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ANNUAL REPORT

—OF—

*The Arizona  
Resources Board*

—TO—

*The Governor*



DECEMBER 31st, 1920

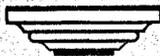
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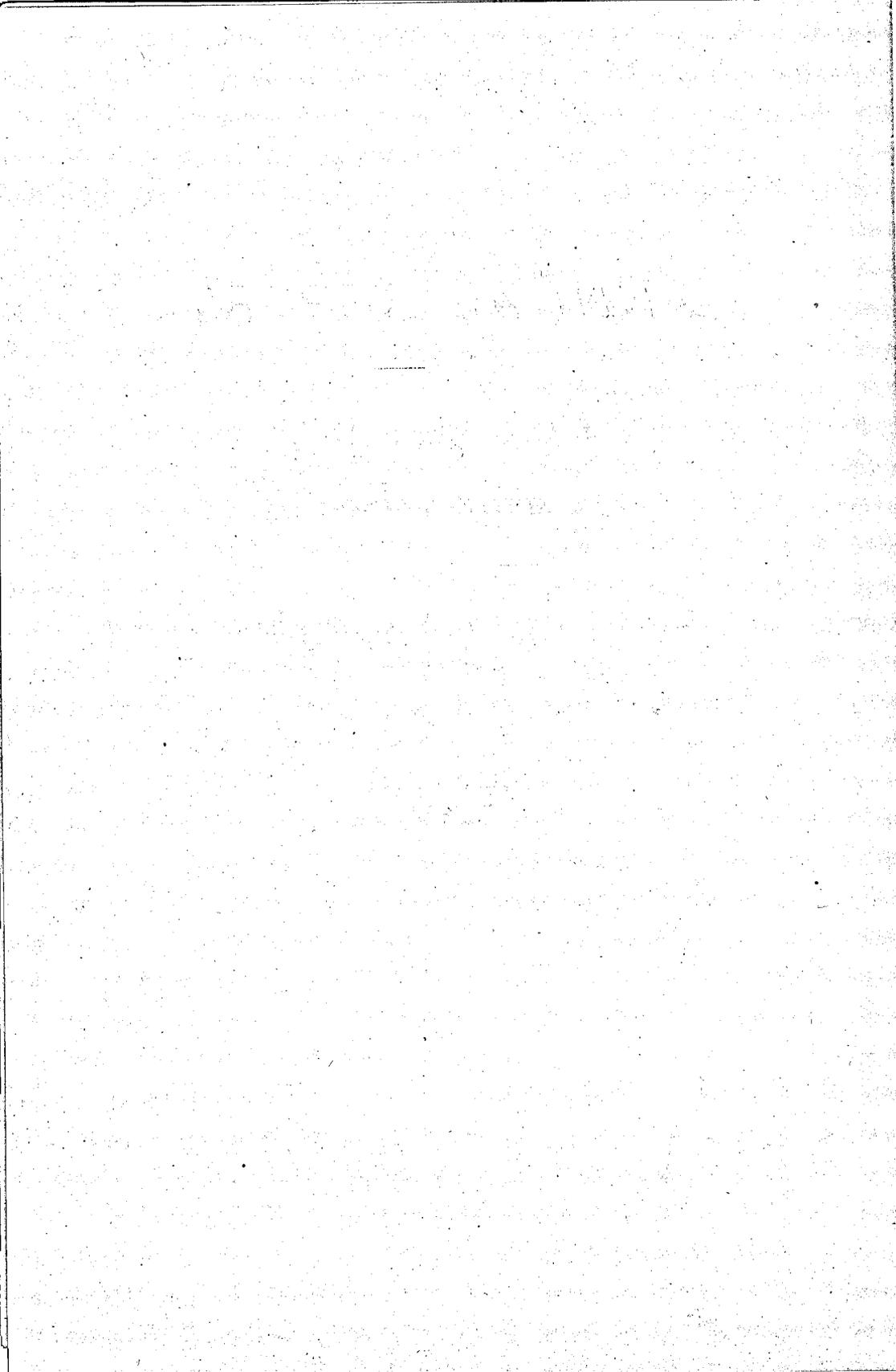
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STAR JOB PRINT—TUCSON



Phoenix, Arizona, December 31, 1920.

HON. THOMAS E. CAMPBELL, Governor,  
Capitol Building,  
Phoenix.

SIR:

Chapter 84 of the Laws of the Fourth Legislature (approved March 17, 1919) creating the Arizona Resources Board, provided for the appointment of five members thereof by the Governor, and for the employment of a Secretary and "such additional clerical, legal and engineering assistants, and such experts in water development and utilization and constructors of experience and eminence" as the Board should deem necessary or proper.

Section 4 of the Act mentioned prescribes in general terms the duties of the Board:

"The Board and the members thereof shall study, investigate and gather information and data upon and prepare and devise means and comprehensive plans for the development, conservation, control, regulation and utilization of all waterways, water sheds, water and water resources, in the State of Arizona, and of all matters and subjects related thereto, including therein, among other things, the related subjects of irrigation, drainage, regulation of flow, flood control; utilization of water power and prevention of soil waste; storage, conservation and development of water for agricultural, mining, stock raising, industrial, municipal, domestic and each and every useful purpose; and to recommend from time to time such regulations as shall be by them deemed necessary, proper or requisite to safeguard, promote and protect the rights and interests of the State and the inhabitants thereof.

"The said Board are further authorized and empowered to cooperate with the United States Water Ways Commission, created by Section 18 of the River and Harbor Bill of 1917, approved by the President August 8, 1917, as well as with any other board, agency, corporation, association or person in the carrying out and exercise of all or any of the powers and duties hereby vested in or imposed upon said Board."

The Governor, in due course, appointed to be members of this Board, Mr. Joseph H. Kibbey, of Phoenix; Mr. Andrew P. Martin, of Tucson; Mr. John R. Hulet, of Holbrook; Mr. J. R. Welker, of Safford, and Mr. F. L. Ewing, of Yuma. The law requiring that the Governor should designate the Chairman of the Board, he named Judge Kibbey to be Chairman.

The Board was organized at Phoenix on July 29, 1919, all members except Mr. Ewing being present. Mr. Martin was elected Vice Chairman, and Mr. Sims Ely, of Phoenix, was elected Secretary of the Board.

The same Legislature enacted a law (Chapter 164: The State Water Code Act) which went into effect March 26, 1919, and provides, among other things, for the appointment of a State Water Commissioner.

By the terms of this latter Act, some of the duties which had been prescribed for the Resources Board were given to the Water Commissioner, this Act giving to the State Commissioner "control over dams, gates and weirs, empowering him to measure the flow of streams and investigate water resources," etc., etc.

The same Legislature (Chapter 150, which went into effect March 26, 1919) enacted a law appropriating the sum of \$100,000 to aid the United States Reclamation Service in making a survey of feasible irrigation projects, and authorizing the execution of contracts by the State of Arizona with the United States Reclamation Service for such work.

At the first meeting of the Resources Board, the provisions of these two later Acts were considered, and the members were unanimously of the opinion that the duties of the Board had been so restricted by these two enactments that it was necessary to give careful consideration to the question of making the Resources Board of real value to the State.

It was obvious that the annual appropriation of \$10,000 which had been made by the Legislature for the purposes of the Board, was insufficient in amount to cover any surveys or engineering investigations in any detail. No surveys were undertaken, therefore; and expenditures have been confined to the strictly necessary expenses of the Board. The total disbursements for the fiscal year ended June 30, 1920, were \$5,420.22; a balance of \$4,579.78 remaining unused.

Considering the fact that the Federal reclamation law had become practically a dead letter—that is, that for some years no funds in any substantial amount had been made available for the construction of water storage or other reclamation work; that some twenty projects heretofore begun by the Federal Government had been idle for many years, and no new projects were under consideration by the Federal Government, the members of the Board reached the conclusion that perhaps the most important function which the Resources Board could perform during the ensuing year or two would be to exert all the influence possible toward the revival of interest in the country generally and especially throughout the western states in a movement for the enactment of such additional legislation at Washington as would assure, not only the completion of the reclamation projects heretofore commenced, but the construction of numerous new projects,—in other words, a revival of national reclamation on a comprehensive scale.

Under instructions from the Board, the Secretary conferred with the Governor, who warmly approved the plan of making this Board an agency through which the people and the State of Arizona could function for the purposes just mentioned.

Governor Campbell thereupon entered into correspondence with other western Governors with the object of securing co-operation of all the western states in a movement for new reclamation legislation at Washington.

In due course, Governor D. W. Davis, of Idaho, issued a call for a conference of delegates to be appointed by the Governors of the western states, this conference or convention to be held at Salt Lake City, Utah, in November, 1919. Six delegates to represent Arizona at this conference were appointed by Governor Campbell, the Secretary of this Board being one of the number, and all were in attendance at the conference.

Thirteen states (all that had been invited to send delegates) were represented, some hundred and seventy delegates being in attendance.

The discussions and deliberations of the conference resulted in the organization of the Western States Reclamation Association, the working body of the organization comprising a President, a Secretary, a Treasurer, and an Executive Committee of thirteen (one member from each of the thirteen states represented). Governor Davis was elected President of the Association, Mr. Frank W. Brown, of Boise, Idaho, was elected Secretary, and Mr. W. W. Armstrong, a banker of Salt Lake City, was elected Treasurer. Mr. Ely, the Secretary of this Board, was elected to serve on the Executive Committee as the member for Arizona.

The conference unanimously adopted a resolution requesting the Congress of the United States to appropriate the sum of \$250,000,000, to be used by the Secretary of the Interior, through the Reclamation Service, in the completion of all the unfinished projects (the cost of which had been estimated at approximately \$120,000,000), and for the construction of such new projects as should be approved by the Secretary of the Interior, the money so appropriated to form a "revolving fund" for reclamation purposes,—that is, the money expended by the Federal Government on each reclamation project to be repaid in due course under the terms of the existing reclamation law.

At this conference it was also arranged that the Executive Committee just created and as many western Governors as could find it convenient to make the trip, should proceed to Washington in the following January for the purpose of urging upon Congress the adoption of the Association program.

Early in January the Governors of Arizona, New Mexico, Utah, Idaho, Colorado and Washington, and special representatives of the Governors of Nevada, California and Montana, and all of the members of the Executive Committee of the Western States Reclamation Association met at Denver and proceeded to Washington.

During a week of conferences at Washington with Senators and Representatives from the western states, and with sundry committees of the two houses of Congress, very substantial progress was made in reviving interest in national reclamation. During the first day or two of these conferences, a pessimistic spirit was encountered on every hand. The visitors from the West were told that it had been so long since there had been any discussion of reclamation matters that interest in the whole subject was at zero; moreover, that the condition of the Federal treasury forbade any appropriation for reclamation purposes. This spirit was almost wholly transformed, however, before the conferences were ended. Special hearings were accorded to the delegation by the Committees on Irrigation and on Public Lands. For the first time in history (it was stated) the "Steering Committee" of the Senate gave a public hearing, and for the first time in many years there was a meeting of the full Committee on Ways and Means of the House of Representatives—at all of these meetings Governor Campbell and Governor Davis, supported by other members of the delegation, making strong pleas on behalf of the West. Many Senators and Representatives from the western states expressed themselves as delighted with the progress which had been made by the delegation, and while they deemed it impracticable to press for the enactment of reclamation legislation at that session of Congress, they advised the delegation to keep representatives of the Association at

Washington during the remainder of the session, and they predicted the enactment of the desired legislation during the period of the following Congress.

The delegation did not confine its attention to the members of the Senate and House of Representatives. Conferences were held with the Secretary of the Interior and with the officials of the Reclamation Service, and a spirit of cordial co-operation was developed.

Former Governor William Spry, of Utah, was appointed Executive Secretary of the Association, with instructions to remain at Washington during the remainder of that session of Congress for the purpose of keeping alive the splendid interest in reclamation which the delegation had aroused.

During and after this visit of the delegation to Washington, sundry bills, expressive of the varying views of western Senators and Representatives concerning the form which reclamation legislation should take, were introduced in Congress. The Secretary of this Board kept in close touch with the progress of these bills, and in conference by correspondence with President Davis of the Association, and with Executive Secretary Spry, made suggestions from time to time. Before the adjournment of that session of Congress (June, 1920) the western Senators and Representatives had nearly all united in support of a measure which has become generally known as the Smith-Fletcher bill, a bill introduced in the House of Representatives by Mr. Smith of Idaho, and in the Senate by Mr. Fletcher of Florida.

This measure proposes, in brief, an appropriation of \$350,000,000 for the reclamation of arid lands and the drainage and reclamation of southern swamp lands, etc., the disbursement to be spread over a period of ten years; not less than \$20,000,000 nor more than \$50,000,000 to be expended in any one year, by the Secretary of the Interior, through the Reclamation Service—the whole to be a permanent revolving fund for reclamation purposes.

The Director of the Reclamation Service has estimated that he can use approximately probably \$20,000,000 a year in construction. The Secretary of the Interior has estimated that from ten to fifteen million of dollars annually will go into the reclamation fund from Federal coal and oil leases, and if this estimate proves correct, the direct outlay from the Federal treasury will not be burdensome. For this reason it is believed there is an excellent prospect for the passage of a measure embodying the principles of the Smith-Fletcher bill at the coming extra session of Congress which it is understood will be called to meet about March 15th, next.

Other activities of this Board, through its Secretary, have comprised attendance at several important conferences called to consider questions relating to reclamation and the compiling from all available sources of reliable information concerning reclamation projects in Arizona which would be practicable under the hoped-for renewal of construction by the Federal Government.

In April, 1920, a convention of the League of the Southwest, attended by hundreds of delegates, was held at Los Angeles. Governor Campbell and the Secretary of this Board, with a large delegation from Arizona, attended this convention. The aims of the League of the Southwest primarily are to secure the fullest possible development of the water resources of the Colorado River Basin.

The potential value to Arizona of the storage and fair distribution of the flood waters of the Colorado River is so enormous that the Los Angeles convention had special importance for this State.

Engineers, eminent in their profession, presented to the convention their views and recommendations relative to storage on the Colorado and, largely because of their recommendations, the convention adopted a resolution approving the so-called Boulder Canyon reservoir site for water for the irrigation of lands in Arizona and California, and requesting Congress to make the necessary appropriation for an adequate engineering investigation of the Boulder Canyon project.

The convention unanimously elected Governor Campbell to be President of the League of the Southwest.

On August 2, 1920, Congress having enacted a measure known as the Kinkaid bill which provided, among other things, for an investigation of the Boulder Canyon site by the Reclamation Service, a conference called by Director Davis of the Reclamation Service was held at San Diego, which was largely attended by representative citizens from Arizona and southern California, particularly the Imperial Valley. The Secretary of this Board attended the San Diego meeting, and expressed to the gathering, on behalf of this State, the wish and intention of Arizona to see to it that the construction of storage works at the Boulder Canyon site or elsewhere on the Colorado River for the benefit of the states of Arizona and California must carry with it the distribution to Arizona of her full share of the stored waters.

The fact that the enlargement of the irrigated area in Mexico from the waters of the Colorado goes on constantly with the assumed initiation of new water rights which must be recognized on the American side of the international line in connection with any storage on the Colorado River in this country, led to strong expressions in the meeting in favor of some limitation of Mexican rights. The Secretary of this Board stated to the meeting that there was a strong feeling in Arizona in favor of the doctrine of "American water for American lands"—an expression which evoked the hearty approval of the people assembled.

No formal action was taken by the meeting—Director Davis, who presided, having explained that he had called the meeting as a preliminary step in his investigations under the Kinkaid bill in order to ascertain the views of the people of the two states affected—Arizona and California.

On August 20-21, the Executive Committee of the Western States Reclamation Association met at Boise, Idaho, the Secretary of this Board attending as the member for Arizona.

Referring to the fact that at Washington, in January, it had been decided that special efforts should be made to secure an endorsement in the national platforms of the Republican and Democratic parties of the aims of the Western States Reclamation Association, Mr. Ely informed the Committee that Governor Campbell had attended the Republican National Convention at Chicago for the express purpose of assuring the desired action by the Convention, and had succeeded in getting a strong endorsement of national reclamation in the Republican platform, which was adopted by the Convention. He also informed the Committee that Governor Campbell had taken up with sundry Democratic governors of the West the matter of securing a like endorsement of national reclamation by the Democratic National

Convention at San Francisco, and all were familiar with the fact that satisfactory planks endorsing reclamation were now in each party platform.

Mr. Ely also informed the Committee that, having conferred with Governor Campbell relative to the advisability of eliciting an expression from Senator Harding, the Republican candidate for President, in favor of the aims of the Association, the Governor had instructed him to take up with Senator Harding and the Republican National Committee the suggestion that there should be a gathering of governors at Senator Harding's home for the purpose of enabling the Senator to state his attitude towards reclamation,—and that Senator Harding and the National Committee had heartily approved the idea, and that the proposed meeting would be held at Marion, Ohio, on August 29th.

Proceeding from Boise to Denver, the Secretary of this Board attended at Denver, August 24-27, a meeting of the Executive Committee of the League of the Southwest, which was attended by the Governors of Arizona, Utah and Colorado, and special representatives of the Governors of California, Nevada, Wyoming and New Mexico—the states drained by the Colorado River. At this meeting there was a very frank and full discussion of the conflicting interests of the Colorado Basin states, and plans were worked out for harmonizing these interests, preliminary to the adoption of a program for the complete development of the water resources of the Colorado and its principal tributaries.

Following the Denver meeting, Governor Campbell and Mr. Ely proceeded to Marion, Ohio (at their own personal expense, of course) to attend the "Governors' Day Meeting" which they had brought about. At that meeting, attended by some seventeen governors, Senator Harding made his famous address in which he stated his unqualified approval of national reclamation as a policy to be adopted by the Government if he should be elected President and could bring about the necessary legislation.

At Salt Lake City, on December 10-11, 1920, there was a meeting of the Executive Committee of the Western States Reclamation Association, at which Mr. Ely was present, and at which all the states in the Association except Texas and Colorado were represented. Governor Davis, the President of the Association, presiding, a report was presented by former Governor Spry, the Executive Secretary of the Association, covering his activities in Washington, whence he had just come to attend this meeting. Governor Spry was of the opinion that there was no probability of the passage of the Smith-Fletcher bill at the present session of Congress, but he was very optimistic as to prospects at the contemplated extra session of Congress.

Several delegates from the Northwestern Reclamation Association (which had been organized at Seattle, Washington, in the previous September) were present for the purpose of extending to the Western States Reclamation Association the cordial co-operation of the northwestern organization, and to urge upon this meeting the adoption of a budget which should provide for adequate representation of western reclamation interests at Washington during the present term and succeeding extra session of Congress. They were in agreement with Governor Spry as to the impracticability of legislation at this session, and supported his suggestion that it was advisable that the Western States Reclamation Association, the League of the Southwest and the Northwestern Association should have representatives at Washington during the remainder of the present session of Congress, following the holiday recess, and during the extra session,—pointing out that if

was the opinion of many western Senators and Representatives that much good could be accomplished before the end of this session by conferring with Senators and Representatives from the West on the form of legislation to be pressed at the extra session.

These views were adopted by the meeting, but the proposed budget of \$100,000 suggested by the gentlemen from the Northwestern Association was scaled down to \$62,000, varying sums being assigned to the thirteen states within the Association as their quota of the proposed budget to be raised. These allotments to the several states were as follows:

Washington .....	\$5,653.66
Oregon .....	4,500.00
Idaho .....	7,369.52
Montana .....	2,305.44
Nebraska .....	1,000.00
Utah .....	9,000.00
Colorado .....	6,000.00
Arizona .....	4,482.00
New Mexico .....	2,100.00
Texas .....	4,168.00
California .....	9,000.00
Nevada .....	1,700.00

It had been the idea of the proponents of the budget that the suggested sums should be raised in the several states by popular subscription, but Mr. Ely stated that in view of the depressed financial conditions in Arizona it would be impracticable, in his judgment, to raise any money in this State by that method for the purposes of the Association. This statement brought similar responses from the states of Utah, Idaho, New Mexico and Wyoming, and Governor Davis stated that it was his intention to recommend to the Legislature of his state that an appropriation to meet the Idaho quota of the budget be made. Governor Spry stated that the same action would be taken in Utah, and the representatives of Wyoming and New Mexico stated they believed the governors of their respective states would recommend the proper appropriations, and that their Legislatures would act favorably thereon. Mr. Ely stated he believed the Governor of Arizona would make the same recommendation to the Legislature of this State, and expressed it as his opinion that the fairest method of raising such a fund was by legislative appropriation, and thus avoid, as is usually the case, the laying of the burden of raising such a fund upon a comparatively small number of public-spirited citizens.

The proposed budget is not for the payment of any salary beyond the salary of the chairman of the committee which is to have headquarters at Washington (\$5,000 a year and expenses), nor for "lobby expenses" nor junkets, but it does contemplate very considerable expenses for carefully considered publicity and the payment of the actual expenses of a "legislative and educational committee" representing the Western States Reclamation Association, the League of the Southwest and the Northwestern Reclamation Association,—the creation of such a committee having been decided upon at this meeting.

All the expressions from the members and visitors present were to the effect that it had been their experience that, exclusive of transportation expense from the time of their leaving home until their return, it had been found that their necessary outlays in attending to business at Washington had amounted to \$20 per day.

The report of a special committee which had been appointed to consider the whole subject was therefore adopted, providing for the appointment by President Davis of a "legislative and educational committee" of five members to represent the organizations just mentioned and to have headquarters at Washington and to remain there so long as, in their judgment, actual progress could be made in securing the proposed legislation, and providing for the payment of the expenses of the members of this committee, as above mentioned.

Governor Davis appointed as the Legislative and Educational Committee, former Governor Spry of Utah (he to be Chairman), Mr. Sims Ely of Arizona to represent the League of the Southwest (in accordance with the previously expressed wish of Governor Campbell), as well as the Western States Reclamation Association; Mr. E. F. Blaine of the state of Washington, Mr. Fred L. Lucas of Colorado, who is the executive member of the Association for Colorado, and Mr. Edward P. McDermott of Nebraska, to represent the American Legion.

In addition to the foregoing activities of the Secretary of this Board, he has attended irrigator meetings at Florence, Arizona, in support of the San Carlos project; at St. David, Arizona, in support of the Charleston project; at Parker, Arizona, in support of the Parker project, and sundry meetings of committees and citizens at Phoenix, to consider irrigation matters, as well as all meetings of the Resources Board.

According to the official returns to the State Board of Equalization, there are 462,565 acres under irrigation or "under ditch" and available for irrigation, in Arizona. The assessed valuation of this acreage is \$68,355,382, plus \$4,502,538 for the improvements thereon. The area of this irrigated acreage in the several counties is as follows:

County	No. of Acres	Total Valuation
Apache .....	6,863	\$ 296,112.00
Cochise .....	3,430,355	184,575.00
Coconino .....	1,254,001	1,825,247.81
Gila .....	4,692,4648	95,449.00
Graham .....	26,851	3,174,576.00
Greenlee .....	4,559	364,902.00
Maricopa .....	284,635	52,045,540.00
Mohave .....	383.50	15,685.00
Navajo .....	3,315	172,241.00
Pima .....	29,037.8	1,774,065.00
Pinal .....	42,752	3,099,238.00
Santa Cruz .....	3,758.50	337,775.00
Yavapai.....	9,842	785,062.00
Yuma .....	42,455.64	5,448,126.00

The total area of arable land in Arizona approximates thirty million acres, but inasmuch as farm land in Arizona has little value unless it can be irrigated, the total acreage which may ultimately be brought under cultivation in this State is mainly dependent upon the potential supply of water for irrigation.

Two national irrigation projects,—the Salt River and the Yuma,—have been constructed by the U. S. Reclamation Service in Arizona, and the unqualified practical success of these projects and the enormous wealth created thereby (as indicated by the assessed valuation of irrigated lands in Maricopa and Yuma Counties in the foregoing table) make it certain that other projects will be urged upon the attention of the Federal Government when it shall be in a position to resume construction.

Chief among the projected enterprises of known merit are the San Carlos, the Parker, the Navajo and the Charleston projects, and storage on the Colorado River at Boulder canyon or Black canyon.

The San Carlos project, which has been under discussion since the very beginning of national reclamation, has a twofold importance because of the great area of land which would be irrigated therefrom in Pinal County, and because of the importance of this project as a factor in the problem of controlling the Colorado River floods.

Exhaustive investigations of this project have been made by the Federal Government. One of these was by a board of United States Army engineers in 1913 and 1914, and another by the United States Indian Service in 1915. Another investigation by the United States Reclamation Service has been under way during the past year and will be completed in the near future,—this latter investigation being mainly for the purpose of re-checking the data heretofore obtained and to arrive at correct estimates of cost under existing conditions.

Situated on the Gila River, some sixty miles above the town of Florence (the county seat of Pinal County), the San Carlos reservoir site offers special attractions for the storage of water in large volume. The dam site, a narrow gorge with bedrock but twenty feet below the stream bed, is ideal. A dam 180 feet in height would give a storage capacity of approximately 710,000 acre feet; at a height of 200 feet, the acre feet capacity is estimated at 1,335,000, and a height of 250 feet would, it is estimated, give a capacity of 1,850,000 acre feet. The height of dam to be decided upon will, of course, be contingent upon the final estimates of cost for the several possible heights mentioned and upon the volume of water available for storage which the Reclamation Service may deem dependable. It is considered unquestioned, however, that there is water available for the constant irrigation of at least 100,000 acres of land, and in all probability a considerably larger acreage can be cared for.

The total area now under cultivation in the Florence-Casa Grande Valley from the Gila River, by diversion at a point some fifteen miles east of Florence, is approximately 25,000 acres. The soil and climatic conditions in this valley are ideal, and the financial success of the project following its construction can not be doubted.

While the construction of the San Carlos reservoir would create an agricultural empire in Pinal County, and is a commendable project from every standpoint, it would have some bearing on the question of controlling the destructive floods of the upper Gila.

One of the most important tributaries of the Colorado, the Gila River has a flood problem of its own. One of the oldest irrigation districts in the State is the valley of the upper Gila, in Graham County, the lands there being under irrigation from canals supplied by diversion weirs. During the last fifteen years approximately 10,000 acres of the most valuable farming land have been cut away and destroyed by floods in the Gila. The value of the land thus destroyed was at least \$2,000,000. Nor is this destruction at an end. Every year the "cutting edge" of the river continues its destructive work.

Under instructions from the Secretary of the Interior, Engineer F. H. Olmstead made a very thorough investigation of the problem of controlling the floods of the upper Gila, and prepared and submitted in 1918 a report of inestimable value. In brief, he found that by constructing a series of retarding dams on the upper reaches of the river and on its more important tributaries, at a total cost of approximately \$6,000,000, the floods could be held back, and, in many localities, thrown into the ground, thus to be returned to the stream bed by the regular process of seepage. The Olmstead plan will undoubtedly have the careful consideration of the Government under the proposed revival of national reclamation.

In Navajo County, the people of Winslow and vicinity have earnestly brought to the attention of this Board, during the past year, the merits of the Navajo reservoir project for the proposed storage of waters of the Little Colorado River. They have estimated that from fifty to one hundred thousand acres could be irrigated by the construction of that reservoir. They were particularly interested in securing the co-operation of the Board in making the proposed site available as a public project instead of a private enterprise.

It appeared that in 1911 this project had been surveyed and filings made by a Mr. McMillan, who in due course presented his maps to the Secretary of the Interior for approval. Subsequently he transferred his rights to the Atlantic & Pacific Railroad Company, the owner of a large proportion of the acreage under the proposed reservoir. The Secretary of this Board ascertained that the McMillan application had never been approved by the Department of the Interior but was just then (June, 1920) up for approval. He telegraphed to the Commissioner of the General Land Office, and requested that all action on the application be deferred until the people of Winslow could be heard; and explained that they would in due course request that the application of the railroad company be rejected, and that the reservoir site be withheld from entry with a view to its use as a Federal reclamation project. The Secretary also telegraphed to Congressman Hayden, who promptly gave his assistance in the matter, and no further action has been taken by the Commissioner.

While ordinarily the Resources Board would not feel warranted in interfering in any controversy between private interests and a public enterprise, it was felt that the action taken in this instance was justifiable because of the fact that the McMillan entry had been made nine years previously and apparently no steps towards the furtherance of the project had been taken. At the request of this Board and of Congressman Hayden, the U. S. Reclamation Service began a preliminary reconnaissance of the Navajo project in September of this year. The results of this preliminary investigation have not been made public.

The Parker project, which calls for a diversion dam across the Colorado River at a point about three miles above the town of Parker, comprises approximately 100,000 acres. Practically all of this acreage is within the Colorado River Indian Reservation.

A complete investigation of the project by the Bureau of Indian Affairs was under way during the years 1919 and 1920, and the report of the engineers to be transmitted to Congress had not been made public at the beginning of this December. It is known, however, that the engineers unqualifiedly commended the project from an engineering standpoint and desirable from a financial viewpoint, the total cost being estimated at approximately \$6,000,000.

It is estimated that to supply all of the Indians on the reservation and who may be hereafter located thereon, some 14,000 acres of irrigated land will be necessary. The larger proportion of this 14,000 acres is already under irrigation from a very complete pumping plant at Parker, which has been installed under the supervision of the Bureau of Indian Affairs.

A very considerable portion of this irrigated acreage is not now used by Indians but is under lease to white farmers.

Last spring, during a visit to Arizona by the Committee on Indian Affairs of the House of Representatives, a hearing was held by the Committee at Parker covering nearly all aspects of this proposed project. The Secretary of this Board attended this hearing. Governor Campbell was also in attendance, as well as Congressman Hayden. The report of the Committee not yet made public will, it is believed, strongly recommend the construction of the Parker project under the proposed plan of allotting to the Indians 14,000 acres, adequately irrigated, and throwing open to settlers—our soldiers of the great war to have preference—approximately 90,000 acres.

Whether the Committee on Indian Affairs will recommend a direct appropriation for the construction of this project, or its inclusion as one of the projects to be constructed under the new reclamation legislation proposed, is a matter not yet determined.

One of the older agricultural districts of the State is within the proposed Charleston, or San Pedro River project. For many years a very considerable acreage has been under cultivation at and near the village of St. David and also near the town of Benson, in Cochise County, partial but wholly inadequate irrigation being achieved through diversion of the water from the San Pedro River and from artesian wells.

The San Pedro River, which arises in Mexico and empties into the Gila at Winkelman, has a watershed of approximately 1200 square miles above the Charleston reservoir site, which is some miles south of St. David. It is a torrential stream and at times carries very considerable floods.

It is proposed to construct an impounding dam near the old townsite of Charleston, which would furnish a storage capacity of 100,000 acre feet. The total area of irrigable land within the project is estimated at 30,000 acres, the land lying at an elevation of 3,500 feet above seal level, and it is believed that the flood waters of the river stored as proposed would furnish water for the adequate irrigation of the entire 30,000 acres.

The owners of the land within the project have organized an irrigation district under the laws of Arizona, and have employed an engineer (Mr. W. R. Elliott of Phoenix) to make a complete investigation of the project.

No close estimate of its cost has yet been made. One of the elements of cost will be the relocation of approximately ten miles of the line of the El Paso & Southwestern Railway, which passes through the reservoir site.

It would be difficult to estimate, from the Arizona viewpoint, the importance of storing the flood waters of the Colorado River.

Just below the Grand Canyon there are two reservoir sites known, respectively, as the Boulder Canyon project and the Black Canyon project—either of which it is thought may be feasible for storage works for the irrigation of lands in Arizona and California. Some question has been raised as to whether the Boulder Canyon is the more desirable for Arizona in view of the problem of diverting the waters to be stored at that point for use on the Arizona side of the Colorado River.

An investigation of the Boulder Canyon site by the U. S. Reclamation Service is now proceeding under the provisions of the Kinkaid bill heretofore referred to in this report.

Whether Arizona should definitely approve the Boulder Canyon project is a matter which can well await the report of the Reclamation Service which, it is understood, will show just how the waters stored at the Boulder Canyon site could be diverted to the Arizona side and how much acreage could be supplied. Undoubtedly before any funds are made available for Federal construction of storage works on the lower Colorado, the Black Canyon site and all other promising sites on the lower Colorado will have been carefully investigated.

A misunderstanding of the attitude of the officials of Arizona (including this Board) toward the Boulder Canyon project seems to be widely prevalent because of the resolution adopted by the League of the Southwest at the Los Angeles convention of last April. The resolution in question reads as follows:

"Whereas, it has been shown by the investigations of the Government that a great dam may be constructed at or near Boulder Canyon, on the Colorado River, as proposed by ex-Secretary Lane, adequate to control the destructive floods of the Colorado River, and of sufficient capacity to supply water for the irrigation of 1,500,000 acres of land in addition to that now under irrigation, with a productive capacity of \$150,000,000.00 in wealth annually, with a livelihood for over 1,000,000 of our population; and

"Whereas, the power available from this reservoir will be sufficient to supply the necessary electrical energy for large portions of the states of California, Utah, Nevada, Colorado and Arizona; and

"Whereas the storage of water at this site will not in any way interfere with the future development of the river in the upper portions of its drainage basin; now therefore be it

"Resolved, that the the United States Reclamation Service be requested and urged to proceed with diligence with its investigations of this site with a view to its very prompt construction;

"Resolved that Congress is hereby requested to appropriate the sum of \$50,000.00 for the use of the Reclamation Service in completing the investigation of Boulder Canyon reservoir site, and that such appropriation be made available at once; \* \* \*

While the engineers who addressed that convention on the problems of the Colorado River suggested that probably the proposed Boulder Canyon site was the most desirable, the convention, knowing that the Boulder Canyon site and the Black Canyon site are in the same district, the resolution was so worded as to apply to either of these sites.

It was recognized by the convention and conceded by every intelligent person that construction should not be begun until the most available site had been selected, and that no selection should be or will be made until all have been carefully investigated; and the investigation of the Boulder Canyon site is the first step in that direction.

It is not at all probable that the construction of any important storage project on the Colorado will ever be made under the general provisions of the existing reclamation act or under the provisions of the pending Smith-Fletcher bill, or any general measure of that sort. On account of the fact that the Colorado is a navigable as well as an international stream, special legislation by Congress will be necessary and possibly a treaty with Mexico may be advisable. Moreover, many of the best students of the problem of the Colorado Basin are of the opinion that a treaty, with the several states of the Colorado Basin and the United States as parties, to settle the question of water rights, is desirable.

Until the meeting of the Executive Committee of the League of the Southwest held at Denver in August last had finished its labors, there had been a feeling of marked hostility in the states of New Mexico, Colorado, Utah and Wyoming toward any and all projects for great storage works on the lower Colorado.

It having been widely reported that the proposed dam at Boulder Canyon could impound the entire flood supply of the Colorado River (estimated at fifteen to sixteen million acre feet), the people of the northern states feared that the construction of this project would lead to the initiation of water rights in Arizona, California and Mexico for an acreage sufficient to require all the water that could be stored at Boulder Canyon. This, the northern states feared, would prevent the construction of storage works on the upper reaches of the river. Governor Campbell's frank and fair statement of the attitude of Arizona served, however, to remove the distrust which had been exhibited in the Colorado press and in the utterances of representatives of the northern states of the basin. The Governor pointed out that inasmuch as special legislation by Congress would be necessary to provide for the construction of the Boulder Canyon project or any other reservoir on the lower section of the river, it was obvious that such legislation could not be achieved without the hearty support of all the states that are directly interested in the basin,—therefore it followed that the proposed legislation would necessarily provide for the protection of all the rights of the several states interested.

Director Arthur P. Davis, of the U. S. Reclamation Service, also addressed this meeting and made it clear that in the judgment of the engineers of the Reclamation Service the flood waters of the Colorado, if impounded at the proper sites, would furnish sufficient water for all of the lands in the basin.

Perhaps the most concise statement of the development already accomplished and proposed for the Colorado Basin by the Reclamation Service that can be made is found in the paper which was read to the convention.

of the League of the Southwest at Los Angeles by Mr. F. E. Weymouth, Chief Engineer of the U. S. Reclamation Service, and that statement is here inserted:

"The Reclamation Act was passed in 1902, under the provisions of which money derived from the sale of public land is made available for the reclamation of land in the sixteen most western states, and an amendment to the Act later on made the law applicable to the state of Texas also.

"Of the thirty projects constructed by the Reclamation Service, four are located within the Colorado River drainage basin and one project outside the basin receives its water supply from this basin. Previous speakers have described in considerable detail the physical characteristics of this river basin, and I will only refer to that in a most general way.

"The river drains a large portion of seven states: Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada and California. Up to the present time there has been little shortage of water in the various states concerned in the tributaries of the Colorado. These states are beginning to view with alarmed interest the gradual increase in requirements on the lower Colorado River. The experience of some of these states in litigation that has arisen over the use of water from streams outside of the Colorado River Basin itself does not tend to lessen the concern with which these states view this increasing use of the Colorado River for irrigation.

"It is not necessary at this time to go into a discussion of the irrigation laws of the various states, more than to call attention to the fact that many of these laws are intended for the protection of each state and its interests in the use of its water as against the use of these waters after they have passed beyond the confines of the state. As the waters of the Colorado River become in greater demand in the future, which they are certain to do, it is obvious that there will result a great economic loss in costly litigation, unless the various states can be assured of no interference of their future requirements by some system of well devised storage plans which will so conserve the water that there will be an irrigation supply for all interested parties.

"I will only discuss at this time the projects of the Reclamation Service that fall within the area of the Colorado River Basin.

"These projects reclaim lands in four states, namely: Colorado, Utah, Arizona and California, and upon which a total construction expenditure from the Reclamation Fund of \$33,188,263 has been made to the end of the last fiscal year which amounts to 27 per cent of the total expenditure from the fund, reclaiming 478,000 acres, or 26 per cent of the total area reclaimed to date under the provisions of this Act.

"During the past season crops to the value of \$38,495,000 were produced on these projects besides a valuation of live stock on the farms aggregating \$9,280,000.

"A conservative estimate of the value of the reclaimed lands on these projects today shows the enormous figure of \$150,000,000.

"The population supported on the farms and towns of these projects is estimated at over 110,000 people.

"Extensions of the present areas for which water can now be supplied and for which works are partially constructed will give an additional irrigable area of some 75,000 acres, bringing the total ultimate irrigable area to at least 550,000 acres in the Colorado River Basin when funds are available to fully complete the same.

"The crops produced on these projects are varied with their location and altitude, but alfalfa predominates, of which 400,000 tons are shown by statistics to have been produced in 1919. Cotton is a close second in acreage on the Salt River and Yuma projects, while sugar beets is an important product on the other three projects. Citrus and deciduous fruits, vegetables and berries give large returns on the southern projects, while potatoes, wheat, oats and such fruits as apples, pears and peaches are the important crops on the northern projects.

"The Salt River project, Arizona, comprising one of the largest bodies of irrigated land in the United States and perhaps the most valuable per acre, provides for the storage of the waters of the Salt River by the construction of the Roosevelt Dam, 70 miles northeast of Phoenix, Arizona. The waters thus stored are carried down the Salt River to a point about four miles below the mouth of the Verde, where, together with such water as may be secured from the Verde, it is diverted to the north and south side canal systems by the Granite Reef diversion dam. The water supply for the north side canals is further augmented by a second diversion at the Joint Head diversion dam. The canal and lateral system leading from the above diversion dams comprise about 850 miles of channel, delivering water to each quarter section of the tract of over 200,000 acres.

"The Salt River, which has a drainage area of 6250 square miles, and the Verde of 6000 square miles, at the Granite Reef dam comprise one division of the great Gila River watershed, which empties into the Colorado just above Yuma, Arizona, and is one of the largest and the last tributary of the Colorado in the United States.

"As the Salt River, which is typical of other branches of the Gila, fluctuates in annual run off from a minimum of 153,000 acre feet, sufficient for the irrigation of only a small part of the present project, to a maximum of three and a half million acre feet, it was necessary to provide storage for the variation in the monthly demand as well as hold-over capacity from years of high run-off to years of low flow, which was done by the construction of the Roosevelt Dam, which forms a storage basin or reservoir with a capacity of about one and a half million acre feet. This dam was completed in 1911, and the first large flood thereafter filled the same, and water flowed over the spillways in 1915, and again in 1916, and for the third time on February 21, 1920, just past. As the reservoir has not been emptied during this period, an ample supply of water has always been available and this is the one element that has made possible the rapid development in this valley. Power plants are located at Roosevelt Dam and at four other points on the project by which 25,000 horsepower is developed for use on the project, where a supplemental supply is secured by pumping from the ground water, thus accomplishing the additional function of

keeping down the ground water, which is possible from the favorable subsoil conditions on the part of project area. The surplus power is sold for commercial purposes and to the mining industry in adjacent territory, and the demand for power is much greater than the supply. The gross irrigable area within the project limits is 212,000 acres, of which 188,000 was cropped in 1919 on 4500 farms, the returns from which were reported in 1918 as aggregating \$18,000,000, and in 1919 over \$23,000,000.

"The Yuma project in California and Arizona secures its water supply from the Colorado River direct, the minimum flow of which has so far been sufficient for the acreage thereunder without storage, but with increased development above the point of diversion or below in Mexico and the United States, regulation by large storage facilities will be imperative.

"The water from the Colorado is diverted at the Laguna Dam, which is located ten miles upstream from Yuma, Arizona, and is the only permanent dam on the lower Colorado. This is not a storage dam but simply controls the flow for diversion into a large canal on the California side, from which lands on that side of the river are furnished water, thence crossing under the Colorado River at Yuma to lands on the Arizona side below the town of Yuma.

"The distribution system consists of 325 miles of artificial channel, in connection with which 32 miles of drainage ditches have been constructed for taking care of the underground waters, and a complete levee system for protecting the lands from the floods of the Colorado River.

"In addition to the lands now under the gravity system, having a gross irrigable area of 70,000 acres, plans have been developed for furnishing water to 40,000 acres of citrus fruit land on the mesa adjacent to the town of Yuma, under what is known as the Yuma Mesa Auxiliary Project Act, by which the lands are sold at auction and the irrigation works constructed with the funds derived therefrom. The sale of the lands in the first unit, comprising about 6000 acres, was held December 10, 1919, just past, and was so successful that work is now begun on the pumping and distribution system to irrigate this area, but as the Act provides for annual payments extending over four years' time and the work cannot proceed faster than funds become available, the progress will be limited accordingly. Work on the second unit will be taken up as soon as the success of the first unit has been demonstrated.

"The Yuma project can now furnish water to about 70,000 acres, of which about 45,000 acres in 1918 showed a gross crop value of over \$5,000,000 or \$113.00 per acre, while the returns in 1919 on 53,000 acres increased to \$7,000,000 or \$132.00 per acre.

"The Uncompahgre Valley Project, in Colorado, is another important development dependent on the water from this great basin. Until 1910, when the Gunnison Tunnel was completed, the fertile Uncompahgre Valley had to depend on a small stream which practically went dry when most needed to mature crops; thus only a few thousand acres were possible of cultivation, but with the completion of this tunnel, six miles in length and carrying 1000 second feet of

water through the Vernal Mesa, several thousand feet below the divide, this area has rapidly increased until it is now possible to supply water to 100,000 acres from water that would otherwise go to waste down the Gunnison and into the Grande, which later intermingles with the waters of the Green River, a second large division of this drainage basin. During low years all the flow of the Gunnison can be diverted into the tunnel and thence through the 450 miles of canals which carry water to over 100,000 acres of irrigable lands.

"Storage has been investigated and can be secured on the Gunnison watershed to supplement the flow of the Gunnison during low years, but as these years occur so seldom, the construction of the same has been delayed until full development has demonstrated a sufficient need therefor.

"The returns from the area cropped in 1919 of about 60,000 acres gave a value of nearly three and a half million dollars.

"The Grand Valley Project, in Colorado, is located just east of the line between Utah and Colorado and is one of the last projects to be undertaken under the Reclamation Act. It was not begun until late in 1912, and the first irrigation was made possible in 1915, and for the few years it has been in operation has shown most rapid development. The water supply for these lands is secured from the Grand River, the minimum flow of which is sufficient without storage.

"The diversion dam is located eight miles northeast of Palisade, Colorado, from which the main canal, 55 miles long, has been constructed on the north side of the river to the Utah-Colorado state line, covering 40,000 acres of mesa land above the old canals in the valley which irrigate the lower lands in the vicinity of Grand Junction, Colorado. The lateral system has been completed for 35,000 acres, and as soon as funds become available will be completed for the balance, as well as a power and pumping plant installed to furnish water to an additional area of 10,000 acres north of Grand Junction. When it is realized that five years ago this area was barren desert without an acre plowed or cultivated or a home existing on the tract, and that last year 9000 acres cultivated showed a value in crops of over a half million dollars or \$64.00 per acre, the future success of the valley can be safely predicted.

"In addition to the new project lands, the main canal carries water for 7600 acres of developed orchard lands near Palisades, Colorado, which was, prior to the construction of the Grand Valley project, watered by an expensive pumping system and upon which crop values of one and three quarter million dollars were realized in 1919.

"The waters of Strawberry Creek, which naturally flow into the Duchesne and thence become a part of the great Green River run off, have been diverted through a tunnel three and three-quarters miles in length to the Spanish Fork River, a stream on which the waters have long become exhausted by irrigation demands in the valley around the south end of Utah Lake. These waters are stored in a basin at the head of the tunnel, having a capacity of 220,000 acre feet, and drawn through the tunnel as needed for the 50,000 acres developed thereon.

Besides furnishing water to 13,500 acres of land having inadequate water supply in the Old Spanish Fork Lake shore, Mapleton and

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Springville units, 25,000 acres can be irrigated under the High Line Canal which was completed in 1917. The water furnished to the old areas is dropped from the main canal through a power plant, thus producing 1200 horsepower used for lighting and power purposes by the towns on the project, and will be available for future development by pumping to extensive areas above the project gravity canals.

"The returns from 30,000 acres cropped in 1918 was \$1,642,000 or \$55.00 per acre, and from about the same area in 1919 was \$1,975,000 or \$65.00 per acre.

"The Reclamation Service has had a small amount of money available during each of the past few years for investigation of new projects, and a considerable portion of this money has been spent in the Colorado River Basin. In carrying on these investigations the service learned approximately the amount of land now irrigated in the Colorado River Basin. The lower Colorado River area was found to contain 463,500 acres irrigated and the total that may be 2,350,000. For convenience, the lower Colorado River was divided into five divisions, the first three divisions including lands along the Colorado River from Cottonwood Island to Laguna Dam, comprising 24,000 acres of irrigated land, and a total of 190,000 acres of irrigable land. The fourth division includes the Yuma project and the Sonora lands in Mexico east of Bee River and Hardy's Channel of the Colorado River. The irrigated area is shown to be 28,000 acres in the Yuma project and total area that may be irrigated 647,000 acres. The fifth division includes the Imperial Valley in California and Mexico. Four hundred fifteen thousand acres are irrigated and 1,500,000 acres are estimated as the total area which may be irrigated.

"Investigations carried out in the upper Colorado River Basin covered the Yampa and White River Basins in Colorado, the Uintah Basin in Utah, Dolores Valley in Colorado, San June River Basin in Colorado and New Mexico, and the Green River in Wyoming, and indicate that the total ultimate irrigable area in the entire Colorado River Basin in the United States is about 4,400,000, and in Mexico about 800,000 acres, making a total of 5,200,000 acres for the entire basin. This area has for convenience been subdivided into another way:

FROM	Area Irrigated. Acres	Additional Area That May Be Irrigated. Acres
Colorado River tributaries above Black Canyon	1,127,000	1,337,300
Colorado River, exclusive of Gila, below Black Canyon	463,400	1,886,300
Gila River and tributaries	313,000	120,000
<b>Total</b>	<b>1,903,400</b>	<b>3,333,600</b>
<b>Total area ultimately irrigable in Colorado River Basin</b>		<b>5,237,000</b>

"The area is divided between the states as follows:

STATE	Area Irrigated in 1916. Acres	Additional Area That May Be Irrigated. Acres
Arizona .....	356,225	326,940
Utah .....	209,700	336,300
Wyoming .....	393,000	358,000
Colorado .....	452,200	492,000
New Mexico .....	47,000	71,000
Nevada .....	5,315	11,260
California .....	365,040	1,018,690
United States .....	1,828,480	2,614,190
Mexico .....	75,000	719,400
Total .....	1,903,480	3,333,530
Total area that may be ultimately irrigated:		
United States .....		4,442,600
Mexico .....		794,400
Total ultimate area irrigable in Colorado River Basin .....		
		5,237,000

"In Wyoming the following projects have been investigated: Church Buttes Project, which has a gross area of about 70,000 acres in Uintah, Sweetwater and Lincoln Counties, of which 25,000 acres are classed as irrigable. The water supply would be secured from the Black and Henry's Fork of the Green River, but it is thought there is only sufficient water for about 7000 acres.

"The Opal Project was investigated and has a gross area of 70,000 acres, of which 30,000 acres are classed as irrigable. This project is located in Lincoln and Sweetwater Counties, Wyoming. The water supply will be secured from Henry's Fork of the Green River, with storage to be provided by the construction of the Hams Fork reservoir, located on Hams Fork and Willow Creek, a few miles above the town of Kemmerer.

"The Small Seedskadee Project was also investigated. This project has a gross area of 50,000 acres, of which 28,000 acres are irrigable. Water from this project could be taken from the west side of Green River near Andersons Island.

"The Large Seedskadee Project was also investigated, which contains a gross area of about 190,000 acres, of which 65,000 acres are believed to be irrigable, water for this canal to be taken from Green River, diverting at a point about two miles above the mouth of La Barge Creek.

"The Big Piney Project has also been investigated. This project has a gross area of about 14,000 acres, of which about 9000 acres are irrigable.

"The Bonneville Project in Wyoming was also investigated. The water for its development must be obtained from the Green River and New Fork River by means of a supply canal aggregating about 90 miles in length, and the storage to be provided in Green, Fremont, Half Moon and Boulder Lakes. The gross area of this project is approximately 720,000 acres, of which 200,000 acres are irrigable.

"The Service is at this time actively investigating the Castle Peak Project on the Duchesne River in Utah, the Duchesne being a tributary of the Green River. There are probably at least 50,000 acres in this project.

"A reconnaissance has been made of a project on the Little Snake River, located in Moffat County, Colorado, near the towns of Dixon and Baggs. A preliminary examination and report has also been made of the Dolores and Montezuma Projects in southwestern Colorado. Each of these projects will take water from the Dolores River and will require considerable storage, but it has been found that storage for each of these projects will be comparatively expensive.

"The Reclamation Service is now actively investigating the San Carlos Project on the Gila River in the vicinity of Florence, Arizona. This project contemplates diverting water from the Gila at a point about 12 miles above the town of Florence and the storage of water at the San Carlos dam site, located about seven miles below the junction of the San Carlos and Gila Rivers.

"The Service has investigated the Sentinel Project on the Gila River. It proposed to build at the Sentinel site a dam not only for diversion but for storage purposes and food control, but the foundations were rather unfavorable, and it was found that a dam at that point would be extremely costly.

"In co operation with the Imperial Irrigation District of California, the Service investigated the proposed All American Canal, this scheme contemplating diverting water from the Colorado River at the Laguna Dam of the Yuma Project and provides for the irrigation of approximately 900,000 acres of land in the Imperial Valley, 515,000 acres of which are included in the Imperial Irrigation District, the remainder, which is mostly public land, being located above existing canals. The present main canal of the Imperial Irrigation District takes water from the Colorado River about one and one-half miles north of the international boundary and in order to avoid deep cuts through a sand hill area, the canal passes through Mexico for a distance of about 50 miles, and in order to divert water into this canal it has been necessary to construct, practically every year, a temporary dam across the Colorado River, which is an item of heavy expense and of serious menace to the Imperial Valley and to the Yuma Project built by the United States. These temporary dams have not been wholly effective and the operation of the canal in Mexican territory has been a serious problem. For the purpose of overcoming these difficulties and to carry a water supply to a large area of higher lands, it has been proposed that the All-American Canal be constructed, this canal to head

at the Laguna Dam, follow the main canal of the Yuma Project for a distance of ten miles and thence in a southwesterly direction past Pilot Knob at the present heading of the Imperial Canal to a point near the international boundary line which it parallels for four miles well into the sand area, where it turns northwest to the sand hills, beyond which the line follows the general contour of the country in a westerly direction. The total length of the proposed canal line from the Laguna Dam is a little over seventy-six miles.

"In making a study of the Colorado River Basin, the Service has compiled all available data relative to the water supply and has found that for a period of 22 years the minimum flow at Laguna Dam was 16,145,000 acre feet. The variation during this period has ranged from about 8,000,000 acre feet in 1902 to a little over 25,000,000 acre feet in 1909. In order to utilize the water supply of the Colorado River and its tributaries, which are subject to sudden and extreme floods, it will be necessary to construct a great many reservoirs and fortunately sufficient sites are believed to exist to so control the flow as to permit the irrigation of all good agricultural land that it is feasible to irrigate.

"The Flaming Gorge reservoir site, located on the Green River in Wyoming, with its dam site in Utah, a few miles below the state line, has a capacity of 3,500,000 acre feet, with a dam having a spillway 225 feet above the river surface. The mean annual run-off of Green River at this site is approximately 2,300,000 acre feet, varying from 1,440,000 in 1905 to 3,880,000 (estimated) in 1899. The foundations at this site have been carefully investigated and it is known that a reservoir could be constructed at that point at a reasonable cost.

"The Juniper Reservoir site is located on the Upper Yampa River and has a capacity of 1,550,000 acre feet, with a dam raising the water 200 feet above the river surface. The estimated mean annual run-off available at this site is approximately 1,200,000 acre feet, varying from 760,000 acre feet in 1915 to 2,150,000 acre feet in 1917.

"The Ouray Reservoir site on lower Green River is located in Utah and receives the discharge of the three main tributaries of the Green River, the Yampa, Duchesne and White Rivers. The capacity of this reservoir site, with a dam in upper Desolation Canyon, raising the water 170 feet above the river surface, is 10,000,000 acre feet. This capacity would be increased to 15,000,000 acre feet with a dam raising water 200 feet above river surface.

"The mean annual run-off through this site is estimated to be 5,400,000 acre feet, varying from 3,500,000 to 8,600,000. The foundations for this dam site have been investigated by the Reclamation Service and suitable foundation has been found but at a great depth. The material to be excavated for the dam would be a fine sand, and the slopes of excavated pit would be extremely hard to maintain, and while it is probable that a storage dam could be constructed at this point, it would be extremely expensive.

"The Service has investigated the Kremmling Reservoir site, located in Colorado in Upper Grand River Basin, at which point there is a run-off of 1,250,000 acre feet with a variation from 890,000 acre feet in 1908 to 1,720,000 in 1914. A dam raising water 230 feet above the river surface would store 2,200,000 acre feet. The foundations for the

dam at this site are not as favorable as desired, but it is thought that the site is feasible.

"The Bedrock Reservoir site is located on the Dolores River in Colorado. A dam with spillway 210 feet above river surface would have a capacity of 800,000 acre feet. Borings have not been made at this site but surface indications are not favorable for a masonry dam. The mean annual run-off is estimated to be 400,000 acre feet.

"The Dewey Reservoir site is located on the lower Grand River and commands practically the entire run-off of Grand River, which is estimated to be a mean of 6,820,000 acre feet, varying from about 3,800,000 acre feet in 1902 to over 9,000,000 acre feet in 1909. This dam site is below the mouth of Dolores River and is below all important tributaries. A dam with spillway 215 feet above the river surface would create a capacity of 2,300,000 acre feet. The foundations at this site have been investigated by the Reclamation Service and found to be favorable, and it is known that a reservoir could be built at this point at a reasonable cost.

"The Bluff Reservoir site in the San Juan River Basin has been considered in connection with storage possibilities, but recent silt observations made at this site indicate a mean silt content of 1.4 per cent by weight or over 1 per cent by volume, so it is doubtful if it would be advisable to construct a storage reservoir at this point.

"In conducting the investigations of the storage sites on the upper Colorado River, the Reclamation Service has not only had in mind the matter of storage for irrigation and for power but with the view of partially controlling the floods of the upper river, and it is known that there are sufficient reservoirs which could be constructed to not only meet the irrigation requirements but to partially control the floods of the upper river. The Service has not had sufficient funds to carry the investigations to the point where it can definitely state which reservoirs or combination of reservoirs should be constructed for the full utilization of the Colorado River. Whether it will be best to attempt to partially control the floods by construction of sufficient reservoirs on the upper river will not be known until more complete investigations have been made of possible reservoir sites on the lower river.

"During 1919 a topographic survey was started on the lower reaches of the river for what is known as the Boulder Canyon Reservoir site in Nevada and Arizona. The proposed dam site for this reservoir is at a point about 20 miles below the mouth of the Virgin River. The topographic survey of this site is not yet completed but it is expected that it will be this coming fall. The Service will also make investigations of the foundations for a dam site this coming fall and if found favorable a dam higher than any yet built could be constructed at this point, possibly 500 or 600 feet high, and it may be possible to store as much as 25,000,000 acre feet. With a reservoir of such capacity it would largely control the floods in the Colorado River, and the silt deposits in a reservoir of that capacity would not be sufficient to cause any material damage for hundreds of years, and a large amount of power could be developed to operate several thousand miles of railroad which are within the limits of practical power transmission."

Within the past month public announcement has been made of the purpose of one of the great power companies of California to construct, under the provisions of the Federal Power Act, enacted at the last session of Congress, a series of dams on the Colorado River at or near Lee's Ferry in Coconino County, this State, the whole project embracing a scheme for the production of 2,500,000 horse power. It is understood that this project does not embrace the use of water for irrigation, but one of the logical results of the proposed construction may be the regulation of the flow of the Colorado to such an extent that the storage of the flood waters below the proposed works, for the purpose of irrigating all lands which may be reached by mere diversion dams, will not be necessary.

In view of the probability that the proposed power dams will be constructed, it becomes highly important that a comprehensive survey of the lands on the Arizona side of the Colorado be made as soon as possible. Such a survey would serve two purposes,—it would show how much land may be irrigated in this State by diversion works on the river, and also whether it would be possible to contemplate the construction of a high dam at some convenient point for the purpose of raising the water to a height from which it could be diverted to the mesa lands of the State.

Several months ago Mr. George H. Maxwell of the National Reclamation Association appeared before this Board and stated his belief that the construction of a high dam at the Black Canyon would raise the water to such a point that the construction of a canal therefrom to the Gila River a short distance below Arlington would be practicable and advisable, and that such a canal, if practicable, could furnish water for the development of perhaps 2,000,000 acres. He asked the Board to expend the sum of \$500 or \$600 for a barometrical survey of the proposed route, beginning at a point not far from Ehrenburg and running to the so-called Sentinel reservoir site on the Gila. The Board authorized the expenditure, but it has not yet been made for the reason that on further consideration it was concluded, as already stated, before the Government will undertake the construction of any great dam on the Lower Colorado, it will first make careful survey of all the lands which may be feasibly irrigated on the Arizona side of the river from such works, and certainly a complete survey will be necessary before any definite conclusions can be reached concerning the soundness of Mr. Maxwell's theory. It is no doubt advisable, however, to have the preliminary barometrical reconnaissance which has been suggested, and possibly this reconnaissance will be made in the near future.

Referring again to the proposed power development at Lee's Ferry, it seems fortunate that this State is already clothed with power to protect, through the Corporation Commission, the interests of the people of Arizona in relation to power development. Many of the great copper mines of the State as well as the railroads in the northern section are potential customers for electric power, and before a license is granted to a power company which proposes to develop power in this State for transmission beyond the State lines, a definite policy should be adopted calling for an assured reserve of power for use within this State adequate to its needs, and to be furnished at a reasonable charge.

The construction of two irrigation projects of importance has been under way during the past year. The Gila Water Company is building a diversion dam across the Gila at a point some 65 southwesterly from Phoenix for the irrigation of approximately 100,000 acres of land owned by the com-

pany. The same company, under former owners, some thirty years ago, constructed a dam at the same point, together with a canal 40 miles in length. The dam was improperly constructed, however, and was destroyed by floods, and the enterprise remained dormant until about two years ago. The new construction will be completed within the coming year. Just how much land can be adequately irrigated by the diversion works under way remains to be determined. It is understood that the total cost of the new construction will approximate \$1,000,000.

With funds provided by the State in the form of a loan to the land owners within the project, a structure known as the Lyman Dam is being built across the Little Colorado River 12 miles south of the town of St. Johns, in Apache County, for the irrigation of 15,000 acres.

The lands within this project have been under cultivation for many years and a prosperous community was developed. The new construction was made necessary by the destruction of the former dam by floods in 1915. The land owners were unable to find the capital wherewith to rebuild the dam, and arrangements were made with the State Loan Board for the necessary funds. The contract for construction is between the Lyman Water Company and Parks & Johnson, contractors, the contract having been approved by the Loan Board. The moneys furnished by the State for this construction are secured by a first mortgage on all of the lands within the project, as well as the dam itself and all of the water rights thereunder. Construction has been under way during the past year and will be completed by April 1st, next.

The dam is a rock-filled and earth structure, having a width of 319 feet at the base, 20 feet on top and a length of 700 feet. The completed project will cost \$645,000. The dam will impound 45,000 acre feet, and as there are two seasons of flood (summer and winter) ample water will be furnished for the irrigation of the entire 15,000 acres.

During recent months there has become apparent a very general public demand for the creation of a State immigration agency or department. This demand is based upon the actual results which have been obtained by other western states through the maintenance of similar departments, and it has been suggested that the Resources Board might, with great propriety, be authorized by the Legislature to take over the functions of an immigration board.

Respectfully submitted,

SIMS ELY,  
Secretary.

JOSEPH, H. KIBBEY,  
Chairman.