use of the water of interstate rivers, Colorado, in the past,

has been a party to more interstate water litigation before the Supreme Court of the United States than has any other state. In the light of this experience, the Colorado Water Conservation Board has adopted the policy of seeking amicable adjustments, if possible, of interstate water controversies by compacts and other means. At the present time, no interstate litigation over water, in which Colorado is interested, is pending. Even before the last United States Supreme Court case was finally settled, the State became actively engaged in negotiating water compacts. Colorado is now a signatory to eight interstate water compacts. These compacts, together with decisions and decrees of the Supreme Court of the United States, cover every major river of the State and some of their tributaries. The State is also taking an active part in the activities of the Missouri Basin Inter-Agency Committee and the Arkansas-White-Red Basins Inter-Agency Committee.

Colorado's pre-eminent leadership in the formulation and exercise of the doctrine of prior appropriation is generally recognized. Another distinction which, I believe, the State can justly claim is that of leadership in developing the principles of equitable apportionment among states of the use of water of interstate streams and in furthering the compact method for settling inter-state water controversies.

In recent years the importance of two phases of present and future water development in Colorado has become more fully recognized. One of them is that of the utilization of underground water resources. More than six years ago, the Colorado Water Conservation Board, in cooperation with the United States Geological Survey, initiated a survey in the State of the extent and occurrence of these ground water resources. This survey is only partially completed, but money has been made available by the last Legislature to continue it. In some parts of the State, the drilling of wells and the utilization of ground waters for irrigation and domestic purposes have greatly increased. As is always the case, such extensive use of ground waters has demonstrated the need of an under-ground water code. Although efforts have been made to formulate such a code, no progress has been made in this direction. At the present time, a committee is being set up to study legislation on this subject. Such a committee would consist of farm, municipal, technical and legal representatives. The Colorado Water Conservation Board has passed a strong resolution expressing the need for the formulation and adoption by the Legislature, of an underground water code.

The other phase which has been more fully recognized in recent years as an important factor in future water development in Colorado is that of increasing needs for water for municipal and industrial purposes. With the increase in population, particularly in urban centers, and with the very apparent need for water for various industrial purposes, such as that for the processing of oil shales and coal for fuel oil production, the availability of water for future irrigation expansion requires continual reappraisal.

The effect of water project development on the fish and wildlife resources of the State and the need of securing the highest and best use of limited water supplies, with as little interference as possible with these fish, wildlife and recreational attractions and resources, constitute another problem which requires serious attention.

Colorado, along with other states of the West, has now approached the time when a final pattern of water development is being cut. The problems are all numerous and complicated. Aside from those which I have mentioned, there are involved questions of national water policy which, at the present time, are being heatedly debated over the entire nation. To preserve the integrity of state water laws, to prevent threatened action for the centralized Federal control of a great natural resource, to accord recognition of the Federal interests while, at the same time, recognizing the rights and interests of the states, to resolve problems related to the repayment of the costs of water development projects and to settle many issues, such as that of the land limitation provision of the Federal Reclamation Law, - all present problems incident to the present and future development of the water resources of Colorado. Colorado will not be able to make the best use of its remaining water resources without careful attention being devoted to these matters and without the interested agencies of the State and its citizens being ever alert and prepared to take appropriate action.

In closing, I wish to emphasize, above everything else, that if Colorado is to utilize, for the present and future welfare of its citizens, the limited remaining water resources of the State, every effort should be made to avoid, or, at least reduce to the minimum, internal controversies over its water resources. Such controversies inevitably result in years of delay in the realization of the use of water in the State which is so greatly needed. Internal controversies long continued might threaten the eventual ability to use a substantial part of the unappropriated waters of the Colorado River Basin, to which the State is entitled under existing compacts.

Theodore C. Henry--Champion Irrigation Project Promoter

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Space in this report does not permit much of the detail of irrigation development in Colorado. Very soon there will, no doubt, be another Centennial observance to take note of the efforts of pioneer irrigation farmers and developers of the basis for present-day irrigation law. This next centennial mile post should be marked in the Cache La Poudre Valley. It is a worth while project for all communities of that valley to unite on.

However, it seems fitting here to mention briefly the work of that champion promoter of irrigation projects, Theodore C. Henry. He was known to a former generation as T. C. Henry or just T. C. He left his marks and his monuments in all the principal irrigated areas of Colorado.

There were numerous irrigation advocates and promoters active in the State during the 1880's and 1890's. However, T. C. Henry appears to have been the most prolific of the group. A dozen large projects are credited to him.

He and his associates are reported to have gained little or nothing for themselves from their vast and scattered activities. It is said that T. C. broke himself and all those who were associated with him. Whether this be fact or fiction will be left for some better researcher to determine. If it be fact it may account for the very significant general acceptance and use of the mutual form of irrigation companies in this State.

Perhaps T. C. Henry planned to turn his projects over to the water using land owners. In any case that is what happened to the extent that today there are comparatively few corporations selling water in Colorado.

The mutalization of some of T. C. Henry's canal systems as well as of those of some other promoters were not accomplished without bitter controversy and long drawn-out legal battles.

Who was T. C. Henry? In his testimony in the famous Kansas-Colorado Suit, before Supreme Court Commissioner, Granville A. Richardson at Denver in October, 1904, he said he was a native of the State of New York. He came to Colorado by way of Abilene and other points in Kansas after extensive and varied experiences in large-scale farming and land speculation ventures in that state. He also served the Kansas Pacific (now Union Pacific) as land agent at Abilene to help promote an economy which would absorb into private ownership the large blocks of granted lands held by the railroad.

His operations in Kansas began, according to the records, in 1867 and included a battle with drought, flood, grasshoppers, famine and abundance until 1883 when he moved to Colorado. Mr. Henry took credit for establishing winter wheat as the preferred wheat crop for Kansas as early as 1873. His farming operations covered some fifteen thousand acres in 1878 and a "seventy-five to a hundred thousand dollars" loss in 1879, the beginning of the end of his operations in Kansas.

Arguments that the rain belt was moving westward with the plow and that the pores of the soil would open up and absorb moisture better when countless buffalo no longer impacted it could no longer hold T. C. Henry in Kansas. He broke with the large railroad land-grant interests and advocated, in an address before the State Horticultural Society, in 1879, I think, or possibly in 1880, the idea of "withdrawing that country from homesteading and making a stock country of it."

Quoting again from Henry's testimony:

"About the year 1880 there began to be more attention paid to the need for irrigation. I myself put in some windmills and experimented, on the uplands particularly, but found that no practical results ensued of any worth. The quantity of water obtained in the face of enormous evaporation, the hot winds, the dry atmosphere and the parched ground made practical results of any value impossible--by pumping. We ran some levels with the idea of taking water from some of the tributaries that were flowing into the Smoky Hill (river, but the expense involved and the small supply of water really available, in the face of large areas of country that needed irrigation, made it too small and pitiful a proposition to advertise. . . . Some Kansas people, particularly Senator Plumb, as I remember it, and some of his associates, about that time began irrigation development in a way, out in the Garden City Section of the Arkansas Valley."

The testimony here emphasizes the point that irrigation was quite generally under discussion, especially following the years 1879 and 1880. The Kansas Pacific railroad had reached Denver in August 1870 and T. C. Henry continues his testimony as follows:

"Naturally, more or less of our people were back and forth (between Kansas and Colorado) and irrigation had become inaugurated in this state. I first visited the state in 1876 and went up into the northern part . . . and investigated the irrigation conditions and soon saw that it was not possible . . . at home to utilize or employ irrigation, our conditions, as I say, not being favorable, and I took some opportunity to promulgate my views as a result of my investigation. I was greatly impressed, of course, with the advantages of irrigation. We were pretty hungry for water sometimes."

This and other similar evidence, together with crop failures, convinced Mr. Henry that Colorado was a more promising area in which to carry out his type and style of operations. So within a few weeks after he arrived in 1883, he became interested in irrigation. His first Colorado enterprise was the Grand Valley Canal System at Grand Junction in the Grand Valley.

Counsel for Colorado, Charles D. Hayt, asked:

"Will you now state in detail what experience you have had in the building of ditches in Colorado and elsewhere in the arid region?"

A. The Grand Valley enterprise covered about forty thousand acres of land. A canal was built proportionately. I raised the money and practically completed the system, involving an outlay altogether, under my administration, of about four hundred thousand dollars. Since then there has been added to that outlay perhaps a couple of hundred thousand dollars more, on the canal system itself. The canal is located in the Grand Valley, which is watered by the Grand River on the western slope, and the water is taken out of that river to supply the canal system so built at a point about sixty miles east of the Utah line and about twelve miles above the town of Grand Junction, Colorado. The canal is about forty feet wide on the bottom, with a carrying depth of about five feet, and it is about forty miles long. The distributing canals have perhaps a total length of two or three hundred miles. The next enterprise I was interested in was at Fort Morgan, called the Fort Morgan Canal, down on the south bank of the South Platte River, about seventy miles below Denver. It waters Fort Morgan flats, in the center of which is the town of Fort Morgan. It is a canal about thirty miles long, about twenty-five feet wide on the bottom at the head gate, with a carrying depth of about four and a half feet, and irrigates about fifteen thousand acres of land. It cost, altogether, about three hundred and fifty thousand dollars.

"The next enterprises I was identified with were in the San Luis Valley, namely, the Del Norte canal, the Citizens' canal, the Empire canal and the San Luis canal. The Del Norte canal, the first one, is about eighty feet wide on the bottom and one hundred and ten feet wide on the top, carrying about seven feet of water and having a grade of about seven feet to the mile for the first few miles--the largest canal in the United States so far as quantity of water or carrying capacity is concerned. It has cost, altogether, with the distributing canals, perhaps three-quarters of a million dollars, and it has a total length, including main canals and distributing laterals, of perhaps five hundred miles.

"The Citizens' canal is about forty miles long and fifty feet wide on the bottom, with a carrying depth of about six feet, the laterals aggregating three or four hundred miles in length, and cost about between four and five hundred thousand dollars.

"The Empire canal is down in the San Luis Valley; it is also taken, as the previous canals in that valley are, from the Rio Grande River. It is sixty-six feet wide on the bottom, with a carrying depth of about six feet; it is about thirty-five miles long--the main canal--and has about one thousand miles of distributing canals under it. The total cost is about seven hundred thousand dollars.

"The San Luis canal, also taken from the same river in the San Luis Valley, is a canal-----

"Q. You are now speaking of canals constructed under your management?

"A. Yes. (Witness continuing)--fifty feet wide on the bottom, possibly, with a carrying depth of about five or six feet, and a total mileage, including main and distributing canals, of about three hundred miles, and cost, altogether, about four hundred thousand dollars.

"These canals were all built in 1884 and 1885, except some of the distributing canals, needed for the use of farms brought under cultivation subsequently.

"The next system was the North Poudre, taken out of the north fork of the Poudre river, northwest from Fort Collins. It has been very greatly extended and improved, but at that time, the time that I was connected with it, it was a canal thirty feet wide on the bottom and about sixty miles long, and with distributing laterals aggregating a couple of hundred miles--a very expensive undertaking. The original cost was about five hundred thousand dollars.

"The Pawnee canal was located in the lower South Platte valley, on the north side of the Platte river, adjoining and tributary to the town of Sterling, in Logan county. The Pawnee canal is about forty feet wide at the head gate, carries about five feet in depth, and the main line is about thirty miles long, with perhaps one hundred or one hundred and fifty miles of distributing canals. It cost about two hundred thousand dollars. The Pawnee canal was built in 1884.

"In 1884 we also built the Uncompahgre canal, now called the Montrose canal, in Montrose county, the water being taken from the Uncompahgre river. It is a canal about thirty miles long with perhaps two hundred miles of distributing laterals, a very expensive proposition, having cost more than half a million of dollars.

"In the Arkansas valley, in 1887, the first project I undertook was what is now known as the Fort Lyon canal. The head is taken out of the Arkansas river on the north side, about two miles northwest from the town of La Junta, and in the course of two years it was extended so that the extreme length of the main canal was one hundred and seventeen miles. It has been subsequently enlarged, but not under my administration, with a much greater capital. It was at that time about fifty feet wide on the bottom, with a carrying capacity and depth of something over six feet, and cost, as originally constructed under my administration, between four and five hundred thousand dollars.

"The next enterprise in the Arkansas valley I undertook is what is called the Bob Creek canal, known as the Colorado Land and Water Company's canal, the headgate of which is taken out on the north side of the Arkansas River about eighteen miles below Pueblo, and is carried about sixty miles and waters Sugar City and the territory tributary to it. It is a canal of about, as I now recollect, fifty feet wide, carrying a depth of perhaps about five feet, and cost, under my administration, about three hundred and fifty thousand dollars. It has subsequently been enlarged and is a much more ambitious enterprise.

"Also in that year, 1890, I undertook the Otero canal enterprise in the Arkansas valley, the canal being taken forty miles below Pueblo. The main canal is about sixty-six miles long, has a width at the headgate of about thirty-five feet, carrying four and a half to five feet in depth, and cost about two hundred and fifty to three hundred thousand dollars.

"Those are all the main canals that I have constructed. I have

been identified with some smaller ones, but comparatively small.

"Q. Were there Kansas people interested with you in the construction of some of these canals?

"A. Yes, most of the capital employed in the Fort Lyon construction at the time I was connected with it was Kansas capital or capital belonging to the friends of Kansas people, including principally Topeka people--the Mulvanes, Senator Burton and others less prominent. That was the first enterprise I undertook in the Arkansas valley. I think there were no Kansas people identified with any of the others there.

"Q. But during all those years the people of Kansas were taking a lively interest in the question of irrigation, were they not?

"A. Yes.

"Q. Attending irrigation congresses and generally advocating aid from the national government?

"A. I think the people of that portion of the Arkansas valley in the State of Kansas were more active and more aggressive in furthering irrigation development and talking irrigation than the people of perhaps any other State in the arid west. The Santa Fe Railway Company was particularly active. It went so far as to employ Judge Emery of Florence as a general solicitor on the subject of irrigation, who first acquainted himself thoroughly with the subject and on all occasions, nearly, appeared, advocating irrigation.

"Q. Do you remember a man by the name of Gregory who resided at Kansas City?

"A. Yes, sir. Gregory was perhaps in some ways even more active than Judge Emery. Judge Emery had no material interests at stake and Judge Gregory had. Judge Gregory was a resident of that part of arid Kansas, and Judge Emery was employed because of his ability as a speaker, but lived in eastern Kansas where irrigation was not so much needed.

"Q. Do you remember E. R. Moses?

"A. Yes; he was another active man, very prominent in the work, chairman of the executive committees of the various congresses, and active in that way.

"Q. Where did he live?

"A. At Great Bend, Kansas, I think.

"Q. What were these congresses you have spoken of?

"A. They were conventions held for the purpose of discussing and furthering irrigation interests as a general proposition and as applied particularly to the respective localities from whence representatives appeared.

"Q. Can you state some of the places where these congresses were convened?

"A. There was a congress held in Denver, a congress in Ogden, a congress in Salt Lake City, a congress, I think, in Los Angeles, in Phoenix, Arizona, and other places--in Phoenix in particular.

"Q. Do you know whether Kansas people generally attended those conferences and advocated the cause of irrigation?

"A. Invariably, with large and influential delegations.

"Q. One purpose was to induce the general government to make appropriations for irrigation, was it not?

"A. I think the idea which has culminated in the reclamation fund originated with Kansas people.

"Q. Over what years did this discussion and this activity on the part of the people of Kansas in favor of irrigation extend?

"A. Well, over the decade beginning, I should say, about the year 1890.

"Q. It continued, I suppose, until it culminated in the act of congress in 1902, setting aside a fund for that purpose?

"A. Yes; I don't think Kansas has displayed so much interest, at any rate in the sessions of the irrigation congress held during the last two or three years, as it did prior thereto.

"Q. You have stated something of your experience in the construction of ditches and in farming in Kansas without irrigation. Have you had experience in farming with irrigation?

"A. In the State of Kansas?

"Q. Anywhere.

"A. Oh, yes, in this State.

"Q. Briefly, over what years would that extend, and to what extent--large or small?

"A. I commenced agricultural operations in the spring of 1884 in the Grand valley, as well as horticultural operations. There I laid out the town of Fruita, and, I think, shipped the first carload of fruit trees over the range. The town of Fruita is under the Grand valley system. And we did some farming besides on various tracts of land that our company acquired there. I began that same year agricultural operations in the San Luis valley, where I opened up what we called the North Farm, under the Del Norte canal, of seven thousand acres, about six miles north of Monte Vista, a town our company laid out; then on the south side of the river, in the San Luis valley, I

opened up the South Farm, under the Citizens' canal, of three thousand acres. I was interested in a ranch of about eight hundred acres that year in Morgan county, near the town of Fort Morgan, also some agricultural operations under the North Poudre valley system, north of Fort Collins. The next year we farmed in the San Luis valley, under the Empire canal. The next two or three years we put about sixty thousand acres under cultivation.

"Q. Well, in general, have your farming operations extended down to the present time?

"A. Yes.

"Q. Conducted under the irrigating systems you have spoken of?

"A. Yes, supplied by canals.

"Q. During the twenty years or more that you have been in Colorado you have had occasion to go about the State considerably, have you?

"A. Well, very considerably. I have traveled over the State.

"Q. Have you given very much attention to the agricultural and horticultural interests of the State during that time?

"A. Very close attention.

"Q. You have, I judge, in addition to your practical experience, made a study of these questions to some extent, have you not?

"A. I think I have.

"Q. Have you ever made investigations abroad with reference to irrigation?

"A. I have.

"Q. When, and what countries have you visited?

"A. I visited southern France and examined the irrigation systems, more particularly in the section of Nice, also in northern Italy, on the plains of Lombardy, and in the vicinity of Milan, and also along the Riviera, below Genoa and Naples, where the operations are comparatively small. Those investigations were made in the year 1889. And I saw something of the irrigation operations in Holland that year. In 1893 I was again in Holland and made some investigation of the conditions of agriculture and irrigation. They were quite different, of course, from the conditions in Italy. I made those examinations, I may say, in order that the work of a commission which had been appointed by Governor Cooper (Job A. Cooper 1889-1891) the year before according to an act of the legislature, of which I was a member, in revising and codifying the irrigation statutes of this State, might possibly be more intelligently done.

"Q. I understand you to say you were appointed an official by the Governor of this State, under legislative enactment to codify the irrigation laws of the State.

"A. Yes, and with those credentials and by virtue of that fact he had given me special consideration and special facilities to examine the system of agriculture and the conditions of irrigation, etc., as practiced there.

"Q. I suppose you have also read extensively the writings of others, and of their experience, upon this subject?

"A. Quite extensively, perhaps.

"Q. I will now ask you to state your conclusions with reference to the productiveness of irrigated lands as compared with non-irrigated lands and with reference to the capacity of these lands to support population.

"A. Well, as a general proposition, under average conditions in the State of Colorado, for instance, where irrigation is practiced, on the one hand, as compared with the average conditions in the section of Kansas of which I have spoken, and where I resided and farmed, in what is termed western Kansas, it is my judgment that a family of five persons, during a decade, can more safely rely upon the production of ten acres of irrigated land in Colorado for a livelihood than upon one hundred and sixty acres of non-irrigated land in, as I said, that section of Kansas; that is, particularly the Smoky Hill and the watersheds of the Smoky Hill, Solomon, Saline, and along the Arkansas river in that State where irrigation is not in vogue.

"Q. What can you say as to the diversity of crops, with reference to those grown on irrigated lands and those grown on non-irrigated lands?

"A. For instance, within the past two weeks I visited the Arkansas Valley and the Fort Lyon Canal, and visited an addition to the town of La Junta, and in looking over lands I was interested in fifteen or seventeen years ago, which had been cut up into small tracts, I saw a tract of two acres in a high state of cultivation, with very heavy adobe soil, a sort of slough; that at the time I was familiar with that particular tract of land I supposed would practically never be reclaimed, now planted to sugar beets, and when I spoke to the man gathering the beets he instantly recognized me, and I found I had sold him, as he told me--and I remembered him then--a tract of one hundred and sixty acres in Dickinson county, twenty-five or thirty years ago, and he was living on this two-acre tract. I think he was a Scotchman by birth, perhaps. He assured me positively he was making a better and safer living for himself and his wife--I think he had no children living with him--on the two acres in question than he was able to make in a term of years on the one hundred and sixty acres in the State of Kansas, 'because,' he said, 'I am sure here of a living.' To be sure, he has his cow, and a pig or two, etc., on the two-acre tract. He had lost his crops entirely on the one hundred and sixty acres in the State of Kansas and became involved and sold out, I think he told me in 1896 or 1897, and moved away."

(Mr. Henry and others of his day might be greatly surprised at the trend in size of both Colorado irrigated farms and Kansas wheat farms today.)

Return of irrigation water to the parent stream and its reuse was observed and studied by T. C. Henry and his contemporaries. There was considerable time spent in the hearings of the Kansas-Colorado case on this point, storage reservoirs and stabilized river flow. Almost a half century ago this promoter and others visualized a project such as the John Martin or Caddoa project in the Arkansas basin but believed land values were too low to justify the necessary outlay by private enterprise. They also talked of many other storage projects, some of which have been given names but have not taken shape. While there are now some nine thousand different irrigation enterprises in Colorado and active part in the first organization and construction of the twelve (among the larger in the State) listed above is quite a record for any one promoter.

Thus we add to the evidence of the pioneers in establishing irrigation and developing a stable agriculture in the watered valleys of our State. A generation is growing up, or should we say has grown up, which discounts the sweat, tears and heartaches of our pioneers in irrigation who were friends and neighbors of many still living among us. This new generation takes these hard-won developments for granted, even more than they now take the weather.

To assume that irrigation is established and fixed and needs no attention or study by any but a few State administrators and ditch company officials is to stalemate progress. A good foundation has been laid toward the structure that must eventually be built.

Stockmen, farmers and their advisors are generally and constantly active in the improvement of their animals and their crops, but find too little time to intelligently study their irrigation problems. I suggest that almost sufficient time has elapsed since the rough-and-tumble development period to begin to correct some of the early mistakes to the end that our limited water supply may serve and increase agricultural production on more acres for more people.

HOW WELL HAVE WE BUILT

Clifford H. Stone

Director of the Colorado Water Conservation Board

Delivered October 13, 1942 at Denver, Colorado  
Banquet Meeting of the Association of  
Western State Engineers

After two days during which you have considered engineering questions, may we put aside the slide rule and review a story of western irrigation? Cold as may be the engineering and legal factors involved, it is a human interest story. It deals with life and the nurturing waters of western rivers. It is inspired by men who envisioned the building of an empire. The principal actors do not appear on the scene as heroes, but as benefactors whose contribution to society has never been adequately evaluated. Many of them play their important roles almost unnoticed.

It is possible in the space of this paper to relate only the outstanding incidents in one typical western community where economic influences and the activities of conspicuous characters present a significant story of irrigation development. We refer to the area in the vicinity of Greeley, Colorado, where the Union Colony, at an early date, brought water and land together to lay the foundation for the prosperous agriculture found there today.

It was at Greeley that a great leader of New York City promoted the cause of irrigation and temperance. When the purpose of the Union Colony, which was founded in April 1870, was under discussion, this man from the East, Horace Greeley, said:

"Now, I desire and I am in earnest for humanity's sake that you people build up an asylum under the shadow of the Rocky Mountains, under new circumstances, where you will live by irrigation and flourish in a new clime, where a man can go and cannot get drunk. There are many men who desire such a place. What I desire in this matter is not for myself but for humanity."

It was the Union Colony which, in its early years, came under the guidance of another crusader for Western Agriculture, N. C. Meeker. Ever a pioneer, pushing his work into new areas, Meeker met his death in the Meeker Indian Massacre of 1879. David Boyd in his "History of Greeley and the Union Colony of Colorado," published in 1890, says of N. C. Meeker:

"Every brick block, every church, every school house, every beautiful residence reared in Greeley is a monument to N. C. Meeker. Every tree planted, every lawn clothed in grass and bordered with flowers, every field waving with grain in and around Greeley is a monument to N. C. Meeker. Every bird that sings in the branches of the trees that border the fields and streets once covered with cactus, every bee that hums in our clover lawns or fields of alfalfa sings or hums a requiem to the ashes of N. C. Meeker."

When land-development promoters in Denver held out to the people in the East the promise of great expanse of land with almost inexhaustible supplies of water, it was J. Max Clark, who, at that early time, made an estimate of the available direct-flow supply of water in the Greeley area for irrigation. He made an estimate without knowing the term "acre-foot", without measuring devices, without previous records, which, in the light of present knowledge, has proven substantially correct.

It was a Greeley man, Delph Carpenter, who in later years became the great exponent of the compact method of adjusting interstate water controversies. He spent his last active days in this work. He lives today but is hopelessly paralyzed. In his time he has performed a work which has redounded to the welfare and advancement of the entire West.

It is in the Greeley area that the proponents of dependable water supply have in this day planned, secured the federal authorization for, and are constructing a \$54,000,000 irrigation and power project to furnish supplemental water supply for more than 700,000 acres of highly developed agricultural land. These men in our time, by this great project, are building the works to bring 320,000 acre-feet of water through the Continental divide by a thirteen mile tunnel from the Colorado River basin. Only yesterday such extensive works were considered possible of realization many years in the future. They are surely a far-cry from the crude, early works of Horace Greeley, J. Max Clark and N. C. Meeker. Their building constitutes an interesting chapter of a story which in its beginning told of hardship, uncertainties and experiment.

But these men of three quarters of a century ago envisioned the pattern of irrigation development. In September 1873 an irrigation convention was held in Denver. To this convention were invited delegates from the states and territories of Utah, Wyoming, New Mexico, Kansas, Nebraska and Colorado. The main objective was to get up a petition to Congress to donate half the proceeds from the sale of Government land for the building of ditches and irrigation works. This was done, but there was no response from Washington. Here, then, we find that in 1873 the principle of the Reclamation Act of 1902 was proposed by an irrigation convention in Denver. Seventy-five years were to pass by before the men of another generation were to see a project constructed under the Reclamation Act, in the Greeley area.

The Greeley, Tribune of September 17th, 1873, contains an article on irrigation in Italy, by J. Max Clark. It indicates how vigorously those early settlers were trying to find out something about irrigation. From this may we quote:

"It has been our great drawback in agriculture from the beginning here, that parties got engaged in the business, and having no practical knowledge of irrigation, and nothing but a sort of theoretical itching interest in the farm, have continually sought to advise us as to what might, could or should be done, while those practical men who have for years been engaged in the pursuit, have lacked either the ability or inclination to tell us what they know. And now, after quite a goodly number of us have been making this system of tilling the soil our exclusive business for

the past three years, and have sought to obtain all the knowledge we could by close observation, repeated experiments, and the most careful study of all available sources of information, here comes a banker, who, in the intervals of business hours has time to do a little not very succesful tinkering in a garden, and has sunk a little money in non-resident farming over the river, and proposes, at one fell sweep to upset all our careful calculations as to our necessities and resources, and tells us, at one guess, more than all we know upon the subject,\* \* \*

"Now a word about the system of irrigation in Utah. It may be said, that while the Monmons have practiced it a little longer than we have, they know very little more about it, and except, perhaps in the City of Salt Lake, they resort to very little more system than we do. They have, so far as I have been able to learn, contributed nothing to the world's store of knowledge on the subject, have written no books, advanced no new theories, recorded no new facts, and when, some three years since, the Farmer's Club of this place corresponded with some of their principal men upon the subject, with a view to ascertain facts of importance for our own application and use, they were able to afford us nothing of any practical value.

"It is quite fortunate for us that in Italy they have practiced this art for centuries. They have there such costly appliances, such extensive works in the shape of dams, sluices, water-gates, head-gates, flumes, reservoirs, etc., and such a perfect system withal as we may not expect for years to come. They have, for us, which is most important still, extensive treatises on the subject, containing valuable information as to the effects of the system upon the soil after hundreds of years of trial, statistics as to the amount of water required, and records of the size and capacity of their canals, and the number of acres cultivated under them, which cannot fail to be of infinite advantage to a people proposing to practice the art in other lands.\* \* \*"

There follows in this article an application of some of the principles found in the article on irrigation in Italy to the problems which were encountered by the Union Colony.

In 1880 Patrick O'Meara, an English engineer, surveyed and superintended the construction of the North Poudre canal. He became interested in the consumptive use of water in the area. When he returned to England in 1883, he read a paper on this subject before the Institute of Civil Engineers, London. The proof of the paper was sent to E. S. Nettleton, Colorado State Engineer, for review and comments. The State Engineer turned the paper over to David Boyd of Greeley for study. His comments were published in the proceedings of the London Institute of Civil Engineers, along with the discussion contributed on the subject by about twenty members of the Institute. The discussions of these men represented the experience gained from nearly every country on the face of the globe where irrigation was then practiced.

One of the problems which perplexed these early irrigationists was how to regulate diversions of water delivered from the main canals to the farmers. The first attempt was made by Dr. G. Law, in the spring of 1872. He constructed a device consisting of a walking beam supported by posts attached to the sides of the delivery flume. One end of the beam was connected by a shaft to the gate, and the other by a shaft to a float in the flume. By this method increased flow lowered the gate. David Boyd, in his history of the Greeley colony says that this contrivance was not adopted "because it would have incurred a considerable expense which the board was not prepared to meet, and partly because the question was not how to deliver a steady quantity at any given place, but rather to divide a fluctuating volume proportionately among the consumers."

J. Max Clark appeared with a device for measuring the amount of water passing through a flume. It consisted of a spring balance which measured the force the water exerted in passing. This method was not workable. Next, Mr. Clark suggested a method used in Italy. This consisted of a receiving aperture regulated by a gate next to the canal, and a delivery aperture regulated by a side slide at the other end of the flume, the front gate being raised or lowered so as to keep the water at the same level in the flume and fill the delivery aperture to the top. This latter device, adopted in various states and territories at the time, came to be used. Another method, more expensive, had been proposed by State Engineer, Nettleton.

Although the principle of priority of use was recognized in the territory when the Union Colony was established, the laws were indefinite and no administration was provided. Recourse to the courts was expensive and entailed delay. The Greeley colony was not threatened by later upstream users until 1874. A colony at Fort Collins was established by four of the original Union colonists. This later enterprise threatened to appropriate and use water on which the early Greeley group depended. There was much discussion of the subject and difference of opinion expressed in the newspapers. A Denver paper expressed itself against the priority of right. This led to a convention of ditch owners, attended by about forty delegates. David Boyd who was present gives this interesting account of the meeting:

"\* \* \* The question took a wide range in discussion, and the Collins parties were told that if their policy of the ditches highest up stream taking what they wanted was the one to be pursued, then we could go above them, and there would result an interminable and exhaustive race in which the greatest numbers and largest purses would come out the winners. The writer was willing to accept, for that season, the proposal of General Cameron, because he saw that nothing could be done in the courts that year to relieve the present pinch. Most of the Greeley delegates differed from him, but might have been made to yield but for the defiant attitude of those up stream. At length patience seemed to him to cease being a virtue, and he hurled back defiance in hot and unseemly language. They would not hear to moderation and justice. Force must meet force. We outnumbered them, and many of us had seen as rough service some ten years ago as we were likely to experience in an encounter with these water thieves, etc. Then some one arose and moved an immediate

adjournment. Every man to his tent, to his rifle and cartridges. But gradually voices of conciliation were heard above the storm. Meeker's, Cameron's, and even J. Max Clark's. It was finally agreed that they would let us down some water to save the most valuable things in Greeley. A promise they did not keep nor mean to keep. They were too intent on running the water out on the cactus plain in order to boom the "Agricultural Colony", which was to be our great rival. A general rain-storm came in about a week afterwards and saved us; but from this day forth we had set our hearts on having some regulations looking towards a distribution of the waters of the state in harmony with the principle of priority of appropriation. But nothing of any importance was reached by the legislature of either 1875 or 1877. A bill had been passed to enable counties to take out ditches and tax parties benefited. But nothing was ever done in this line."

In the meantime (1876) the constitution of the state had been adopted. The difficulties encountered in the Greeley area had arisen in other settlements of the territory and the constitution recognized the principle of "first in time, first in right," and specified that the waters of the state were dedicated to the people, subject to regulation and control under state law. There followed a call for an irrigation convention to be held in Denver during the last days of December 1878 to formulate proposed irrigation legislation. Some vigorously opposed any legislation claiming that the rights to the use of water should be worked out through the courts. Concerning an opponent to legislation, David Barnes, Boyd relates:

"He was a fifty-niner. In his gray hair he stood as erect as a palm tree, over six feet high, spare of flesh, but probably weighing two hundred pounds--splendid specimen of well-preserved physical vigor. He undertook to bully the committee and force down our throats his opinion that no legislation on the water question was advisable. The chair told him that we had met to do business, and that if he had any resolution to offer, or motion to make, it would be entertained; but if not, he was out of order, and would have to take his seat, and in case he did not do so an officer would be called. This brought him down. He off and nothing."

Those favoring legislation prevailed. Considerable discussion ensued as to what constituted priority of appropriation. One group contended that the construction of a ditch entitled the owner to use all of the water it could irrigate and that the priority dated from the date that work was commenced in good faith and prosecuted to completion with due diligence. Another group maintained that only an actual application of water to the land effectuated an appropriation, and that not only the use of the water but its application to specific parcels of land under each ditch was necessary to determine priority. No definite conclusions were reached, but a committee of five was appointed to meet in Denver and draft legislation for submission to the legislature. This committee spent a week in its work and presented to the legislature which met in 1879 a proposed bill which provided for:

(1) Division of the state into water districts corresponding to areas irrigable from certain natural streams; (2) The appointment of water commissioners whose duty it was to divide the water from the natural streams according to priority of use as established by a specified record; (3) A plan for securing a record of priority of use, the controversial question as to what constituted such priority being compromised; (4) Regulations for the construction of reservoirs; (5) The appointment of a state engineer; and (6) The gauging of the streams.

One Judge Brownell, who was a member of the committee on irrigation, in the legislature, worked out charges with respect to the procedure for establishment of priorities. The legislation was passed by the legislature. The clause providing for the state engineer and for gauging stations failed of legislative approval.

In the fall of 1879, the Poudre district was the first to move for the appointment of a referee to hear testimony under the new law. Much difficulty was encountered in obtaining information which could be relied upon in establishing water rights under the procedure. Exorbitant claims were made. A few years later, Elwood Mead, Assistant State Engineer in Colorado, reporting on the relation of amount of water decreed and amount used, stated:

"In District number six I was able to gauge twelve out of fifty recorded ditches of Boulder and South Boulder creeks. While gauging the canals of this district, my attention was very forcibly called to a matter to which it seems proper to refer. This is the wide discrepancy which often exists between the decreed and actual carrying capacity of ditches and canals. So great was this in some instances, that the results of the gaugings and the decreed capacity seemed to have no connection with each other. Ditches were met with having decreed capacities of two, three and even five times the volume they are capable of carrying, ever have carried, or will probably ever need. Other ditches in the same district have decrees which fairly represent their actual needs.\* \* \*

"The majority of the decrees of small ditches are based on the testimony of men having no engineering training or experience, and however honest the estimate may have been, it is in the majority of cases, a mistaken one, being almost universally too large. The remedy would seem to be to permit no decrees to be rendered until the state has been represented, and an estimate of the capacity of the ditch made by some competent and disinterested engineer, either the state engineer or some one selected by him."

Although the legislation for the acquisition and regulation of water rights was passed and the reference for the taking of testimony thereunder was made, still the controversy with respect to appropriate procedure was not settled. Those who felt that the courts afforded the exclusive and proper forum to determine and control such rights unaided by the procedure authorized by the 1879 legislation, continued to inject legal obstacles. When application was made for a decree in District Three upon the report of the referee, objection was made that the act

was unconstitutional. This brought about much bitter criticism by those who thought that the matter was settled. In this respect, we must indulge the engineers who so greatly relish a "panning" administered to the bench and bar, by quoting from an article by David Boyd, published in the Greeley Tribune of April 21, 1880. He gave expression to his disgust in no uncertain terms when he wrote:

"So Judge Elliott has decided that the irrigation law is unconstitutional. No doubt he is conscientious in this opinion. But it is the opinion, nevertheless, of a narrow-minded, conservative lawyer who fears to proceed upon any ground not covered by a precedent. It will doubtless greatly delight all that class of lawyers who had been looking ahead to endless fat jobs about to come to them from the wasting and ceaseless litigation likely to arise in reference to the establishment of priority of claims to the use of water. The farmers foresaw the same thing staring them in the face, and have done the best they could to avert it.\* \* \*

"But what are the reasons that Judge Elliott gives as the reason for the unconstitutionality of the law? Well, I have seen the reasons as copied by our lawyer. It is not an opinion of which he need be proud, either as to the clearness of its views or the ability of its arguments. Indeed, it is the thinnest and dimmest statement imaginable upon a subject of the greatest importance to the whole state. It throws a cloud over the face of millions of dollars' worth of invested property. But for the reasons--or, rather, reason, for there appears to be but one offered--it is this: 'That it is unconstitutional to deprive a man of property without due process of law.' But the law was passed for the express purpose of protecting property, not for the purpose of taking it away. It was made for the express purpose of simplifying the process of protecting vested rights. Who but a crotchety lawyer could construe such a bill into a device for taking away property without due process of law? It was an act for the establishment of property rights. But the trouble with it is, that it is a little new in its mode of procedure. It does not follow the usual routine.\* \* \*

"\* \* \* The decree of the court was to fix these titles and put them on record. And any party deeming itself aggrieved by decree of the court could ask for further hearing, give in evidence, and appeal to a higher court. Now all this would appear to the non-legal mind as sufficient guaranty of the rights of individuals or corporations, and the parties interested have accepted the provisions of the bill as the best possible settlement of impending difficulties. Not so, however, the lawyers. To a logical mind not hampered by legal crotchets and antiquated precedents, it seems to me the numerous statutes of limitations, with which our laws now fairly bristle, would appear far more in conflict with the constitutional clause quoted than would any provisions of this law.\* \* \*

"But you say, 'What are we going to do about it?' There appears to be only one course left. This is for all farmers to unite and bring the matter before the Supreme Court of the State, and there have its constitutionality tested. There it must be argued fully, and we must secure the best and most high-minded counsel the State affords. That the ordinary lawyer will fight the measure tooth and nail is to be expected, because, if it is sustained, a good part of his occupation is over in the rural districts; and besides, he will fight it because the movement commenced among the farmers, a class of men who believe very little in patronizing his profession. \* \* \*

"Legal gentlemen, we have laid down a plan with the assistance of one of the clearest headed and broadest minded of your profession. This plan on the whole suits us--at least as many of us as have early vested rights to maintain. We ask you to respect it, or suggest a better. If you only have the ability to pull down, to criticise destructively, you are enemies of the human race and must be superseded by saner and broader minded leaders. \* \* \*

"\* \* \* That Utah is getting into like difficulties is certain. I had a letter, last winter, from a member of its legislature stating that they needed sadly some legislation on the subject. He had heard that we had here done something wisely and well on the subject, and wanted a copy of our bill. But alas! The lawyers have proved that we, too, are at sea without a compass, rudder or telescope. How long, my fellow sufferers, are we to be the playthings of these quibbling lawyers, these men of hide-bound precedents, of regular procedures, of blind conservatism, of narrow routine, of crass stupidity? The toils that bind us must be cut if they cannot be untied."

This was a rather severe indictment. In defense of the legal profession it should be said that many lawyers of the time favored and defended the legislation. Over the years lawyers have played a prominent part in an effort to develop a constructive irrigation code. At this present time lawyers and engineers in Colorado have under consideration revisions designed for improvement of the code and to meet changed conditions.

Before the irrigation act of 1879 came before the supreme court, Judge Elliott denied that he had formally held the law unconstitutional, but stated that it was defective, that the court could not remedy it without stepping into the legislative sphere. And so the matter came before the Supreme Court on the question of the competency of the court to make rules covering the deficiency of the law. The lower court had prescribed what were deemed necessary rules to comply with recognized judicial procedure. The lower court was sustained. The appellate court refused to dictate the rules to be followed by the trial tribunal in such a case.

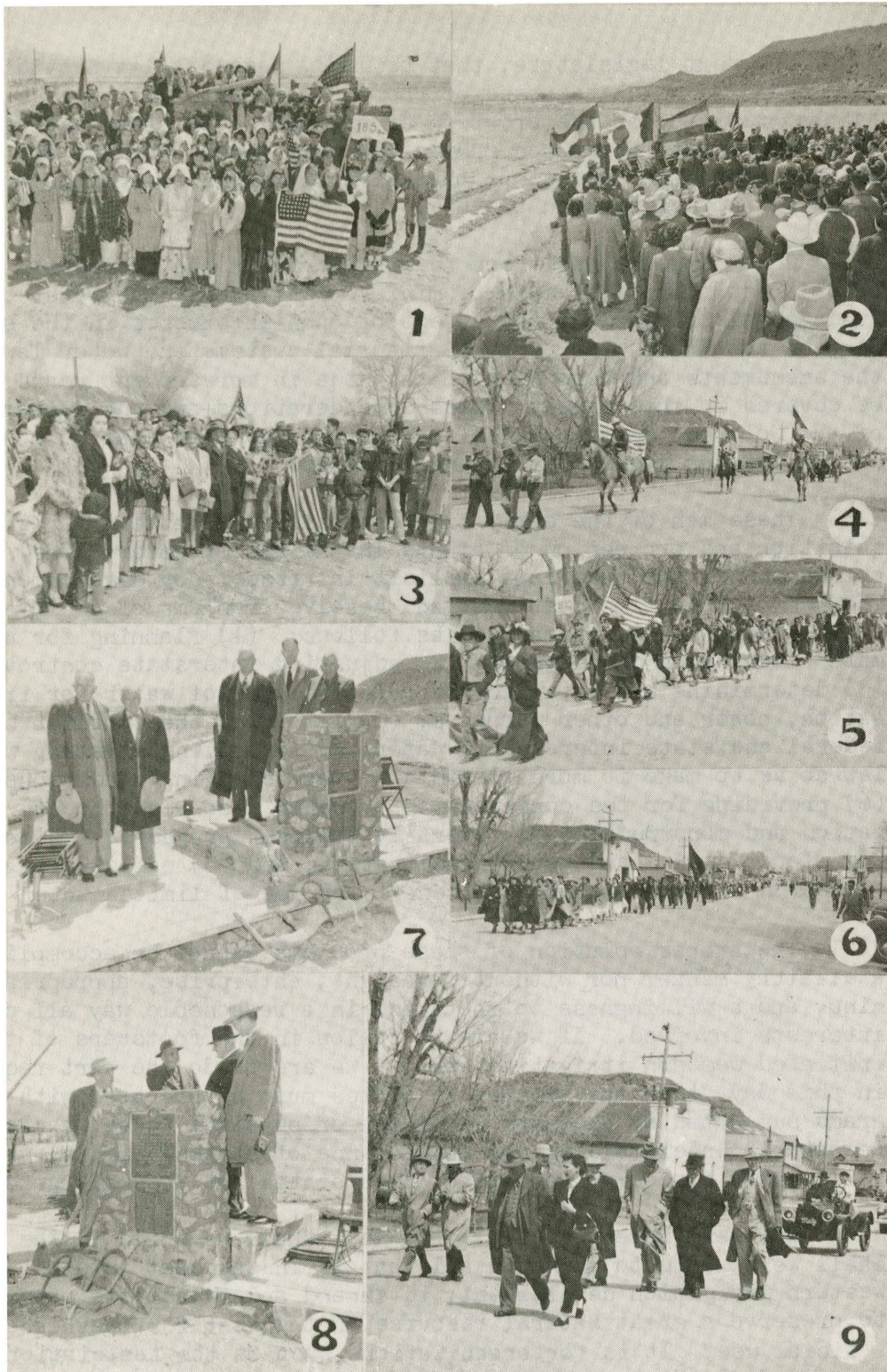
The next legislature, that of 1881, passed a law providing for procedure which disposed of the controversy. This same legislature provided for the creation of the office of state engineer. Other important irrigation provisions were made. Changes and additions have been made since that time out basic provisions are found in the legislation of 1879.

No attempt is made here to analyze fully the irrigation code of Colorado. The influence of mining requirements for water upon fundamental principles, the effect of Spanish customs in the southern part of the State, the early territorial customs and water law and the amendments and expansion of the code in more recent years cannot be covered in this paper. These considerations and the comparison of the Colorado development of irrigation law with that of other western states present an extensive study.

These men of the early time established a pattern for the acquisition and protection of rights in the use of water. They did not encounter the questions implicit in present-day development. The men of this time must meet and resolve problems of a different type. These may be summarized as follows: (1) Planning for ultimate river basin development; (2) adjusting interstate controversies; (3) determining and settling the relative uses of water for irrigation, power and other purposes; (4) resolving the conflict between federal and state interests in water; (5) modifying existing water law so as to make it more flexible to meet changing conditions; (6) providing for the conservation of water resources through investigation and construction of federally financed projects; (7) coordinating flood control and water conservation; and (8) effectuating conservation through the highest beneficial use of limited water supplies.

The proper solution of these problems cannot be accomplished in a dilatory manner nor without foresight, enterprise, appropriate planning, and a willingness to recognize in a reasonable way all of the interests involved. If we are to follow in the footsteps of those who initiated western irrigation, and if we are to do the part required in this day, then the interested states must be prepared with programs supported by adequate knowledge of physical facts, a clear and reasonable understanding and maintenance of states' rights, and a willingness to collaborate with other states and federal agencies.

How well have we built? How well shall we build in the future? Shall we be able to maintain all that is in the best interest of western irrigation development, to expand and adjust the program and to preserve a great natural resource in the west for the highest beneficial use? It is for organizations such as the Association of Western State Engineers, the National Reclamation Association, and the federal and state agencies to answer.



1, 2, 3. Descendents of the pioneers with their friends and neighbors at the dedication of the monument. Flags in background in No. 2 are Colorado, Mexico, Spain, and Old Glory. 4. A string trio serves as a band to lead the parade. 5. Some of the paraders bring their shovels and hoes. 6. Everybody is in the parade. 7. A. J. Hamman, Clifford H. Stone, Charles A. Lory, William E. Morgan and Delfino Salazar, of the Governor's Committee at the Monument. 8. Hamman, Lory and Morgan congratulate Delfino Salazar on his handling of arrangements. 9. Part of the Governor's Committee in the parade.

CENTENNIAL PROGRAM AT SAN LUIS

Thursday, April 10, 1952

10:30 a. m. Pioneers' parade.

11:00 a. m. Dedication of plaque - Mr. James C. Peabody, Director,  
State Historical Society of Colorado, Pueblo.

Dedication of monument and blessing of the waters -  
San Luis People's Ditch - Reverend J. S. Garcia,  
Chaplain, San Rafael Hospital, Trinidad, Colorado.

Lunch at San Luis.

Old Spanish Palota game, Chama, Colorado, vs.  
San Francisco, Colorado.

Display of Spanish antiques and handcraft - College  
auditorium. Display of early agricultural imple-  
ments and old Grist Mill, College and Court House  
grounds - tour of Culebra Valley, its century-old  
farms, Sanchez Reservoir and old San Acacio.

May those who follow us here improve on what we have done.



Left. James C. Peabody presents the Bronze Plaque of the State Historical Society.

Right. The monument is unveiled.

A Brief Historical Review

Delfino Salazar  
San Luis, Colo.

I am very happy to welcome all of you to this Centennial Celebration and the unveiling of this monument. There are two groups here this morning which I especially want to welcome. One is our visitors from outside our community and the other is the group of descendants of the first settlers in this, the oldest town in Colorado.

I would like to review very briefly some of the history of this area which has laid the foundation for this gathering this morning.

In 1601, Onate came this way but left little or no record of his trip. Juan D. Archuleta visited the area in the middle of the 17th century to recapture runaway Indians. Juan Ulibarri took possession of eastern Colorado at El Quartejejo, a point believed to be in Cheyenne County, in 1706, in the name of Don Felipe V of Spain. Antonio De Valverde made a trip from Santa Fe to the site of Salida in 1719. Governor Anza, in 1779, led an expedition against Indians in the San Luis Valley who were raiding Spanish settlements in New Mexico.

Many other Spanish explorers are reported to have visited points in Colorado before any permanent settlement was established. Santa Fe was established in 1605 and this settlement at San Luis de la Culebra was begun 246 years later in 1851. There was ample time for many visitors who left to us no record of their wanderings or their purpose.

In 1803, James Pursell traversed the valley on his trip from Franklin, Illinois, to Santa Fe, New Mexico. He was followed the next year by Baptiste Leland who was sent with an ox train of goods by William Morrison, a merchant of Kaskaskia, Illinois. There were, no doubt, several who came this way and left no record of their origin, their purpose or their destination.

During the fall of 1806, Lieut. Zebulon Pike, in his exploration trip along the Southern borders of the Louisiana Purchase, wandered across the Arkansas river into what was then Spanish and Mexican territory. He arrived late in the season at the junction of the Conejos and Rio Grande where severe weather forced him to spend the winter. Thinking that he was on United States soil he set about building a military post (now known as Pike's Stockade). He had hardly completed it when a Mexican military force appeared and arrested him and his men and took them to Santa Fe, before the Governor who, after an investigation of the case sent them on to Chihuahua, Mexico. After being retained as prisoners for a few months and after further review of the case they were released. Most of their records were confiscated, destroyed or lost.

In 1842, Queen Isabella II of Spain (1833 - 1870) granted Narciso Beaubien, a mere boy, and Stephen L. Lee, a youth, almost a million

acres of land known as the Sangre de Cristo Grant. It included all of the present Costilla County, Colorado and the northern part of Taos County, New Mexico.

The Beaubien and Lee families had previously received large areas of land from the Spanish Crown. Evidently it appeared to be better policy not to give too much to one person. Gifts to members of the same family did not appear to matter. The elder Beaubien was the original grantee of the lands now described as the Maxwell Grant, Maxwell being Beaubien's son-in-law.

On December 27 of the following year (1843) Lee and Beaubien petitioned Manuel Armijo, Civil and Military Governor of New Mexico for approval of said grant of land. The drainage basins of the Costilla, Culebra and Trinchera rivers, including El Ritcs de los Indios and Sangre de Cristo, to their junction with the Rio Grande Del Norte. The petition was ratified on the 30th day of December by Governor Armijo and sent to the Prefect with instructions to give the petitioners possession as requested if no impediment stood in the way.

The Prefect, Juan Andres Archuleta, on January 7, 1844, directed the Justice of the Peace of the area in which the land was situated to place the parties in possession in accordance with the decree of the Civil and Military Governor. Justice Jose Miguel Sanchez accordingly placed Lee and Beaubien in possession of the lands within the boundries described in their petition and vested in them, their children and successors, a fee title to said lands.

The terms of Queen Isabella's Grant were explicit in providing that the lands would be opened to Spanish settlers. War was declared against Mexico by the United States on May 13, 1846, and ended by the treaty of Guadalupe Hidalgo, which was ratified by the United States Senate on May 10, 1848. During much of the war period young Beaubien was in school in St. Louis, Missouri, where he came under the influence of many new friends and acquaintances. When he returned to Taos, New Mexico, his body servant is reported to have spread the story that the lands would be opened to Anglo American settlers. Suspicion of Beaubien's and Lee's intentions led to the murder of both of them, Governor Bent, a District Attorney named Lieh and some others in the Taos revolt of January 19, 1847.

Young Beaubien was only 17 years of age at the time he was killed and dying without issue, his father, Carlos Beaubien, became his heir. The elder Beaubien also acquired the undivided interests of Stephen L. Lee from Joseph Pley, the administrator of the Lee estate.

By the 1848 treaty with Mexico the Rio Grande Del Norte was fixed as the boundary between Mexico and the United States and the Beaubien grant came under the jurisdiction of the United States. The grant was confirmed and approved by the Congress of the United States on June 21, 1860.

Because of Indian hostility special inducements were made to attract settlers, each man was to get a strip of land one hundred varas wide; a

married man and wife to get a strip 200 varas wide across the valley with an additional 100 varas for each child. These parcels of land were described as follows: for a single man one hundred varas wide from east to west (or across the valley) bounded on the east by the land of a neighbor; on the south by a line equi-distance between the Culebra and Costilla rivers; on the west by the land of another neighbor and on the north by a line equi-distance between the Culebra and Trinchera rivers. Thus a parcel of land for a single man was a little less than 100 yards wide (a vara being  $33 \frac{1}{3}$  inches) and 16 to 20 miles long. The measurements were made with a horsehair rope because it would not stretch or shrink when wet. The object in making this type of land divisions was to give each land owner farm land which could be irrigated, grazing land and timber. This has proven to have been a very wise method of allotting land. This is the only community in this area where every farm has land for cultivation, grazing, fuel and timber.

In 1842, Antonio Jose Martiniz, Juan Manuel Salazar, Julian Gallegos and Benancio Jaquez attempted to settle here but the Indians ran them out. The first permanent white settlement was made in 1851 by Faustin Medina, Marienc Pacheco, Ramon Rivera, Juan Manuel Salazar, Benancio Jaquez, Dario Gallegos, Antonio Jose Vallegos, Diego Gallegos, Juan Angel Vigil, Juan Ignacio Jaquez, Jose Gregorio Maríntez, and Jose Hilario Valdez. The underscored names indicate those killed by the Ute Indians in the fall of 1851.

These settlers located at San Luis de la Culebra, now known as San Luis. The name was chosen because most of the settlers were devotees of San Luis Gonzaga, and the settlement was on Culebra (water snake) river. Hence San Luis de la Culebra. When the application for a post office was made in 1852, de la Culebra was eliminated.

The first building was erected about 100 yards east of the present Catholic Church, of adobe walls 24 to 30 inches thick. It was arranged on the placita style, that is several houses were built adjoining each other to form a square with only one entrance. No windows were used in the outside walls which were provided with 4- x 4-inch peep holes. A well was dug in the patio. This style of building was to protect against Indian raids.

Chama, Colorado, and Costilla, New Mexico were established in 1854.

In April, 1854, the first white child was born in Colorado to Mr. and Mrs. Jose Hilario Valdez and named Juan C. Valdez. He lived in San Luis all his life and died there in 1936. Ten days after this child was born the Ute Indians came in from the north and caught the settlement unawares. To save young Juan and his mother they were hidden in near by willows and trees. However, the Utes made off with the 8-year old son of Antonio Jose Vallejos. The settlers gave chase and overtook the raiders about a mile north of San Luis where they were fortunate enough to kill the horse of the Indian carrying the boy and rescued him.

While I have this opportunity I would like to call the attention of our visitors to something which cannot be found any where else in

this area. Before you and to my back is the San Luis Commons or to the local people, The San Luis Vega. It is a grass land area of 633.32 acres. According to the donation decree it is set aside forever as a pasture for use by the people of San Luis, San Pablo, and San Pedro. Its use is limited to horses and cattle. No goats, sheep or swine are permitted. Each head of a family is entitled to turn on four head. This land cannot be taxed, sold or rented.

The original document establishing this Vega was rather ambiguous. A law suit instituted by the Costilla Estates Development Company against S. N. Smith, Delfino Salazar and Francisco Barela, Trustees for the users clarified the status of this land. On January 21, 1916, a decree was rendered which forever sets this area aside for a commons and pasturage.

Among the first community projects undertaken was to dig an irrigation ditch to assure the production of food for the settlers. This ditch flowing here by this monument was put into operation in the early spring of 1851. It was surveyed by digging a small trench with a wooden shovel and letting the water follow. Here by this monument are the remains of an ox yoke and a wooden plow used in its construction. This ditch has been in continuous operation and use for 100 years. Many of us gathered here this morning are descendants of the settlers who built this ditch. We have gathered to unveil and dedicate this monument to commemorate a century of modern irrigation in Colorado.



Father Onofre Mortterell dedicates the monument.  
Delfino Salazar stands by

Presentation of State Historical Society's Plaque

James C. Peabody  
Director, State Historical Society  
Pueblo, Colo.

Friends and Pioneers of Colorado, I am really much flattered and highly pleased to be able to meet with you, on this 100th year of peaceful use of the waters of one of our streams.

We, whose parents, by their foresight, nerve and determination, have made out of this, which was a barren wilderness, a land of peaceful neighbors and loyal citizens, we must never lose sight of the hardships they endured, and remember the only help they received was from each other and the good Lord who watched over them. (My grandfather came to Colorado in 1858.)

Our efforts and our goal must be to keep His land independent, free, and safe from the encroachments of foreign dictators and the selfishness of some few of our citizens.

This plaque is presented to you by the State Historical Society of Colorado, which I represent. May it give an uplift to your community and a strong feeling of friendship between the State Historical Society and all who live hereafter.

Let this monument stand as our tribute to pioneer achievement. May it make us mindful of our rich heritage from the past, our bright opportunities of today, our great obligations to the future. May it inspire succeeding generations with courage for the day's tasks, with aspiration to emulate their most illustrious forebears.

We reverently dedicate this plaque as a memorial to the past, and a pledge to the future.

. . . . .

EXCERPTS FROM ADJUDICATION DECREE granted by the Court in Costilla County  
in 1890 giving Priority No. 1 to The San Luis Peoples Ditch - The oldest  
priority in the State of Colorado April 10, 1852.

\* \* \* \* \*

That said ditches be <sup>and</sup> the same are hereby  
numbered according to the date of their se-  
veral <sup>and</sup> respective constructions <sup>and</sup> said  
dates are hereby determined <sup>and</sup> decreed to  
be as follows:

- No 1 The San Luis Peoples ditch,  
original Construction April 10 '1852  
No 2 The San Pedro ditch,  
original Construction April '852.  
No 3 The Arroyo Madre ditch,  
original Construction 1853,  
No 4 The Hunter ditch  
original Construction August 1853,  
No 5 The Vallegas ditch  
original Construction March 1854  
No 6 The Mansaneros ditch  
original Construction April 1854,  
No 7 The Arroyo Acito ditch  
original Construction April 1855  
No 8 The San Jacinto ditch  
original Construction April 1856  
No 9 The Madriles ditch,  
original Construction April 1856

\* \* \* \* \*

\* \* \* \* \*

And more particularly in regard to said  
vitches respectively, as follows:

No One: The San Luis Peoples Vitch.

That said vitch is entitled to Priority  
No 1.

The Claimants are: Grego Gallegas, Alexan-  
der St Clair, Donaciano Gallegas, Francisco  
Barela, Juan Andres Cruzillo, Rafael Pacheco  
Maria Rosa Vigil, Robert Allen, Jose Carlos  
Valdez, Mariano Pacheco, Mark Nathan,  
Juan Pacheco, Rumbaldo Gallegas, Juan Au-  
stin Baca, Eulogia Gallegas, V. A. Salazar,  
Rafael Sanchez, Eulogia Herrera, Juan  
Martinez, Juanita Herrera, Francisco Valdez,  
Antonio Pacheco, Manuel Vigil, Miguel  
Martinez, Eusebio Vargas, Rumbaldo Martinez,  
Juan Valdez, Donaciano Martinez, Francisco  
Sanchez;

That it is a ditch <sup>and</sup> used for the irri-  
gation of lands, taking its supply of water  
from the Pilebra Creek, that said ditch has a  
feeder, called the Rito Seco feeder, taking  
its supply of water from the Rito Seco Creek

a tributary to the Culobra Creek and the head of said main ditch is located on the right bank of the Culobra River about one mile above the Culobra bridge in the town of San Luis and the head of said feeder is located about four hundred yards below the bridge across the Rio Seco and about 1500 yards from the confluence with the River Culobra; said ditch is  $8\frac{1}{4}$  feet wide at the bottom,  $8\frac{3}{4}$  feet wide at the top, depth of water and flow 1,066 feet, grade 11 feet per mile and carrying capacity 21,96 cubic feet per second and the feeder to said ditch is 6 feet wide at the bottom, depth three feet, grade  $12\frac{1}{2}$  feet per mile, that the total number of acres of cultivated lands and meadows subject to irrigation from said Ditch and its feeder is computed at 900 acres.

And it is hereby adjudged and decreed, that there be allowed to flow into said ditch for the use aforesaid and for the benefit of the parties lawfully entitled thereto and by virtue of appropriation by construction and priority No. 1, from said Culobra Creek 21 cubic feet of water per second of time and into its feeder from said Rio Seco Creek 2 cubic feet of water per second of time.

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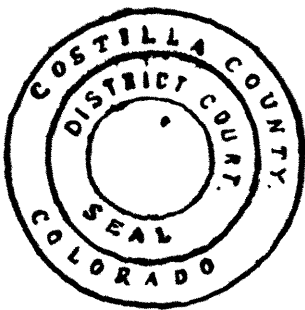
(signed) Geo. P. Summer  
Judge.

State of Colorado } ss.  
County of Costilla }

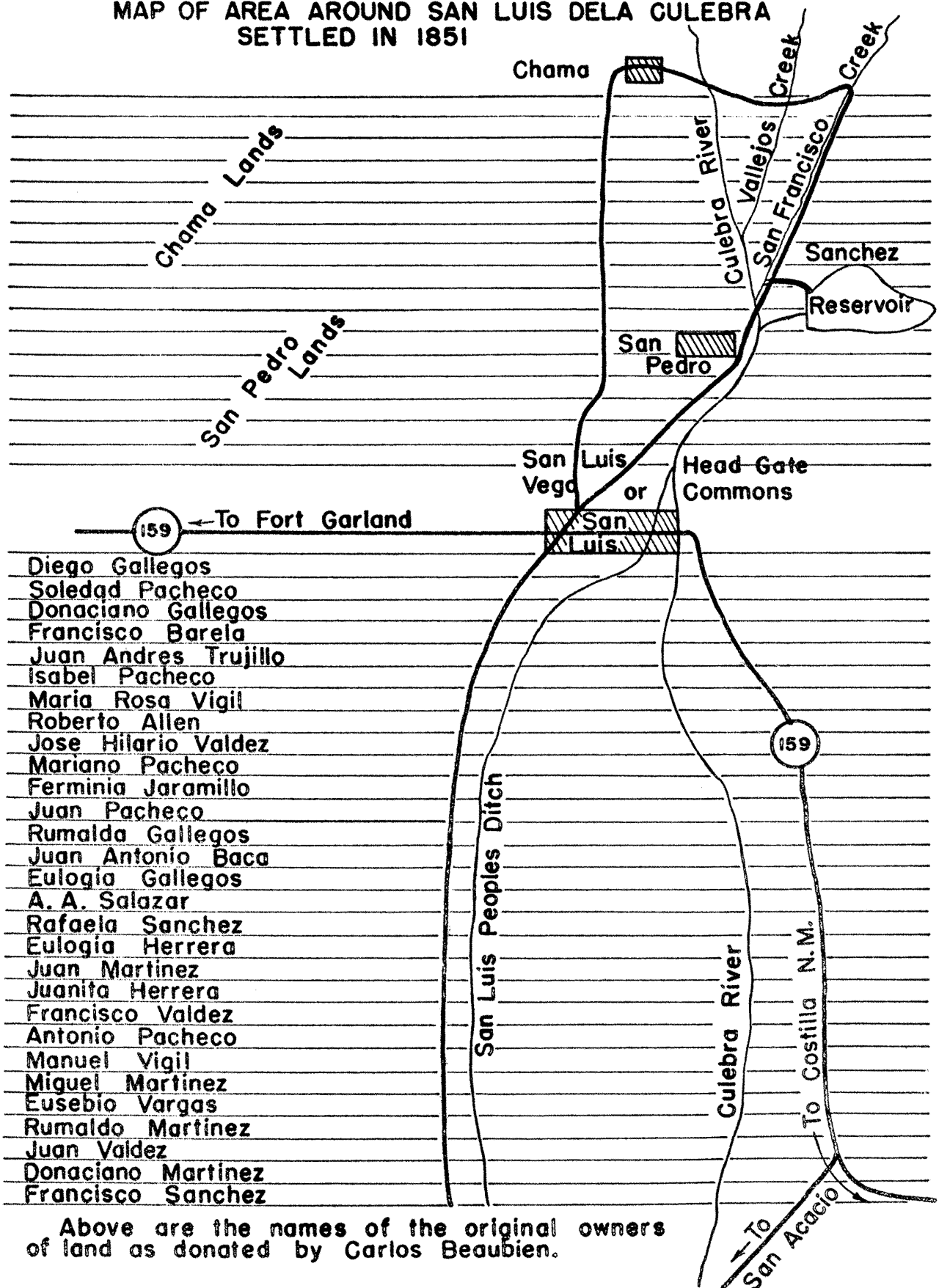
I, Charles John, Clerk of the District  
Court within and for the County, in the State  
aforesaid, do hereby certify, the above and  
foregoing to be a true, correct and com-  
plete copy of a certain decree, adjudicating  
the priority rights for irrigation in water

District No 24 of the State of Colorado.  
Witness my hand and the seal of said  
Court at San Luis, Colorado, this 31<sup>st</sup>  
day of January, 1890.

Charles John  
Clerk.



MAP OF AREA AROUND SAN LUIS DELA CULEBRA  
SETTLED IN 1851



1852

1952

**COMIDA  
DINNER**

**POLLO CON ARROZ  
FRIED CHICKEN WITH SPANISH RICE  
PAPAS  
POTATOES**

**CHICHAROS, GARBANSOS, EJOTES, FRIJOL.  
PEAS, CHICK—PEAS, STRING BEANS, BEANS  
ENSALADA DE VEGETALES      SALSA DE CHILE  
VEGETABLE SALAD      GREEN CHILE SAUCE  
BUNUELOS      JALEA  
A BUN FRIED IN DEEP FAT.      JELLY  
PANOCHA CON CREMA      CAFE  
WHEAT PUDDING WITH CREAM      COFFEE**

**THIS MEAL IS BEING SERVED AT THE OLD  
A. A. SALAZAR RESIDENCE.**

*By Sr. Delfino Salazar*

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