NEW RECLAMATION ERA

VOL. 21 JANUARY, 1930 NO. 1

PATHFINDER DAM, NORTH PLATTE PROJECT, NEBRASKA-WYOMING

RECLAMATION

WE HAVE a third problem of major dimensions in the reconsideration of our reclamation policy. The inclusion of most of the available lands of the public domain in existing or planned reclamation projects largely completes the original purpose of the Reclamation Service. There still remains the necessity for extensive storage of water in the arid States which renders it desirable that we should give a wider vision and purpose to this service.

To provide for careful consideration of these questions and also of better division of responsibilities in them as between the State and Federal Governments, including the possible transfer to the States for school purposes of the lands unreserved for forests, parks, power, minerals, etc., I have appointed a Commission on Conservation of the Public Domain, with a membership representing the major public-land States and at the same time the public at large. I recommend that Congress should authorize a moderate sum to defray their expenses.

HERBERT HOOVER.

(From the message to Congress, December 3, 1929)

NEW RECLAMATION ERA

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Secretary of the Interior

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Interesting High Lights on the Federal Reclamation Projects

OF the 70 tons of turkeys shipped from the Orland project for the Thanksgiving market, more than 20 tons were marketed through the cooperative association of turkey growers, which was organized last summer and whose members received from 6 to 8 cents a pound more than was paid by independent buyers several days prior to Thanksgiving.

THE Klamath County Dairymen's Association, a cooperative organization on the Klamath project, has begun the operation of a creamery and the retailing of dairy products at Klamath Falls.

THE Fruitdale Community Club has been organized on the Belle Fourche project, giving the irrigation district a working force that will have for its object the development of the town and vicinity as a honey center, town resort, and more intensive agricultural production.

ON November 7 the town of Grandview, on the Sunnyside division of the Yakima project, celebrated the lighting of the first commercial natural gas in the State of Washington, the gas having been piped from wells 25 miles distant. It is expected that natural gas for domestic use will be available shortly for Grandview, Sunnyside, Prosser, and Mabton from the line now being installed at a cost of approximately $1,100,000.

THE Associated Seed Growers (Inc.), on the Shoshone project, has been working with a full force cleaning and picking seed peas and beans for distribution in eastern markets.

PLANS are under way for a determination of the possibilities of sugar-beet development on the Sun River project. It has been suggested that the sugar company make a practical demonstration on an area of at least 5 acres.

THE voters of El Paso County, Rio Grande project, have authorized a bond issue of $550,000, of which $300,000 is to be used for improving the levee system and $250,000 for county roads.

BEDROCK has been uncovered over much of the foundation site for the Owyhee Dam, Owyhee project, and stripping of the remaining narrow embankment, extending from the downstream cofferdam to the center of the dam site, will be finished shortly. At the end of the month the dam contract was 25 per cent completed.

A 2-YEAR-OLD Holstein cow, owned by S. W. Beck, of Rupert, Idaho, on the Minidoka project, had an enviable record during the past year by producing 635 pounds of butterfat, valued at $300, besides a heifer calf worth $125, which won second place in the annual Black and White Day at Rupert last spring.

THE 219 cows in the Mini-Cassia Cow Testing Association, Minidoka project, produced 139,415 pounds of milk and 5,493 pounds of butterfat during November, or an average of about 465 pounds of milk and 25 pounds of butterfat per head. Thirty-nine cows produced 40 pounds or more of butterfat each.

SEVERAL settlers on the Garland division, Shoshone project, who are interested in the sheep industry have held meetings recently with a view to forming an association to lease a block of grazing land near the project. It is expected that the organization will be effected shortly.

THE crop census on the Sunnyside division of the Yakima project for 1929 shows a return of $7.900,000, or about $100 per acre for the cropped area. This is an increase of 48 per cent over that for 1928 and 63 per cent over the 1927 crop values.

FIVE carloads of turkeys were sold recently by the North Platte Valley Poultry Marketing Association to the American Stores of Philadelphia.

ON November 15 payments by the sugar companies to beet growers in the North Platte Valley for beets delivered to the factories in October totaled $5,420,000.

INCLUDED among the marketing organizations on the Grand Valley project are a bean growers association, two turkey and poultry associations, and a dairy association. All report a satisfactory season. The cooperative movement is constantly gaining in favor on the project. The crop census shows the production of more than 10,000 turkeys on the project last year.

IT IS estimated that last year's yield of citrus fruit from the Yuma Mesa division of the Yuma project will amount to 36,000 boxes from Unit B lands, with an additional 8,000 boxes from groves adjacent to that unit. The older trees are burdened with fruit which hangs in large clusters of 8 to 10 to the cluster. The large yellow grapefruit with its background of dark-green foliage presents a very pleasing picture and one which represents added prosperity to the project and community.

A CONTRACT has been awarded for the construction of a casein factory at Rupert, Minidoka project, to cost from $30,000 to $40,000. The factory will be 48 by 80 feet in size and will be completed early in the spring.

THIS season's crop of paper-shell pecans on the Yuma project has been practically all harvested, with a good yield reported. The crop has been selling at 40 cents a pound for seconds to $1 a pound for the fancy varieties.

The Growth of Cooperative Effort on Federal Reclamation Projects

By Dr. Elwood Mead, Commissioner, Bureau of Reclamation

NOWHERE is there a more fertile field for the development of cooperative effort than on the Federal irrigation projects. The seed of cooperation is planted when a project is begun. It sprouts when water first becomes available for irrigation and the settlers discover that they are dependent on a common water supply and on the operation of a canal system in their joint interest. It develops to fruition with increasing settlement and the realization on the part of the dwellers in these compact desert oases that the enforced cooperation based on the community use of the irrigation system can be extended advantageously in purchasing materials and supplies for the farm and in processing and disposing of the farm products.

During the past year the community conscience and public spirit on the Federal irrigation projects have been manifested as never before in the growth of cooperative effort, reflected in a wide variety of ways. Each month has brought to the Bureau of Reclamation the story of the erection of new cooperative creameries, cheese factories, canneries, cotton gins and compresses, crop storage and seed warehouses, and the organization of growers' and marketing associations for practically every kind of crop grown on the projects, from the hardy apple of the Northwest to the citrus fruit, dates, and almonds of the Southwest. The following typical items, culled from recent reports, will more clearly indicate the wide diversity of this steadily increasing industrial and cooperative development:

The orange packing plant on the Orland project, California, was enlarged to accommodate the olive growers in grading and preparing their product for shipment. Two cooperative marketing associations were also formed on this project to market turkeys, prunes, and apricots. A cooperative credit association was organized on the Minidoka project, Idaho, to finance the purchase of dairy cows, and contract was awarded for the construction of a potato meal plant, which is nearing completion. The settlers on the Tule Lake division of the Klamath project, Oregon-California, who entered their lands only a little over a year ago, formed a hay growers' and a dairy association and constructed a farmers' creamery.

The Yuma Mesa Grapefruit Co., Yuma project, Arizona-California, erected a $25,000 packing plant to handle their crop. The pecan growers and others interested in the growth of this relatively new crop on this project celebrated recently their second "Pecan Day." The North Platte Valley Cooperative Cheese Co. opened a cheese factory and centralizing plant on the North Platte project. A new farmers' cotton compress company was organized on the Rio Grande project, New Mexico-Texas, for the construction of another compress. The potato and onion growers on the Boise project, Idaho, joined a state-wide association to control the grading and marketing of their crops. A new dehydrating plant for drying fruit and vegetables was constructed on this project. The Associated Seed Co., on the Shoshone project, Wyoming, completed an addition to its seed house, furnishing storage capacity for 50 carloads of seed.

Practically every project boasts its community clubs for farm men and women, and its community recreation center. One project has an ambitious community park development well under way, a feature of which is an up-to-date swimming pool. The irrigation reservoirs are ideal pleasure resorts, and their recreational features are being extensively developed through the cooperative efforts of near-by towns and farming communities interested in boating, fishing, and camping. Project fairs, financed by community effort, are an established institution on virtually all projects, the friendly rivalry resulting in a steady improvement in livestock, poultry, and farm products.

Although much remains to be done, it is clear that the cooperative effort already in evidence on the Federal irrigation projects is playing no small part in strengthening their economic position and making not only possible, but probable, the repayment to the Government of the cost of their construction.—*U. S. Daily.*

Hampshire sheep on Roselawn farm, Sunnyside, Yakima project, Washington

Beet Growers Enjoy Large Payment for Crop

Farmers in the Billings-Lovell district of the Great Western Sugar Co., which includes the Huntley and Shoshone projects, will receive a total of $2,198,000 for their sugar beets in 1929. The returns to the farmers in the Billings district, in which the Huntley project is located, will be approximately $1,463,000, or more than $400,000 more than was received by the growers in 1928. The total crop for the Billings-Lovell district was 293,000 tons from 28,000 acres, or an average of 10.5 tons per acre. The average yield was nearly a ton to the acre larger than in 1928, with many individual yields reaching a much higher figure.

The use of the incubator is recommended as the most economical and labor-saving way of reproducing the flock, and also the most certain means of insuring an early batch.

"Agriculture is at the Threshold of Better Times"

"With fewer farms, fewer acres and fewer farmers, and a large increase in consumers it is only logical to assume that food production is very closely balanced with consumption—much nearer, perhaps, than most people realize"

IN an editorial in the December issue of the Country Gentleman the death knell is sounded for the agricultural surplus. An exhaustive analysis of the agricultural situation leads the editor of this national magazine to the conclusion that "it is not likely that farming from now forward will suffer so much from overproduction," as "many of the factors which cause distress have disappeared. Agriculture is at the threshold of better times."

The editorial in full is as follows:

"The total crop yield of the United States for the current year is estimated at 4.1 per cent below the 10-year average. This may appear to be an almost insignificant amount, yet the results are startling. Agriculture is not weighted down with an unwieldy surplus of any important crop; production and consumption needs are nearly balanced for the first time in almost a decade.

"The principal reason for decreased crop yields was the severe midsummer drought that prevailed all over North America and most of the Southern Hemisphere. It cut heavily into the corn, cotton, Irish potato, and spring-wheat crops in the United States and proved disastrous to wheat in Canada, Argentina, and Australia.

"Last spring the carry-over of old wheat in Canada and the United States amounted to about half a billion bushels and was responsible for the low price of 95 cents last May. Before next May arrives both the old carry-over and the present year's wheat crop will be almost consumed. There is no possibility of such a disastrous break in prices next spring. Other crops are in similarly strong position.

"A cotton crop of approximately fourteen and a half million bales is barely America's share of the world's needs. In view of the increasing use of cotton, present prices should be maintained throughout next year.

"The year's corn crop is around two and a half billion bushels, or about 350,000,000 below the 10-year average. The market price, around a dollar a bushel, reflects the shortage. It should make the growers of market corn happy, even if it does work some hardship to eastern dairymen and poultry growers who are heavy purchasers of commercial feeds. There will be no heavy carry-over of this year's corn into next year.

"Fruit crops this year have been lighter than usual, with very satisfactory prices. Here, again, there is no likelihood of heavy stocks of canned fruits being held until next year's harvest; neither will there be much carry-over of canned vegetables.

"High feed prices and poor fall pastures have reduced the production of both dairy and poultry products. Prices of eggs, of baby chicks next spring, and of dairy products should be considerably higher than they have been for several years.

"The market for all kinds of meat animals is satisfactory. Beef and lambs are bringing high prices, and hogs appear due for better prices during the winter and next spring.

"All in all, agriculture is in a better balanced position than it has been in several years. While crop yields were low this year, the increased prices have more than made up for the deficiency in tonnage.

"Many close observers believe this year marks the beginning of a definite turn upward in agricultural affairs. They point to the facts that during the past decade nearly 5,000,000 people have left the farms, that there has been an increase of approximately 15,000,000 in total population, and that there are now about 20,000,000 more food consumers than there were 10 years ago.

"With fewer farms, fewer acres, and fewer farmers and a large increase in consumers it is only logical to assume that food production is very closely balanced with consumption—much nearer, perhaps, than most people realize.

"There doubtless will be occasional surpluses of certain crops for years to come, particularly of wheat, tobacco, and certain fruits, but it is not likely that farming from now forward will suffer so much from overproduction. Many of the factors which caused distress have disappeared.

"The elimination of 3,000,000 horses in city traffic and of about 5,000,000 on farms, brought about through the use of automobiles, motor trucks, and tractors, increased the area for the production of human food by more than 30,000,000 acres. This came at the height of overproduction. While further reduction of the horse population is sure to take place, it will be at a slower rate and will not prove so disturbing.

"Another factor tending toward agricultural stability that is frequently overlooked is the increasing use of machinery. Expensive equipment is now required for the economic production of any crop. This makes it increasingly difficult for farmers to jump from one kind of farming to another, as they have been in the habit of doing. Machinery is compelling every farmer to restrict his operations to the crops he has the equipment to produce.

"Economic forces work slowly, and it has taken a long time for them to bring agriculture into balance with other industries. The task is not yet completed but every sign indicates there is not much farther to go. Agriculture is at the threshold of better times."

Arrowrock Dam, Boise, project, Idaho

Commission on Conservation and Administration of the Public Domain

PRESIDENT Hoover's Commission on the Conservation and Administration of the Public Domain met in the Interior Department Building on November 23 and 25. The members of the commission are as follows:

James R. Garfield, chairman, Cleveland, Ohio.

Elwood Mead, Washington, D. C. (representing the State of California).

I. M. Brandjord, Helena, Mont.

R. K. Tiffany, Olympia, Wash.

Rudolph Kuchler, Phoenix, Ariz.

Charles J. Moynihan, Montrose, Colo.

George W. Malone, Carson City, Nev

William Peterson, Logan, Utah.

I. H. Nash, Boise, Idaho.

Perry Jenkins, Big Piney, Wyo.

E. C. Van Petten, Ontario, Oreg.

Wallace Townsend, Little Rock, Ark.

H. O. Bursum, Socorro, N. Mex.

George Horace Lorimer, Philadelphia, Pa.

James P. Goodrich, Philadelphia, Pa.

Gardner Cowles, Des Moines, Iowa.

Huntley Spaulding, Rochester, N. H.

Col. W. B. Greeley, Seattle, Wash.

Mary Roberts Rinehart, Washington, D. C.

Francis C. Wilson, Santa Fe, N. Mex.

All members of the commission were present, with the exception of Messrs. Lorimer and Townsend. The discussions were of a general character for the purposes of developing the problems submitted to the commission by the President as outlined in his letter of August 21 to Hon. Joseph M. Dixon, Assistant Secretary of the Interior. Chairman Garfield stated that in considering the water problem the commission has in mind not only the direct use and application of water to the land for irrigation purposes, but as well to the use of water in the great interstate watersheds in such fashion and under such conditions as will tend to prevent erosion and aid in the prevention of floods in the lower stretches of such watersheds.

NATIONAL RECLAMATION POLICY

The following statement concerning the preparation of a report on a national reclamation policy was presented to the commission by Dr. Elwood Mead, Commissioner of Reclamation, who represents the State of California:

"The preparation of a report on a National reclamation policy will involve consideration of the following:

"1. The activities which properly belong to State and Federal authorities in measuring the flow, keeping continuous records of discharges of streams, and creating and maintaining conditions favorable to the unimpaired annual run-off should be investigated and stated. If possible, plans should be evolved for the establishment of the equities and division of water across State boundaries on interstate streams by some more speedy and less costly method than resort to the courts. Consideration of interstate compacts would be part of this inquiry.

"2. Economic changes which have taken place during the past 25 years have been a controlling influence in the evolution of State and Federal reclamation policies. The requirements of successful development to-day are entirely different from those which prevailed in the arid region when the Federal reclamation law was enacted in 1902. The working out of a policy suited to the next quarter of a century must be based on a forecast of the probable economic changes of the future.

"3. This will involve a collection of information as to what reclamation has done for the upbuilding of wealth and population in the various arid States and its effect, injurious or beneficial, on agriculture and other industries in the country outside the arid region.

"4. This inquiry should include an inventory and classification of the schemes for which Federal aid is now being sought and those which are being promoted as private enterprises, the inventory to include the location of these different projects, area of land involved, probable cost, character of the agriculture to be established, the income which may be anticipated for repayment of costs, and the indirect benefits to the locality and the Nation. Should it be the policy to take over and reconstruct projects which have encountered financial difficulties, and what should become of their existing liabilities?

"5. At present private reclamation development has practically ceased because of the greater cost of the work and the slow and uncertain returns therefrom. Is there anything to indicate that these conditions will be changed in the future? Inquiries on this would include information from bond houses that have in the past marketed irrigation securities and from State irrigation authorities.

"6. At the outset the construction of works to conserve and distribute water was regarded as all of reclamation which required preliminary investigations and planning, and it was all that the Government has thus far financed. Experience has shown that providing water will not alone insure successful development. There must be settlers, there must be the working out of a program for crops and markets suited to the locality. The money cost of changing raw land into farms is as great as, or greater than, the cost of building the irrigation works. Modern development includes planning of roads, subdivision of the land into farms, selection of settlers, and providing credit for settlers of small capital.

"7. If reservoirs are to be built as public works with no repayment of cost, from what source should come the money for this construction, and what amount of money per year will be needed to carry on development at a reasonable rate? (Include statistics of the number, capacity, water supply, probable cost of reservoirs, the construction of which is now desired.)

"8. Gather information as to the number, location, and area of projects where new or additional irrigation works are now desired. Where construction by the Government has been asked, or where it is being promoted as private or district. Gather information as to the extent and probable cost of these works. Who is to build the laterals and drains? What consideration should govern subsidies, if any, to be given in the construction of canals, the length of the repayment period, and whether or not interest should be charged on deferred payments. If interest is charged, what should be the rate?

"9. One of the difficult matters connected with present irrigation development is to secure organized efficient action in the settlement and improvement of privately owned, unimproved lands. Often the owners are unable to develop. In many instances such lands are held as speculative properties, and some action is needed to prevent inflation of prices. The same need of control over privately owned land exists as over the control of public land in order to secure the right type of settlers. This raises the question whether all such land should not be acquired before development begins.

"10. Should the Federal and State Governments cooperate in the selection of projects, determination of feasibility, working out plans of settlement, and repayment of cost, and should projects where construction costs are high be aided by the imposition of a tax on the towns and railroads which are benefited by this improvement?

"11. Heretofore all public land has been either given away or sold at a uniform price. This frequently results in great economic unfairness. Some farms, because of location, better surface, or greater soil fertility are worth several times that of others. Should not the price reflect these different values and the public land be sold at an appraised price depending on classification, the same as the private land under present incremented value contracts in force on reclamation projects such as Vale and Kittitas?

(Continued on p. 5)

Allocation of Power to be Generated at Proposed Boulder Dam

A HEARING in regard to the allocation of power to be generated at the proposed Boulder Dam on the Colorado River was held on November 12 and 13, 1929, in the office of Secretary Wilbur, who opened the meeting with the statement that it was officially called to permit those interested parties who wished to do so to make protests, ask questions, or present statements in connection with the tentative allocation of Boulder Dam power. This tentative allocation was printed in the NEW RECLAMATION ERA of November, 1929.

The following were present at the hearing:

Hon. Ray Lyman Wilbur, Secretary of the Interior, presiding.

Hon. E. C. Finney, Solicitor, Department of the Interior.

Dr. Elwood Mead, Commissioner of Reclamation.

Mr. P. W Dent, Assistant Commissioner of Reclamation.

Mr. Raymond F. Walter, chief engineer, Bureau of Reclamation, Denver, Colo.

Mr. E. K. Burlew, administrative assistant to the Secretary.

Mr. Northcutt Ely, Executive Assistant to the Secretary.

Mr. W. B. Mathews, counsel, department of water and power, city of Los Angeles, Calif.

Mr. E. F. Scattergood, chief electrical engineer, department of water and power, city of Los Angeles, Calif.

Mr. Harlan Palmer, adviser, department of water and power, city of Los Angeles, Calif.

Mr. H. A. Van Norman, general manager and chief engineer, department of water and power, city of Los Angeles, Calif.

Mr. William P. Whitsett, chairman, board of directors, Metropolitan Water District of California.

Mr. F. E. Weymouth, chief engineer, Metropolitan Water District of California.

Mr. W. B. Mathews, representing also the Metropolitan Water District of California.

Mr. W. C. Mullendore, representing the Southern Sierras Power Co., and the Southern California Edison Co., Los Angeles, Calif.

Mr. George C. Ward, Southern California Edison Co., Los Angeles, Calif.

Hon. William H. King, United States Senator, representing the Utah-Colorado Commission.

Mr. B. F. DeLanty, mayor of the city of Pasadena, Calif.

Mr. George W. Malone, State engineer, State of Nevada.

Hon. Key Pittman, United States Senator, representing the State of Nevada.

Hon. Tasker L. Oddie, United States Senator, representing the State of Nevada.

Hon. Sam S. Arentz, Member of Congress, representing the State of Nevada.

Prof. Colin G. Fink, on behalf of the State of Nevada.

Mr. H. E. Bruce, mayor of Burbank, Calif.

Mr. T. E. Kimlin, mayor of Glendale, Calif.

Mr. Bernard Brennan, representing Glendale, Calif.

Mr. P. Diederich, superintendent of plant and production, Glendale, Calif.

Mr. M. W. Conkling, city attorney, San Diego, Calif.

Mr. L. Ward Bannister, Denver, Colo., representing the city of Denver.

At the conclusion of the hearing the Secretary stated that he did not propose to complete the contracts before the second week in December in the hope that Arizona could be brought into the picture. Continuing he said:

"It will be a most unfortunate thing, in this great series of epochs that the West is necessarily to go through in the development of the water, not to carry this thing through upon a uniform program. This must go through so when the Flaming Gorge and all the other projects come on, as they will, we can have a united front against all of those who do not have the vision to see the necessity. Do not forget in your particular thing that you are involved in that your real interest is in this country and its development and that the western part of the United States must depend upon water and its controlled use for its further development. We must not lose this first battle, since otherwise years must elapse before we can do as we should in the maturing of the necessary plans for the West. The easy things have all been done. We are now facing the hard things like this where we must all get together. I hope we may close this conference in that spirit."

(Continued from p. 4)

Conservation Commission

"12. On many reclamation projects power plants can be built and power made a very profitable feature of the enterprise. It has been the practice to build these power plants to furnish cheap power for construction and then to utilize them after construction is over to supply power for lighting towns or operating machinery on the projects. In some instances the income from these power plants is contributing a large share of the cost of the enterprise, and it is believed that by more systematic planning in the future these revenues can be largely increased. The question arises, Should not the power revenue be kept entirely apart from irrigation revenue and after the works are paid for the power revenues be used to assist in the construction of new works?

"13. These would include the Forest Service, experiment stations on reclamation projects, and State activities in the settlement and agricultural development of project areas."

RESOLUTIONS

The commission adopted the following resolutions:

"That the chairman be authorized to make a request for an appropriation of $50,000 for expenses of the commission.

"That the chairman appoint an executive secretary to the commission and other necessary officers.

"That the chairman appoint such committees as he may deem advisable.

"That three subcommittees be appointed, one each to make a study of the following:

"(1) Disposal and use of the surface of unreserved public lands, including use and conservation of forage, protection of important watersheds, and the conserving of timber growth and recreational values when present.

"(2) Disposal of use of subsoil fuel minerals.

"(3) Future development of reclamation policy.

"That the chairman may in his discretion assign to each representative from the 11 public-land States for study and report any topic under which the facts are likely to be widely different for the several States, and that each of these representatives be asked to cover such additional topics as he may deem helpful.

"That the commission express its sincere gratitude to the President of the United States for giving the commission this special opportunity to study the problems of the West and their relation to the problems of the Nation."

THE Strawberry Water Users' Association has distributed net profits of $34,283.97 from the proceeds from the sale of power and from grazing leases, which will be applied to the payment of water-right charges payable to the Bureau of Reclamation. The amount of profits distributed is approximately one-third of the total construction charges for the current year.

Reclamation Project Women and Their Interests

By Mae A. Schnurr, Assistant to the Commissioner and Associate Editor New Reclamation Era

Junior Club Activities On Reclamation Projects

4-H Club work and other junior club activities on Federal reclamation projects develop the growing boy and girl physically and mentally and make of them useful citizens, leaders in their communities, and constructive thinkers and doers.

This work takes a very important place in the education, development, and training of boys and girls on farms or in farming communities. Their efforts are often stimulated by monetary returns. Teaching better and improved methods on farm subjects, on a competitive basis, thereby getting good material and financial results, has done more to retain the interest of the farm boy and girl than any other one thing could do.

In successive issues since September their activities have been featured in this section and, judging by the letters being received, this recognition is appreciated.

Umatilla Project—Oregon

There are seven 4-H Clubs on the Umatilla project. Included in that number are 1 pig club, 1 sheep club, 2 calf clubs, 1 poultry club, 1 corn club, and 1 rabbit club. The combined membership of all these clubs is 65.

Club work is carried on with the assistance of a local club leader in the Umatilla Project Farm Bureau. Mr. E. L. Jackson, who has acted in that capacity for the past several years, has taken active leadership in organizing and stimulating the club work.

The various clubs are organized in the spring each year, and the work during the year consists of club meetings, demonstration tours, judging practice, fitting for the show ring, and exhibiting at the various fairs. Fifteen registered animals are now owned by club members on the project. These include calves, sheep, and hogs. An exhibit was made by every club member at some fair during the season; $268 in prize money was captured by the club members. In some cases the members more than paid for a registered Jersey calf from the winnings for the year. A carload of 4-H Club livestock and other exhibits was taken to the State fair at Salem, where a very creditable showing was made.

The Irrigon Club Band, of 30 members, is entirely composed of 4-H Club members, 22 of whom are grade-school children. The grade and high schools have a total enrollment of 60; thus the membership of the band represents 50 per cent of the school children of this section.

Here, too, the factor of competition enters. This band competed with high-school bands in a State contest held at Portland on May 2 of this year and carried away second honors in the class C division. Mr. R. J. Maaske is director. A picture of the band appears on the back cover page.

The livestock pictures represent animals and entrants in the various shows conducted last year.

The animals shown were fitted by the boy or girl handling the entry and were entered at the State Fair at Salem in competition with stock from all parts of Oregon. It was here a very creditable showing was made.

Boise Project, Idaho

Mr. W. D. Kinder, district extension agent in charge of 4-H Club work on this project, sends an account of its aims, accomplishments, and future anticipations, as follows:

"It is work to demonstrate better practices, to give the boy and girl the educational value of agriculture and home economics, to teach them self-reliance, to develop leadership, to increase initiative, to give ownership, and best of all to make for the boy and girl the farm home a much better place in which to live.

"We do not know of any extension activity that is doing more good for the United States of America than that which develops our boys and girls. These boys and girls are enrolled in clubs with not less than five members working on the same project under the supervision of a local leader in each community. At the present time we have corn, wheat, calf, pig, sheep, canning, cooking, and sewing clubs, in which there are about 900 boys and girls enrolled. Each boy and girl carrying on a specific project keeps an accurate account of expenses, receipts, and other detail relative to their project. The boys and girls are required to carry their project to completion with the aid of the local leader, the district agent, and the specialists of the university.

"District agents and university specialists hold field demonstrations for the benefit of the local supervisors and club members, demonstrating to them better practices. In addition to this, subject-matter material for each project is prepared by the professors and specialists of the university, so that the boy and girl may study and put the best known principles into practice.

"At the close of the year 'Achievement Days' are held, at which time the club members are required to exhibit their project work in competition with other local members. The top exhibitors at the local shows take part in district and State competition. This gives to the club members an opportunity of observing each other's work, making comparisons, and learning how they may improve their work another year. It teaches them how to be good losers, as well as good winners, and gives to them the benefits to be derived from association.

"When the actual project is exhibited we ask the boy and girl to make their final report and file it with their exhibit. This

Blooded stock raised by 4-H Club boys and girls

complete report, giving the value, cost, and profit of the work, as well as other details, counts 25 per cent toward the prize awarded, while the exhibit itself counts 75 per cent. The final report is one of the biggest phases of our club work, inasmuch as it trains the boy and girl to understand the importance and method of keeping records. It is a wonderful thing to know just what it has cost a boy to grow an acre of corn, a pig, or a calf, and to be able to give the profit of the year's work.

"There were 52 clubs organized in 1928, with an enrollment of 600. The interest in 1928 was very good, but it does not begin to equal the interest of 1929, with an enrollment of about 1,000. A general understanding of club work is becoming more prevalent, and of course it is no longer difficult to organize clubs in communities where adapted."

A home on the Tieton Division, Yakima project, Washington

SOME OF THE HIGH POINTS OF 1928

In 1928 the Portland Union Stockyards pig-feeding contest was emphasized. Each boy growing a pen of four pigs from the same litter was eligible to participate in the Portland feeding contest fostered by the Union Stockyards. One hundred and thirty-five dollars were won in cash prizes by the boys in this district on their pens of four. Roy Stark, of Meridian, placed second in the champion contest, competing against the first-prize pens of the various districts in Washington, Oregon, and Idaho. Roy was paid 16 cents a pound on his second-prize pen, and hogs were selling that morning at 9½ cents a pound. You can readily see the encouragement given by the packers connected with the Union Stockyards. The nine boys made $1,057 participating in the Portland feeding contest.

CALF-CLUB WORK

Calf-club shows were started in May, 1928, first in the community, then in the county, and last at Boise, where individuals were selected and taken to Portland to compete against the Pacific Northwest. Five Jersey animals and four Holstein heifers were selected at the Boise show and sent to Portland. The entrants of Jerseys won, as follows: Keith Reynolds, Emmett, first in 2-year-old in milk; Kenneth Douglass, Caldwell, third in yearling heifer; Naomi Sargent, Fruitland, first in senior calf; Kathren Sargent, Fruitland, second in senior calf; and Eugene Ferguson, Caldwell, third in senior calf. The group of fine animals from this State placed second in the class of the five best club animals from any one State.

In the Holstein class, Elizabeth Weick, Notus, placed first in senior calf; Dorothy Weick, Notus, placed second in senior calf; Clayton Tschirgi, New Plymouth, placed third in senior calf; and Harold Miller, Nampa, placed second in the junior-calf class. The heifer owned by Elizabeth Weick was made champion of the Holstein show.

The boys' judging team, consisting of 3 sheep-club boys of Meridian, won the Portland judging contest in competition with 39 teams, placing 2 classes of beef, 2 classes of dairy cattle, 2 classes of hogs, and 2 classes of sheep. Through the courtesy of the Boise Valley business men these boys were sent to Chicago to compete in the national contest. There they won twelfth place, with 19 States competing.

This gives you some idea of the quality of boy and girl in Idaho club work and also the quality of stock grown by them. Club work is no longer treated as an unsound project, but is boosted and fostered by everyone in touch with it. The quality of work among the girls at the Boise show in 1928 was very high. Elimination contests are being conducted this year by the community in order to select the very best to compete at Boise. Thus, the quality of exhibit can not help but grow from year to year with this sort of program.

Those who are best succeeding in agriculture to-day are those who through foresight and management are able to turn a profit from their labors.

on the Umatilla irrigation project, Oregon

The Accomplishments of Reclamation in the State of Washington

By Porter J. Preston, superintendent, Yakima project, Washington

FEDERAL reclamation in the State of Washington has been confined to two general locations—the Okanogan and Yakima Valleys.

The State has a great range of rainfall, and these changes in the rainfall conditions are in many places so abrupt that the arid section and the region of abundant rainfall are not far distant one from the other. The western third of the State is abundantly supplied with moisture, and irrigation is little practiced, and then only for some special crop.

The eastern third of the State in part consists of rolling hills that are more or less elevated, upon which grain crops are grown more or less successfully. Through this section the two great river systems, the Columbia and the Snake, have cut valleys well below most of the land, so that the irrigation possibilities are either limited in extent or are costly to construct.

In the middle third of the State are found large areas of arid lands that require irrigation to make them productive. It is in this section that water is found abundant enough and at a sufficient elevation to place upon these lands at a reasonable cost, especially so along the Yakima River system and to a lesser extent along the Okanogan and Wenatchee Rivers.

Irrigation from these streams on a large scale is made possible by the abundant rainfall in the Cascade Mountains, in which these streams rise. The Cascade Range runs generally in a northerly and southerly direction, along or near the one hundred and twenty-first parallel of longitude. This range of mountains is relatively low, the peaks ranging from 6,000 to 10,000 feet in elevation, with passes 3,000 to 5,000 feet high.

Owing to the proximity of the Pacific Ocean and to the fact that this section lies in the path of most of the storms that cross the northern part of the United States, these mountains receive an abundant rainfall, mostly in the form of snow during the spring, fall, and winter months. The mildness of the climate and the moderate elevation of the watershed area all contribute to an early and abundant run-off during the winter, spring, and early summer months, with a very low flow in the latter summer months. With such conditions, irrigation depending upon the natural flow of the streams could make a comparatively small use of the total stream run-off.

The reclamation law was passed in 1902, and active investigations were undertaken immediately in a number of the arid States, on one or more projects in each of these States. In the State of Washington most of the irrigated area was then confined to the Yakima Valley, and it was also in this valley that one of the greatest opportunities lay for reclamation development.

The early investigations included a number of possible projects in the eastern two-thirds of the State, finally resulting in the selection of the Okanogan and Yakima projects for early development.

THE OKANOGAN PROJECT

The Okanogan project as originally contemplated consisted of about 8,500 acres situated in the northern part of the State, on the right bank of the Okanogan River, the irrigable land having an elevation of 850 to 1,350 feet. These lands were desirable for fruit tracts, owing to good air, drainage, and character of soil. The better lands attained a considerable elevation above the Okanogan River, so that a gravity supply from that source was out of the question. Salmon Creek, a tributary of the Okanogan River and bounding the proposed irrigable tract on the south, gave promise of furnishing a sufficient water supply by the development of a proper storage system.

Vested rights by lands then under irrigation on this stream were willing to confine their requirements to a total of a little more than 4,000 acre-feet annually from the natural flow of the stream.

This stream had a drainage area of 152 square miles, and the early records showed a run-off of 28,000 to 56,000 acre-feet, averaging better than 30,000 acre-feet for a number of years. It was considered that a reservoir capacity of 18,000 acre-feet would be ample to furnish the above-mentioned acreage a minimum of 36,000 acre-feet annually, except in case of two dry years in succession.

With this general basis, construction of the project was undertaken, and by 1918 the project was well under cultivation. During the preceding four years the run-off of Salmon Creek had been ample, although some water had been wasted owing to inadequate storage. In 1918 the run-off of the stream fell to 7,640 acre-feet. This required a supplemental supply to carry the then-existing irrigated acreage through the season, which was in part supplied by emergency pumping of 2,130 acre-feet from adjacent lakes. This permitted a little less than 1 acre-foot per acre to be delivered to the land. Again, in 1920, the run-off of Salmon Creek dropped to 5,184 acre-feet.

Since 1918 the run-off of the watershed has been insufficient to adequately take care of the acreage originally contemplated. The shortage of water led to a considerable contraction in the irrigated area, although all reasonable measures were exhausted to supplement the water supply. In 1927 a survey of the situation convinced all the parties interested that the project had been developed to cover a greater area than the dependable water supply would justify, and a conclusion was reached which was later enacted into a bill, reducing the area of the project to 3,700 acres, less than half that originally contemplated. The reduced project should succeed, as it is a desirable fruit section.

THE YAKIMA PROJECT

Conditions on the Yakima project, when the Government first began investigations, were that existing irrigation canals and the lands under them were using all the low water flow of the stream. If the acreage to be irrigated was to be materially increased, the flood waters would have to be stored. There were several very fine reservoir sites, but their full ultimate development and usefulness depended upon the extent to which plans might be worked out for the valley as a whole, rather than for any definite existing canal.

The companies or organizations owning or operating canals at that time claimed quantities of water far beyond the capacity of the streams' normal low water flow. If the Government was to spend large sums of money in the construction of reservoirs and the building of other irrigation works for the reclamation of new lands, it would be necessary to definitely define the rights of canals then constructed. To accomplish this, court procedure would ordinarily take years, a slow process when public interests were anxious for something to get started. It was therefore desirable to get nearly all the water users or canals to agree to limit their rights to a certain part of the low water flow of the stream. This was accomplished by mutual agreement, resulting in what have come to be known as the limiting agreements.

The securing of these limiting agreements and the withdrawal of the waters of the Yakima watershed from appropriation by the State until the Government could work out its plans gave a basis upon which the Government could proceed with a definite reclamation project in the Yakima Valley.

YAKIMA PROJECT DIVISIONS

The Yakima project as conceived, and as is being carried out, consists of all the reclamation development in the Yakima Valley as one project. The separate irrigated units are designated as divisions of the project.

The Sunnyside division, the construction of which was originally undertaken by the Washington Irrigation Co., was taken over by the Bureau of Reclamation and reconstructed and enlarged to a capacity sufficient to reclaim 100,000 acres of land on the north side of the river, east of Union Gap.

The construction of the Tieton division involved some very difficult and expensive canal construction in the Tieton Canyon to bring water to 31,000 acres of choice fruit lands.

The Kittitas division, now under construction, involves more types and different forms of canal sections than any irrigation plant yet constructed in this country and is probably one of the most expensive covering so large an acreage. This division, when completed, will serve 70,000 acres in and adjacent to Ellensburg.

The following reservoirs have been developed: Keechelus, Kachess, Bumping Lake, Tieton, Clear Creek, and Cle Elum with a temporary dam, having an aggregate capacity in excess of 600,000 acre-feet.

There remain still to be developed the Moxee, Roza, and Kennewick divisions, and the construction of the Cle Elum Dam. The completion of this dam, for which a part of the funds is already available, will give a storage capacity of about 1,000,000 acre-feet in the six reservoirs.

In constructing the above works the Government has spent the following amounts upon the several different units:

Sunnyside division, to Sept. 30, 1929	$3, 496, 613
Tieton division, to Sept. 30, 1929	3, 399, 497
Kittitas division, to June 30, 1929	4, 949, 364
Reservoir system, to Sept. 30, 1929	7, 351, 462
Total construction as indicated above	19, 196, 936

ECONOMIC RESULTS

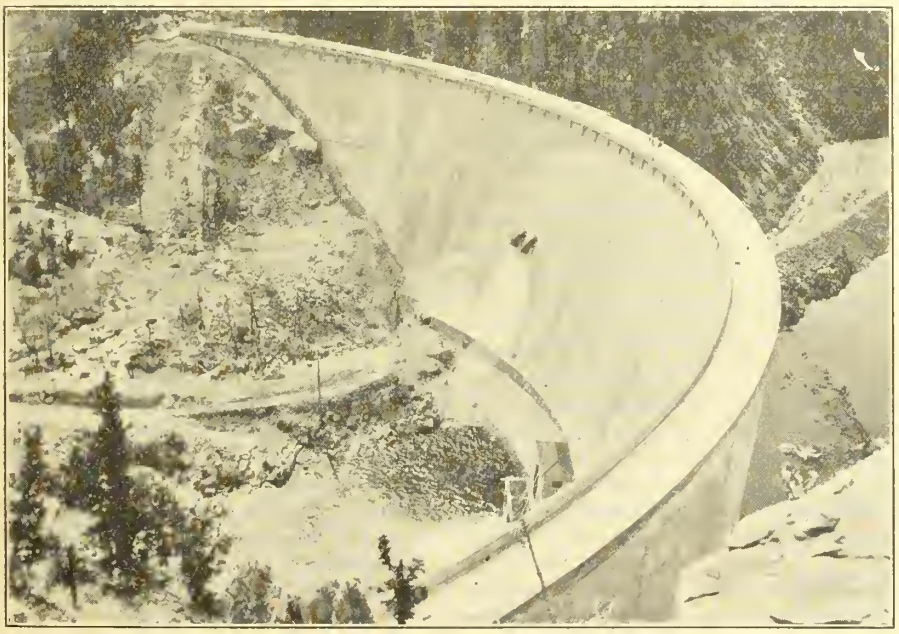
Has this expenditure been justified in this valley? If so, it must be measured by the homes it has enabled the population of the valley to build, the opportunity it has created for people to work, and finally by the wealth it has created.

There are no data to accurately measure these accomplishments. We have crop census reports on the Sunnyside and Tieton divisions that give us a picture of what those two divisions have produced in crop returns. From 1910 to date the Sunnyside division has produced, in round figures, crops to the value of $117,000,000, and the Tieton division $41,000,000 or a total of $158,000,000. In these 20 years, the crop production has been more than eight times the toal amount spent to date in construction. Eliminating the construction cost of the Kittitas division, which expenditure is not yet earning a return, the value of crops produced in the 20 years is eleven times the construction cost of the two divisions and the reservoir system.

In addition to furnishing storage water for the Sunnyside and Tieton divisions, contracts have been entered into with the Wapato Indian Service project and a number of private canal systems to which the Government furnishes a supplemental water supply that greatly increases their productive capacity. No data are available to segregate the increased production due to this service. The construction of the reservoir system enabling the canals of the valley to furnish a dependable and adequate water supply when needed has encouraged the development of a class of agriculture and horticulture that produces a much higher per acre return than would have been possible with conditions as they existed at the time the Bureau of Reclamation came into the valley.

The production of the Yakima Valley, exclusive of the Kittitas Valley, last year was around $45,000,000. Those who are familiar with conditions as they existed prior to the development by the Bureau of Reclamation state that a conservative estimate of the productive capacity of the valley would not have been in excess of one-third what it is to-day if the works of the Bureau of Reclamation had not been carried out.

Assuming that this is a reasonable basis, as far as wealth production is concerned, to gage the accomplishments of the Bureau of Reclamation in the State of Washington, it would appear that it had amply justified its works and the cost of the same with an annual production valued at one and one-half times its cost to date.



Gibson Dam from top of north abutment, Sun River project, Montana

San Gabriel Dam Report

A CONSULTING board of engineers and geologists on safety of the proposed San Gabriel Dam has submitted a unanimous opinion that foundation conditions are such that the 500-foot curved gravity concrete dam can not be built without creating a menace to life and property. This structure would have exceeded by nearly 100 feet the height of the Owyhee Dam, the highest of this type undertaken to date. The board decided that a safe dam of the combination earth and rock fill type, placed by the hydraulic method with concrete core wall, can be constructed at the site. The members of the board were Charles P. Berkey, G. A. Elliott, M. C. Hinderlider, George D. Louderback, John L. Savage, and Ira A Williams.

Federal Reclamation and the Railroads

By Hugh A. Brown, Director of Reclamation Economics

LAST year more than 200,000 carloads of goods and merchandise, valued at $278,000,000, were shipped to and from the railroad stations on 17 of the 24 operating irrigation projects of the Bureau of Reclamation in the arid and semiarid States. To get a clearer picture of what this means to the industrial development of isolated regions, which have been changed from waterless sagebrush plains to fertile fields, take the specific example of the Shoshone Federal irrigation project in northern Wyoming.

At the time construction of this project was begun in 1905 by the Bureau of Reclamation there were but 17 miles of railroad on the project, extending from the State line to the town of Garland. The entire project contained only four farms in private ownership. The total assessed valuation of farms, towns, and public utilities amounted to scarcely $250,000. To-day the project is served by 65 miles of railroad, extending from one end of the irrigated area to the other, bringing manufactured articles from eastern factories to the 860 irrigated farms, with their population of 2,000, and to the 5 towns, with an additional population of 1,600 and carrying to market the products of the irrigated land. To-day the assessed valuation of the farms, towns, and public utilities on the project is $5,000,000. The gross value of crops grown yearly approaches the million mark, that of livestock is more than $400,000, and of farming equipment over $350,000.

During the year the railroad shipped from the project 1,875 carloads of agricultural products valued at $1,055,680, the principal items being 1,000 cars of sugar beets, 550 cars of potatoes, 134 cars of alfalfa meal, 54 cars of Great Northern beans, 68 cars of sheep, and 176,600 pounds of butterfat. In return the railroad brought to the project 433 carloads of goods and manufactured products valued at $729,375. Among these were 31 cars of automobiles, 86 of gasoline and lubricating oils, 47 of lumber, 53 of groceries, 27 of flour and feed, and 14 cars of agricultural implements.

It should be remembered that this is one of the average projects, by no means the most successful. It is, however, typical of the growth in industry brought about by Federal reclamation and illustrates the point that these desert oases, when capably served with adequate railroad facilities, furnish an excellent market for products manufactured largely in eastern factories.

That the agricultural and industrial departments of the railroads traversing the Federal irrigation projects are fully alive to their importance as potential sources of commerce and trade is indicated by the whole-hearted cooperation the Bureau of Reclamation receives in its settlement and development programs.

The Santa Fe road has been particularly active in advertising the advantages of the Rio Grande project, New Mexico-Texas; the Carlsbad project, New Mexico; and the Salt River project, Arizona. The Southern Pacific has been equally effective in making the Salt River project and the Roosevelt Dam nationally famous. This road has more recently turned its attention to the opportunities on the Orland project, California, one somewhat unique method of advertising the attractions of the project being through the medium of its dining car menu cards. This railroad's interest in the Yuma project, Arizona-California; the Rio Grande project, the Newlands project, Nevada; and the Klamath project, Oregon-California, has been very helpful in their economic development.

The Chicago, Burlington & Quincy Railroad has left no stone unturned to cooperate with the Bureau of Reclamation in the settlement and development of the North Platte project, Nebraska-Wyoming, and the Willwood division of the Shoshone project, Wyoming, three units of which have been opened to entry during the past two years. This road also serves the Huntley project, Montana, and runs fairly close to the Riverton project, Wyoming.

The Grand Valley and Uncompahgre projects, Colorado, and the Strawberry Valley project, Utah, are under the watchful eye of the Denver & Rio Grande Western Railroad, the latter project also enjoying the helpful assistance of the Union Pacific, which serves as well the Boise, King Hill, and Minidoka projects in southern Idaho; the North Platte project, the Umatilla project, Oregon; and the Yakima project, Washington.

The Montana projects—Milk River, Sun River, and Lower Yellowstone—and the Okanogan project, Washington, are traversed by the Great Northern, while the Northern Pacific serves equally well the interests of the water users on the Huntley project, Montana, and the Lower Yellowstone and Yakima projects. The Sun River project and the Kittitas division of the Yakima project also have the benefit of the transportation facilities and advice of the Chicago, Milwaukee & St. Paul.

The Chicago & Northwestern Railroad is especially interested in the continued development of the Belle Fourche project, South Dakota, which was described recently by one of its officials as a "garden spot." This road also has a branch line running to the Riverton project, Wyoming.

Adequate rail facilities to practically all the Federal irrigation projects have extended their markets to an amazing degree. Yakima project apples, Minidoka project potatoes, Salt River project lettuce, Newlands project cantaloupes, Yuma mesa grapefruit, and many other products of the irrigated areas are as well known in eastern markets as they are in the localities where they are produced. Most of this produce reaches the eastern markets at a season when it could not be grown in that locality, so that it has no appreciable effect on the agricultural surplus. As a result of its sale, however, millions of dollars yearly find their way to eastern manufacturers for the purchase of supplies, machinery, equipment, and furniture to meet the needs of the settlers on the projects and their neighbors in the project towns and cities. Is it any wonder that these transcontinental shipments are of vital interest to the railroads, and that an increasing amount of time, effort, and money is spent by them in cooperating with the Bureau of Reclamation in the settlement and development of the Federal irrigation projects?—*United States Daily.*

Irrigation Development in Mexico

An item in a recent issue of Commerce Reports states that the amount actually expended on irrigation work in Mexico during 1928 is not known definitely, but the budget for the year provided for an expenditure of $10,000,000, according to Consul Charles W. Lewis, jr., of Mexico City. The sites for eight large irrigation projects have been selected by the National Irrigation Commission and work on some of these was initiated during the past year. Two other irrigation projects were undertaken during 1928, one in the valley of Tecozautla, Hidalgo, which was completed in August and the other in the Tia Juana Valley, Lower California. The former project was financed by the State of Hidalgo, while it is understood that the latter is being financed by the Government of the northern district of Lower California.

ACCRETIONS TO THE RECLAMATION FUND, REPAYMENTS TO THE RECLAMATION FUND, AND EXPENDITURES FOR CONSTRUCTION AND FOR OPERATION AND MAINTENANCE OF RECLAMATION PROJECTS TO JUNE 30, 1929

(1) State and project	(2) Accretions to reclamation fund to June 30, 1929	(3) Collections (repayments to reclamation fund) to June 30, 1929	(4) Total accretions and collections (column 2+column 3)	(5) Expended for construction of reclamation projects to June 30, 1929	(6) Expended for operation and maintenance to June 30, 1929	(7) Total expenditures to June 30, 1929
Alabama	$52,656.93		$52,656.93			
Arizona:						
Salt River project		$9,686,544.51		$15,106,942.10		$15,106,942.10
Yuma project [1]		[2] 4,851,447.26		8,421,905.21	[3] $2,123,027.19	10,544,932.40
Yuma Auxiliary project		11,993.79			166,143.22	166,143.22
Total Arizona	2,392,620.60	14,549,985.56	16,942,606.16	23,528,847.31	2,289,170.41	25,818,017.72
California:						
Orland project		1,210,235.84		2,500,788.17	402,435.23	2,903,223.40
Yuma project [1]		[2] 2,304,413.55		[3] 1,653,581.82	863,067.73	2,516,649.55
Klamath project [1]		[2] 252,600.00		1,981,958.00	57,717.00	2,039,675.00
Total California	14,927,074.76	3,767,249.39	18,694,324.15	6,136,327.99	1,323,219.96	7,459,547.95
Colorado:						
Grand Valley project		742,652.99		5,326,169.37	79,594.77	5,405,764.14
Uncompahgre project		2,615,132.75		7,928,760.97	891,219.98	8,819,980.95
Total Colorado	10,302,900.65	3,357,785.74	13,660,686.39	13,254,930.34	970,814.75	14,225,745.09
Idaho:						
King Hill project		129,854.49		1,905,318.80	156,734.25	2,062,053.05
Minidoka project		7,709,854.86		7,249,906.39	2,048,337.75	9,298,244.14
American Falls Reservoir		3,961,672.91		7,644,054.96		7,644,054.96
Gravity Extension Unit		101,188.97		374,541.92		374,541.92
Boise project [1]		[2] 6,816,623.34		15,176,883.07	2,674,734.94	17,851,618.01
Owyhee project [1]				487,018.69		487,018.69
Total, Idaho	6,864,520.88	18,719,194.57	25,583,715.45	32,837,723.83	4,879,806.94	37,717,530.77
Kansas: Garden City project	1,032,764.48	58,002.27	1,090,766.75	395,831.78		395,831.78
Louisiana	18,167.66		18,167.66			
Montana:						
Huntley project		1,169,829.34		1,562,302.99	1,014,943.79	2,577,246.78
Milk River project		591,396.23		7,438,043.84	169,210.57	7,607,254.41
Sun River project		757,498.47		6,966,136.52	286,146.57	7,252,283.09
Lower Yellowstone project [1]		[2] 465,439.22		2,239,429.38	782,721.43	3,022,150.81
Total, Montana	15,896,473.72	2,984,163.26	18,880,636.98	18,205,912.73	2,253,022.36	20,458,935.09
Nebraska: North Platte project [1]	2,092,488.16	[2] 5,056,872.26	7,149,360.42	15,304,799.05	2,524,158.83	17,828,957.88
Nevada: Newlands project	982,808.35	2,584,172.77	3,566,981.12	7,956,626.60	1,453,190.54	9,409,817.14
New Mexico:						
Carlsbad project		1,617,117.49		1,464,522.57	780,684.34	2,245,206.91
Hondo project		34,956.70		381,573.39		381,573.39
Rio Grande project [1]		[2] 3,369,302.55		8,547,137.17	1,397,415.20	9,944,552.37
Total, New Mexico	6,202,208.85	5,021,376.74	11,223,585.59	10,393,233.13	2,178,099.54	12,571,332.67
North Dakota:						
Buford Trenton project		17,873.93		223,423.06	74,781.07	298,204.13
Williston project		586,089.55		517,630.09	904,662.04	1,422,292.13
Lower Yellowstone project [1]		[2] 206,456.35		1,198,266.07	418,815.85	1,617,081.92
Total, North Dakota	12,261,898.13	810,419.83	13,072,317.96	1,939,319.22	1,398,258.96	3,337,578.18
Oklahoma	5,924,052.79		5,924,052.79			
Oregon:						
Baker project		5,879.29		68,334.33		68,334.33
Umatilla project		1,156,143.45		5,176,914.15	685,619.30	5,862,533.45
Vale project		8,089.65		1,305,251.04		1,305,251.04
Klamath project [1]		[2] 2,144,044.37		3,633,077.71	1,012,158.46	4,645,236.17
Owyhee project [1]		6,351.37		1,122,091.05		1,122,091.05
Boise project [1]		[2] 49,286.70		483,210.00	73,109.75	556,319.75
Total, Oregon	11,846,011.59	3,369,794.83	15,215,806.42	11,788,878.28	1,770,887.51	13,559,765.79
South Dakota: Belle Fourche project	7,712,824.89	1,419,141.16	9,131,966.05	3,855,320.21	1,432,494.18	5,287,814.39
Texas: Rio Grande project [1]		2,584,092.53	2,584,092.53	7,133,089.24	1,163,791.16	8,296,880.40
Utah:						
Strawberry Valley project		2,065,021.30		3,519,935.39	437,856.39	3,957,791.78
Salt Lake Basin project		44,358.60		1,399,028.95		1,399,028.95
Total, Utah	4,250,263.67	2,109,379.90	6,359,643.57	4,918,964.34	437,856.39	5,356,820.73
Washington:						
Okanogan project		689,529.64		1,456,456.67	649,647.22	2,106,103.89
Yakima project		10,249,925.52		14,452,110.86	3,943,506.24	18,395,617.10
Kittitas division		37,054.26		4,907,003.47		4,907,003.47
Total, Washington	7,368,111.07	10,976,509.42	18,344,620.49	20,815,571.00	4,593,153.46	25,408,724.46
Wyoming:						
Riverton project		128,482.12		3,372,605.08		3,372,605.08
Shoshone project		1,986,259.23		9,612,518.75	899,729.21	10,512,247.96
North Platte project [1]		[2] 919,000.00		4,859,626.57	[4] 200,000.00	5,059,626.57
Total, Wyoming	35,527,249.52	3,033,741.35	38,560,990.87	17,844,750.40	1,099,729.21	18,944,479.61
All States:						
Secondary investigations		771,666.89	771,666.89	2,395,573.06		2,395,573.06
Federal water-power licenses	59,209.22		59,209.22			
Other collections (including general offices, Indian projects, etc.)		4,409,775.48	4,409,775.48			
Grand total	145,714,305.92	85,583,323.75	231,297,629.87	198,705,698.51	29,767,654.20	228,473,352.71

[1] Interstate projects, expenditures for construction and for operation and maintenance prorated on an area basis.
[2] Distribution between States of collections on interstate projects partly estimated.
[3] Levee maintenance reimbursed by or financed from the General Treasury not included.
[4] Estimated.

Means for Helping to Stabilize the Commercial Phases of the Use of Water

By Prof. Frank Adams, University of California

IN times of more general agricultural prosperity some of the projects which have proven to be infeasible for one cause or another would have worked out without material loss to investors, because farm returns would have been higher and available lands in projects would have been more in demand. On the other hand, many projects have been started which were doomed to failure regardless of the general economic situation.

STRICTER FEASIBILITY TESTS

Following the completion of our recent irrigation districts study in California in which the question of economic feasibility was constantly in mind, it has been my privilege during the past six months to visit a number of Federal reclamation projects and to sit as a member of a committee to review economic reports prepared during the present season covering 21 Federal reclamation projects or parts of projects.

With this recent background of experience it is impossible for me to escape the conviction that much stricter feasibility tests are needed and should be imposed by Federal and State officials having authority over the organization of irrigation and drainage projects. There is, in fact, a very wide appreciation of the need for such stricter feasibility tests. The problem is how to insure that they are imposed.

Some projects have failed or are in difficulties because of lack of water supply or poor construction. On the whole, however, the engineering requirements seem to be well in mind and are in general being met. On the other hand, sufficient consideration has not been given, even within very recent years, to such important feasibility factors as soil productivity; crop adaptability; the crop yields reasonably to be expected; crop marketability and price trends for the crops proposed to be grown; costs of development on the reclaimed farms, including such factors as farm building, preparation of land for irrigation, necessary farm equipment; and the other general capital requirements in setting up successful farm units. The money needed to go into these subjects has not been supplied.

To be sure, no one is wise enough to forecast all of the things that will affect the production and the profits which will be yielded by our reclamation projects. It is all the more necessary, therefore, to study very carefully in advance the whole question of economic feasibility and to reach the best possible judgment before construction is started.

One reason why we have failed to impose stricter feasibility tests in the advance of the construction is that many of the projects have been organized on a speculative basis. Promoters of projects of this type have not desired to stress the question of feasibility. On the other hand, many doubtful projects have been organized and built in entire good faith on the part of the promoters. State authorities have not always been impressed with the need for careful economic scrutiny. Few men trained in economic analysis of proposed projects have been available for employment by the States, even if the desirability of such studies had been fully sensed.

Without attempting further to inquire into the causes for the past failure to give due weight to economic feasibility, it is suggested that the present need is to set up a schedule of economic tests to which proposed projects should be subjected and then to develop the technique by which the work is to be done. I know of no agency better able to lead in this than the Association of Western State Engineers.

You will recall that a partial statement of what seemed to me ought to be considered was presented in the concluding comments of Bulletin 21, particularly item 4, pages 412 to 414.[1] The State engineers probably will not accept all of the requirements set forth in item 4, but, on the other hand, they probably would add others. My specific suggestion is that the association, in conjunction with those interested in the various agricultural colleges, the Bureau of Reclamation, and the division of agricultural engineering of the Federal Department of Agriculture, study this whole matter with a view to formulating a procedure which will meet the present situation. It is of course not sufficient that new projects be subjected to careful economic analysis; the same need exists in connection with projects now in financial distress or those which are approaching the problems of settlement.

In what is said above there is no intention to overlook the fine economic studies that have been made within the past few years in a number of the States. These studies have laid the foundation for the more complete treatment of the question of economic feasibility which is needed for the future.

[1] See NEW RECLAMATION ERA, December, 1929, p. 181.

SETTLEMENT CREDIT

The question of settlement credit is one of the most important of those facing new reclamation projects, as well as some which have been constructed for a number of years but are not yet paying their way. It is perhaps the most important economic question facing many of the projects. No attempt has been made to assemble statistics regarding the areas of land within projects which are now unfarmed. All of the State engineers are perfectly familiar with the fact that these areas exist and that many projects are in critical condition because of them.

The delayed settlement of projects is due in the first instance to the generally unsatisfactory condition of agriculture throughout the country following the postwar deflation. Notwithstanding that the general economic situation in agriculture is now much improved, there are not enough farms with sufficient capital or credit to establish themselves to meet the present need.

In an arid-land reclamation project devoted to general crops and livestock the amount required to set up a farm and put it on an earning basis is not less than $8,000 to $10,000 for each 40 to 60 acres. A minimum requirement for the man of experience, ability, and right temperament for pioneer farming is $5,000. Few new settlers, however, possess capital or credit in excess of two or three thousand dollars, and a large percentage of those who attempt the development of an irrigated farm with these limited resources fail. It is believed that a very considerable percentage would succeed if they had available an additional credit of $1,500 to $3,000, but no existing agency is in a position to give this.

The question of settlement credit is perhaps not highly important in many parts of California, but it is the crucial matter in a number of the other States. A committee of economic advisers on the Federal reclamation projects is undertaking to outline a solution of this problem of settlement credit on Federal projects. It is my belief that the State engineers can very well give consideration to the same problem.

FEDERAL ASSISTANCE TO RECLAMATION PROJECTS IN DISTRESS

You are already fully familiar with the various proposals that have been advanced for Federal aid to irrigation and drainage districts in distress, and particu-

Spraying an apple orchard on the Tieton Division, Yakima, project, Washington

larly with the bills that have been introduced, or proposed for introduction, in the National Congress. Undoubtedly many of the projects in distress would be found on careful examination to merit assistance. On the theory that it is proper for the Federal Government to subsidize reclamation to the extent of equalizing the costs of agricultural development as between the East and the West and as between different parts of the West, some of these projects in distress are undoubtedly entitled to Federal aid.

If funds were available for such aid it, of course, would be very difficult to separate out the worthy from the unworthy enterprises and to resist political pressure to give aid where those who would be most benefited would be the holders of the district bonds or other evidences of overdue indebtedness. Futhermore, even if a selection could be made between the worthy and unworthy projects and all political pressure successfully resisted, some of the projects given assistance would still be on the border line and perhaps be subject to defaults in repayments to the Government.

The State engineers are undoubtedly fully familiar with the fact that the funds necessary to aid distressed irrigation projects are not available in the reclamation fund but would have to come from the General Treasury. The present income of the reclamation fund is approximately $9,000,000 per year. This is going to complete the 10-year program adopted with the approval of the Secretary of the Interior, 1927.

Even if money were available in the reclamation fund, it is not likely that the responsibility for rehabilitation of the projects now in distress would be undertaken by the Bureau of Reclamation unless the States would stand ready to join in the cost and other responsibilities involved. Speaking only of districts in distress, my feeling is that if Congress ever authorizes an appropriation out of the General Treasury for aid to the reclamation districts a similar requirement will be imposed on the States. The basis for this belief is that State participation seems the only way to bring home to the States their responsibility for the success of these projects.

GOVERNMENT PURCHASE OF RECLAMATION DISTRICT BONDS

Some of the bills that have been drafted for the purpose of extending Federal aid to irrigation and drainage districts provide for the purchase or taking over by the Government of outstanding district-bond issues. My feeling is that the Government will never consent to do this and that to attempt to induce it to will jeopardize the whole effort to obtain the aid needed to make the projects successful. If the projects have spent more than is warranted by the earning capacity of the land, it is inevitable that the bondholders must lose part of their investment. All that can reasonably be expected from the Government and the States is that they help in connection with additional expenditures that may be needed. This in itself will greatly improve the equity of the bondholders. If no additional expenditures are required, refunding of outstanding bonds on a basis that the income from the land benefited will justify seems to be the only feasible procedure.

Proposals for Federal relief generally provide that the Government will accept district bonds in the amount of the Government expenditures. This would make the Government instead of the districts the collecting agency, at least in cases of default, and would create a wrong psychology among the landowners. The Government now contracts with the districts for repayments. Holding the district bonds would give the Government no better security than it has under its contracts. My feeling is that the pending bills or drafts of bills should be amended to conform to present procedure.

"How the Other Fellow Does It"

By A. S. Keys, Pavillion, Wyo.

SWEET CLOVER INCREASES GRAIN YIELD ON NEW LAND

A RANCHER in the Big Wind Valley just south of the Riverton project plowed 50 acres of sagebrush land in the spring of 1927 and seeded oats and barley as a nurse crop for yellow sweet clover. In 1928 the 50 acres of new seeding and an additional 20 acres carried 775 ewes and lambs. In the spring of 1929 the clover was turned under before it had a chance to make much growth, and the land was again planted to oats and barley, which made a yield of 72 bushels of oats and 80 bushels of barley per acre, or an increased production of more than 100 per cent over the yield of 30 bushels of oats and 20 bushels of barley harvested the first year.

MOISTURE IN SUBSOIL GIVES PROFITABLE RETURNS FROM SAGEBRUSH LAND

A ditch, running through a piece of sagebrush land on a farm operated by Mr. Jordan, a successful stockman in the Riverton Valley, washed out and allowed water to spill over the land during a part of the irrigation season. The following spring the land was plowed and seeded to oats. At harvest time the ground that had been soaked made an estimated yield of 75 bushels to the acre, while the same soil that had received water after the crop was planted produced an estimated yield of 20 to 25 bushels per acre. Federal project crops were valued in 1928 at more than $143,000,000.

The Highest and Largest Dams in the United States and Abroad

By P. I. Taylor, Assistant Engineer, Washington Office, Bureau of Reclamation

THE Pacoima Dam near San Fernando, Calif., recently completed by the Los Angeles County flood control district bears the distinction of being the highest dam in the world. It is a concrete arch 380 feet high, with a crest length of 680 feet, and contains 225,000 cubic yards of concrete. The height is taken as the maximum height above the rock foundation. However, the Pacoima will soon be exceeded by two dams now under construction. The Diablo or Diablo Canyon Dam being built by the city of Seattle, Wash., on the Skagit River, is rapidly nearing completion and will be 400 feet high. This structure is a constant-angle concrete arch between gravity-section abutments. It will have a crest length of 1,100 feet and a volume of 275,000 cubic yards of concrete. The Owyhee Dam in eastern Oregon on the Owyhee (Federal) irrigation project, on which construction was recently started by the Bureau of Reclamation, will surpass the two dams named, as it will be 405 feet in height. The Owyhee will be of the concrete arch-gravity type, with a length of 850 feet on the crest, and is to contain 550,000 cubic yards of concrete. It is interesting to note that the dam will have a total height of 520 feet above the lowest concrete in the foundation cut-off.

The Los Angeles County flood control district recently began construction of the San Gabriel Dam near Azusa, Calif. The plans called for a concrete arch 500 feet high, with a crest length of 2,300 feet and containing 3,800,000 cubic yards of concrete. Abutment slides have recently caused the contractors to stop work, and it may be necessary to modify the structure or possibly build at another site. The proposed Boulder Dam on the Colorado River, construction of which has been authorized by Congress, will make all other dams in the world look small, as it will be about 700 feet in height.

ROCK-FILL DAMS

The Dix River Dam, near Danville, Ky., owned by the Kentucky Hydro-Electric Co., is the highest and largest rock-fill dam in the world. It is 275 feet high and contains 1,747,000 cubic yards of rock; the crest length is 910 feet. Near Jackson, Calif., on the North Fork of the Mokelumne River, the Pacific Gas & Electric Co. has begun construction of the Salt Springs Dam, a rock-fill structure with concrete face, which will be 330 feet high and contain 3,000,000 cubic yards of rock, thus surpassing both in height and volume the Dix River Dam.

EARTH-FILL DAMS

There may be some question as to the highest earth-fill dam. The Davis Bridge Dam, on the Deerfield River near Readsboro, Vt., built by the New England Power Co., is considered to be the highest hydraulic-fill dam in the world. It is 200 feet high, with a crest length of 1,250 feet, and contains 1,900,000 cubic yards. The Calaveras Dam of the Spring Valley Water Co. in Alameda County, Calif., is 215 feet in height, about 1,300 feet long, and contains 3,461,000 cubic yards of material. The lower portion was placed by hydraulic-fill methods, but after a slide of 800,000 yards in March, 1918, the upper portion was completed with a dry fill of earth and rock. On the Yakima (Federal) irrigation project in Washington, the Bureau of Reclamation in 1925 completed the Tieton Dam. This structure is an earth, gravel, and rock-fill embankment 222 feet high, of the semi-hydraulic-fill type with a concrete core wall. From the deepest core-wall foundation to the crest it is 321 feet. However, the question of the highest earth dam will soon be settled, as the Cobble Mountain Dam now under construction near Springfield, Mass., will surpass in height all structures of its kind with its 245 feet. The city of Springfield is building this structure in connection with its water-supply system. It is a hydraulic fill embankment with concrete cut-off wall and will contain 1,800,000 cubic yards of material.

Reclamation

If you want to do a wonder,
In that arid west out yonder,
Why not place the landless man
Upon the land that knows no man?

Start the crystal waters flowing
In broad fields; they'll soon need mowing,
From that bleak and barren plain
You'll reap rich fruit and golden grain.

Build a home of peace and plenty
On the margin of each twenty.
Is not life made worth the while
If you can cause another's smile?

When you've done this act sublime,
You've stamped your name in sands of time;
And you have changed that waste infernal
To a Home Sweet Home eternal.

—Author unknown.

MULTIPLE-ARCH DAMS

The highest multiple-arch dam in the world is the Lake Pleasant Dam on the Agua Fria River in Arizona. This structure is 256 feet in height and was built by the Maricopa County water conservancy district No. 1 in 1927. A partial failure of the dam in 1928 made it necessary to lower and enlarge the spillway and also strengthen the buttresses, with the result that part of the 256 feet of height is not utilized. One of the main structural features is the double-wall type buttresses. The Coolidge Dam on the Gila River in Arizona, which stores irrigation water for the San Carlos project, which is under the supervision of the United States Indian Service, is 249 feet high and is the first multiple-dome structure to be built. It consists of a series of egg-shaped domes supported by intermediate buttresses and the canyon walls. Among the dams of the reinforced concrete Ambursen type, the La Prele at Douglas, Wyo., is the highest, rising about 150 feet above the foundation

LARGEST DAMS

The largest dam in the world is the Gatun Dam in the Canal Zone, Panama, an earth embankment which contains 22,958,000 cubic yards. It is 115 feet high, 7,700 feet long, and the dam forms a reservoir with an area of 167½ square miles, containing 4,413,000 acre-feet of water. The creation of this lake permits slack-water navigation for about 23 miles, or more than half of the total length of the Panama Canal. In comparison, the Boulder Canyon Reservoir will be about 100 miles long, with an area of 200 square miles and a capacity of 26 to 30 million acre-feet. In this country, the Wachusett North Dike, at Clinton, Mass., a part of the water-supply system of the metropolitan district of Boston, is the largest dam and contains 5,500,000 cubic yards of earth, but will be exceeded in size by the Saluda semihydraulic fill dam now under construction on the Saluda River near Columbia, S. C., which will contain 11,000,000 cubic yards of earth. This will be one of the highest earth dams, with a maximum height of 208 feet. Its crest length will be 7,838 feet, and the reservoir formed by the dam will be 41 miles long and have a capacity of 2,300,000 acre-feet. Among the concrete-masonry dams the Wilson or Muscle Shoals Dam on the

Tennessee River, near Florence, Ala., is probably the largest, as it contains 1,440,000 cubic yards of concrete. The dam proper has a maximum height of 98 feet above the river bed and 140 feet from the lowest point of the foundation. The length comprises 200 feet of north abutment, 2,668 feet of spillway section, and 230 feet of sluiceway section. There are 58 spillway sections, each containing a steel control gate 40 feet long by 18 feet high. The combined discharging capacity of the spillways and gates is 950,000 cubic feet per second. The Mathis Dam on the Tallulah River in Georgia is said to be the largest structure of the reinforced-concrete Ambursen type and is reported to have a volume of 1,376,000 cubic yards.

DAMS IN FOREIGN COUNTRIES

In foreign countries the highest dam is the Schraeh in Switzerland, a concrete gravity-type structure 362 feet high. The largest dam is the Necaxa No. 2 in Mexico, built by the Mexican Power & Light Co., and reported to contain 2,300,000 cubic yards of earth. This structure partially failed in May, 1909, when about 715,000 cubic yards of the upstream part of the dam slid into the reservoir. The gap made in the dam was filled in again and the work successfully completed. However, the Necaxa No. 2 will be exceeded in size by the Hume Dam now under construction by the River Murray Commission in New South Wales, Australia. This immense structure, with earth embankments and concerete spillway section, will contain 3,900,000 cubic yards of earth and 533,000 cubic yards of concrete. It will be 200 feet high, 5,300 feet long, and will store 2,000,000 acre-feet of water. The highest multiple-arch dam outside of the United States is the Tirso, in Sardinia, Italy, built in 1923, which is 239 feet high. This structure is remarkable because the buttresses are built of cut-stone masonry, the arches being of reinforced concrete. There is now under construction in Mexico the Rodriguez Dam on the Tia Juana River, about 11 miles south of the international boundary. It is the highest dam of the reinforced-concrete Ambursen type to be undertaken up to the present time. It will have a height of 255 feet, crest length of 2,400 feet, and will contain 300,000 cubic yards.

RECLAMATION DAMS

Since 1902 the Bureau of Reclamation has constructed over 100 dams and now has under construction the Owyhee in Oregon, Echo in Utah, Deadwood in Idaho, and Weber-Provo in Utah. The Arrowrock Dam, a rubble concrete structure of the arch-gravity type, on the Boise River in Idaho, is 349 feet in height and is the highest completed to date. The largest dam is the McKay, on the Umatilla project, Oregon, a gravel embankment with a reinforced-concrete slab on the upstream face and containing 2,287,000 cubic yards. The 306-foot Elephant Butte Dam, on the Rio Grande in New Mexico, stores the most water, the capacity of the reservoir being 2,638,000 acre-feet. This is a straight structure of the gravity type, built of rubble concrete. An interesting dam completed by the Bureau of Reclamation in 1928 is the Stony Gorge, on the Orland project in California. It is the non-continuous type of Ambursen type of dam, with provision for spillway discharge through three bays of overflow section in the central portion of the dam. The height is 125 feet and the crest length 863 feet. In the Engineering Division of the Washington office a card index of dams is maintained, the data being obtained principally from technical publications.

The accompanying tables give the highest and largest dams of various types both in this country and in foreign countries:

DAMS IN THE UNITED STATES

Name	Location	Type	Height	Volume
			Feet	*Cubic yards*
Boulder [1]	Arizona-Nevada		700	
San Gabriel [2]	California	Concrete arch gravity	500	3,800,000
Owyhee [3]	Oregon	do	405	550,000
Diablo [3]	Washington	Concrete arch	400	275,000
Pacoima	California	do	380	238,000
Pardee	do	Concrete arch gravity	357	615,000
Arrowrock	Idaho	Rubble concrete arch gravity.	349	585,130
O'Shaughnessy	California	Cyclopean masonry, arch-gravity.	344	390,223
Exchequer	do	Concrete arch gravity	330	440,000
Salt Springs [3]	do	Rock fill, concrete face	330	3,000,000
Shoshone	Wyoming	Rubble concrete arch	328	78,576
Kensico	New York	Cyclopean masonry, gravity.	307	900,000
Elephant Butte	New Mexico	Rubble concrete gravity.	306	605,200
Horse Mesa	Arizona	Concrete variable radius arch.	305	147,357
Dix River	Kentucky	Rock fill	275	1,747,000
Lake Pleasant	Arizona	Concrete multiple arch	256	72,000
Coolidge	do	Concrete multiple dome	249	187,000
Cobble Mountain [3]	Massachusetts	Hydraulic earth fill	245	1,800,000
Tieton	Washington	Earth and rock fill	222	1,995,000
Calaveras	California	Semihydraulic fill	215	2,709,000
Gatun	Canal Zone, Panama.	Earth fill	115	22,958,000
Saluda [3]	South Carolina	Semihydraulic fill	208	11,000,000
Wachusett North Dike.	Massachusetts	Earth fill, sheet-piling core.	80	5,500,000
Englewood	Ohio	Hydraulic earth fill	120	3,500,000
Standley Lake	Colorado	Earth fill, puddled core	113	3,250,000
Lower San Fernando.	California	Semihydraulic fill	123	2,713,000
Scituate	Rhode Island	Earth fill	180	2,500,000
San Pablo	California	Hydraulic earth fill	110	2,250,000
McKay	Oregon	Gravel fill, concrete paving.	160	2,313,000

[1] Authorized for construction. [2] Construction work suspended. [3] Under construction.

DAMS IN FOREIGN COUNTRIES

Name	Location	Type	Height	Volume
			Feet	*Cubic yards*
Schraeh	Switzerland	Concrete, gravity	362	305,000
Camarassa	Spain	Concrete arch gravity	335	283,140
Talarn	do		330	
Bhandardara	India	Concrete, gravity	282	444,444
Suviana	Italy		279	340,000
Chavanon	France		279	
Montejaque	Spain	Concrete arch	273	
San Antonio	do	Concrete arch gravity	269	351,000
Assume	Egypt	Concrete gravity	115	1,200,000
Grimsel	Switzerland	Concrete, gravity	266	
La Boquilla	Mexico		261	390,000
Rodriquez [1]	do	Ambursen	255	300,000
Barherine	Switzerland	Cyclopean concrete gravity.	252	275,000
Burrinjuck	Australia	Cyclopean masonry, curved gravity.	247	320,000
Camplicciolí	Italy	Concrete, arch gravity	246	301,300
Tirso	do	Multiple arch	239	214,000
Hume [1]	Australia	Earth embankments, concrete spillway.	200	[2] 4,433,000
Don Martin [1]	Mexico	do	105	[3] 2,675,000
Necaxa No. [4]	do	Hydraulic earth fill	190	2,300,000
Assuan	Egypt	Concrete gravity	115	1,200,000
Patillas	Porto Rico	Semihydraulic fill	147	920,000
Lloyd	India	Rubble masonry	190	80,0000

[1] Under construction. [2] 3,900,000 earth, 533,000 concrete. [3] 2,500,000 earth, 175,000 concrete. [4] Construction work suspended.

Reclamation Organization Activities and Project Visitors

DR. ELWOOD MEAD, Commissioner of Reclamation, addressed the meeting of the American Society of Agricultural Engineers in Kansas City on December 31, his subject being "Economic justification of reclamation activities."

R. F. Walter, chief engineer, returned to the Denver office on November 29, after spending two weeks in the Washington office in connection with hearings on Boulder Canyon power allocations and on appropriations for the bureau for the fiscal year 1931.

Miguel E. Montalva and Luis Eyquem, civil engineers from Santiago de Chile, were recent visitors at the Denver office. They have visited several projects studying irrigation methods.

S. A. Blok, civil engineer from the Netherland East Indies, visited the Denver office recently to make a special study of hydraulic-fill dams and grouting of foundations of dams.

F. E. Weymouth, A. J. Wiley, Richard R. Lyman, T. Merriman, J. B. Bond, S. L. Parrott, and William Mulholland, members of the consulting board on the Los Angeles aqueduct, were recent visitors on the Yuma project.

Prof. John G. Alexandrov, director of the State institute for hydraulic construction, chief engineer of hydroelectrical development on the Lower Dnieper River, member of the Board of State Planning Commission, Union of Socialist Soviet Republics, and chief consulting engineer to the Russian Government on irrigation work, spent several days in the Denver and Washington offices, obtaining drawings and technical studies and studying the bureau's system of organization.

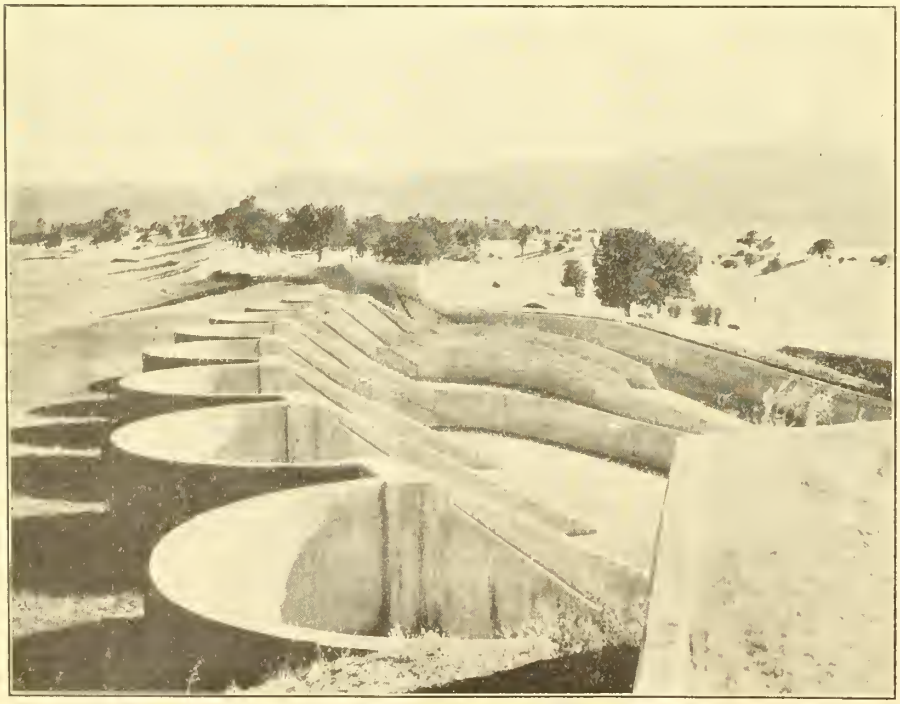
The secretary and directors of the Klamath irrigation district and the directors of the Lower Klamath Lake Grazing Association visited the Klamath project offices recently to meet B. E. Hayden, the new superintendent of the project.

Messrs. Cannon and Smoot, of the Utah-Idaho Sugar Co., R. L. Howard, superintendent of the Chinook sugar factory, and Reyn Leedom, secretary of the Great Falls Chamber of Commerce, visited the Sun River project recently to see what might be done in the development of the sugar-beet industry on the project.

George O. Sanford, superintendent of the Sun River project, has been transferred to the Washington office as reclamation economist in the division of reclamation economics. Mr. Sanford will assist in the settlement and economic work on the projects.

Hugh A. Brown, director of reclamation economics, addressed the meeting of the land reclamation division of the American Society of Agricultural Engineers in Kansas City on December 30 on the subject of the work of the Bureau of Reclamation in providing supplemental water for irrigation.

H. A. Parker, superintendent of the Lower Yellowstone project, and Miss Fannie Harriet Gorton, of Sidney, Mont., were married on December 10, 1929.



Spillway, East Park Dam, Orland project, California

Washington Office Christmas Fund Society

The Reclamation Christmas Fund Society was organized about 13 years ago by employees of the Washington office of the Bureau of Reclamation for the purpose of establishing a convenient form of saving of a fund with which to make Christmas purchases. The fiscal year of the society runs from December 1 to November 30. Shares are subscribed at the beginning of the fiscal year, each share representing an amount of $1 per month to be paid into the fund. Payments are made semimonthly on each pay day, and the entire fund with earnings matures on November 30 of each year. In addition to the savings feature of the society it has another important advantage in loaning money to its members during the year. Members are permitted to borrow approximately one and one-half times the amount they will pay in during the year, each loan being secured by the indorsement of two members of the society. Delinquencies in payments on shares are penalized 1 cent per share per day of delinquency after three days of grace.

During the year ending November 30, 1929, the 29 members paid in a total of $3,048 in shares. The earnings during the year amounted to $83.25, made up of interest at 6 per cent on loans to members, interest from the bank at 5 per cent on savings certificates and at 4 per cent on savings balance, and penalties. Earnings amounted to nearly 6 per cent on payments made to the society. The average interest on Christmas savings accounts in Washington, D. C., is approximately 3 per cent. At the end of the year $1,000 was outstanding in loans which was wiped out by amounts due the borrowers.

The affairs of the club are administered by a treasurer, which position changes hands every few years in order to distribute the work. In recognition of the work the treasurer is required to perform, a deduction is made of 25 per cent from the gross earnings as salary.—*Mrs. Margaret G. Young.*

U. S. GOVERNMENT PRINTING OFFICE: 1930

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

HON. RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department, **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistants

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Engineer

S. O. Harper, General Superintendent of Construction; J. L. Savage, Chief Designing Engineer; E. B. Debler, Hydrographic Engineer; L. N. McClellan, Electrical Engineer; C. M. Day, Mechanical Engineer; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Project	Office	Superintendent	Chief clerk	Fiscal agent	District counsel	
					Name	Office
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Mitchell, Nebr.
Boise [1]	Boise, Idaho	R. J. Newell	W. L. Vernon		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	W. C. Berger	W. C. Verger	H. J. S. Devries	El Paso, Tex.
Grand Valley	Grand Junction, Colo.	J. C. Page	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Huntley [2]	Ballantine, Mont					
King Hill [3]	King Hill, Idaho					
Klamath	Klamath Falls, Oreg.	B. E. Hayden	N. G. Wheeler	Joseph C. Avery	R. J. Coffey	Berkeley, Calif.
Lower Yellowstone	Savage, Mont	H. A. Parker	E. R. Scheppelmann	E. R. Scheppelmann	E. E. Roddis	Billings, Mont.
Milk River	Malta, Mont	H. H. Johnson	E. E. Chabot	E. E. Chabot	do	Do.
Minidoka [4]	Burley, Idaho	E. B. Darlington	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Newlands [5]	Fallon, Nev				R. J. Coffey	Berkeley, Calif.
North Platte [6]	Mitchell, Nebr	H. C. Stetson	Virgil E. Hubbell	Virgil E. Hubbell	Wm. J. Burke	Mitchell, Nebr.
Okanogan [7]	Okanogan, Wash				B. E. Stoutemyer	Portland, Oreg.
Orland	Orland, Calif	R. C. E. Weber	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	H. N. Bickel	Frank P. Greene	B. E. Stoutemyer	Portland, Oreg.
Rio Grande	El Paso, Tex	L. R. Fiock	Henry H. Berryhill	Henry H. Berryhill	H. J. S. Devries	El Paso, Tex.
Riverton	Riverton, Wyo	H. D. Comstock	R. B. Smith	Erle W. Shepard	Wm. J. Burke	Mitchell, Nebr.
Salt Lake Basin	Salt Lake City, Utah					
Salt River [8]	Phoenix, Ariz					
Shoshone [9]	Powell, Wyo	L. H. Mitchell	W. F. Sha		E. E. Roddis	Billings, Mont.
Strawberry Valley [10]	Payson, Utah					
Sun River [11]	Fairfield, Mont	A. W. Walker	H. W. Johnson	H. W. Johnson	E. E. Roddis	Do.
Umatilla [12]	Irrigon, Oreg Hermiston, Oreg					
Uncompahgre	Montrose, Colo	L. J. Foster	G. H. Bolt	F. D. Helm	J. R. Alexander	Montrose, Colo.
Vale	Vale, Oreg	H. W. Bashore	C. M. Voyen	C. M. Voyen	B. E. Stoutemyer	Portland, Oreg.
Yakima	Yakima, Wash	P. J. Preston	R. K. Cunningham	C. J. Ralston	do	Do.
Yuma	Yuma, Ariz	R. M. Priest	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif

Large Construction Work

Salt Lake Basin, Echo Dam.	Coalville, Utah	F. F. Smith [13]	C. F. Williams		J. R. Alexander	Montrose, Colo.
Kittitas	Ellensburg, Wash	Walker R. Young [13]	E. R. Mills		B. E. Stoutemyer	Portland, Oreg.
Sun River, main canal construction.	Fairfield, Mont	A. W. Walker [14]			E. E. Roddis	Billings, Mont.
Boise project, Deadwood Dam.	Cascade, Idaho		C. B. Funk		B. E. Stoutemyer	Portland, Oreg.

[1] Operation of Arrowrock Division assumed by Nampa-Meridian, Black Canyon, Boise-Knna, Wilder, Big Bend, and New York Irrigation Districts on Apr. 1, 1926.
[2] Operation of project assumed by Huntley Project Irrigation District on Dec. 31, 1927. E. E. Lewis, manager.
[3] Operation of project assumed by King Hill Irrigation District Mar. 1, 1926. F. L. Kinkade, manager.
[4] Operation of South Side Pumping Division assumed by Burley Irrigation District on Apr. 1, 1926, and of Gravity Division by Minidoka Irrigation District on Dec. 2, 1916.
[5] Operation of project assumed by Truckee-Carson Irrigation District on Dec. 31, 1926. D. S. Stuver, manager.
[6] Operation of Interstate Division assumed by Pathfinder Irrigation District on July 1, 1926, Fort Laramie Division by Goshen Irrigation District and Gering and Fort Laramie Irrigation District on Dec. 31, 1926, and Northport Division by Northport Irrigation District on Dec. 31, 1926.
[7] Operation of project assumed by Okanogan Irrigation District on Dec. 31, 1928. Joe C. Iddings, manager.
[8] Operation of project assumed by Salt River Valley Water Users' Association on Nov. 1, 1917. C. C. Cragin, general superintendent and chief engineer.
[9] Operation of Garland Division assumed by Shoshone Irrigation District on Dec. 31, 1926.
[10] Operation of project assumed by Strawberry Water Users' Association on Dec. 1, 1926. Lee R. Taylor, manager
[11] Operation of Fort Shaw Division assumed by Fort Shaw Irrigation District on Dec. 31, 1926.
[12] Operation of West Division assumed by West Extension Irrigation District on July 1, 1926. A. C. Houghton, manager; and East Division by Hermiston Irrigation District informally on July 1, 1926, and formally, by contract, on Dec. 31, 1926. Enos D. Martin, manager.
[13] Construction engineer.

Important Investigations in Progress

Project	Office	In charge of—	Cooperative agency
All-American Canal investigations	Yuma, Ariz	H. J. Gault	
Gila River cooperative investigations	Safford, Ariz		Arizona and New Mexico.
Boulder Canyon reservoir investigations	Las Vegas, Nev	W. R. Young	
Red Bluff (Pecos River) investigations	Washington, D. C	C. A. Bissell	
Salt Lake Basin investigations	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga projects	Casper, Wyo	J. R. Iakisch	

IRRIGON 4-H CLUB BAND, WEST DIVISION, UMATILLA PROJECT, OREG.

(SEE WOMEN'S SECTION, P. 6)

NEW RECLAMATION ERA

VOL. 21 FEBRUARY, 1930 NO. 2

RAINBOW DAM AND FEED CANAL HEADWORKS, ORLAND PROJECT, CALIF.

BOULDER DAM IN ITS TRUE MEANING

THERE ARE THOSE, to be sure, to whom Boulder Dam will mean nothing more than a dam higher than any other dam in the world, a great many millions of tons of water, and a great many millions of bags of cement—a construction feat for which our engineers are to be commended. But there are others to whom Boulder Dam signifies an intangible something which can not be measured in cubic feet—something which caused citizens of every town along the banks of the majestic Colorado River to ring bells, fire cannons, and meet in public halls to testify to their joy and relief when news came to them that President Calvin Coolidge had signed the Swing-Johnson bill, committing the Government to provision of $165,000,000 for the conservation and use of the waters of the lower Colorado.

For to these people Boulder Dam means the protection of their homes and families, the crops that are their livelihood; to them it means relief in the dreaded periods of drought, protection in flood time. It means the development of the entire Southwest, the building of a vast region, the reclamation of desert areas; it means the springing up of cities, the hum of commerce and trade.

LUCY SALAMANCA

(In Washington Post, January 12, 1930).

NEW RECLAMATION ERA

Issued monthly by the Bureau of Reclamation, Department of the Interior, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 | February, 1930 | No. 2

Interesting High Lights on the Federal Reclamation Projects

SHIPMENTS of approximately 75 tons of dressed turkeys were made from the Orland project during the month, together with 4 cars of cattle, 7 of hogs, and 3 of sheep.

COMMUNITY organizations have been very active on the Orland project. A community welfare council was organized prior to the holidays and was engaged in providing cheer among the needy during the Christmas season.

ON the Belle Fourche project the community clubs are entering into an agreement with the State Department of Agriculture and the Chicago & Northwestern Railway Co. whereby a new settlement plan is to be undertaken. The publicity and furnishing of advance agents is to be the work of the railway company and Agricultural Department, the local organizations to lend their assistance in acquainting these agents with the available farming opportunities so that their reports to constituent friends will be based on actual facts.

TWO new settlers have located on the Belle Fourche project, and two others from the Black Hills will probably take up immediate residence on the project. A substantial farmer in the vicinity has recently purchased two units northeast of Newell for a cash consideration of $3,700, the combined units consisting of 160 acres, with 130 acres irrigable. A modern set of improvements will be erected which will be a valuable addition to that part of the project.

PLANTING of watermelons and cantaloupes on the Yuma project started in December, and if there is a continuance of the existing mild weather these crops will be ready to market earlier than usual.

THE Burley sugar factory, Minidoka project, completed the season's run on January 14 with a record of 65,000 tons of beets sliced, from which 10,000 tons of sugar were obtained.

THE close of the old year marked the practical completion of the new freight depot at Burley, Minidoka project, which was built by the Oregon Short Line Railroad.

New Reclamation Era in New Form

Commencing with this issue, the New Reclamation Era will hereafter be divided into departments, in charge of the following:

Legal, P. W. Dent, assistant commissioner.

Engineering, C. A. Bissell, chief, engineering division, Washington office.

Economics, Dr. Hugh A. Brown, director of reclamation economics.

Women and their interests, Miss M. A. Schnurr, assistant to the commissioner.

Accounting, W. F. Kubach, chief accountant.

It is believed that this division will make the magazine more useful to its readers. Those in charge of the departments would appreciate the cooperation of the field force and the water users in furnishing appropriate articles and news items.

TWO utility companies on the Milk River project started delivery of natural gas to the towns of Malta, Saco, Hinsdale, and Glasgow during the month at prices calculated to encourage the use of this fuel not only in the towns, but also by project farmers adjacent to the supply lines. The development of its natural resources will no doubt be of considerable benefit to the project as a whole.

SEVERAL properties in the valley division of the Yuma project have been planted to paper-shell pecans and it is believed that the next few months will witness the largest single year's plantings of pecans.

ON the Minidoka project the Mini-Cassia Cooperative Dairymen's Association reported an increase of some 33 per cent over the business done during the corresponding month in 1928, and the association now has more than 600 patrons.

SALES of rural property continued active on the Minidoka project. A 73-acre farm south of Rupert sold for $6,000; a 62-acre farm in the Pioneer district sold for $5,500; a 40-acre tract 3½ miles northwest of Rupert brought $7,500; and an 80-acre tract southeast of Paul was disposed of for $6,200. Another farm of 80 acres east of Declo was sold, the price not being stated.

BUILDING and construction for the Yakima Valley totaled approximately $2,060,295 for the year 1929, with a building program estimated at two and a half million for 1930. In Yakima contract has been let for the new office building of the Liberty Savings & Loan Association to cost $250,000, and negotiations are now being made for the site of a new 13-story community hotel. A new bank building will also be erected by the recently merged First National and Yakima National Banks.

ANNOUNCEMENT has been made that a representative of the Purina Mills, one of the largest cash buyers of alfalfa hay, will be located permanently at Scottsbluff, Nebr., North Platte project, and that the company will buy large quantities of alfalfa hay in the valley.

Economic Justification for Reclamation Activities

Address by Dr. Elwood Mead, Commissioner of Reclamation, at meeting of the Land Reclamation Division of the American Society of Agricultural Engineers, Kansas City, Mo., December 31, 1929

IT is an appreciated privilege to be able to attend this meeting of the American Society of Agricultural Engineers. I was one of its earliest members, am now an honorary member, and I have watched its growth in numbers and influence with peculiar satisfaction. Your invitation gives me an opportunity to outline some of the triumphs of the agricultural engineer in the conquest of the arid region. In one-third of the country, in 17 States, the reclamation achievements of the agricultural engineer have added immensely to the national wealth, greatly improved the conditions of life and given to the western third of the country a new outlook.

SPECULATIVE RECLAMATION A MYTH

Before dealing with economic achievements of reclamation I wish to refer to the references which have been made here to speculation as an active instrument in carrying out reclamation development. Those who think speculation has anything to do with reclamation development, public or private, don't understand conditions. Every influence is against it. The farm population of this Nation has decreased nearly 5,000,000 in the last nine years. There was a net movement from the farms to the cities of more than half a million people last year. In the older developed and prosperous parts of the country there is a continuous movement toward the cities, with a decline in the price of farm lands.

In the arid region the cost of providing water has grown with the loss of opportunities for cheap diversion. We can no longer depend on the natural flow of streams, but must rely largely on stored water. Building reservoirs is costly. Today there is no project being carried on where the cost of providing water is less than $100 an acre, and in some it rises to $200 an acre. These outlays have to be made before there can be any return. Promoters and speculators are not looking for that sort of enterprise. They are out for profit and no one but a fool could hope for any immediate returns from reclamation.

As a result, reclamation by private enterprise has practically ceased. It is being carried on by the Government, and where it can be carried on in connection with power development because of the advantages, both local and national; but for this kind of development there was never a greater need for its continuance or never a time when its national value was greater than now.

There is another reason why speculative development has entirely disappeared. In the early days speculation thrived on an unreasonable inflation of land prices. That is no longer possible. Following the investigations of 1924, carried on by former Secretary of the Interior Garfield, of Ohio, Mr. Julius Barnes, of Minnesota, Doctor Widtsoe, of Utah, and others, the economic and social relations of irrigation were given a thorough and impartial review, and as a result laws were passed which require privately owned land to be appraised before irrigation works are built. Its value without irrigation is fixed, and the owners are required to sell at that value. Under this, on the Kittitas development now being carried on in Washington, private land is being sold for $2.50 an acre, which is far less than the local State taxes which have been paid on it since the present owners acquired it. Before any project can be undertaken now, there has not simply to be an estimate of the engineering costs. To that has been added a study of soils, a study of markets, a study of the costs of changing raw land into farms, and of the kind of agriculture and kind of equipment these farms should have. As far as human foresight can accomplish it, the aim is to think the entire problem through to its conclusion. Then, after the Reclamation Bureau has completed that work, the project is submitted to the Secretary of the Interior and it must not only have his approval, but he must certify to Congress that the project is feasible and will probably return all the money invested. Even there, the safeguards do not stop. Before the Secretary's certificate can go to Congress the project has to be approved by the President.

None of these safeguards was thrown around the previous developments. No such safeguards surround private development at the present time, and they are so complete and are being carried out with such thoroughness that speculation as an influence in any development has been entirely eliminated.

SURPLUS NOT AFFECTED

There is another objection to reclamation which is more potent, and that is the widespread belief in the eastern part of the country that every new farm created in the arid region adds to the surplus and lessens the price of the farms in other parts of the country. It is this belief which has led to so many resolutions by granges and other organizations against any further reclamation development, and that belief is not confined to the country outside the arid region. It exists there. I know of a little valley which grows a few hundred acres of asparagus. It has a market, high prices, is doing well, feels sure that if there were not another acre of asparagus grown, it would do better. Consequently it passed a resolution against any further reclamation. The people do not realize that the number of asparagus eaters is growing all the time; that there is need for more; and that if their policy had been adopted 10 years ago, their farms would not have been reclaimed.

The truth is that irrigation development, with the single exception of the fruit area in California, is not keeping pace with the need for its products. In the arid region itself the cities are growing much faster than the country, the demand for food products is growing faster than the increase in production, so that to meet the needs of the arid region reclamation must go on.

Furthermore, every new farm established within the arid region, every new area which is brought under cultivation, means the purchase of new equipment, it means the purchase of material for houses, it means the purchase of clothing, it means a thousand and one things furnished by factories in the East which are operated by people who live in the East and who are fed from eastern farms.

A few days ago, in Chicago, I called attention to the demand for manufactured goods by the irrigated oases of the West. I pointed out that 17 of the 24 reclamation projects in 1928 bought 95,000 carloads of goods, largely manufactured in the East, by workmen who lived in the East and whose food came largely from eastern farms.

The gentleman to whom I made this statement said that if the half a million people on western reclamation projects had all stopped in Iowa and stayed there, they would have needed just as many clothes and just as many automobiles. I told him that was doubtful. Moreover, if they had stayed in Iowa they would have grown corn, oats, and hay, of which we have a surplus, whereas they are now growing olives, oranges, sugar beets, and long-staple cotton, things that the country needs and things which we now have to purchase in part from abroad. Instead of competing with Iowa farmers, they enabled everyone in Iowa to have better food. The idea that the irrigated West is adding or will add to the surplus of staple farm crops is a delusion that a

better knowledge of what is taking place will remove.

The crops grown on Federal projects have never exerted an injurious influence on the price of staple farm crops. The area of such crops on the projects is too small. The total project cultivated area is only three-tenths of 1 per cent of the Nation's cultivated area. Shown on a map, these widely scattered areas of reclaimed land are only a series of dots in the billion acres of land in the 15 arid States. They are still more insignificant when compared with the billion acres of farm land in the whole country. Their value, like that of Robinson Crusoe's goat, is not measured by their size, but by the overwhelming need for what they produce.

Furthermore, we have reached the time when all talk about a surplus is destined to cease. An editorial in the Country Gentleman for December notes the fact that this year we have no surplus in agriculture, and even if we did, one good rain in the Mississippi Valley does more to increase that surplus than all the products grown on the reclaimed areas of the arid States.

RECLAMATION'S CONTRIBUTION TO NATIONAL WELFARE

Thus far I have endeavored to show you that there is nothing in Federal reclamation which warrants your disapproval. I now desire to show what a marvelous contribution it is making to our national comfort and prosperity. Irrigated agriculture is the greatest economic asset of nearly every arid State. Try to visualize the Utah deserts as the Mormon pioneers first saw them, and contrast that dreary prospect with the orchards and gardens which now surround the State's beautiful capital city.

When I first saw the Big Horn Basin in Wyoming, there was an area as large as the State of Massachusetts without a hotel. Its rivers had to be forded, and travel was mainly by pack trains. Now it has some of the finest farms in the West, beet-sugar factories, creameries, a growing and prosperous agriculture. There is no question as to the value of these reclamation activities or the intense desire of the arid States to have them continued.

The works already built have cost $186,000,000. The benefits from much of this expenditure have not yet been realized because the works are not completed and the farms are not all cultivated, but even in this unfinished condition, the crops grown last year were worth $143,573,000. When these works are completed and the land all cultivated, the yearly value of the crops will equal the entire cost of the works. No greater national benefits were ever produced by a similar expenditure.

ARIZONA'S WEALTH CENTERS IN IRRIGATION PROJECT

When the Government took over the reclamation of Salt River Valley, Ariz., the few private enterprises were bankrupt and insolvent and the pioneer settlers were being slowly starved out. Without Government aid that section of Arizona would have reverted to the desert. The Government spent $12,744,000 and thereby created farms from which the crops sold last year brought $26,000,000. Before irrigation began that region was a hideous desert. Now the homes, gardens, and beautiful environment cause thousands of people from all over the country to go there for the winter. The cheap local food supply from these farms has been one of the great factors in the development of the copper mines immediately to the east. This project is the mainstay of Arizona's prosperity and of its stable and enduring wealth.

This marvelous transformation has been accomplished without any injury to agriculture in other sections of the country. On the contrary, the East and Middle West have gained. Its farmers buy farm machinery and other manufactured products made by workers fed from eastern farms. The long-staple cotton grown there is needed by our tire makers. Every pound grown there means that much less to be imported from Egypt.

It is one of the centers for the production of citrus fruits and winter vegetables. Thousands of carloads of winter lettuce go from there to eastern cities, but if not grown there, it would simply mean that the country would have less good food, because it would cost too much if grown in eastern hothouses.

THE YAKIMA VALLEY TRANSFORMED

Let us leave the Southwest for the dry Northwest. When the Northern Pacific Railroad was built there was not enough freight in the whole of the Yakima Valley in Washington to pay for the oil used on the locomotives. The cost of transcontinental travel and transportation had to fall on the rest of the country, and that made freight and passenger rates high. There were no farms, there were no towns, the Yakima River ran unused to the sea. Private enterprise sought to bring about its development. A promoter spent his fortune before the canal was completed and committed suicide. The people on the dry farms under a half-built canal, threatened with ruin, appealed to the Government, and for 20 years work has gone steadily on, carrying out a coordinated plan for the complete conservation of the water of this river. It means the building of 6 reservoirs, of which 5 have been completed. The sum of $18,350,000 has already been spent on irrigation works. It will be 10 years before the work is completed and that will mean a further expenditure of 20 or 25 million dollars.

What has been accomplished? Instead of a desert there are thousands of acres of orchards the fruit from which goes to practically every country in the world. You can find it in the stores of Australia, India, China, Japan, Germany, and Italy. It has a world-wide market because of its superior appearance and quality. It does not compete with the orchards of Iowa, Illinois, or Kansas, but it does add to our export trade and national wealth. The Government has spent $4,230,000 on irrigation works for the Sunnyside division of the project. Last year the crops from this division were valued at nearly $8,000,000. The irrigation of this valley has created the cities of Yakima, Ellensburg, and half a dozen other smaller cities. The leading cities, with their stores, their fine hotels, their thousands of people, their immense refrigerating plants, are as much the result of irrigation as the dairy herds and the apple and pear orchards. Automobile makers sell thousands of cars. Several of the great chain stores are found there. That has not hurt eastern agriculture. On the contrary, it has helped it. It has not hurt the people who like good food and more of it. On the contrary, it has made a great contribution to their needs and desires.

DESERT CHANGED INTO GARDENS

Before the Government started reclamation in the North Platte Valley it was an unpeopled sagebrush desert, with jackrabbits and coyotes the principal inhabitants. Last year one town in that irrigated area paid one railroad $800,000 for freight shipments.

Before Government irrigation started on the Snake River and the Boise River in Idaho that State had to depend on mining and stockraising. It had few people and little wealth. Now the freight paid each year by the irrigation districts along Snake River amounts to more than all of the yearly freight payments to the railroads by the entire State before these projects were begun.

I could extend this recital to other Federal reclamation projects. In nearly one-third of our national area it has created on what was once dreary, worthless deserts, an agricultural, economic, and social life, equal to that where lands are watered by rain. It has given the Nation more kinds of food and better quality than can be grown elsewhere in this country or be purchased abroad. It has given pioneers a chance to make homes for themselves and families. It has been the greatest experiment station and demonstration farm in our national history.

A CONSERVATIVE RECLAMATION PROGRAM

So far as the justification of reclamation activities is concerned, we can say with Webster that the past is secure. Now let us consider what is going on at present. Let us see what sort of speculation and promotion is behind the work which the bureau is now doing.

The disappointing feature of our activities is that we are doing so little compared to what the West needs. People living on farms that lack water appeal to us to save them and are often bitter when we can not respond. What we do now depends largely on the success of what has been done in the past. We can only spend each year the money that year by year comes into the reclamation fund. The main part is the payments for water from users on the older projects. It amounts to eight or nine million dollars a year. That has to meet the development needs of one-third of the Nation. All of it is now being spent on a 10-year program designed to complete projects begun in the past. It does not go far because we can not rely on the natural flow of streams. New development has to be based on storage, which is costly. An adequate review of what is being done is not possible. Only a few examples can be given.

We will begin with one of the largest and costliest enterprises of the 10-year program, the Kittitas division of the Yakima project in Washington. That division is to cost $11,000,000. We are now building canals to water 70,000 acres of land at a cost of $160 an acre. Why are we doing it? The answer is that the soil and climate of that valley give exceptional returns from irrigated farms. The water of this river ought therefore to be conserved. Doing this will make a large increase in our national wealth.

We are doing it in part to save the homes of heroic pioneers who went there when irrigation was new. They settled on small tributary streams which they thought would furnish ample water. Experience has shown they will not. There must be a supplemental water supply or these people must move out. They know what water is worth. They are contracting to pay the full construction cost. To make sure that there would be no speculation all this land has been appraised by expert valuers, and the owners have agreed, if they do sell, to sell at this appraisal value. Some of that land is in a railroad grant. It is being sold to settlers at the appraised price, which in many cases is $2.50 an acre, or less than the company has paid the State in taxes.

A very difficult and costly canal is being constructed in Idaho. It has to go for 50 miles across a lava bed. Why is that being done? Is this the work of a promoter or speculator? Far from it. This canal is being built to save homes, orchards, farms, and towns already established. The labor, money, privation, and heroism which went into their creation are all endangered by an uncertain water supply. Over on Snake River water is running to the ocean unused. These farmers could not build the canal needed to bring a dependable, ample supply of water to their doors, but they can pay the Government for doing it. That canal is a rescue agency like the engine that puts out a fire. The crop lost two years ago was worth almost as much as this canal will cost. These improved farms are obligated to pay for that water and will pay for it. How anyone, east or west, could question the wisdom of such a sound business and beneficent activity is more than I can conceive, and no one would question it if he knew the facts.

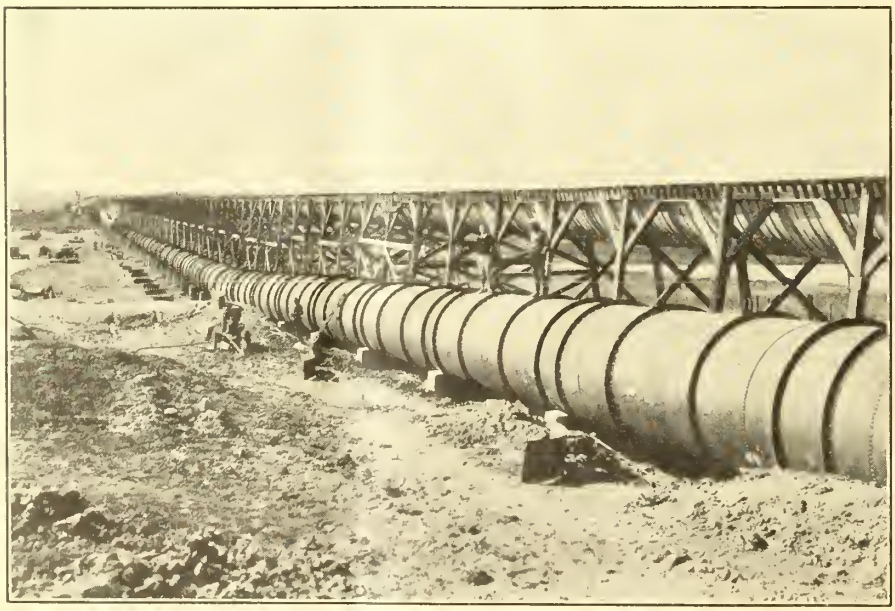
The Owyhee project in Oregon and Idaho is the costilest project yet undertaken by the Government. Eighteen million dollars will be spent on the storage works to regulate the flow of Owyhee River and build the tunnels and canals to carry the water to 70,000 acres of exceptionally fertile sagebrush desert, and to the homes and fields on 50,000 acres which have only a partial water supply. They can not survive without it. The national loss and economic injustice of doing nothing are so apparent that Congress has supported, without division, the department's recommendation of this work.

BOULDER DAM

I would like to go on with this recital and furnish instance on instance to show how far this society has gone astray in characterizing this as a speculative and promotional activity. I surmise that this misconception has grown in part out of the controversy over Boulder Dam, and the talk of 1,000,000 acres of land to be brought under cultivation, but if there is any activity in this country which is not speculative, if there is anything which is being done by public or private effort in response to an imperative public need, it is the great dam which is to control the Colorado River. That river as it is now is of little value. When in flood it is a turbulent, dangerous stream, and when the snows are melted, it shrinks to a shadow of its former size and has very little value for irrigation. It needs regulation, beyond all other rivers, because at the mouth it flows on the rim of a basin, and down below it, in southern California, is the Imperial Valley, with 60,000 people and $100,000,000 worth of property menaced by its floods. Following these floods, droughts often menace the rewards of the farmers who grow crops which can not be produced elsewhere and which the country needs.

All of us are better off because of the thousands of carloads of early lettuce that come out of that valley, and the other thousands of carloads of cantaloupes which we are all glad to get and better off for getting. They come at a season of the year when they can not be produced elsewhere.

Boulder Dam was started to save Imperial Valley, but in the eight years in which it has been under discussion, the factories, the homes, the population, the commerce of the coast counties of California, which include the cities of Los Angeles and San Diego and a score of other important cities, have been growing at a marvelous rate. They have now reached



Indian Creek siphon, Belle Fourche project (under construction)

a point where the demands for water are greater than can be supplied by the rains that fall on their foothills. If they are to continue to grow, if the present prosperity is to be maintained, they must have water from the Colorado River, and that water can not be drawn from an unregulated stream.

The original idea was to pay for the dam, in large part, out of the Federal Treasury and make the farmers of Iowa and Illinois contribute, as they do toward flood protection on the Mississippi River, but the industrial development has made a market for power, and the water released for the farms and towns can be made to generate power in being released. This means an industrial development which will create a demand for far more food than the irrigated area under this project will supply. It is no menace to the agriculture of the rest of the country. It is no burden on the taxpayers of the rest of the country, and opposition to it by anyone is based on a lack of knowledge of the facts.

OTHER PROPOSED DEVELOPMENTS

There are other great developments proposed which have size and cost that place them outside the income of the reclamation act. Most of these are on the great rivers of the Pacific slope. Columbia Basin is the largest. It is so monumental in size and cost and in the agriculture that it will create that it needs an economic as well as engineering plan. That will be worked out just as it has, by years of study, been worked out on the Colorado. Meantime other sections need not worry about its competition. This century is to see a marvelous development of commerce and industry on the Pacific. It will need all these farms will produce long before these homes and farms can be created.

Meantime, those of us who are spending the income of the reclamation fund have our sympathy and interest enlisted by scores of projects started by private enterprise, where settlers are in distress, where money they can not provide is needed to complete canals or build storage works which will water their fields and enable their courage, their self-denial and heroism to have its deserved reward. Statements like the one proposed to be put in the platform of this society do these people infinite harm. They prevent a fair appraisal of their needs. I hope it may be stricken out and action be deferred until the economic report now being prepared by the Bureau of Reclamation, and the report of the Commission on Conservation and Administration of the Public Domain, recently created by the President, can be read by the members and a fair and better informed judgment made possible.

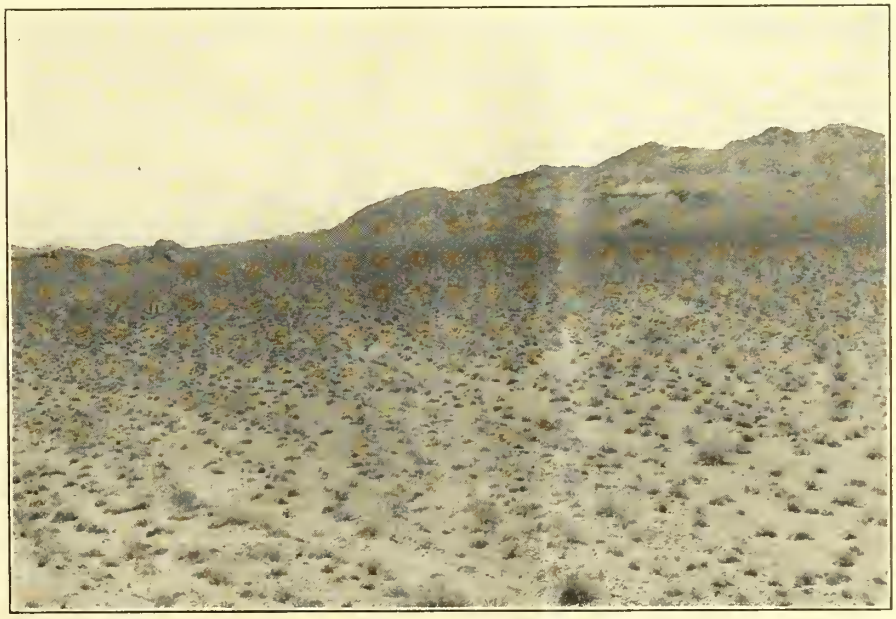
Construction of Lloyd Barrage Across the Indus, India

THE great irrigation project at Sukkur, some 300 miles east of Karachi, known also as the Lloyd Barrage, which is designed to provide perennial irrigation for about 6,000,000 acres of land in the Province of Sind, made continued progress during 1928. The barrage across the Indus will consist of 66 spans. Of these the underwater work on 15 spans has been completed and the flank abutments and piers are now rising to be connected with arches which will carry the control gates. During the coming season it is expected that another 19 piers will be constructed. The completion of the barrage is expected in 1932. The following figures from a report by Chief Engineer C. S. C. Harrison show the results accomplished during the 1928 season's work: 410,000 square feet of piling were driven; by dredges and donkey labor, 21,000,000 cubic feet of earth were excavated and filled; 2,000,000 cubic feet of masonry were constructed; nearly 3,000,000 cubic feet of stone filling were carried out; 340,000 cubic feet of concrete blocks were placed for protection.

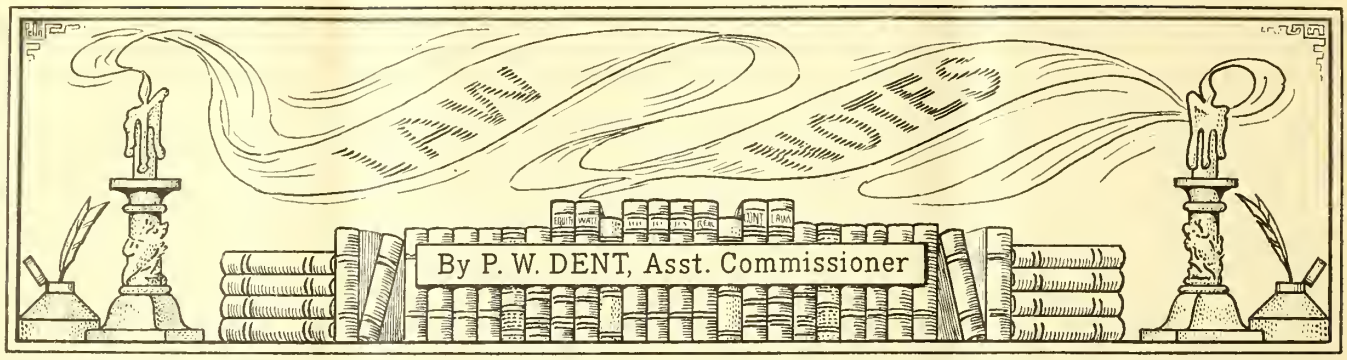
While work on the barrage has been going forward, there has been steady progress in building the canal system. In all, there are 5,000 miles of canals to be excavated including main canals, branches and distributaries. Work has been concentrated on the largest of the caals,n some of which are over 200 feet wide. About 900 miles of canals have been completed. For this work the largest group of mechanical excavators ever assembled has been put to work. There are 46 drag-line excavators, most of which are of American manufacture. The excavating capacity of this fleet of machines is approximately 70 tons of earth per minute, and the work is carried on day and night throughout the year. These machines represent the labor of 30,000 men working continuously. The total quantity of earthwork to be carried out in the whole project, including watercourses, is 205,555,000 cubic yards. To the end of September, 1928, just one-third of this total had been completed.

The barrage is expected to be completed in 1932 and the whole project in 1934. The total cost is estimated at approximately $73,530,000. Up to the end of August, 1928, the expenditure had amounted to about $30,330,000.

In connection with this irrigation project, the Government is developing a program of railway extension to provide a feeder service to the main line of the Northwestern Railway from Karachi to Lahore. Such transport facilities will be essential to moving the crops from the vast areas which will ultimately come under cultivation. Attention is also being given to the construction of roads for similar purposes. At present there are few roads in Sind and the development of motor transportation is greatly retarded.



View of proposed Boulder Canyon townsite



Attorney General Construes Boulder Canyon Project Act

IN a letter to the Secretary of the Interior dated December 26, 1929, the Attorney General construed the Boulder Canyon project act. The opinion is of fundamental importance in connection with the proposed Boulder Canyon project, and the following excerpts will set out the main points decided.

I have the honor to comply with the requests contained in your letters of August 3 and August 8, 1929, for my opinion upon certain questions arising under the Boulder Canyon project act, 45 Stat. 1057, which you state as follows:

"1. Whether or not advances from the General Treasury to the Colorado River Dam fund for construction costs of the All-American Canal, and disbursements from the Colorado River Dam fund for that purpose, should be interest-bearing.

"2. In fixing the sale rates for power to be generated at Boulder Dam, must provision be made for amortization within 50 years of the $25,000,000 allocated by the act to flood control?

"3. Must provision be made for payment out of power proceeds, during the 50-year period of amortization, of interest upon the principal of the $25,000,000 allocated to flood control? If so, should interest start to run from the first appropriation made from the General Treasury to the Colorado River Dam fund?"

The provisions of the Boulder Canyon project act which are especially relevant to these questions are the following:

[The opinion then quotes from the Boulder Canyon project act as follows: Sec. 1 (in part), sec. 2, sec. 4 (b), sec. 5 (first and third sentences), sec. 7 (first sentence), sec. 9 (in part), the definition of "Reclamation law" in sec. 12, and sec. 14.]

The All-American Canal is one of the works which the Secretary of the Interior is authorized to construct under section 1 of the act, being therein described as "a main canal and appurtenant structures located entirely within the United States connecting the Laguna Dam near the Mexican boundary, * * * with the Imperial and Coachella Valleys in California." The other physical construction thereby authorized are "a dam and incidental works at Black Canyon or Boulder Canyon" and a power plant at or near that dam. Section 1 recites the purposes of these constructions as controlling the floods, improving navigation, and regulating the flow of the Colorado River, providing for storage and for the delivery of the stored waters thereof for reclamation of public lands and other beneficial uses, and for the generation of electrical energy as a means of making the project a self-supporting and financially solvent undertaking.

The "Colorado River Dam fund," to which your question relates, is established by section 2 (a) of the act as a special fund to be available only for carrying out the provisions of the act. It is further provided that "revenues received in carrying out the provisions of this act shall be paid into and expenditures shall be made out of the fund, under the direction of the Secretary of the Interior." It is thus apparent that a single fund is provided into which and out of which all receipts and disbursements connected with any phase of the project must flow, regardless of source. By section 2 (b) the Secretary of the Treasury is authorized to advance to the fund, from time to time and within the appropriations therefor, such amounts, not exceeding $165,000,000, as the Secretary of the Interior deems necessary.

Section 2 (b) further provides:

"Interest at the rate of 4 per centum per annum accruing during the year upon the amounts so advanced and remaining unpaid shall be paid annually out of the fund, except as herein otherwise provided.

NO INTEREST REQUIRED ON CONSTRUCTION COST OF ALL-AMERICAN CANAL

The question is, therefore, whether the act should be construed as providing that interest is not to be paid on moneys advanced to the fund for the cost of construction of the All-American Canal.

The act nowhere so provides in express terms, and there are provisions in section 2 relating to the fund which, taken literally, would require that all moneys advanced by the Treasury for any part of the authorized project should bear interest. By section 2 (d) the Secretary of the Treasury is directed to charge the fund as of June 30 in each year "with such amount as may be necessary for the payment of interest on advances made under subdivision (b) at the rate of 4 per centum per annum accrued during the year upon the amounts so advanced and remaining unpaid, except that if the fund is insufficient to meet the payment of interest the Secretary of the Treasury may, in his discretion, defer any part of such payment, and the amount so deferred shall bear interest at the rate of 4 per centum per annum until paid." It may be suggested that the phrase "except as herein otherwise provided" in section 2 (b) should be deemed to refer only to the exception with respect to the deferment of interest provided in section 2 (d), just quoted. The references in section 2 (c) to "the payment of interest, during construction, upon the amounts so advanced," and in section 2 (e) to "payment of interest," are not expressly qualified. An inference that all sums advanced from the Treasury for any part of the project are to be interest bearing may also be drawn from the reference in section 5 to "the repayments to the United States of all money advanced with interest" and the provision of section 7 that the Secretary of the Interior may, in his discretion, "when repayments to the United States of all money advanced, with interest, reimbursable hereunder, shall have been made, transfer the title" to the said canal and appurtenant structures, with certain exceptions, to the districts or other agencies of the United States having a beneficial interest therein.

On the other hand, there are other provisions of the act which provide an entirely different plan of reimbursement of expenditures for the canal and appurtenant structures than those which govern the reimbursement of the cost of the dam and power project. Section 1 provides that "the expenditures for said main canal and appurtenant structures are to be reimbursable, as provided in the reclamation law, and shall not be paid out of revenues derived from the sale or disposal of water power or electric energy at the dam authorized to be constructed at said Black Canyon or Boulder Canyon, or for water for potable purposes outside of the Imperial and Coachella Valleys." No such provision is made with respect to the dam or power plant, and it is manifest from the act as a whole that the expenditures for their construction are to be paid mainly, if not wholly, from those revenues which were excluded as a source of reimbursement of expenditures for the canal. In section 4 (b), which requires the Secretary of the Interior to make certain provisions for revenues before any money is appropriated for the construction of the works comprised in the project or any construction work is done thereon, the dam and power plant and the main canal and appurtenant structures are treated in separate paragraphs, which differ materially in their provisions. The first paragraph, dealing with the dam and power plant, requires that the Secretary make provision for revenues, adequate in his judgment to insure, among other

things, "the repayment, within 50 years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (b) of section 2 for such works, together with interest thereon made reimbursable under this act"; whereas in the second paragraph, dealing with the main canal and appurtenant structures, the requirement is that he shall make provision for revenues adequate in his judgment "to insure payment of all expenses of construction, operation, and maintenance of said main canal and appurtenant structures in the manner provided in the reclamation law"; and interest is not mentioned.

Thus, while the dam and reservoir were to provide for the storage of waters for the purpose of reclamation of public lands as well as for flood control, improvement of navigation, generation of electrical energy, and the other purposes recited in section 1, the main canal was singled out and treated as a purely reclamation project, the expenditures for which were to be reimbursable in the same manner as those for other projects administered under the reclamation law.

The reclamation law is defined by section 12 as meaning the act of June 17, 1902 (c. 1093, 32 Stat. 388), and the acts amendatory thereof and supplemental thereto. The plan set forth in those acts, so far as here material, is as follows: By section 1 of the act of June 17, 1902, a special fund was created in the Treasury known as the "reclamation fund," consisting of moneys received from the disposal of public lands in certain States and certain fees and commissions; other sources of revenue were added by supplemental acts. The moneys in this fund are used for the construction of irrigation projects which the Secretary of the Interior determines to be practicable, and the fund is then reimbursed by charges made upon the lands designated by the Secretary by public notice as irrigable under the project, whether held by entrymen or in private ownership. Those charges are to be determined "with a view of returning to the reclamation fund the estimated cost of construction of the project," and are to be apportioned equitably (*id.*, secs. 2, 3, 4, and 5; see also act of August 13, 1914, 38 Stat. 690; act of December 5, 1924, section 4, 43 Stat. 702). By the act of May 25, 1926, section 46 (44 Stat. 647) no water is to be delivered upon the completion of the project until contracts approved by the Secretary shall have been made with irrigation districts providing for the payment, among other things, "of the cost of constructing" the works in not more than 40 years from the date of the public notice. The reclamation fund is thus a permanent revolving fund, created in the first instance by an appropriation of public moneys and used for the financing of reclamation projects.

This fund is not to be used for the works authorized by the Boulder Canyon project act, which are financed instead through the Colorado River dam fund created by section 2, and that act contemplates (see secs. 5 and 9) that revenues received under the reclamation law in connection with this project are to be covered into that fund. The provisions of section 9, however, closely parallel those of the reclamation law, and the references in sections 1 and 4 (b) to the reimbursement of the cost of construction of the main canal and appurtenant structures in the manner provided by the reclamation law manifestly refer to the charging of the cost of construction upon the lands benefited as therein described.

The reclamation law contains no provision for the payment by the land owners of any interest upon the sums advanced from the reclamation fund, and I am advised that the term "construction charge" as used in the reclamation law has never been construed by the Interior Department as including an interest charge upon the cost of construction. Congress must be deemed to have been familiar with the reclamation law, to which frequent references are made in the act, and with the practical interpretation thereof by the Interior Department as not authorizing the charging of interest upon the cost of construction of a reclamation project against the lands benefited thereby. In this view, the omission of any mention of interest in the second paragraph of section 4 (b), in contradistinction to the express mention thereof in the first paragraph, is significant, and strongly indicative of an intention of Congress that interest upon the construction cost of the all-American canal should not be charged against lands benefited.

If interest is not to be charged against the land, the act designates no source of revenue from which interest might be paid to the General Treasury upon sums advanced for the construction costs of the canal. Section 1 explicitly provides that the expenditures for the canal shall not be paid out of revenues from the sale or disposal of water power or electric energy at the dam or for water for potable purposes outside of the Imperial and Coachella Valleys. It is reasonable to presume that, since Congress forbade the use of such revenues for payment of the principal of such expenditures, it did not intend that they should be reached to pay interest thereon. It appears that the cost of the canal and appurtenant structures is expected to be nearly $40,000,000. Under the reclamation law repayment may not be accomplished for 40 years. Interest at 4 per cent upon that sum for that period would constitute an amount of such magnitude that the failure of Congress to specify any revenues out of which it could probably be paid creates a strong inference that it was not intended to be paid.

The apparent conflict between the provisions of the act above discussed is, in large part, explained by its legislative history, which, in my judgment, makes it clear that it was the intention of Congress that advances for the cost of construction of the All-American Canal should not bear interest.

[The opinion then reviews in detail the legislative history of the Boulder Canyon project and continues:]

In view of the legislative history above outlined, I think that the qualification, "except as herein otherwise provided," to the requirement in section 2 (b) of the payment of interest on all sums advanced can not be regarded as referring exclusively to the case of the deferment of interest payments under section 2 (d). In my judgment, Congress must be considered to have "otherwise provided" with respect to interest on the cost of construction of the All-American Canal, and the expressions in section 2 (c), (d), and (e), section 5, and section 7, must be deemed to refer only to such interest as is made payable by the act construed as a whole.

It is my opinion, therefore, that advances from the General Treasury to the Colorado River Dam fund for construction costs of the All-American Canal are not interest bearing.

With respect to the branch of your question which relates to whether disbursements from the fund for that purpose should be interest bearing, I understand from your letter of December 11 that the only purpose of that inquiry was to bring up the question of the time from which interest on advances from the General Treasury should be computed if interest is chargeable at all. In view of my opinion, above expressed, consideration of that question is not necessary.

AMORTIZATION WITHIN 50 YEARS OF $25,000,000 ALLOCATED TO FLOOD CONTROL

Your second question is as follows:

"In fixing the sale rates for power to be generated at Boulder Dam, must provision be made for amortization within 50 years, of the $25,000,000 allocated by the act for flood control?"

The provisions of the act requiring the Secretary of the Interior to make provision for revenues to insure repayment of sums expended for the various constructions contemplated by the act are found in section 4 (b). Flood control is one of the purposes recited in section 1 and was to be secured chiefly by means of the dam and incidental works at Black Canyon or Boulder Canyon. The first paragraph of section 4 (b) relates to those works and, if it stood alone, would require the Secretary of the Interior to make provision for revenues by contract adequate in his judgment to insure repayment within 50 years of all amounts advanced from the Treasury under section 2 (b) for their construction.

Section 2 (b) itself, however, after authorizing the Secretary of the Treasury to advance to the fund such sums as the Secretary of the Interior deems necessary for carrying out the provisions of the act, not exceeding $165,000,000, provides:

"Of this amount the sum of $25,000,000 shall be allocated to flood control and shall be repaid to the United States out of 62½ per centum of revenues, if any, in excess of the amount necessary to meet periodical payments during the period of amortization, as provided in section 4 of this act. If said sum of $25,000,000 is not repaid in full during the period of amortization, then 62½ per centum of all net revenues shall be applied to payment of the remainder."

* * * * *

It is my opinion, therefore, that the Secretary of the Interior is not required, in fixing the sale rates for power to be generated at Boulder Dam to make provision for the amortization within the 50 years of the $25,000,000 allocated by the act to flood control.

INTEREST UPON $25,000,000 ALLOCATED TO FLOOD CONTROL

Your third question is as follows:

"Must provision be made for payment out of the power proceeds, during the 50-year period of amortization, of interest upon the principal of the $25,000,000 allocated to flood control? If so, should interest start to run from the first appropriation made from the General Treasury to the Colorado River dam fund?"

With respect to the matter of interest upon the principal of the $25,000,000 allocated to flood control, the act is very ambiguous. I have had great difficulty in reaching a satisfactory conclusion as to what Congress intended in respect of this item. The act is susceptible of any one of three interpretations:

First, that no interest is to be paid under any circumstances or out of any source of revenue on the $25,000,000 allocated to flood control, or

Second, that such interest must be paid and that it is payable annually during the 50-year period of amortization, and that the power rates should be fixed at a high enough figure to pay such interest during the 50-year period, or

Third, that it was the intention of Congress that interest should be paid on the principal of the amount allocated to flood control, but that such interest is not required to be paid absolutely during the 50-year period and is only to be paid, as is the principal of the item, out of 62½ per cent of excess earnings, if any, during the 50-year period and out of the 62½ per cent net earnings after the expiration of that period.

It does not seem reasonable to suppose that Congress intended to make the payment of interest on the $25,000,000 allocated to flood control an absolute charge during the 50 years when it left the payment of the principal to the chance that there might be excess earnings during that period. I am inclined to believe that Congress intended that interest should be ultimately paid on the $25,000,000 allocated to flood control from the same source as is provided for the payment of the principal, to wit: Out of 62½ per cent of the excess earnings during the 50-year period and out of 62½ per cent of the net earnings thereafter.

The word "thereon" in section 4 (b) following the word "interest" in the phrase "all amounts advanced to the fund under subdivision (b) of section 2 for such works, together with interest thereon made reimbursable under this act" apparently limits the requirement, with respect to interest, to interest on such principal sums as are embraced within the scope of the paragraph.

A construction of the act as not absolutely requiring the fixing of rates high enough to cover the payment of interest during the 50-year amortization period upon the $25,000,000 allocated to flood control is entirely consonant with the apparent purposes of Congress in adopting the amendment which made that allocation, namely, to discharge a governmental obligation to provide flood control, and to make the project more probably feasible by reducing the amount which would have to be amortized out of revenues obtained from power and water at the dam.

It does not seem necessary to pass further upon the question of the ultimate payment of interest, as I am of the opinion that if such interest is ultimately payable, the act does not require you to make provision for its payment out of power proceeds during the 50-year period of amortization.

Subsidy of Land Settlement in Switzerland

By Dr. H. Schildknecht, Agricultural Engineer, Switzerland

SETTLEMENT on reclaimed land has been subsidized by the Swiss Government only within the past few years, although subsidies were previously granted to a considerable extent for reclamation. In 1893 an act providing for Government aid in reclamation was passed, enabling the Government to spend large sums for reclamation enterprises, such as irrigation, drainage, agricultural roads, land clearing, and the reparceling of properties, without refunding obligations by the farmers. By this means the Swiss Government is striving to keep the agricultural population at least at its present size by checking to a certain extent the dangerous cityward drift and helping to overcome the menace of unemployment which is extremely serious in all countries of Europe. These subsidies are highest in the inaccessible mountain valleys of the Swiss Alps. In this region the population averages a very poor living, but the reclamation subsidies sometimes keep the farmers and their families from leaving their homes. In other parts of Switzerland, where farming pays better, the support by the Government is naturally considerably smaller.

By helping reclamation the Swiss Government believed that settlement on reclaimed land would follow without further aid. This proved to be untrue in most cases. Many farmers wanted to take possession of the farms but were deterred because of lack of the capital required to erect the needed buildings, and then, too, the reclaimed lands were remote from the next village or farm, and this was an added disadvantage. Such examples showed clearly that settlement was the important feature of reclamation. A reclamation enterprise is not accomplished as long as the land is not settled and farmed. At the beginning an effort was made to settle such reclaimed areas by private initiative only, but this was entirely unsuccessful. The majority of the farmers who wished to buy farms were not able to build without borrowing, and loans at reasonable interest rates were not obtainable. Therefore the Swiss Government realized that more money must be spent to protect the investment in reclamation.

The second stage of reclamation, namely, settlement, was assured when in 1918 the Swiss bureau for land settlement started its important work. The idea was to build settlements with Government aid and to complete them as model farms, with the expectation that the standard of farming would be raised in the vicinity of such farms, on which the farm buildings would embody the most up-to-date technical features. This idea was in some cases carried too far, making the settlements too expensive when compared with the market value of the land itself.

FARM BUILDINGS AND THEIR COST

The average Swiss farmer wants to live in a substantial, well-furnished house. Each district of Switzerland has its own type of farm buildings, which renders more difficult the establishment of a uniform type of farm construction, but in recent years the demand for inexpensive, standardized buildings has increased steadily. Each settlement has an average area of only 25 acres, but the land is farmed very intensively. As the settlements are mainly constructed for the needs of dairy production special care is taken for good and practical stables.

Careful studies have been made to estimate fairly the amount of capital which

A recently constructed Swiss home and farm buildings

One of the farm homes built recently in Switzerland

should be required by the settler in the erection of farm buildings. According to the calculations of the Swiss bureau for land settlement the cost of reclaimed land and settlement (including the items listed below) should not exceed the following values:

	Per acre
Reclaimed land	$280
Settlement (buildings, agricultural roads, light and power, water supply)	300
Total	580

If the Swiss farmer wants to settle today, he has to spend 10 to 30 per cent more than the above amount, part of which is subsidized by the Government. This is done not by loans, but by actual contribution to the settlement costs, which are not to be refunded. By thus helping the farmer the country is investing wisely in the public interest, and by this means the problem of settlement on reclaimed land is solved in Switzerland. The reclaimed areas are now without exception settled and farmed.

Settlement Opportunities on Vale Project

On December 5, 1929, the preference right period allowed ex-service men for filing on the public lands on the Harper and Little Valley divisions of the Vale project having expired, in accordance with departmental order of August 10, 1929, the public lands still available for entry were thrown open to the general public. One farm application was received and approved by the examining board; two temporary water rental applications were approved by the project superintendent; and three homestead entries were made, one of which has been allowed by the local Land Office.

Aided Settlement in Canada

SOLVING to a certain extent the problem of accommodation for British farm work families on the farms of those who employ them, a comprehensive cottage scheme has now been put into effect in the western Provinces of Canada by the Canadian National Railways department of colonization and the White Star Line Canadian service. The plan has the full approval of the oversea settlement board of the British Government, who are contributing financial support to the proposal.

Briefly, the scheme provides for the erection of suitable farm cottages in prosperious farming districts in western Canada to house selected British families who will be placed under the auspices of the Canadian National Railways and White Star. These cottages are being carefully located in the three prairie Provinces, where the resident farmers are predominantly Anglo-Saxon. Each cottage will stand in a fenced plot of ground averaging from one-half to 1 acre, and will be close to a good road and within easy access to the local market village, and as near as possible to the local rural school. The cottages are modest but substantial. There will be two types—one for small families, with a large living room and two bedrooms, and one for larger families, with living room and three bedrooms. Simple furniture will be provided in each cottage, including a good stove.

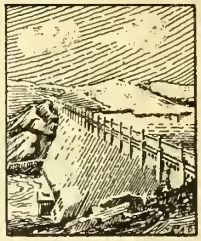
The nominal rental to be charged the families for these cottages will be $3 a month. It is to be understood that families will occupy the cottages only while they are securing preliminary experience in Canadian farming, presumably for a year's time, after which it is anticipated that they will be in a position to make their own arrangements. The Canadian National Railways farm placement service will assist in securing employment for the newly arrived families.

Progress in Settlement on the Shoshone Project

Three Willwood prospects having qualified and selected their units are preparing to make entry in the near future. One transfer from the Garland division to the Willwood is nearly consummated. One new settler from Nebraska reported on Christmas Day with his family and a small amount of equipment. He has already built a shack on his homestead which he plans to use later on as a chicken house.

An up-to-date suburban Swiss dwelling

ENGINEERING



By C. A. BISSELL, Chief, Engineering Division

Salton Sea Surface Stationary

TO travelers on the Southern Pacific Railroad going through southern California, that immense lake known as the Salton Sea is an object of much interest. It is located in the extreme southern portion of the State, in the north end of Imperial Valley, about 45 miles north of the international boundary and 150 miles southeast of Los Angeles. The water surface at the present time is about —246, or 246 feet below sea level; and the area is 175,000 acres, or 273 square miles. The sea is in the lowest part of the Imperial Valley, which is the second lowest point in the United States, Death Valley in the same State being 276 feet below sea level. Prior to 1905 early authorities gave the elevation of the lowest point in the sea bed as 287 feet below sea level.

The Salton Sea came into national prominence in 1905 when the Colorado River broke through its banks a few miles below Yuma, Ariz., and for a year and a half, until the break was closed in February, 1907, flowed down the Alamo River and through Imperial Valley into the sea. The water-surface area was thereby increased to 515 square miles, or about 2½ times the area of the proposed Boulder Canyon reservoir. The water surface elevation was raised to 197 feet below sea level, giving an average depth of 45 feet and maximum depth of 80 feet. About 22,000,000 acre-feet of water, the entire flow of the river went into the sea during the 1905-1907 break.

Prior to 1905 it was only a small lake known as Lake Cahuilla, named after the tribe of Cahuilla Indians. The Gulf of California originally extended north into what is now Imperial Valley, and the lake area occupied the northwestern part of what was once the gulf, being that portion cut off from the sea by delta deposits. The "Salton Sea," formed by the Colorado River break of 1905, attained a length of 45 miles with a maximum width of 17 miles. It extended from Imperial Junction (Niland) almost to Mecca, and submerged railway stations and necessitated removing about 67 miles of Southern Pacific tracks to higher ground. A bed of salt on the shore of the original lake at Salton had been exploited by the New Liverpool Salt Co. and shipments made for many years, but the works were destroyed by the 1905 river break.

The rate of evaporation less rainfall on the sea is about 7 feet per year. The sea is being utilized by the Imperial irrigation district as a sump in connection with the drainage of the 515,000 acres of irrigable lands. In March, 1907, the water-surface elevation was —197. There was a gradual lowering up to January 1, 1920, when the elevation was —252. Since that date there has been a variation of less than 6 feet, the evaporation about offsetting the inflow.

Assuan Dam Raised To Ultimate Height

With the signing of the "Nile waters agreement" in April, 1929, by the Egyptian and British Governments providing for control of the waters of the Nile for irrigation purposes in Egypt and the Sudan, the way is now clear for carrying out the Egyptian program of irrigation expansion. In January, 1929, a commission of experts submitted a report on the greatest possible elevation of the Assuan Dam, an increase in height of 9 meters, or 29 feet, being recommended. This construction will make available for irrigation an additional 2.2 billions of cubic meters of water or 1,780,000 acre-feet, which will give a maximum reservoir capacity of 4,060,000 acre-feet. The volume of water stored in the reservoir is taken as the amount conserved over and above the natural river.

The Ministry of Public Works recently received 11 bids for constructing the masonry portion of the dam enlargement, 3 bidders being British, 1 Italian, and 1 German. Bids ranged from $9,791,891 to $13,250,230, the low bidder being Norton, Griffiths & Co. (Ltd.), of England. Only 1 bid was received for ironwork, the British firm of Ransone & Rapiers submitting a bid of $1,526,392.50. A price of $1,000 per set was placed on the specifications and drawings for interested companies, and accompanying this sum a preliminary deposit of $25,000 was required, which was to be refunded if the company did not submit a bid.

The Assuan Dam is one of the most interesting irrigation structures in the world. It was built from 1898 to 1903 at Assuan on the Nile to retain the flood waters for irrigation. In length the dam is about 6,400 feet with a lock for navigation on the west bank. There is a solid masonry section of 1,800 feet and a 4,600-foot sluiceway section with 180 sluiceways located at 4 different levels. These sluiceways are able to pass the entire flow of the Nile, the maximum recorded being 494,500 cubic feet per second. The original height was 98½ feet above the foundation, and the structure as originally built contained about 700,000 cubic yards of masonry. It cost approximately $12,250,000.

In 1907 the Egyptian Government decided to raise the dam 16.4 feet and thereby increase the irrigable area from 420,000 to 988,000 acres. The work was done by the original contractor at a cost of $7,400,000. Not only was the height of the dam increased, but also the cross section by building on the downstream side an additional thickness of masonry to increase the volume to 1,200,000 cubic yards. As a result of this work the length of the reservoir was increased from 140 to 180 miles. Now the dam is to be raised again, this time to its ultimate height of 144 feet. With the completion of this heightening at Assuan, together with construction of a dam at Gebel Aulia on the White Nile above Khartoum, which is scheduled for early undertaking at a cost of $17,500,000, the irrigable area will be increased by 750,000 acres, or to a total of approximately 1,740,000 acres.

Development Plan for the American River, Calif.

The State engineer's office at Sacramento, Calif., has recently completed a report on the development of the lower American River. The project includes flood control, salinity control, irrigation and power development, with three reservoirs having an aggregate storage capacity of 1,719,000 acre-feet and power installation of 200,000 horsepower. Floods on the American River may be controlled to 100,000 second-feet by the utilization of 175,000 acre-feet of storage space during the flood season. If operated primarily for irrigation, 266,000 acres can be served with a water supply. The power output would be 150,000,000 kilowatt-hours per year. Control of salinity would be slight. The report is to be issued as a State bulletin and will soon be available.

Drainage Experiment

YUMA PROJECT

An interesting experiment is being tried on the Yuma project in Arizona to determine the feasibility of lowering the water table by drilling wells and pumping the seepage water back into the Colorado River. The sum of $15,000 has been made available and a test well having a 24-inch casing will be driven near the A. R. Heineman ranch in the Yuma Valley.

The experiment will be watched with interest and should it prove successful other wells will be drilled in the valley. The proponents of the project hope that not only will the underground water level be lowered but also that the wells may have considerable effect in leaching salts from the soil.

Minidoka Gravity Extension

CANAL BIDS

At Burley, Idaho, on December 27, 1929, four bids were received for the construction of about 16 miles of the main canal, Gravity Extension division, Minidoka project, Idaho, under specifications No. 503. The low bid was $537,199.85, submitted by Haas, Doughty & Jones, of San Francisco, Calif., newcomers in Bureau of Reclamation work. The next lowest bidder was the Utah Construction Co., of Ogden, Utah, with $546,211.95. It is interesting to note that the engineer's estimate was $544,860.95, which shows that both engineer and contractor were of about the same opinion as to the cost of moving dirt. And the other two bidders were not so far away with bids of approximately $558,000 and $594,000. This section of canal is at the northerly end near Shoshone, Idaho, and extends to the Little Wood River. Over a million cubic yards of excavation are involved, together with about 30 canal structures.

Investigations of irrigation possibilities and reservoir sites are now being made by this bureau on the upper Gila River in Arizona and New Mexico, under a cooperative agreement with those two States. The Hooker dam site has been eliminated from further consideration owing to the excessive cost of a dam in comparison with the area which would be benefited. The Conner and Cliff sites are being investigated and detail surveys and geological examinations made. Drilling operations are now in progress at the Camelsback and Conner sites. O. C. Smith, associate engineer, is in charge of the work for this bureau.

Boulder Canyon Project

PRIMER

Q. Where is Boulder Dam to be built?

A. In upper Black Canyon on the Colorado River about 30 miles southeast of Las Vegas, Nev., on the Arizona-Nevada State line.

Q. Why the name Boulder?

A. The original site investigated was in Boulder Canyon, about 20 miles up river from Black Canyon. Since the Bureau of Reclamation has constructed a Black Canyon dam in Idaho, the name Boulder Canyon, because of long usage was retained, but shortened to Boulder.

Q. What does the project include?

A. Construction of a dam and power plant in Black Canyon and the All-American Canal.

Q. What are the purposes of the project?

A. Flood control and general river regulation, irrigation, silt control, power development and domestic water supply.

Q. What will the project cost?

A. The act authorizes appropriations not to exceed $165,000,000 divided as follows: Dam and reservoir, $71,600,000; power development, $38,200,000; All-American Canal, $38,500,000; interest during construction, $17,700,000.

Q. How high will the dam be?

A. Preliminary plans call for a height of 680 feet above foundation rock, which would raise the water surface of the river 550 feet. Consideration is now being given to increasing the height to 700 feet.

Q. What type of dam is being considered?

A. The arch-gravity type, in which the water load is carried by both gravity action and horizontal arch action.

Q. What is the volume of concrete masonry?

A. About 3,600,000 cubic yards in the dam, or 4,500,000 cubic yards in the dam, power plant, and appurtenant works, according to preliminary estimates. For comparison the Bureau of Reclamation has placed in dams and structures a total of 4,191,553 cubic yards of concrete up to June 30, 1929.

Q. How much cement will be required?

A. About 5,500,000 barrels. The daily demand might tax the capacity of any one or two cement plants. This bureau has used 4,664,450 barrels in 25 years of construction activities.

Q. How much reinforcement steel will be used?

A. About 19,000,000 pounds.

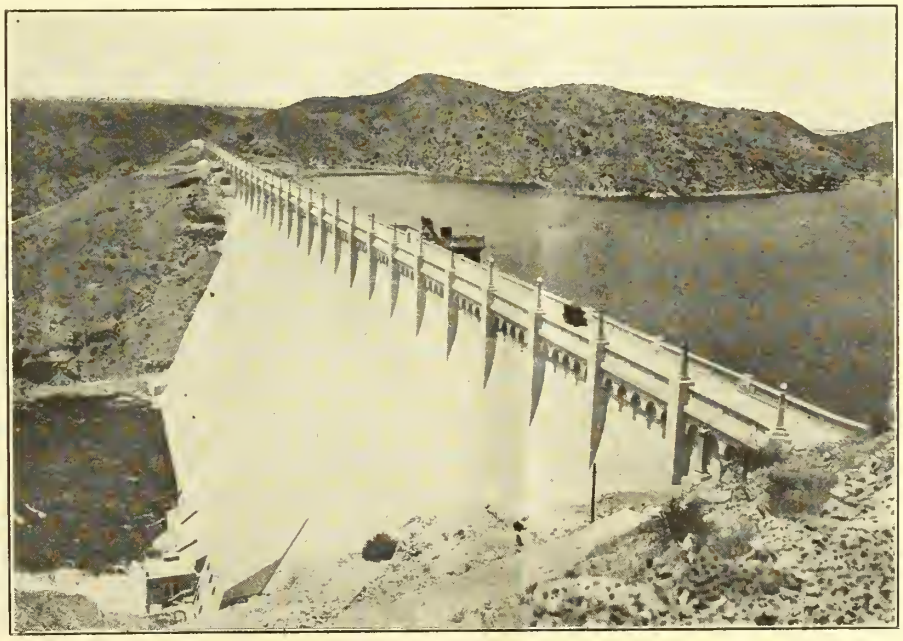
Q. What are geologic conditions at the dam site?

A. The foundation and abutments are rock of volcanic origin, geologically termed "andesite breccia," hard and very durable.

Q. How long will it take to build the dam?

A. About seven years after work on the project is started.

The shareholders of the Salt River Valley Water Users' Association on December 17 voted against a proposed contract between that organization, the Verde River Irrigation and Power District, and the United States, which would have authorized the development of a project of 84,500 acres on the Verde River north of the Salt River project. The majority of votes against the contract was about 10,000 in a total vote of 130,000.



Elephant Butte Dam, Rio Grande project, New Mexico-Texas

Deadwood Dam Construction Camp Snowed In

The unusually favorable weather for construction work at the Deadwood dam site on the Payette division of the Boise project in Idaho finally ended on December 8, on which date a storm of 11 days' duration began, the precipitation totaling 11 inches. The Utah Construction Co. of Ogden, Utah, which was awarded the contract for building the dam last July, put their work in the best possible shape for the winter and disbanded the main part of their force before December 20. An effort was made to keep the road to Cascade open for trucks by means of a caterpillar and snowplow, but it did not prove feasible to clear the road sufficiently for truck traffic because of the considerable depth of wet, heavy snow. The first 75 men made the 3-day trip to the railroad in horse-drawn sleds. A start was made with the last 40 men in sleds towed by the caterpillar, but the caterpillar soon broke down and the passengers were obliged to abandon their baggage and walk 30 miles to Warm Lake, where they were met by teams. There were no casualties but it was a trying experience for the workmen. Repair parts for the tractor were sent in later by dog team and the baggage brought out. A few of the men were left in camp to take care of the outfit and work on clearing the reservoir site under the one schedule awarded to the company. It is expected that operations will be resumed about April 1, which is about two months before condition of the road will permit the hauling of cement.

Owyhee Tunnels

Bids will be opened at Nyssa, Oreg., on March 11, 1930, for the construction of concrete-lined tunnels and roads for the distribution system of the Owyhee (Federal) irrigation project in Oregon-Idaho. The work will consist of the construction of a 14-foot diameter tunnel 18,722 feet long and a 9-foot 4-inch diameter tunnel 33,307 feet long; or a 16-foot 7-inch diameter tunnel 18,722 feet long and a 9-foot 3-inch diameter tunnel 21,920 feet long; and appurtenant roads and structures.

The work will be divided into nine schedules, and the principal items and estimated quantities involved are as follows: 280,000 cubic yards of tunnel excavation; 114,000 cubic yards of excavation other than tunnel excavation; 23,000 station cubic yards of overhaul; 74,000 cubic yards of concrete in tunnel lining; 1,600 cubic feet of pressure grouting; laying 600 linear feet of 12-inch and 18-inch corrugated metal pipe; constructing 53,000 linear feet of tunnel and outlet closed drains; furnishing and erecting 330,000 feet board measure timbering in tunnels; furnishing and erecting 209,000 pounds of structural steel in tunnels. The specifications will be available for distribution about February 5.

CONSIDERABLE interest is being manifested at the project office regarding opportunities for settlement on the Kittitas division of the Yakima project.

Civil Engineering

The State board of registration for civil engineers in California has adopted the following definition for the term "civil engineering":

That branch of professional engineering which deals with the economics of, the use and design of the materials of construction and the determination of their physical qualities; the supervision of the construction of engineering structures; and the investigation of the laws and phenomena and forces of nature; in connection with fixed works for irrigation, drainage, water power, water supply, flood control, inland waterways, harbors, municipal improvements, railroads, highways, tunnels, airports and airways, purification of water, sewerage, refuse disposal, foundations, framed and homogeneous structures, bridges, buildings, city and regional planning, valuations and appraisals, surveying (other than land surveying).

It is noted that irrigation heads the list. Civil engineers have until July 1, 1930, to register.

The Strawberry Valley Water Users' Association, now operating the Strawberry Valley project in Utah, recently presented to the water storage commission a program for development of Utah water resources. It is proposed to develop from 1,000,000 to 1,500,000 acre-feet of water for irrigation in the Salt Lake and Sevier drainage areas, to generate 125,000 horsepower of hydroelectric energy and to reclaim large areas in Salt Lake, Sanpete, Tooele, Millard, Juab, and Utah counties.

Mozambique Irrigation

In the Limpopo Valley in Portuguese East Africa, it is planned to irrigate about 75,000 acres and utilize the land for large sugar-cane plantations. One of the aims in view is to attract Portuguese colonists to this territory. The system adopted in Natal, Cuba, and Mauritius will be used. Tracts of approximately 350 acres are granted to each colonist and at the same time grants are given for the purpose of establishing sugar refineries and alcohol distillery plants, the latter supplying the national fuel.

CONSTRUCTION of the potato-meal factory at Burley, Minidoka project, was so far advanced that it was ready at the close of the month to receive potatoes for storage. and it was expected that operation of the factory would begin in a month or two.

Home of a first settler on the Harper Unit, Vale project, Oregon

Aided and Directed Settlement in South Australia

Questions and Answers

IMPROVEMENT OF LAND AND SALE OF FARMS TO SETTLERS

Q. What is done to improve the land before farms are sold to settlers?

A. Swamp lands are reclaimed by erection of levee embankments, main drainage systems are constructed, and pumping plants erected. On pumping schemes, pumping plants are erected and main distributory channels are constructed.

On reclaimed swamp land subdivided into holdings, watering and drainage channels are constructed and connected with the main system, land graded.

On pumping schemes for civilian settlement, nothing, but for discharged soldiers' blocks have been cleared, fenced, and channeled, and partly graded and planted.

For civilian settlers improvements are carried out after allotment of the land.

Q. Under what terms are farms sold?

A. All irrigation lands are allotted under perpetual leases.

SERVICE OR ADVICE TO SETTLERS

Q. What service or advice is given settlers in development of farms, working out agricultural programs, or in designing or erecting dwellings?

A. Instructors attached to the Department of Agriculture are appointed to each district, and their advice on all orchard or farm matters is always available free of charge.

An experimental farm has been established for carrying out horticultural experiments in pruning, manuring, and in testing varieties of fruits most suited for local conditions, etc. Results are made available to settlers.

The cost of these services is met from the general revenue of the State.

ADVANCES TO SETTLERS

Q. How much is advanced to a settler for effecting permanent improvements and for purchase of equipment or livestock?

A. $3,000, or $150 per irrigable acre, whichever sum is the greater, the maximum allowed for stock, plant, etc., being $1,000.

Q. What per cent of the cost of improvements, equipment, or livestock is advanced?

A. When improvements are effected by the commission 15 per cent of the cost is payable by the settler.

Advances may be made up to the full amount applied for, subject to the value of the land and improvements offered as security being sufficient.

Q. What is the interest rate and for what period of time do such loans run?

A. The rate of interest charged is 6½ per cent, with rebate of one-half per cent for prompt payment. The period of the loan is 40 years, interest only being payable for first five years; thence the loan is repayable in 70 equal half-yearly payments, with interest on the amount outstanding at the above rate.

Irrigating potatoes on the Minidoka project, Idaho

Poultry Raising

WALTER N. HOLDEN, of Heyburn, Idaho, born in Massachusetts in 1860, a pioneer in Kansas in 1867, in Montana in 1880, and on the Minidoka project in Idaho in 1904, where he has lived on his own farm for the past 25 years, gives the observations of a lifetime spent at farming and a long and valuable experience at poultry raising, which should be most helpful to the prospective project poultry man. He lists as follows 10 essentials if success is to be attained in this attractive industry:

1. *Location.*—A well populated community with favorable climate and soil, plenty of good water and sunshine, cheap land and feed, good transportation facilities, and nearness to a ready market.
2. *Stock.*—The best breeds and readily mated.
3. *Eggs.*—Fertile and of good size and color texture.
4. *Incubation.*—Artificial and well directed.
5. *Shipping.*—Scientifically done with the exercise of good judgment.
6. *Feeding.*—Proper and regular feeding at all times.
7. *Culling.*—Rigidly practiced at all times.
8. *Brooding.*—The best of care with no crowding.
9. *Sanitation.*—Cleanliness, ventilation, fresh air, sunshine, and good drainage.
10. *Management.*—Trust nothing to luck; have plenty of able, gentle, level-headed, satisfied help on the job all the time, bearing in mind that one extra competent hand is better than one too few, and that you are dealing with life and not with inanimate rock.

Let our slogan be "A flock on every farm." See to it that that flock is the best and that the conditions outlined above are fully met. The result you will find will fully justify your efforts and you will have the satisfaction of engaging in a business which is not only profitable but is attended by personal enjoyment.

Work of the Bureau of Reclamation in Providing Supplemental Water for Irrigation

THERE are two principal phases of the work of the Bureau of Reclamation in furnishing supplemental water for irrigation. Ordinarily we think of this work in terms of the Warren Act, so named for the late Senator from Wyoming, and approved on February 21, 1911. Specifically this act provides—

That whenever in carrying out the provisions of the reclamation law, storage or carrying capacity has been or may be provided in excess of the requirements of the lands to be irrigated under any project, the Secretary of the Interior, preserving a first right to lands and entrymen under the project, is hereby authorized, upon such terms as he may determine to be just and equitable, to contract for the impounding, storage, and carriage of water to an extent not exceeding such excess capacity with irrigation systems operating under the act of August 18, 1894, known as the Carey Act, and individuals, corporations, associations, and irrigation districts organized for or engaged in furnishing water for irrigation. Water so impounded, stored, or carried under any such contract shall be for the purpose of distribution to individual water users by the party with whom the contract is made.

Early in the history of the bureau it became apparent that it would be economically feasible to construct reservoirs adequate in size to store sufficient water to meet the needs of the Federal project lands for which they were primarily to be used, and at the same time serve as regulating basins for the storage of surplus water for which a nearby market might readily be available at that time or potentially available in the course of future private development.

When construction of the North Platte Federal irrigation project, in Nebraska and Wyoming, was authorized in 1904, the total irrigated area in the North Platte Valley was approximately 50,000 acres. It was evident that without storage and river control even this relatively small area could not be materially extended under irrigation. As a result the Pathfinder Reservoir, in Wyoming, was constructed to its full capacity, even though the Federal project could not utilize the entire storage and there was no immediate market for the surplus. This decision received the enthusiastic support of the beet-sugar interests, which entered into an active campaign for the extension of this industry in the valley during the succeeding years. The benefits of river regulation, through the construction of Pathfinder Reservoir, were so pronounced that the private canal companies west of Bridgeport requested the Secretary of the Interior to permit them to buy supplemental storage in the reservoir as an insurance against water shortage in the latter part of the irrigation season. This request was granted, and practically all these private companies between the Wyoming-Nebraska State line and Bridgeport availed themselves of the privilege and purchased supplemental water to the aggregate amount of 344,000 acre-feet at a cost of more than a million dollars. Last year water was furnished from the Government works alone for the irrigation in whole or in part of 300,000 acres in this valley.

The Arrowrock Reservoir on the Boise Federal irrigation project, Idaho, is another example of a reservoir which, at relatively little additional cost, was constructed with a capacity considerably greater than at that time was considered necessary for the irrigation of the lands included in the project, but with the distinct idea in mind that the surplus storage would find a ready market sooner or later among the private organizations in the vicinity whose normal supply of water was inadequate for their needs. That this opinion was justified is evidenced by the fact that a number of these organizations, suffering from an inadequate supply, have gladly entered into contracts providing for the purchase of surplus water to the extent of 32,000 acre-feet, at a cost of $528,000.

In general, contracts for the sale of surplus water provide for the purchase of a definite amount of storage capacity in a given reservoir at a specified cost per acre-foot, such cost to be returned in annual payments, without interest, over a period of years.

AMERICAN FALLS RESERVOIR

An entirely different method was used, however, in financing the construction of American Falls Dam on the Snake River, Idaho. The Snake River Valley is one of the largest irrigated valleys in the United States. It contains thousands of irrigated farms, with a total population of 250,000 people. Inadequate water supply for the various irrigation districts along the valley led to negotiations for the construction of a new reservoir at American Falls. A large part of the valley is under the American Falls reservoir district No. 1. Under contracts with the Federal Government this district and other smaller districts, aggregating approximately 1,500,000 irrigable acres, advanced $3,378,000 to finance the cost of the great reservoir at American Falls, with a capacity of 1,700,000 acre-feet, the total cost of which is about $7,500,000. The additional water supply furnished the farmers throughout the valley is expected to increase the value of crops grown annually by approximately $40,000,000 under full development.

REPAYMENTS UNDER WARREN ACT CONTRACTS

An interesting table was compiled recently by the chief accountant of the Bureau of Reclamation. Since the passage of the Warren Act the bureau has entered into 77 contracts for the sale of supplemental water for irrigation. These contracts have a total value of $7,514,521 and involve the purchase of 1,600,000 acre-feet of water. The irrigated area of these lands served in whole or in part with

water from the Government works amounted last year to 1,235,020 acres, of which 1,192,030 acres were cropped, producing crops valued at $62,500,000. Repayments due under these contracts to June 30, 1929, amounted to $5,333,519, of which all but $72,190, or about 1.3 per cent of the amount due, has been paid. In the case of the American Falls development, as stated above, $3,378,000 was contributed to the Government in advance of construction. Although it is true that a few of these contracts have been modified to provide for a longer term of payment, as has been found necessary in the contracts with the water users' organizations on some of the Federal projects, this is undoubtedly a remarkable record of repayments, involving as they do a range from a few hundred to two million dollars. Thirty-nine of these contracts are for the sale of surplus water from storages on the Minidoka project, Idaho, with only 1 in arrears; 17 are under the Yakima project, Washington, with only 1 delinquent; 10 are under the North Platte project-Nebraska-Wyoming, with 3 delinquent; 6 are under the Boise project, Idaho, with 1 delinquent; and 4 are under the Klamath project, of which 3 are in arrears.

FEASIBILITY TESTS FOR WARREN ACT PROJECTS

Despite the excellent record of repayments taking the districts as a whole, a few of them are not in good financial condition, owing to causes with which the United States has been in no way connected. The responsibility for their success lies with the private organization so long as the United States carries out its part of the contract obligations. It is a question, however, whether the largest usefulness under the Warren Act would not be gained if the United States exercised the same caution in entering into Warren Act contracts as it now exercises in determining the feasibility of strictly Federal projects. There is of course involved in this the desirability of protecting the Government's investment. But aside from this, the fact that it is generally known to the public that a Warren Act project is being furnished water from a Federal storage reservoir might well result in the purchase of such land by settlers chiefly because the Government is a participating agency. During the past summer an economic survey of certain Federal and private projects was made by the Bureau of Reclamation. Among the questions given consideration was that of the responsibility of the United States under Warren Act contracts. This report has not yet been made available for public distribution, but in the discussion of this question it was the general consensus of opinion that before a contract was entered into with a private organization for the purchase of surplus water under the Warren Act, such project should be subjected to the same tests of feasibility as are now required before a strictly Federal project is recommended for construction; in other words, that it should comply with the present law—

> That no new project or new division of a project shall be approved for construction or estimates submitted therefor by the Secretary until information in detail shall be secured by him concerning the water supply, the engineering features, the cost of construction, land prices, and the probable cost of development, and he shall have made a finding in writing that it is feasible, that it is adaptable for actual settlement and farm homes, and that it will probably return the cost thereof to the United States.

The investigators also were of the opinion that construction by agencies seeking assistance under the Warren Act should be carried out under sufficient Government supervision to insure a satisfactory standard of work; and that the financing of the project which is to receive such assistance should be satisfactory to the Secretary of the Interior.

If these checks and safeguards were insisted upon they would result in withholding aid to infeasible or premature projects, and on the other hand, in the case of projects that can be successfully carried out if soundly planned and effectively supervised, the general reclamation program would be strengthened and Federal aid would be largely confined to communities which have a proper claim to it.

The preceding discussion has had to do with those instances in which the Federal Government, in connection with its primary purpose of furnishing an adequate water supply to strictly Federal projects, has, as an incident thereto, furnished the whole or a supplemental supply to adjacent private developments from available surplus storage.

AID TO PARTIALLY DEVELOPED COMMUNITIES

Another phase of our work has to do with the construction of storage works primarily to meet the needs of already partially developed communities, whose water supply is inadequate to meet their needs. A typical example of this is the construction now being carried on by the bureau in the State of Utah, where the Echo Reservoir is being built to furnish an ample supply of water for the irrigation of about 80,000 acres of land in the Salt Lake Basin. All of this land is in private ownership, is fully colonized and settled, but needs a supplemental supply of water for late irrigation. The land embraced in the project is of more than average fertility, and can be utilized for the production of crops with the effective application of water. The farmers on the project have savings and checking accounts in the local banks, are industrious, pay their debts, and constitute a solid class of citizens in the State of Utah.

A contract has been entered into with the Weber River Water Users' Association for repayment of the cost of the construction in 20 equal annual installments, payment to begin on December 1 of the year in which the Secretary of the Interior announces the completion of the expenditures for the first unit. The average construction cost of this division will probably be about $40 an acre, making the average yearly payment $2 an acre, to which will be added the annual expense of operation and maintenance. The total yearly charge, however, will not be greater than the irrigators can pay, and there is every reason to believe that the additional water supply will increase their incomes to such an extent that they will be able readily to meet the required payments.

There can be no question of the value of such work by the Bureau of Reclamation. The safety of the Government's investment is assured, because the work is done not in a sparsely settled region where settlement and development must be built up over a long period of years before the construction cost can be announced and repayments commence, but in localities already settled as active growing communities, but handicapped in attaining their full development because of the lack of an adequate water supply usually for late irrigation, and their inability to finance the necessary construction. Such work is in direct line with President Hoover's suggestion in his letter of August 21 to Hon. Joseph M. Dixon, First Assistant Secretary of the Interior, that in the case of certain insufficiently capitalized community-owned irrigation projects the reclamation fund might be made a proper vehicle to rescue homes that are now in jeopardy.

DURING the year 1929 visitors to Carlsbad Cave numbered 78,469, an increase of at least 50 per cent over any preceding year. This increased travel to the cave has stimulated efforts of the Carlsbad Chamber of Commerce on the Carlsbad project toward securing needed improvements in the local highways.

Farmers and poultry specialists are urged to hatch chicks early in order to bring pullets to the laying age in time to supply the autumn market when egg prices are highest.

Another advantage of early hatching is that it allows the cockerels more time to build good bodies and cover them with meat.

THIS is a continuation of the interesting accounts of junior club activities on our reclamation projects which have been carried in successive issues of the Era.

The young folks not only take pride in seeing accounts of their particular activities in the Era, but are able to gain knowledge of how boys and girls on other projects are conducting their club affairs.

Belle Fourche Project, South Dakota

4-H Boys' and Girls' Club work has played an important part in the development of diversified agriculture on the Belle Fourche irrigation project. This work has been carried on quite extensively on the project since 1920. In the winter of 1928–29 the following clubs were organized and are being carried through to completion this year:

The project Ayrshire Club, which was first organized in 1924, was reorganized during the winter with 19 members enrolled. Eli W. Long, of Newell, is the local leader and C. A. Watkins, of Newell, is the assistant local leader for the club this year. All club members enrolled own purebred Ayrshire dairy cattle.

The 4-H Sheep Club of Newell was organized last fall with 12 members. B. F. Richards, of Newell, is local leader of this club. During the winter the club purchased 24 head of high-grade Rambouillet ewes which were divided among the club members, each member purchasing two ewes. According to a recent inventory of the 11 who are now completing their work, their records show 20 ewes with 21 lambs. The oldest member in the club is 15 years of age, which indicates that the young sheep raisers have made a very good showing so far this year.

The Live-Wire Sheep Club of Arpan was organized early last spring with 13 members. Oliver Herrett, graduate of the School of Agriculture at State College, was selected as local leader for the club. Twelve of the members enrolled, secured two ewes each, some of which are purebreds, and they are carrying their project on to a successful close.

A county-wide corn club was organized in April of 1929 with 11 members enrolled. Oliver Herrett was selected as the local leader for the club. Paynes' White Dent seed corn was furnished through the experiment farm at Newell to all club members who wished to grow this particular variety. Four of the members in the club later planted Gehu Flint, which was pastured with sheep belonging to members last fall.

The County Baby Pork Club was organized in May of 1929 with 10 members enrolled. Seven of the 10 members secured pigs, which were weighed in during the first part of June. These 7 members will bring their pigs to the county fair and have them weighed out, records being based on the increase, gain, and cost of feed during the feeding period.

Realizing the importance of a well-balanced garden, Mrs. J. C. Milne, of Belle Fourche, helped to organize a garden club composed of 11 members. The club members selected Mrs. Milne as local leader. A few of the garden club members are in the canning club work and will can a large quantity of their garden products.

THE PROJECT AYRSHIRE DAIRY CLUB [1]

The project Ayrshire Dairy Club was organized in 1924 with 19 members. At the time of its organization it was the largest purebred dairy club in the State. Through the efforts of Mr. Miller and Mr. Lawrence, local leaders, the club as a whole made a creditable showing with its judging and demonstration teams, both at the county fair and at the State fair. The demonstration team was awarded State championship and was also awarded a trip to the National Dairy Show in Milwaukee.

In 1925 the Ayrshire Club was reorganized with 15 members of the previous year enrolled in the Dairy Cow Club and 15 enrolled in the Dairy Calf Club. Mr. Miller and Mr. Glover were local leaders and assisted the club members in developing a dairy judging and demonstration team for the county and State fairs. The teams were placed second in the State.

When 1926 rolled around it still found the boys and girls enthusiastic in reorganizing for more and better dairy practice. The Ayrshire Dairy Club was again reorganized with two units, a Dairy Cow Club and a Dairy Calf Club, with 27 enrolled.

The members exhibited 18 head of Ayrshire cows and heifers at the county fair, then at the Pennington County fair and the State fair. The dairy judging team was awarded first place at the State fair. Kenneth Moorehead of Vale, a member of the club and judging team, was high man in the State judging contest and was awarded a trip to the National Dairy Show held at Detroit.

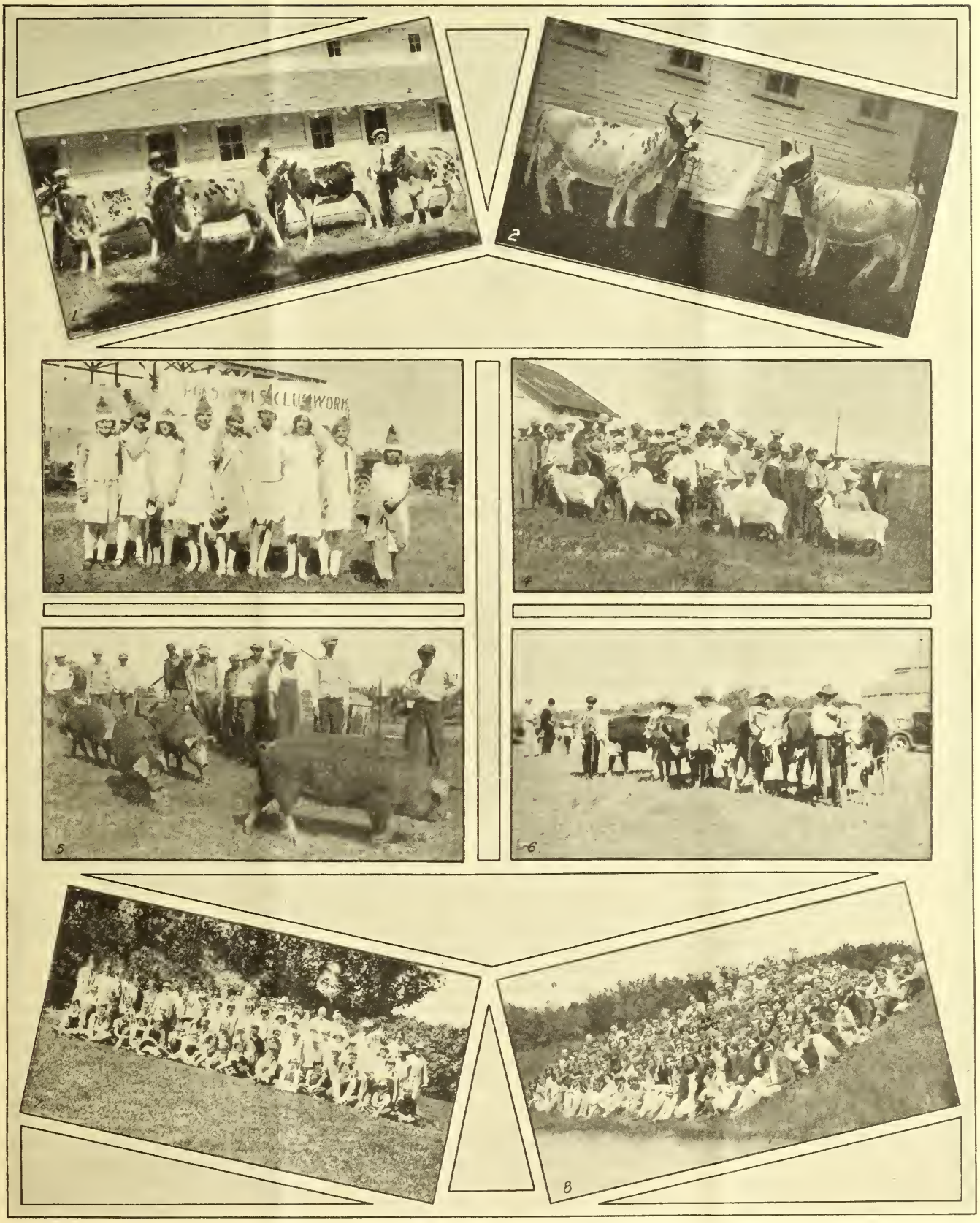
The project Ayrshire Club was again reorganized during the winter with 24 members. During the year 1927 13 of those enrolled kept and reported production records on their cows. From inventory of 13 members it shows 28 cows and heifers owned, valued at $2,250. During the year $743.77 of stock and dairy products were sold and their feed and care cost amounted to $599.59. A majority of the animals reported in the inventory, were either calves or young heifers, which accounts for the low average profit per individual. Many of the members now have profitable producing cows, while others have young, well-developed heifers.

Last winter the club entered into its fifth consecutive year. Some of the original members are no longer in the club, but their places have been taken by younger boys and girls. Those who have grown beyond club age still maintain a keen interest in the work and own purebred Ayrshires.

H. W. Barber and Eli W. Long were local leaders for the club this year. The club members assisted in developing both a dairy-judging team and a demonstration team. Both teams took part at the county fair and also at the State fair. The dairy demonstration team gave an instructive demonstration on "selecting profitable dairy cows." The club exhibited 6 heifers under 2 years old which were all placed in the State club department.

Through the interest shown by the project Ayrshire Club a marked improvement in dairy practices has manifested itself in various districts of the irrigation project. With large quantities of available feed, dairy practice should prove very profitable.

[1] Notes by county agent, Belle Fourche, S. Dak.



1. Ayrshire Club exhibiting at Butte County Fair, 1928; 2. The project Ayrshire demonstration team at State Fair, 1928; 3. Club girls at Butte County Fair, 1928; 4. Boys attending club encampment at Newell, S. Dak., sheep-judging contest; 5. Boys attending annual club encampment at Newell, S. Dak., hog-judging work; 6. Baby beef club exhibit at the 1927 Butte County Fair; 7. Boys' and girls' club camp at the Experimental Farm, Newell, 1927; 8. Club encampment at Newell, U. S. Experiment Station

The Reclamation Fund

The Government's Contribution

THE reclamation act of June 17, 1902, committed the Government to a national reclamation policy. Instead of financing reclamation work with direct appropriations from the Federal Treasury (the usual method adopted by Congress to finance Government activities), the act created the "reclamation fund," a revolving fund, by reserving, setting aside, and appropriating to this fund moneys received from the sale and disposal of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming—in all, 16 Western States and Territories—beginning with the fiscal year 1901, to be used in the examination and survey for and the construction and maintenance of irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands in the said States and Territories. In 1906 Congress extended the reclamation act to include the State of Texas.

Annual increments to the fund thus created from the sale and disposal of public lands in the 16 Western States, the State of Texas having no public lands, have ranged from a peak of $9,430,573.78 during the fiscal year 1908 to $509,624.61 during the fiscal year 1926. Annual increments have gradually diminished from the peak in 1908 until the average annual increment for the past 4 years is little more than $600,000. At the close of the fiscal year 1929, a total of $109,631,974.40 had accrued to the fund from the sale and disposal of public lands.

From time to time Congress has reserved, set aside, and appropriated to the fund moneys derived from other sources.

At the close of the fiscal year 1905, $22,000,000 in excess of expenditures had accumulated in the fund. Soon thereafter the Government embarked upon an extensive construction program. The accretions to the fund from the sale and disposal of public lands were insufficient to permit the economical construction of the irrigation projects in progress, and in 1910 a loan of $20,000,000 to the fund was authorized by Congress. This loan was advanced in amounts ranging from $1,500,000 to $8,500,000 annually during the period from 1914 to 1918, and is now being repaid to the Federal Treasury at the rate of $1,000,000 annually.

In October, 1917, Congress passed an act authorizing the exploration for and the disposition of potassium, which provides that all moneys received from royalties and rentals under the act, excepting those from Alaska, shall be paid into, reserved, and appropriated as a part of the reclamation fund. From this source $52,684.69 had accrued to the fund at the close of the fiscal year 1929.

In February, 1920, Congress passed the "oil-leasing act," which provides that of the money received from sales, bonuses, royalties, and rentals from the mining of coal, phosphates, oil, oil shale, gas, and sodium on the public domain, excepting in Alaska, 70 per centum from past production and 52½ per centum from future production shall be paid into, reserved, and appropriated as a part of the reclamation fund. The annual increments from this source commenced in the fiscal year 1921 and reached a peak of $6,693,908.15 during the fiscal year 1924, decreasing rapidly to $1,852,785.03 in the fiscal year 1929. At the close of the fiscal year 1929, $35,920,437.61 had accrued to the fund.

Under the provisions of the Federal water-power act of June 10, 1920, 50 per centum of the charges from Federal water-power licenses for use of public lands is paid into, reserved, and appropriated as a part of the reclamation fund. From this source a total of $59,209.22 had accrued to the fund on June 30, 1929.

Other acts have been passed by Congress which provide for the setting aside, reserving, and appropriating moneys to reclamation fund. These acts represent potential sources of accretions to the fund, but to June 30, 1929, nothing had accrued to the fund.

Summarizing the above, there had accrued to the fund at the close of the fiscal year 1929, a total of $147,714,305.92—the Government's contribution to the reclamation fund.

The Revolution of the Fund

The revolving-fund feature of the original reclamation act is one of its most important and valued provisions and has been carefully preserved and followed in reclamation operations. From time to time the Bureau of Reclamation is confronted with the criticism that the reclamation fund is not revolving as contemplated by the reclamation law. The original reclamation act provided for the repayment of the construction charges over a period of 10 years, i. e., in 10 annual installments from the time notice to commence repayment was issued by the Secretary of the Interior, the said construction charges to be determined with a view of returning to the fund the cost of construction of the project equitably apportioned to the land. Repayment of construction charges commenced during the fiscal year 1908. At that time 27 projects were under construction, of which only 5 had commenced the repayment of construction charges. Actual revolution of the fund commenced in 1908 at which time $30,000,000 was "frozen" in work in progress.

Unquestionably the revolution of the fund was retarded because of the policy of carrying on, simultaneously, the construction of a large number of irrigation works and the initiation of new ones without awaiting the completion of the old. Under such a policy the resources of the fund were considerably overburdened. The future prosperity of the country was considered rather than the immediate return to the reclamation fund. This is in contrast with the usual efforts made by speculative investors seeking large and immediate returns rather than the ultimate full development of land and water.

The extension act of 1914 increased the period of repayment to 20 years for new projects, and granted 20 years additional to the projects then repaying construction charges under the 10-year repayment

plan. At the end of 1913, approximately $100,000,000 had been expended and $13,000,000 had been collected and redeposited to the fund. Of the amount collected $3,500,000 was for repayment of construction charges. As late as 1914 the revolution of the fund was in its early stages. Approximately $75,000,000 was "frozen" in work in progress.

In 1924 Congress passed the fact finders' act, which provided for the repayment of construction charges on the basis of the productive power of the lands irrigated, the annual installments to be 5 per cent of the average gross annual income for 10 calendar years. Under the crop production plan, the repayment period will vary from 25 to 75 years. This plan of repayment was repealed in 1926, and in lieu thereof Congress provided the 40-year repayment plan.

The natural conclusion would be that these several extensions in the repayment period would retard the revolution of the fund. Prior to the fact finders' act of 1924 charges due and unpaid aggregated $10,000,000. Charges under the plan of repayment in effect prior to 1924 were burdensome and few projects were meeting their obligations. There was a period of stagnation in collections.

Refunding of debts and the lessening of annual construction charges provided for by the adjustment acts of 1924 and 1926 resulted in prompt payments. Repayments to the fund have increased materially. The adjustment acts of 1924 and 1926 have tended to accelerate rather than to retard the immediate revolution of the fund.

During the fiscal year 1929, repayment collections amounted to $7,321,851.72, which exceeds the repayment collections for any previous year. Repayment collections at the close of the fiscal year 1929, amounted to $85,583,323.75, approximately 60 per cent as much as the amount contributed by the Government to the fund—$147,714,305.92. During the fiscal year 1929, accretions to the fund amounted to $2,529,740.73, of which $1,000,000 was returned to the Federal Treasury as payment of an annual installment of the $20,000,000 special loan. Of the total amount accruing to the fund during 1929 and available for expenditure for reclamation activities, 83 per cent was derived from repayment collections and 17 per cent was contributed by the Government from the several sources enumerated above. What is the significance of this? Reclamation activities must be practically self-supporting by virtue of the revolving feature of the original reclamation act, as present conditions indicate continued diminished annual accretions to the fund. As annual appropriations by Congress for reclamation activities are conditional upon sufficient money coming into the fund, the major part of which is coming from the revolution of the fund, future progress of reclamation depends largely upon these repayments by the beneficiaries of reclamation, because the bureau can only spend each year the money that comes into the fund year by year.

There can be no doubt that the reclamation fund is revolving. Because of the revolution of the fund approximately one-quarter billion dollars has been available for reclamation—approximately 60 per cent more than would have been available had reclamation activities been restricted to money contributed by the Government. Over a period of 29 years, the annual diversion of money from the Federal Treasury to the fund has ranged from $9,443,438.04 to $2,014,859.37, or an average of $5,000,000. Diversion of so small an amount for the development of the vast expanse of the arid Western States can not be expressed in terms of probable reduction in Federal taxation had the amount not been diverted for reclamation activities. Irrigation has resulted in a demand for the arid public lands of the West. The population of the Western States has been materially increased and additional taxable wealth of a vast amount has been created from which the municipalities, counties, States, and the Nation at large have benefited. Federal taxation alone has unquestionably benefited from the additional wealth created, at least to the extent of moneys diverted from the Federal Treasury to the reclamation fund.

Nonliability of Irrigation District Cooperating With the United States for Damages for Canal Breaks

THE case of Malone *v.* El Paso County Water Improvement District No. 1, Court of Civil Appeals of Texas, 20 S. W. (2d) 815, was a suit against the irrigation district for damages alleged to have been incurred as a result of canal breaks. The defendant is one of the districts for which the Rio Grande project in New Mexico and Texas, now operated and maintained by the Bureau of Reclamation, was constructed. A general demurrer filed by the district was sustained by the lower court and on plaintiff's refusal to amend the court dismissed the action. Plaintiff appealed. The court of civil appeals sustained the action of the lower court.

It was contended by the plaintiff that the irrigation project was a joint undertaking between the United States and the defendant district, the latter having been formed under the Texas statutes for the purpose of contracting with the United States for the construction, operation, and maintenance of the necessary works for the delivery of water to the lands under the irrigation project, and that the district was accordingly liable.

In upholding the district's demurrer the court considered the reclamation act and related legislation, the irrigation district statutes of Texas, and the contracts between the district and the United States. It was held that as a matter of law the El Paso County Water Improvement District could not be held liable for damages claimed by the plaintiff.

After differentiating between districts operating independently of the reclamation act and those under a project operated by the United States the court held, in effect, that the El Paso County Water Improvement District No. 1, by reason of its contract with the United States, was of a class of such districts the powers and liabilities of which consisted primarily of acting as fiscal agent to do the things authorized and necessary to be done to reimburse the United States for the money expended.

In overruling the plaintiff's motion for rehearing the court pointed out that where an irrigation district existing independently of the reclamation act had constructed its system and was operating and maintaining it in the distribution of water to its lands such district might be held liable. The court concluded, however, that where this was being accomplished for an irrigation district by the United States, the Federal Government using its own money in constructing, operating, and maintaining such system under the reclamation act and rules and regulations promulgated by the Secretary of the Interior, the district, as a matter of law, could not be held liable in a suit for damages growing out of such operation and maintenance of the irrigation system.—*H. J. S. Devries, District Counsel.*

On December 31 the Owyhee Dam was 27 per cent completed.

Reclamation Organization Activities and Project Visitors

DR. ELWOOD MEAD, Commissioner of Reclamation, addressed the metropolitan section of the American Society of Mechanical Engineers in New York on January 24, the subject of his talk being Reclamation Construction and Economic Results, illustrated with motion pictures. On February 20 Doctor Mead will address the officers of the Engineer Corps at Fort Humphreys, Va., on the Boulder Dam, and also use a reel of motion pictures showing the construction and development work on the projects.

P. W. Dent, assistant commissioner, is planning to attend the National Drainage Congress in St. Louis on February 20–22. He will present a paper to the Congress on Reclamation Policy of the Southeast.

R. F. Walter, chief engineer, and J. L. Savage, chief designing engineer, arrived in New Orleans on January 14 on their return from inspecting the plans for the Madden Dam, Panama.

H. A. Brown, director of reclamation economics, attended the meeting of the Georgia Association in Atlanta on January 7 and 8, and addressed the members on the subject of planned rural development in the South.

E. B. Debler, hydrographic engineer, stopped off recently at the Washington office on his way to attend the second meeting of the civil engineering subcommittee to plan exhibits for the Chicago Worlds Fair in 1933.

C. N. McCulloch, chief clerk of the Washington office, who was taken ill with sciatica just before the holidays and has been confined to his home for several weeks, has returned to duty.

Herbert W. Yeo, State engineer of New Mexico, recently visited the Denver office in connection with the Gila River investigations and irrigation development on San Juan River.

Prof. H. J. Gilkey, of the department of civil engineering of the University of Colorado, visited the Denver office the latter part of the month in connection with the Boulder Canyon concrete tests and dam design.

George Mc. Hawthorne, of Kerang, Victoria, Australia, was among the recent visitors to the Denver office. Mr. Hawthorne is making a study of the methods of this bureau in the management of water and growing of crops.

C. A. Lyman, field representative, completed the transfer of the repayment accounts of the North Platte project to the Washington office and returned to Denver the latter part of the month.

Representative A. G. Simms paid a recent visit to the Carlsbad project to confer with water users on additional storage problems. He made an inspection trip to Avalon and McMillan Reservoirs and left the project the same day.

At a recent meeting of the Huntley Project Irrigation District, Huntley project, E. E. Lewis was reelected manager of the district for a term of two years.

S. A. Blok, civil engineer of Java, who has been appointed by the Government of Netherlands East Indies to make a special investigation of hydrualic fill dams, visited the Denver and Yakima offices during the month.

D. C. Pittuck, representing the Texas Cotton Growers' Finance Corporation, of Dallas, Tex., recently visited the Carlsbad project, his purpose being the setting up of a crop-production credit program through the Federal Intermediate Land Bank of Houston.

Joseph C. Gawler, special fiscal agent on the Yakima project, reached the age of retirement in December, 1929, was separated from the service, and is now an annuitant. Mr. Gawler was an employee of the Government for more than 45 years, 28 of which were spent in the Interior Department. His loyal and conscientious service with this department will long be remembered.

Hakop M. Hakopian, irrigation engineer for the Caucasus Water Economy, and Messrs, Alexander A. Jimsky and Serge G. Zaprometov and Madam Tatiana A. Kolpakova, irrigation engineers for the Central Asia Water Economy, spent several days during December inspecting the construction work in progress and studying the methods used on the Vale, Klamath, Owyhee, and Yakima projects.

J. Mulholland, assistant engineer, irrigation and water supply commission of Queensland, Australia, concluded his inspection of the Orland project early in the month.

A LOCAL agent for a large vegetable and melon packing concern is preparing ground on the Yuma Mesa, Yuma project, for the planting of 40 acres to cantaloupes. They hope to be able to raise cantaloupes that will be ready to ship from 15 to 30 days ahead of adjoining territories. If this proves sucessful, next season will undoubtedly see a material increase in the area devoted to melons and vegetables on the mesa.

COTTON—ACREAGE, PRODUCTION, AND RETURN, RIO GRANDE PROJECT, NEW MEXICO-TEXAS

Year	Total acres irrigated and cropped	Total acres in cotton	Total cotton production	Average yield of cotton per acre	Average price of cotton per pound	Total cotton crop value	Gross return per acre for cotton
			Pounds	*Pounds*			
1917	63,626						
1918	64,002	608	148,000	243	$0.25	$37,000	$60.86
1919	65,462	289	92,620	320	.40	36,705	127.00
1920	77,880	15,996	6,972,332	434	.16	1,141,402	71.52
1921	77,651	4,317	1,315,210	304	.196	257,885	59.73
1922	84,413	13,319	5,807,520	432	.253	1,471,956	110.51
1923	93,731	36,364	14,618,303	402	.315	4,597,524	126.43
1924	103,115	58,721	25,807,577	439	.243	6,267,369	106.73
1925	121,799	81,373	33,851,168	416	.22	7,447,257	91.52
1926	128,858	83,337	32,680,800	392	.145	4,738,716	56.90
1927	133,731	78,915	34,487,150	437	.209	7,198,423	91.22
1928	139,598	104,159	48,528,500	466	.191	9,273,571	89.02

Above values do not include value of cotton seed, which adds about $10 to the gross per acre return.
Return of the Hudspeth County Conservation and Reclamation District of about 13,000 acres below project proper not included in above figures, which are for Federal project only.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

HON. RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department;
E. K. Burlew, Administrative Assistant to the Secretary and Budget Officer;
Northcutt Ely, Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
Hugh A. Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Engineer

S. O. Harper, General Superintendent of Construction; J. L. Savage, Chief Designing Engineer; E. B. Debler, Hydrographic Engineer; L. N. McClellan, Electrical Engineer; C. M. Day, Mechanical Engineer; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Project	Office	Superintendent	Chief clerk	Fiscal agent	District counsel	
					Name	Office
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Mitchell, Nebr.
Boise [1]	Boise, Idaho	R. J. Newell	W. L. Veruon		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Grand Valley	Grand Junction, Colo	J. C. Page	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Huntley [2]	Ballantine, Mont					
King Hill [3]	King Hill, Idaho					
Klamath	Klamath Falls, Oreg	B. E. Haydeu	N. G. Wheeler	Joseph C. Avery	R. J. Coffey	Berkeley, Calif.
Lower Yellowstone	Savage, Mont	H. A. Parker	E. R. Scheppelmann	E. R. Scheppelmann	E. E. Roddis	Billings, Mont.
Milk River	Malta, Mont	H. H. Johnson	E. E. Chabot	E. E. Chabot	do	Do.
Minidoka [4]	Burley, Idaho	E. B. Darlington	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Newlands [5]	Fallon, Nev				R. J. Coffey	Berkeley, Calif.
North Platte [6]	Guernsey, Wyo	H. C. Stetson	Arthur T. Stimpfig	Arthur T. Stimpfig	Wm. J. Burke	Mitchell, Nebr.
Okanogan [7]	Okanogan, Wash				B. E. Stoutemyer	Portland, Oreg.
Orland	Orland, Calif	R. C. E. Weber	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	H. N. Bickel	Frank P. Greene	B. E. Stoutemyer	Portland, Oreg.
Rio Grande	El Paso, Tex	L. R. Fiock	Henry H. Berryhill	Henry P. Berryhill	H. J. S. Devries	El Paso, Tex.
Riverton	Riverton, Wyo	H. D. Comstock	R. B. Smith	Erle W. Shepard	Wm. J. Burke	Mitchell, Nebr.
Salt Lake Basin	Salt Lake City, Utah					
Salt River [8]	Phoenix, Ariz					
Shoshone [9]	Powell, Wyo	L. H. Mitchell	W. F. Sha		E. E. Roddis	Billings, Mont.
Strawberry Valley [10]	Payson, Utah					
Sun River [11]	Fairfield, Mont	A. W. Walker	H. W. Johusou	H. W. Johnson	E. E. Roddis	Do.
Umatilla [12]	Irrigon, Oreg Hermiston, Oreg					
Uncompahgre	Montrose, Colo	L. J. Foster	G. H. Bolt	F. D. Helm	J. R. Alexander	Montrose, Colo.
Vale	Vale, Oreg	H. W. Bashore	C. M. Voyen	C. M. Voyen	B. E. Stoutemyer	Portlaud, Oreg.
Yakima	Yakima, Wash	P. J. Preston	R. K. Cunningham	C. W. Ralston	do	Do.
Yuma	Yuma, Ariz	R. M. Priest	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.

Large Construction Work

Salt Lake Basin, Echo Dam.	Coalville, Utah	F. F. Smith [13]	C. F. Williams		J. R. Alexander	Montrose, Colo.
Kittitas	Ellensburg, Wash	Walker R. Young [13]	E. R. Mills		B. E. Stoutemyer	Portland, Oreg.
Sun River, main canal construction.	Fairfield, Mont	A. W. Walker [13]			E. E. Roddis	Billings, Mont.
Boise project, Deadwood Dam.	Cascade, Idaho		C. B. Funk		B. E. Stoutemyer	Portland, Oreg.

[1] Operation of Arrowrock Division assumed by Nampa-Meridiau, Black Canyon, Boise-Kuna, Wilder, Big Bend, aud New York Irrigation Districts on Apr. 1, 1926.

[2] Operation of project assumed by Huntley Project Irrigation District on Dec. 31, 1927. E. E. Lewis, manager.

[3] Operation of project assumed by King Hill Irrigation District Mar. 1, 1926. F. L. Kinkade, manager.

[4] Operation of Sonth Side Pumping Division assumed by Burley Irrigation District on Apr. 1, 1926, and of Gravity Division by Minidoka Irrigation District on Dec. 2, 1916.

[5] Operation of project assumed by Truckee-Carson Irrigation District on Dec. 31, 1926. D. S. Stuver, manager.

[6] Operation of Interstate Division assumed by Pathfinder Irrigation District on July 1, 1926, Fort Laramie Division by Goshen Irrigation District and Gering and Fort Laramie Irrigation District on Dec. 31, 1926, and Northport Division by Northport Irrigation District on Dec. 31, 1926.

[7] Operation of project assnmed by Okanogan Irrigation District on Dec. 31, 1928. Joe C. Iddings, manager.

[8] Operation of project assumed by Salt River Valley Water Users' Association on Nov. 1, 1917. C. C. Cragin, general superintendent and chief engineer.

[9] Operation of Garland Division assumed by Shoshone Irrigation District on Dec. 31, 1926, and of Frannie Division by Deaver Irrigation District on Jan. 1, 1930.

[10] Operation of project assumed by Strawberry Water Users' Association on Dec. 1, 1926. Lee R. Taylor, manager.

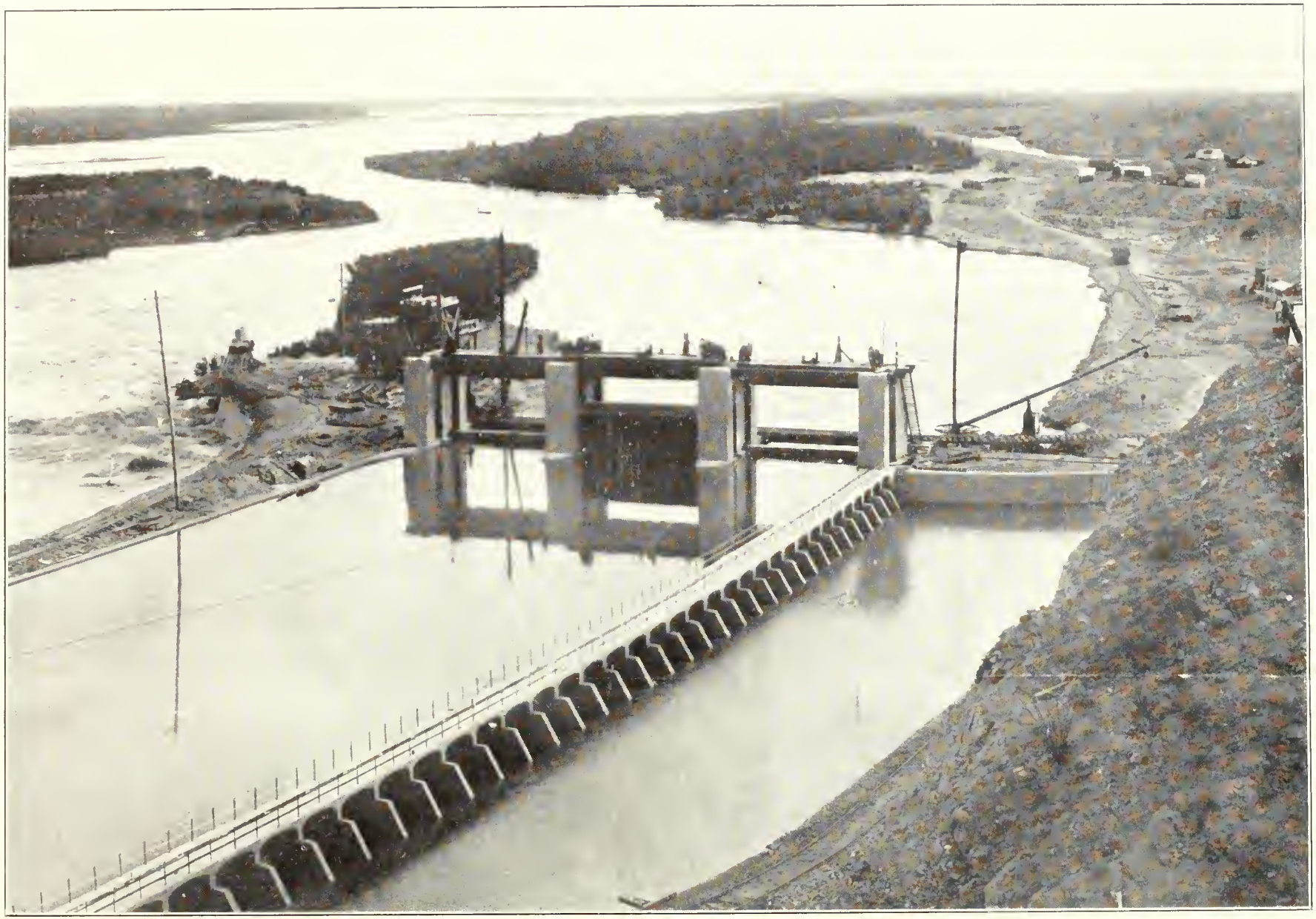
[11] Operation of Fort Shaw Division assumed by Fort Shaw Irrigatiou District on Dec. 31, 1926.

[12] Operation of West Division assumed by West Extension Irrigation District on July 1, 1926. A. C. Houghton, manager; and East Division by Hermiston Irrigation District informally on July 1, 1926, and formally, by contract, on Dec. 31, 1926. Enos D. Martin, manager.

[13] Construction engiueer.

Important Investigations in Progress

Project	Office	In charge of—	Cooperative agency
All-American Canal investigations	Yuma, Ariz	H. J. Gault	
Gila River cooperative investigations	Safford, Ariz		Arizona and New Mexico.
Boulder Canyon Reservoir investigations	Las Vegas, Nev	W. R. Young	
Red Bluff (Pecos River) investigations	Washington, D. C	C. A. Bissell	
Salt Lake Basin investigations	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga projects	Casper, Wyo	J. R. Iakisch	



HEADWORKS FOR MAIN CANAL, YUMA PROJECT. ENLARGEMENT PROPOSED FOR ALL-AMERICAN CANAL DIVISION

U. S. GOVERNMENT PRINTING OFFICE. 1930

NEW RECLAMATION ERA

VOL. 21 MARCH, 1930 NO. 3

PURE BRED HAMPSHIRE YEARLING RAM ON THE SUNNYSIDE DIVISION, YAKIMA PROJECT, WASH.

Reclamation

AS WE LOOK at many of the more difficult problems of the West to-day we find that they involve millions of people and are regional in character. The checkerboard of political units placed over the continent often is a handicap rather than an advantage in trying to handle these great regional resources. Streams bringing necessary water for the irrigation of vast tracts of lands often rise high up in the mountains of distant States. We can drop the stream over artificial waterfalls and make power; we can hold the water back and, where gravity permits it, bring life to settlements through irrigation. But the higher the mountain, the greater the elevation, the less suitable is the climate for those forms of vegetable life most productive of income when brought under control. The political units of all the low valley land have the greatest opportunity to develop wealth, but the development of that wealth is dependent upon the resources of the distant hills. This brings about conditions which demand the regional handling of the great physical problems associated with the settlement of the West. Inevitably we have a conflict of the interests of political units in the use of available regional resources.

In the development of the plans for the erection of a great dam in the Colorado River at Black Canyon, the so-called Boulder Dam, seven States are vitally interested. The watershed of the Colorado brings in the States of Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, and California. As the water flows down the hills of the so-called four upper basin States it becomes of increasing value to the so-called three lower States—Nevada, California, and Arizona. The Boulder Dam Act is the first great attempt in this federation of States to bring together seven States as political units for the development, control, and management of the regional river in which they are all interested. Since this is but the beginning of a whole series of similar agreements or compacts between States which must be made if we are to wisely advance the welfare of the citizens of our States, it is of great consequence that this particular project should succeed.

—RAY LYMAN WILBUR,
Secretary of the Interior.

(Extract from radio address, February 6, 1930)

NEW RECLAMATION ERA

Issued monthly by the Bureau of Reclamation, Department of the Interior, Washington, D. C.
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RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 | March, 1930 | No. 3

Interesting High Lights on the Federal Reclamation Projects

YUMA had its coldest day of the winter on January 9, when the temperature dropped to 20° above zero, with probably as low as 19° above in the lower valley. These low temperatures caused no apparent injury to the lettuce crop or to melon plantings.

THE contractors engaged in clearing the Deadwood Reservoir site on the Payette division of the Boise project continued work throughout the month with an increased force in spite of severe cold and much snow. More or less communication was maintained by means of an airplane, and a number of men were moved in to the work by this means.

IT was anticipated that work would start during February on the reconstruction of one of the largest flume crossings in the valley division of the Yuma project. The old structure was of wooden construction and it is to be replaced by a metal flume supported by false wooden bents on precast concrete piling.

DURING the month 6,000 packed boxes of fruit were shipped from the unit B groves and private orchards adjoining unit B lands on the Yuma auxiliary project. This brings the total to date this season to 16,500 packed boxes of grapefruit and 2,200 of oranges. In addition to this several thousand boxes were shipped by express from the various orchards for holiday gifts and for exporting to foreign countries.

ON the Milk River project several agencies are cooperating in the preparation of a bulletin on standard farm practices in northern Montana. This bulletin will contain reliable information helpful in project development and will be used both for educational and advertising purposes.

ON the Yuma project contracts were let recently by Yuma County for the construction of two clay runways at Fly Field, the local airport which lies on the Yuma Mesa just north of unit B. The contract price was very satisfactory and will permit the building of a hangar and accommodations for pilots with the remainder of the $25,000 bond issue voted last year for this work. In addition, a contract will be let shortly for paving a new connecting link of highway between the valley division highway system and the Federal-aid highway to Phoenix and east, which passes by Fly Field.

AS a result of the newspaper advertising financed by the Water Users' Association on the Orland project numerous inquiries have been received at the project office concerning the farms still under option to the United States. Eight formal applications have been filed, 2 of which have been approved by the examining board. An area exceeding 10,000 acres adjacent to and east of the project was purchased by a Los Angeles syndicate, which plans the immediate subdivision and development of the area.

INTEREST is being shown in the transfer of project lands on the Grand Valley project, and there are prospects of several sales, one or two of which have apparently been consummated. The prices paid have been low, but it is believed the new owners will be an asset to the project and will prove excellent farmers.

MRS. C. W. Tolman, of Rupert, Minidoka project, realized gross returns of $476.19 from four turkey hens and one tom during the past season, with net profits of almost $300. There were 127 birds sold. Practically all of them were No. 1, averaging about 15 pounds each.

IT is estimated that the Western Slope Swine Growers Association shipped out 90 per cent of a total of 130 carloads of hogs that have gone out from Montrose and Delta Counties, Uncompahgre project, during the calendar year 1929.

ON the Boise project there are approximately five renters for each farm available for rent. Selling prices of land have not yet reflected the increased demand.

THE first schedule to reach the Washington office for the irrigation census of 1930 was from A. C. Houghton, covering the West Extension Irrigation District, Umatilla project, Oregon.

ACCORDING to its annual report for 1929 the Mini-Cassia Dairymen's Association on the Minidoka project purchased 390,009 pounds of milk butterfat at an average price of 52½ cents per pound and 315,099 pounds of cream butter fat at an average price of 44½ cents per pound. Total payments for butterfat were $344,974, or an average of almost $30,000 per month.

THE Merrill Poultry Hatchery at Paul, Minidoka project, one of the largest institutions of its kind in Idaho, expects a production of 100,000 baby chicks this spring. The hatchery has on hand more than 1,000 cockerels and pullets, all pedigreed White Leghorn stock.

THE Fruitdale Community Club on the Belle Fourche project is sponsoring a movement to organize the sheep farmers in the vicinity with a view to securing orderly and cooperative marketing of both fat lambs and wool. Other community clubs are working on publicity matters and plans for securing more highway improvement north and east of the project.

Salt Deposits in Boulder Canyon Reservoir Not Detrimental

A report on "Salt Deposits of the Virgin Valley, Nevada," by F. L. Ransome, shows that the presence of these deposits will not result in any appreciable increase in the salinity of the reservoir water

A REPORT on the geological features of the salt deposits of the Virgin River Valley in Nevada, with particular reference to the possible effect of the salt upon the water of the proposed Boulder Canyon Reservoir, by F. L. Ransome, consulting geologist, has just been received by the Denver office of the Bureau of Reclamation. Mr. Ransome was formerly with the United States Geological Survey and is at the present time professor of economic geology at the California Institute of Technology at Pasadena, Calif. He made a preliminary study of the salt deposits in 1922 in connection with a general study of the geology of the Boulder Canyon and Black Canyon dam sites and reservoir sites on the Colorado River, which is contained in the unpublished Weymouth report. The present report is based partly on the older work, but mainly upon a reexamination of the deposits, made in December, 1929, at the request of the Bureau of Reclamation. A summary of the 50-page report, which contains numerous maps and photographs, follows.

GENERAL FEATURES OF THE SALT DEPOSITS

The visible salt deposits of the Virgin River Valley occur at rather widely separated localities, on both sides of the river, between the town of St. Thomas on the north and the Colorado River on the south, along a distance of 21 miles. All of them are in the lower part of the Muddy Creek formation, below an intercalated flow of basalt, which in places is continuously exposed for miles. This Muddy Creek formation is composed essentially of fine, lacustrine silts and sandy clays. The character of these sediments and their association with layers of gypsum, common salt, and sodium sulfate indicate deposition under arid conditions in a closed basin.

All streams carry more or less sodium chloride derived from the rocks which they traverse, and in arid regions this salt content is ordinarily higher than in humid countries. The Virgin Valley deposits have sometimes been referred to as "volcanic salt," but are obviously stratified deposits. Whether the salt extends continuously under the whole valley or occurs only in lenticular deposits is not essential to the present investigations, which is concerned with exposed salt and not buried salt. The salt once covered by a layer of sediment is protected from solution. It is not that the covering layer necessarily prevents the access of water to the salt. Its principal function may be to prevent movement in the saturated saline solution in contact with the solid salt and so greatly to retard the rate of solution as to make it practically negligible. Some of the salt in the valley, although deeply buried, is nevertheless being dissolved, as shown by sinks and underground drainage channels. With the submergence of the salt deposits beneath the water of the reservoir this process must cease. The general water table will stand above the level of all but a very small part of the deposits.

SALVATION, CALICO, AND FAIRVIEW DEPOSITS

The Salvation salt deposit, sometime known as the St. Thomas or Big Cliff deposit, the only one in the valley from which any considerable quantity of salt has been extracted, lies on the west side of the river about 3 miles south of St. Thomas. This deposit is composed of coarsely crystalline massive rock salt. In places it is practically pure, but much of it contains more or less silty material. The valley is bounded by cliffs rising to a maximum height of 250 feet, and the top of the salt shows through in places at a height of from 100 to 150 feet.

The Calico deposit is located about 1¾ miles north of Bitter Spring Wash in section 32, T. 18 S., R. 68 E. Mr. Ransome visited this deposit in 1922 and noted that no work had been done on it for many years. The top of the salt rises to a maximum height of 50 feet above the valley floor.

The Fairview deposit lies 1 mile southeast of the Calico deposit and is exposed to a height of 50 feet above the ravine in which it is located. Apparently no mining has been done in this deposit. The salt is generally brown and impure and contains a large proportion of silt. Other smaller deposits are the Black and the Bonelli.

At the mouth of the Virgin on the Colorado River is the brine-filled depression known as the Salt Well. This interesting feature is a roughly circular pit about 250 feet in diameter at the top with steep walls, the lower part of the pit occupied by a pool of clear brine. It is one manifestation of a subterranean circulation of saline water which will cease when the reservoir is filled with water.

It is difficult to calculate the areas of these various salt deposits because they are of such irregular outline. At the Salvation deposit about 6.8 acres are exposed, at the Calico deposit 5.5 acres, and at the Fairview deposit 8.8 acres, giving a total of 21.1 acres. The remaining small outcrops do not exceed 0.9 acre, which makes 22 acres which may be taken as a generous estimate of the area of salt that is now actually exposed within the reservoir area.

The entire area of the proposed reservoir, with a flow line or water surface of 1,222 feet above sea level, is 142,700 acres. From these figures it can be determined that the part of the entire area represented by the salt exposures is 0.000154, or less than 1 in 5,000.

SOLUBILITY OF SALT

The rate of solution of salt depends upon a number of factors, such as amount of surface in contact with the solution, concentration of the solution, and temperature. In the case of a mass of salt submerged in a reservoir these factors are not determinable, and any accurate prediction of the rate at which the Virgin Valley salt will dissolve when covered by water is unattainable.

In order to arrive at a rough approximation of this rate some simple experiments were carried out. Rectangular cleavage blocks of salt from the Salvation deposit were imbedded in paraffin so as to leave exposed one cleavage surface about one-half inch square. Two of these blocks at a time were then immersed, face upward, in a 2-liter beaker of fresh water at room temperature. At the end of 6 hours the first two blocks had dissolved below the surface of the paraffin an average distance of 3 millimeters, or at the rate of 0.5 millimeter an hour or 4 38 meters a year. This is equivalent to about 14.6 feet a year. Similar experiments for periods of 28 and 48 hours showed rates of solution of 7.3 feet and 4.8 feet a year, respectively. This showed that the longer the salt is immersed in standing water the more concentrated becomes the solution immediately above the solid salt and the slower the rate of solution, a result that was to be expected.

These experiments indicate that on the assumptions (1) that the water in the reservoir has sufficient circulation to prevent the accumulation of a concentrated solution in contact with the submerged salt, (2) that solution is not impeded by any covering of silt, and (3)

that, on the other hand, it is not hastened by porosity of the salt bodies, the recession of any particular exposure of salt will be rather less than 15 feet annually.

Of course, none of these assumptions is in accordance with the facts. The water of the reservoir will not be in rapid circulation and there will be more or less concentration of salt solution next to the salt masses. This concentration will vary greatly with local conditions and will tend to increase as solution proceeds. The accumulation of a covering of silt will soon become increasingly effective in slowing down solution. Finally, as the salt masses are known to be perforated by solution channels, solution of the mass will, for a time, also take place elsewhere than on the actual outcrops of the salt. To some extent these conditions are compensatory. On the whole, however, it is apparent that solution must become increasingly slow and in the end practically cease.

THE EFFECT OF COVER

That a bed of salt, when covered by a relatively thin layer of mud, silt, or sand is largely protected from solution by an overlying body of fresh or unsaturated water is shown by the relations which many salt deposits, in all parts of the world, bear to the sedimentary beds associated with them. In the great Stassfurt deposits in Germany, for example, after the laying down of over 1,000 feet of common salt and other soluble salts, the basin was invaded by water that was unsaturated with respect to the sodium and potassium salts, and a layer of clay from 15 to 30 feet thick was deposited on the salts. Above this clay a second series of soluble salts was subsequently deposited as the water became concentrated by evaporation.

If the salt of the Virgin Valley receives a cover of the fine clayey silt, such as makes up the greater part of the Muddy Creek formation, a sodium clay will be found immediately above the salt, and the effect of the fresh water of the reservoir will be to render this clay practically impermeable. Even without the intervention of the process of sodium and clay combining when clay is deposited in salt water, a cover or blanket of any fine-grained material, by checking convection currents and keeping a saturated solution in contact with the solid salt, must inevitably reduce the rate of solution to a process so extremely slow as to be practically negligible.

RELATION OF VIRGIN VALLEY SALT TO RESERVOIR WATER SURFACE

With the water surface of the proposed reservoir at elevation 1,222 feet above sea level, the Bonelli, Black, and Fairview deposits will be completely submerged. The Calico deposit will probably also be covered and the Salvation deposit mostly covered. The Bonelli deposit is wholly below the 900-foot contour, while the Black deposit rises to about 1,025 feet and the Fairview deposit to about 1,050 feet elevation.

EFFECT OF VIRGIN VALLEY SALT ON THE RESERVOIR WATER

While it is impossible to calculate accurately the quantity of salt that will go into solution when the reservoir is filled with water, it is of interest, however, to make certain assumptions and to see what results follow.

Let it be assumed that the whole of the estimated 22 acres of exposed salt is attacked by solution and dissolved out to an average depth of 15 feet during the first year that the reservoir is filled, This is the fastest rate of solution found by experiment, with no allowance for retardation by the increasing concentration of the solution in the immediate vicinity of the salt. The assumption does not recognize any lateral solution of the salt beyond the boundaries of the 22 acres, but, on the other hand, it disregards altogether the fact that, as solution proceeds, much of the solid salt will soon become covered by silt and débris from the overhanging bluffs, which would greatly retard the general rate of solution. The assumption of a recession of 15 feet annually is believed to be far in excess of what would really take place.

On the assumption made, 15 times 22, or 330 acre-feet of salt, equivalent to 532,400 cubic yards, or about 987,389 short tons, will be dissolved during the first year. To the expectant consumer of Colorado River water this is an appalling quantity of salt, but the other quantities involved must not be forgotten.

The reservoir, when full to the 1,222-foot contour, will contain 29,500,000 acre-feet of water, weighing 47,593,235,000 short tons. Consequently the solution of 987,389 tons of salt will give a sodium chloride content of 20.7 parts per million by weight or a chloride radicle content of 12.6 parts per million.

In this calculation it is assumed that there has been no water added to the reservoir after the initial filling and none drawn off. Allowing for inflow and outflow the quantity of water affected by the assumed mass of salt will be 49,500,000 acre-feet, which gives a salt content of 14.6 parts per million and of chloride radicle 8.9 parts per million.

The assumption that the salt will retreat by solution 15 feet annually is regarded as extreme and improbable. It would be well within the limits of safety to assume the rate given by the experiment in which the salt was submerged for 28 hours, namely, about 7 feet per year. A calculation based on this rate gives a sodium chloride salinity of 11.5 parts per million in 29,500,000 acre-feet of water, or 6.8 parts per million in 49,500,000 acre-feet. Whatever may be the initial solution of soluble salts in the reservoir, such solution must inevitably become less from year to year.

According to G. C. Whipple in his book: The Value of Pure Water, experiments show that water must contain about 200 parts of sodium chloride per million before the presence of salt can be detected by taste. J. C. Thresh, in Examination of Water and Water Supplies, says that some persons can taste 571 parts per million, whereas others can scarcely detect 1,428 parts per million. He also states that water of less than this salinity should not be considered as impure or unwholesome. W. D. Collins, in United States Geological Survey Water Supply Paper No. 496, says that few people can detect the taste of salt in water that contains less than 600 to 800 parts per million. In another publication, Ground Water Resources of Sacramento Valley, Water Supply Paper No. 495, Collins classes as "good" water one that, among other requirements, contains less than 250 parts per million of the chloride radicle, equivalent to 412 parts of sodium chloride. The United States Public Health Service specifies that an acceptable water supply shall not contain over 250 parts of chloride per million.

Except as an indication of pollution through human agency, the presence of sodium chloride or of chlorine ion in water supplies does not commonly call for consideration, and consequently most of the treatises on water supply are lacking in specific data as to the permissible maximum of common salt in water used for irrigation and domestic purposes.

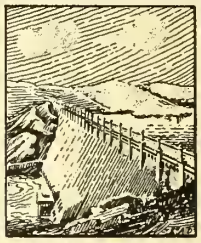
It is generally assumed that the chlorine shown in water analysis is combined with enough of the available sodium to form sodium chloride (NaCl) or common salt. Such analyses, when stated in modern form, usually gives the chlorine ion or chloride radicle in parts per million. The equivalent to a salt content of 6.8 parts per million is 4.2 parts of chlorine per million.

F. W. Clarke in Data of Geochemistry, United States Geological Survey Bulletin No. 770, 1924, gives the average content of chlorine in the lake and river waters of North America as 7.44 parts per million. Recent analyses of Colorado River water show that the average content of the chloride radicle at Grand Canyon is 98 parts per million and at Topock, Ariz., it varies from 18 to 189

(Continued on p. 43)

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Harper Diversion Dam, Vale Project, Oregon

BY H. W. BASHORE, CONSTRUCTION ENGINEER, BUREAU OF RECLAMATION

THE Harper diversion dam of the Vale project is located about 1 mile west of Namorf, Oreg., on the Malheur River. The selection of the site was controlled by its proximity to the upper portal of tunnel No. 1 of the Vale main canal, and it is through this portal that the water is taken directly from the river.

On the east or diversion side of the river an almost perpendicular wall of volcanic rock rises precipitously for several hundred feet, and along the base of this wall is a county road. The main river channel, about 150 feet wide, also follows the east side of the river, and in flood times the waters spread over the gravel flat immediately west. This flat is about 5 feet higher in elevation and 400 feet in width. The natural river bank on the west side is about 15 feet higher than the river channel and gradually ascends to the higher elevation of the surrounding hills. Examination of the bottom of the river disclosed that rock foundation was not available at a reasonable depth for a dam of this size. The materials encountered were found to be fairly well graded sand and gravel in which were imbedded a number of bowlders having a maximum size of 1½ cubic yards.

DESIGN OF DAM

The design selected was considered the most economical for meeting the requirements, such as offering the least obstruction to the passage of large quantities of floating ice during periods of heavy run-off and preventing an excess accumulation of silt in the river channel with the subsequent diversion of same into the main canal.

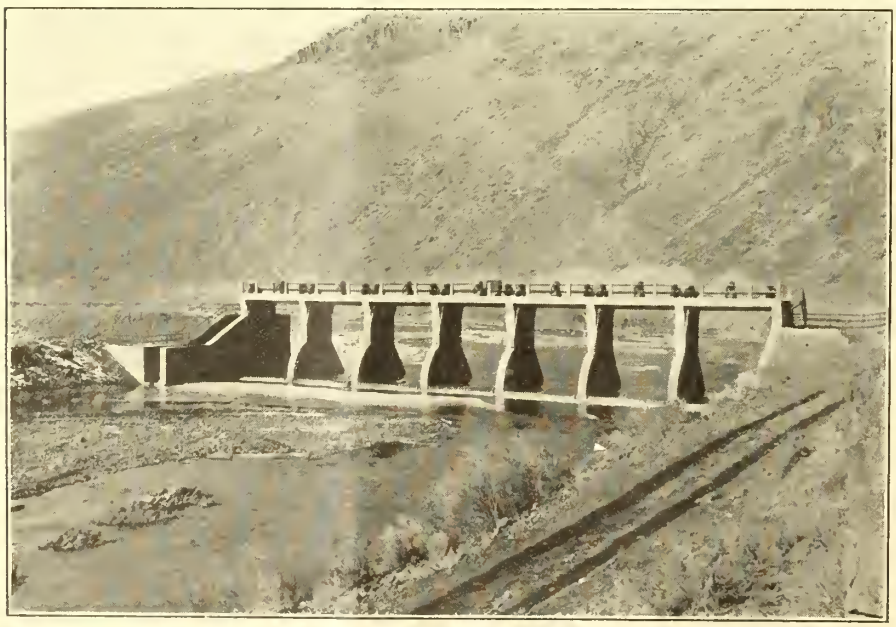
The diversion dam consists of a concrete structure and an embankment. The concrete structure abuts against the canyon wall on the east. It is constructed at right angles to the line of flow of the main channel of the river and connects with the embankment on the west. The principal features of the concrete structure are a heavily reinforced floor slab laid in the bottom of the river having dimensions as follows: Thickness, 2 feet, length parallel to the line of flow of the river, 52 feet, and width between abutments, 152 feet; an upstream cut-off wall having a maximum depth of 14 feet; 7 piers, 2 feet thick, 23 feet high, resting on the floor slab, providing, with the 2 end abutments, 7 openings 20 feet wide, and also supporting the floor beams on which are the walkway, handrails, and mechanism for operating the gates.

A fishway 6 feet wide is also provided at the west end of the concrete structure. The floor slab is stepped downstream, the lower step providing a stilling pool 3 feet deep and 26 feet long, and the upper one, a recess 2 feet deep and 12 feet long, into which the 11 feet by 20 feet rectangular steel gates lower to prevent any obstruction in the river channel. When these gates are fully raised, or closed, the elevation of the water surface in the river is raised 10 feet.

The embankment is constructed of earth, sand, gravel, and loose rock, the finer materials being deposited on the upstream side and the loose rock on the downstream portion. A rock facing 18 inches thick protects the upstream face from wave action. The top width is 20 feet, upstream slope 3 to 1, downstream slope 1½ to 1. The top of the embankment is 7 feet above the elevation of the top of the gates when closed. The maximum height of embankment is 12 feet.

OPERATING MECHANISM

The 7 rectangular gates, each weighing 4 tons, are hinged at each lower corner on 3-inch diameter pins projecting from the base of the piers. Attached to the opposite edge of the gate at the corners are 2¼-inch diameter rods 12 feet long, and to the ends of these rods are attached the hoisting cables ⅜ inch thick and 6 inches wide. In raising the gates these cables are wound on the drums of back-geared hoists of 60,000-pound capacity. The power for operating the hoists is



Harper diversion dam, looking upstream. Gates are down; fishway and dike on left; county roadway on right

furnished by a Ford engine mounted on a car which is moved, on a narrow-gauge track laid parallel to the axis of the dam, back and forth to its position opposite the clutch for each gate. Each gate is independently operated and is held in any position from partial to full opening with the water pressure against it, by the single thread worm which receives and transmits the first work from the engine in raising the gates. The total weight of gates and operating mechanism is 75.73 tons. The regulating gate for admitting water into the portal of tunnel No. 1 is a 10½ by 14 foot radial type, operated by a separate hoist and Ford power unit, and is located at the entrance to tunnel No. 1 and upstream from the dam a distance of 200 feet.

Costs to the United States

Class of work	Unit	Quantity	Total cost to date	Unit cost
Excavation for concrete portion of dam and head-gate structure, including concrete curb on county road:				
Class 1	Cubic yard	5,707	$4,280.25	$0.75
Class 2	do	675	1,012.50	1.50
Class 3	do	1,190	4,760.00	4.00
Excavation for county road:				
Class 1	do	438	109.50	.25
Class 2	do	2,039	1,223.40	.60
Class 3	do	727	2,181.00	3.00
Embankment, placing earth, sand, and gravel portion, material from borrow or from required excavation.	do	2,483	2,483.00	1.00
Embankment, borrow for county road, class 1	do	85	85.00	1.00
Compacted fill under floor of concrete portion of dam	do	365	365.00	1.00
Back fill for concrete portion of dam and head-gate structure	do	1,848	1,848.00	1.00
Puddling or tamping back fill about concrete portion of dam and head-gate structure	do	206	103.00	.50
Laying 6-inch drainpipe with uncemented joints	Linear foot	56	8.40	.15
Concrete in dam, head-gate structure, and curb for county road	Cubic yard	1,686	31,116.64	18.50
Placing reinforcement bars	Pound	134,322	6,181.98	.046
Installing and painting regulating gates and hoisting mechanisms, including steel rails for dam.	do	151,477	29,806.31	.197
Installing and painting radial head-gate, with pin bearings, wall plates, seals, hoists, and anchor bolts for canal headworks.	do	8,481	2,027.92	.24
Installing and painting miscellaneous metal work not included in items 37 and 38.	do	8,360	2,077.92	.25
Total			89,669.82	

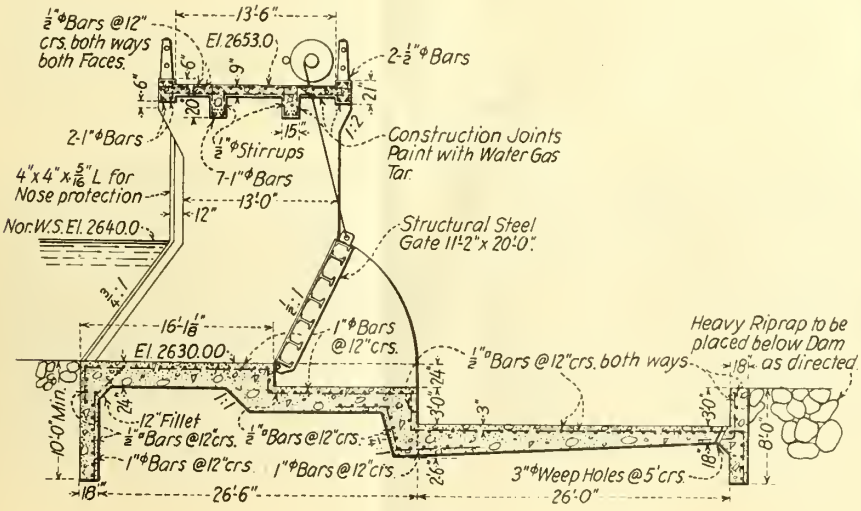
CONSTRUCTION METHODS

The construction of the dam was included in a contract entered into June 19, 1928, with the Derbon Construction Co., of Seattle, Wash., which also included 8,493 feet of tunnels and 4,320 feet of open canal. The work was performed under the provisions of specifications No. 475.

Derbon Construction Co., on July 11, 1928, entered into a subcontract with W. H. Puckett Co., of Boise, Idaho, for the construction of the open canal and the diversion dam. The W. H. Puckett Co. sublet the dam to Young & Roberts, of Boise, Idaho, and actual work was started by these subcontractors on March 30, 1929. A P. & H. 700 dragline was used to excavate a diversion channel to carry the river around the site and also to provide a means of diverting the traffic on the county highway away from the work. The channel intersected the center line of the embankment about 100 feet east of the west end, required the excavation of 4,200 cubic yards of sand and gravel, and had an estimated maximum carrying capacity of 2,500 cubic feet per second.

The river flow during construction did not exceed 800 cubic feet per second. With the completion of this channel and the diversion of the river, excavation of the cut-off trench and construction of the earth and gravel portion of the embankment were undertaken and completed with the dragline, the material in the embankment being compacted by dropping the dragline bucket. A 6-inch centrifugal pump, operated by a Ford engine, furnished ample capacity to keep down the water in the cut-off trench during its construction. A narrow-gage track was laid from the embankment to the portal of tunnel No. 1 and the rock excavated in the tunnel was hauled by horse-drawn cars to the downstream part of the embankment. The backwater from the dam with gates closed, submerges the grade of the old county road, and it was necessary to raise this grade as much as 10 feet and construct a parapet wall. The excavation for this was also done with the P. & H. 700 dragline.

The contractor constructed a screening and mixing plant about 60 feet upstream from the axis of the concrete portion of the dam. The aggregate was obtained from the bed of the river within a distance of several hundred feet and hauled to the plant with dump wagons. Test cylinders made daily when concreting operations were in progress showed, at 28 days, a minimum compressive strength of 2,300 pounds and a maximum of 3,000 pounds. A mix of 1 : 2 : 3.5 and a water cement ratio of 0.8 to 0.9 were used. The total number of sacks of cement used amounted to 10,019, or 5.94 sacks per cubic yard of concrete measured for payment. All work was completed November 26, 1929. The management, skill, and more than ordinary care displayed by contractors and subcontractors in carrying out the intent of the specifications and the requirements of the design, were largely responsible for a well-built and very creditable structure.



Section of dam

Salt Water Barrier Report

The division of water resources of the department of public works, State of California, has recently published Bulletin No. 22 (two volumes) "Report on Salt Water Barrier," by Walker R. Young, engineer, Bureau of Reclamation. The investigations were carried on from April, 1924, to March, 1926, under a contract executed jointly by the Bureau of Reclamation, the then California State Division of Engineering and Irrigation, and the Sacramento Valley Development Association.

Boulder Canyon Project

PRIMER—(Continued)

Q. How much water will the reservoir hold?

A. From 26,000,000 acre-feet to 30,000,000 acre-feet according to the height of dam adopted. An acre-foot is the amount of water that will cover 1 acre 1 foot deep. The water in the larger reservoir would cover the State of Connecticut to a depth of 10 feet.

Q. What will be the area of the reservoir?

A. For storage of 26,000,000 acre-feet, an area of 130,000 acres, or 200 square miles, which is about the size of Lake Tahoe in California-Nevada. For storage of 30,000,000 acre-feet, an area of 143,000 acres or 223 square miles.

Q. What will be the length and width of the reservoir?

A. It is about 115 miles by river from Black Canyon to Bridge Canyon, the limit of the backwater. The reservoir will extend up the Virgin River about 35 miles. The width varies from several hundred feet in the canyons to a maximum of 8 miles.

Q. What will be the elevation of the high-water line?

A. Between 1,200 and 1,225 above sea level, according to present plans. It is proposed to retain for reservoir purposes all lands below elevation 1,250.

Q. How will the reservoir capacity be utilized?

A. 9,500,000 acre-feet for flood regulation; 16,500,000 to 20,500,000 acre-feet for irrigation, power, and silt.

Q. How much silt will be deposited in the reservoir?

A. Estimates vary from 100,000 to 140,000 acre-feet annually under present conditions and decreasing with upstream development.

Q. Will salt deposits have an injurious effect on the water?

A. While some salt from the extensive deposits in the Virgin River Valley will go into solution, the amount should not be sufficient to cause any appreciable salinity in the water.

Q. What will be the length of the shore line?

A. About 550 miles.

Q. What is the estimated annual evaporation on the reservoir?

A. 600,000 acre-feet.

Q. Are there any private lands in the reservoir site?

A. There are a number of mining claims, but most of the area is Government land. All the land is withdrawn from entry for construction purposes.

Boulder Canyon Project News-Record Articles

The Engineering News-Record of February 6 contains two articles on the development of the Colorado River and the Boulder Canyon project, which should be read by everyone interested in the utilization of the resources of this great river for the benefit of the seven basin States. One article by Doctor Mead is entitled "The Colorado River—Economic Development of Its Basin." The second article is by Raymond F. Walter, who writes on "Controlling the Colorado—Engineering Plans and Construction." Each article occupies seven pages of the News-Record, and both articles are profusely illustrated.

Doctor Mead traces the history of the Colorado from the Spanish explorations of the sixteenth century down to the present day—the early attempts at navigation, the beginning of irrigation, and the present use of its water for agriculture. He then discusses the present needs of the various States which the Colorado can supply, the extensive investigations, surveys, and studies made by the Bureau of Reclamation, and then interestingly pictures the delta region and the Imperial Valley. Doctor Mead, who is an authority on State water rights, discusses the various problems in this connection, with the complexities of titles to water, and tells of the Colorado River compact. The power feature of the Boulder Canyon project is presented in an instructive way, with discussions of the price of power and the contracts for sale of power.

The engineering article by Mr. Walter gives in detail the results to date of the work of the Denver office in its studies and preparation of plans, designs, and estimates for this immense project. He presents findings as to water supply and explains how the Boulder Canyon Reservoir storage will be utilized for flood control, irrigation, power, and silt. Mr. Walter then describes the 700-foot dam, the outlet works, power plant, construction railroad, river diversion, program of construction, and the All-American Canal.

There has been much written of late regarding the Colorado River and this 165-million-dollar project with its many varied problems, but here are two authoritative articles presenting facts which are well worth the reading.

Interest on Debt Due Government

In the Comptroller General's decision of February 7, 1930, A–25734, he considered a case where the National Park Service had leased grazing land for the period of one year beginning May 1, 1926, to one Frank Spring for a total rental of $134, $67 of which was paid at the date of the lease and the remainder of which was to be paid on or before December 1, 1926. Payment of the second installment had not been made at the end of 1929, and the question proposed to the Comptroller General was whether the debt could be liquidated by the payment of $67 without interest. The Comptroller General's reply was in the affirmative, it being held: "There is no general authority for charging interest on a debt due the United States, not reduced to judgment by judicial proceedings. Where such debts are collected without suit, it has not been the practice to charge the debtor interest on the amount of the indebtedness when not specifically provided for by statute or by contract. A–29054."

Parshall Measuring Flume

The special committee on irrigation hydraulics of the American Society of Civil Engineers has recommended that the appellation "improved Venturi flume" be changed to "Parshall measuring flume." This device has been developed by the United States Department of Agriculture under the direction of R. L. Parshall and has found considerable favor in the Western States for measuring irrigation water. Flumes have been built from 3 inches to 40 feet in size, and larger ones are contemplated.

Maps Available

Map No. 23800. Boulder Canyon reservoir site topography; also dam site topography, reservoir area and capacity curves, river profile and profile of dam site. 21 by 37 inches. Printed in colors. Price, 25 cents.

Map No. 23530–A. Lower Colorado River, Imperial Valley and Boulder Canyon Reservoir, with textual overprint in red giving considerable data on the Boulder Canyon project and the lower Colorado River Basin. 16 by 34 inches. Scale, 9 miles to an inch. Price, 25 cents.

Salt in Boulder Reservoir

(Continued from p. 39)

parts per million, varying with the season. The Gila River at Gillespie Dam, Ariz., on April 28, 1926, was carrying 1,167 parts of chlorine per million, according to W. D. Collins.

It is therefore obvious that the salinity produced in the Boulder Canyon Reservoir by the solution of the mass of salt to a depth of 7 feet, amounting to 6.8 parts per million of sodium chloride, or 4.2 parts of chloride radicle, is entirely too slight to be detrimental to the use of the water for irrigation or for domestic purposes. Even on the improbable assumption that the whole of the existing salt exposures are dissolved back 15 feet annually, with no influx of fresh water into the reservoir, which gives a salt content of 20.7 parts per million and a chloride radicle content of 12.6 parts per million, it does not appear that there is anything alarming in a condition which could not fail to improve after the first year of operation.

OTHER SOLUBLE SALTS IN THE RESERVOIR AREA

The area of the Boulder Canyon Reservoir is known to contain at least one deposit of sodium sulphate, located just south of the Salvation salt deposit. This deposit is below the 1,222-foot contour line and is so situated that it would quickly become covered by sediment and protected from any but exceedingly slow solution. As a factor in influencing the quality of the reservoir water, the deposit is negligible. The reservoir area undoubtedly contains a larger quantity of gypsum than of salt, but the rate of solution will be far slower than that of salt and will not have any ordinarily appreciable effect upon the water.

POSSIBLE REMEDIAL MEASURES IN CONNECTION WITH THE SALT DEPOSITS

Although the salt deposits are practically negligible and can safely be left to take care of themselves and to become effectively blanketed by local landslides and sedimentation within the reservoir, it would be an easy and comparatively inexpensive matter to cover all of the salt exposures before the reservoir is filled. The Salvation deposit could readily be covered by blasting down the bluffs above the exposures, and the same procedure could be followed at the Calico deposit. At the Fairview deposit there is less immediate overburden and scrapers would probably be required to effect complete blanketing.

GENERAL CONCLUSIONS

(1) Under the improbable assumption that 987,389 tons of salt will be dissolved during the first year of reservoir operation, with no change of water in the reservoir, the reservoir water will have added to it a chloride radicle content of 12.6 parts per million. This, added to the average content of 98 parts per million in the river water entering the reservoir, would give 110.6 parts per million, chloride radicle content, which is less than half of the total quantity permissible in good water.

(2) The quantity of salt that will actually go into solution the first year will probably be considerably less than half of the amount calculated in the preceding paragraph.

(3) The quantity of salt passing into solution from the Virgin Valley salt deposits must decrease at a rapid rate after the first year of submergence.

(4) The effect of the salt deposits on the water of the reservoir will be practically negligible.

(5) Solution can be almost wholly prevented, in any practical sense, by covering the salt deposits before submergence and taking steps to prevent wave or stream action on any masses that are likely to stand above water level at any stage.

(6) Such protective measures are probably not necessary, but they could be accomplished easily and at comparatively small cost.

Uncompahgre Conference in Denver

On February 25 and 26 Dr. Elwood Mead, commissioner; P. W. Dent, assistant commissioner; and George O. Sanford, reclamation economist, attended a conference in Denver on a proposed plan for the financial and economic reorganization of the Uncompahgre project.

In addition to the above, those invited by Secretary Wilbur to attend and participate in the conference were as follows:

R. F. Walter, chief engineer, Bureau of Reclamation, Denver, Colo.

L. J. Foster, superintendent, Uncompahgre project, Montrose, Colo.

W. P. Dale, president, Uncompahgre Valley Water Users' Association, Delta, Colo.

C. J. Moynihan, Montrose, Colo.

Walter Lacher, Montrose, Colo.

John Howell, county commissioner, Montrose, Colo.

Dr. Charles A. Lory, president, State Agricultural College of Colorado, Fort Collins, Colo.

L. A. Moorhouse, professor of rural economics and sociology, State Agricultrual College of Colorado, Fort Collins, Colo.

George B. Harrison, president, Denver National Bank, Denver, Colo.

Edward D. Foster, State commissioner of immigration, Denver, Colo.

J. S. Pyeatt, president, Denver & Rio Grande Western Railroad, Denver, Colo.

W. H. Olin, supervisor of agriculture, Denver & Rio Grande Western Railroad Co., Denver, Colo.

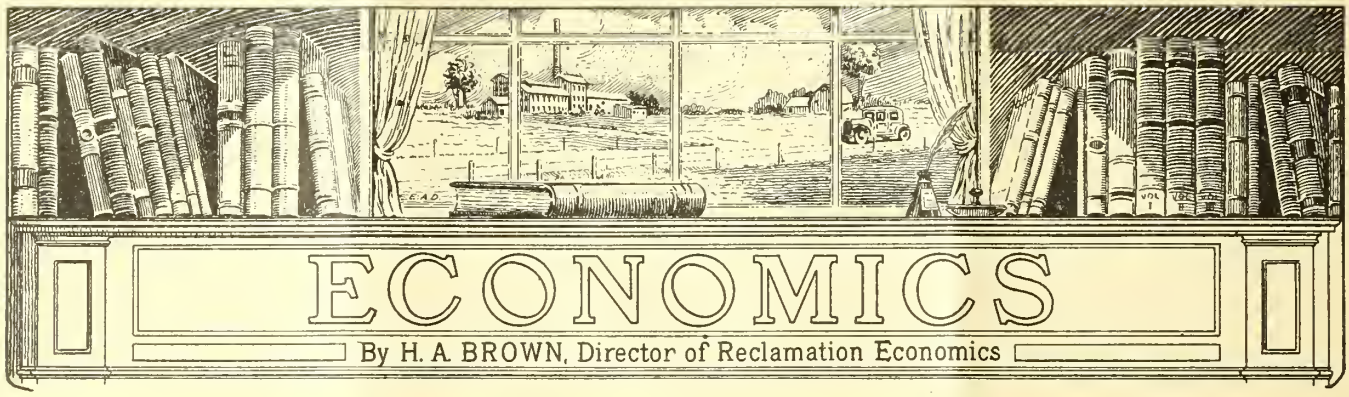
Edward B. Morgan, chairman, State tax commission, 722 First National Bank Building, Denver, Colo.

Charles A. Dobbel, executive assistant to the Secretary, Department of the Interior.

The art of irrigation dates back to the beginning of written history.

SUGAR-LOAF RESERVOIR, VICTORIA, AUSTRALIA

Left: Storage in valley of Delatite River. Colburn River comes in on right.
Center: Water flowing over spillway.
Right: Rock fill dam with power plant under construction.



Riverton Project Needs Settlers, a Railroad, and a Sugar Factory

PUTTING the Riverton project, Wyoming, on its feet as a going concern is proving one of the most difficult tasks confronting the Bureau of Reclamation. There is no question about the sufficiency of the water supply, the adequacy of the engineering works, or the ability of the soil to produce a wide variety of crops. Yet so far settlement has lagged and the development of the project is being unduly prolonged. Of the 100,000 acres in the project, water is available for 20,300 acres and will be available in 1930 for an additional area of 12,700 acres. The major works have also been constructed for 10,200 acres with laterals to be constructed with the present appropriation.

Two openings of public land farm units have been held—one in the spring of 1926, when 20 farm units were made available, and one in the fall of the same year, when 40 units were opened to entry. To date only 8 of these units have been filed on by qualified entrymen. A few farms in private ownership are receiving water. The crop report for 1929 showed that of the irrigable area of 20,000 acres only 1,075 acres were irrigated and only 875 acres cropped, producing crops valued at $10,120, or $11.56 per acre. Altogether, only 19 farmers were using water in 1929. Evidently more farmers are needed to put the project on a basis which will justify its construction.

Two things are evident to the most casual observer. They are the need of a railroad to reach the 20,000 acres of irrigable land around Pavillion and a sugar factory. The situation is a classic example of a vicious circle. Both railroad and sugar factory are waiting for more settlers who are not inclined to come unless they have adequate railroad facilities and a sugar factory within a reasonable distance to market what will eventually be the leading crop on the project.

The bureau is by no means discouraged at the apparently unfavorable outlook and is leaving no stone unturned to provide for the settlement and development of the project.

Doctor Mead has taken up with Governor Emerson the question of including in the highway program of the State the construction of a series of graveled and oiled roads through the project, which would enable trucks to reach beet growers in all parts of the project and haul beets to Riverton if necessary.

The Holly Sugar Corporation will agree to build a factory as soon as 6,000 acres of beets are available. This brings us back to the starting point and the necessity of getting more settlers on the project. It is believed that much can be accomplished by an active settlement campaign, in which the State, the railroads, chambers of commerce, the project, and the bureau would join. Doctor Mead has already taken up with Governor Emerson the question of enlisting the aid of the State in advertising the project this year in four or five of the leading agricultural papers. The efficacy of judiciously selected advertising on even a small scale is indicated by the results obtained by Mr. A. G. Keys, of Pavillion, Wyo.

Mr. Keys in 1928 inserted a very brief classified advertisement for several weeks in two farm papers of wide circulation. In reply he received more than 100 inquiries concerning the project. In the spring of 1929 he inserted a similar advertisement for three months in three farm papers, and again in the fall for three months. He received more than 600 replies, mostly from farmers, several of whom filed farm application blanks and a few of whom visited the project.

Advertising such as this, on a larger scale, would doubtless result in obtaining a selected list of prospective settlers, many of whom would become land owners on the project. Another form of advertising might be the use of the radio to broadcast three-minute talks about the project, such as are now being given under the auspices of Val Kuska, colonization agent of the Burlington Railroad, in advertising the opportunities on the Willwood division of the Shoshone project.

With all agencies working together—Federal, State, and local—there is every reason to anticipate the early settlement and development by home owners of this fine body of agricultural land.

Imperial Valley Soil Classification

W. W. Johnston, reclamation economist, and A. T. Strahorn, soil scientist, of the Bureau of Soils, Department of Agriculture, are making plans for a soil survey and land classification of areas under the All-American Canal in Imperial Valley, Calif. They will be joined later by E. H. Neal, who has recently been appointed in the division of reclamation economics, and who is now teaching at the University of Idaho at Moscow.

1929 Crop Returns Beat All Previous Records

The crop returns on land served in 1929 with water from the works of the Bureau of Reclamation are estimated at $161,000,000, the largest return ever recorded in the history of the Bureau of Reclamation. This figure was approached in the abnormal war year of 1919, when the total value of crops amounted to $152,974,100. Since that time the nearest approach to this record figure is that of 1928, amounting to $143,573,100. The average value of crops per acre in 1929 amounted to $59.06, compared with $52.43 in 1928. Detailed figures are given in the accompanying table. The chart on page 46 shows graphically the total and per acre value of crops from 1919 to 1929 inclusive.

TOTAL CROPPED ACREAGE AND VALUE, 1929, COMPARED WITH SIMILAR FIGURES FOR 1928

State and project	Lands on projects covered by crop census							
	1928			1929			Increase	Decrease
	Cropped acreage	Crop value		Cropped acreage	Crop value			
		Total	Per acre		Total	Per acre		
Arizona: Salt River	219,970	$26,082,055	$118.57	214,750	$25,423,030	$118.39		$659,025
Arizona-California: Yuma	53,580	4,907,055	91.58	54,065	4,369,560	80.82		537,495
California: Orland	13,310	759,380	57.07	12,370	503,490	40.70		255,890
Colorado:								
Grand Valley	13,340	552,715	38.47	14,435	634,985	44.00	$82,270	
Uncompahgre	60,750	2,265,100	37.29	60,380	2,212,710	36.65		52,390
Idaho:								
Boise	149,260	4,938,040	33.08	150,180	5,389,330	35.88	451,290	
King Hill	6,230	176,620	28.33	6,375	249,560	39.15	72,940	
Minidoka	98,495	3,321,720	33.72	99,340	4,417,910	44.47	1,096,190	
Gravity division	55,730	1,842,630	33.07	56,730	2,478,610	43.69	635,980	
Pumping division	42,765	1,479,090	34.59	42,610	1,939,300	45.51	460,210	
Montana:								
Huntley	21,800	698,430	32.04	23,485	1,037,150	44.12	338,720	
Milk River	15,820	211,195	13.35	38,330	975,160	25.44	763,965	
Sun River	24,800	388,210	16.00	27,700	426,920	15.41	38,710	
Fort Shaw division	6,930	111,920	16.15	7,340	153,250	20.88	41,330	
Greenfields and Big Coulee division	17,870	276,290	15.46	20,360	273,670	13.44		2,620
Montana-North Dakota: Lower Yellowstone	19,770	499,450	25.27	23,945	779,960	32.58	280,510	
Nebraska-Wyoming:								
North Platte	185,650	5,455,210	29.38	183,450	7,289,140	39.73	1,833,930	
Pathfinder irrigation district	89,890	2,450,790	27.26	87,995	3,242,370	36.85	791,580	
Gering and Fort Laramie irrigation district	48,260	1,653,380	33.84	49,240	2,364,940	48.02	711,560	
Goshen irrigation district	36,260	1,115,080	30.75	39,830	1,432,110	35.96	317,030	
Northport irrigation district	11,240	235,960	20.99	11,385	249,720	21.93	13,760	
Nevada: Newlands	46,085	1,773,200	38.50	51,380	2,057,280	40.04	284,080	
New Mexico: Carlsbad	23,820	1,291,160	54.21	24,220	1,847,500	76.27	556,340	
New Mexico-Texas: Rio Grande	139,600	12,733,650	91.22	139,775	10,957,325	78.39		1,776,325
Oregon:								
Umatilla	11,040	242,740	21.98	11,020	286,400	26.00	43,660	
East division	7,125	140,230	19.68	7,440	177,590	23.88	37,360	
West division	3,915	102,510	26.16	3,580	108,810	30.41	6,300	
Oregon-California:								
Klamath	45,450	1,270,300	28.00	43,765	1,790,670	40.91	520,370	
Main division	36,610	1,041,590	28.45	33,975	1,447,160	42.60	405,570	
Tule Lake division	8,840	228,710	25.85	9,790	343,510	35.10	114,800	
South Dakota: Belle Fourche	46,700	1,173,370	25.13	47,955	1,206,575	25.16	33,205	
Utah: Strawberry Valley	38,850	1,202,115	30.94	38,495	1,305,440	34.00	103,325	
Washington:								
Okanogan	3,600	1,092,725	303.73	3,835	979,220	255.35		113,505
Yakima	103,140	8,242,930	79.92	101,675	12,431,920	122.27	4,188,990	
Sunnyside division	80,890	5,467,160	67.58	79,075	7,947,570	100.51	2,480,410	
Tieton division	22,250	2,775,770	124.75	22,600	4,484,350	198.42	1,708,580	
Wyoming:								
Shoshone	42,980	954,760	22.21	43,270	1,270,970	29.37	316,210	
Garland division	34,300	792,090	23.10	33,130	1,092,330	32.97	300,240	
Frannie division	7,580	151,710	20.00	8,030	160,340	19.96	8,630	
Willwood division	1,100	10,960	9.93	2,110	18,300	8.68	7,340	
Riverton	520	6,670	12.95	875	10,120	11.56	3,450	
Total with irrigation	1,385,560	80,238,800	57.91	1,420,070	87,852,325	61.73	7,397,450	
Cropped without irrigation								
Milk River	19,100	191,390	10.02	14,140	72,180	5.11		119,210
Sun River	12,970	193,140	10.50	6,315	59,120	9.36		134,020
Fort Shaw division	304	3,520	11.58	145	1,340	9.24		2,180
Greenfields and Big Coulee division	12,666	189,620	14.97	6,170	57,780	9.37		131,840
Lower Yellowstone	16,880	208,800	12.37	11,970	109,980	9.18		98,820
Klamath	54,730	245,620	4.45	59,760	658,440	11.00	412,820	
Total cropped without irrigation	103,680	838,950	8.09	92,180	899,720	9.13	60,770	
Grand total	1,489,240	81,077,750	54.44	1,518,570	88,752,045	58.55	7,458,220	

State and project	Warren Act or other water service contract lands							
	1928			1929			Increase	Decrease
	Cropped acreage	Crop value		Cropped acreage	Crop value			
		Total	Per acre		Total	Per acre		
Arizona: Salt River	61,000	$6,547,130	$107.33	61,000	$6,547,130	[1] $107.33		
Arizona-California: Yuma	140	32,840	232.88	150	35,255	232.70	$2,415	
Colorado:								
Grand Valley	13,000	1,802,000	138.60	13,400	1,891,000	141.11	89,000	
Uncompahgre	1,545	38,070	24.64	1,545	61,800	40.00	23,730	
Idaho:								
Boise	125,700	4,485,000	35.68	128,400	5,046,500	39.30	561,500	
Minidoka	649,090	28,377,840	43.70	682,000	33,000,000	[1] 48.39	4,622,160	
Montana: Milk River	22,360	473,190	21.16					$473,190
Nebraska-Wyoming: North Platte	103,085	4,205,375	40.79	102,290	4,831,900	47.22	626,525	
New Mexico-Texas: Rio Grande	48,970	2,431,620	48.02	49,060	1,818,760	37.00		612,860
Oregon: Umatilla	495	18,325	37.00	435	20,825	50.00	2,500	
Oregon-California: Klamath	35,515	557,730	15.70	34,540	1,060,840	30.70	503,110	
Utah: Strawberry Valley	6,990	184,000	26.32	6,990	184,000	[1] 26.32		
Washington: Yakima	124,140	13,342,200	107.00	124,390	18,315,030	147.00	4,972,830	
Total with irrigation	1,192,030	62,495,320	52.43	1,204,200	72,813,040	60.46	10,317,720	
Grand total	1,192,030	62,495,320	52.43	1,204,200	72,813,040	60.46	10,317,720	

[1] Estimated.

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Development of Tule Lake Lands

On January 22, 1927, public order No. 19 opened to entry 145 farm units comprising 8,052 acres of Government land in the Tule Lake division of the Klamath project, Oregon-California. The whole tract was quickly filed on. In 1928 another tract of Government land was opened by Public Order No. 22, making available eight farm units totaling 573 acres of land. Public Order No. 23 issued on February 6, 1929, opened up an additional area of 1,887 acres, comprising 28 farm units. Canals and structures have been built and public notice drafted and sent to Washington for the opening as early as practicable of 24 farm units with an irrigable area of 1,648.8 acres. It is planned to extend the system to bring under irrigation about 3,000 acres a year until all suitable lands in the Tule Lake area have been reclaimed.

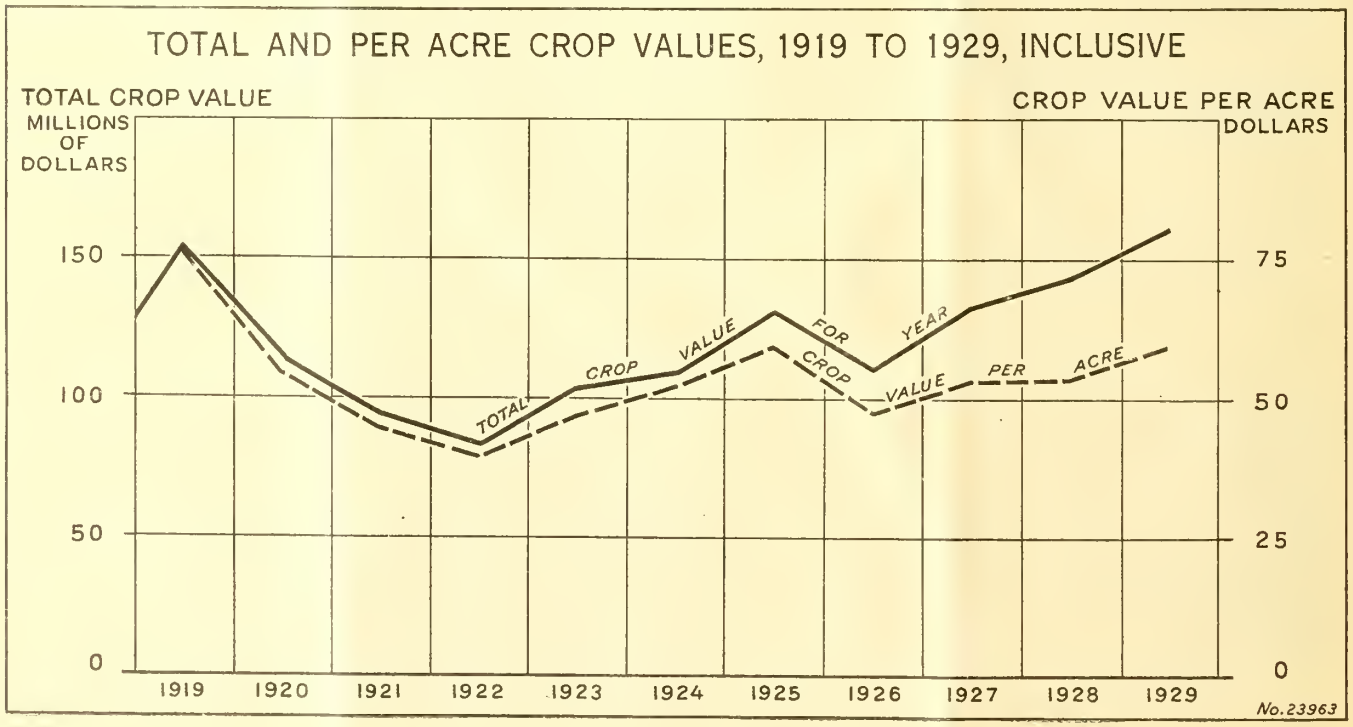
Concurrent with the development of the irrigated lands of Tule Lake has occurred the reclamation of another tract nearly twice as large which may be considered a very valuable asset to the wealth-producing lands of the Klamath Basin. I refer now to the sump lands that lie before the dike that protects the irrigated farms from possible inundation. At the present time about 59,760 acres, mainly sump land, is covered by leases that range in price from a few cents per acre to five or six dollars per acre. The value of crops grown on this area in 1929 amounted to $658,444, which might have been doubled had it been possible to distribute to dry lands the water pumped over the dikes and permitted to evaporate in the lowest part of the sump. When other developments more pressing have been made, I have no doubt that canals will be built either by the Government or private parties leading from the drainage pumps into the middle of this large area of fertile land. There no doubt will be years when the run-off from Lost River will be so great that much of the land in the sump will be covered with water until too late to permit the growth of grain crops, but such years will not be frequent, and even then it will be possible to grow some kind of forage crops on most of the area. The danger lies in the possibility that the extension of these distributing canals into the sump area may be delayed so long that a large area lying near the dike will become alkaline and covered with tules so that reclamation will not be feasible. When the 50,000 acres of irrigable land lying above the dikes, the drainage water from which must go into the sump, are fully irrigated, there should be sufficient inflow, including the winter run-off from project main division lands, to furnish a fair water supply for most of the area that has been set aside for sump purposes. Should it transpire that more irrigation water is needed, additional water could be turned down through the canal system. These sump lands can never be permitted to go into private ownership, but could be farmed under long-term leases and would in this way return a handsome revenue to the project and create much wealth in the district.—*B. E. Hayden, Superintendent.*

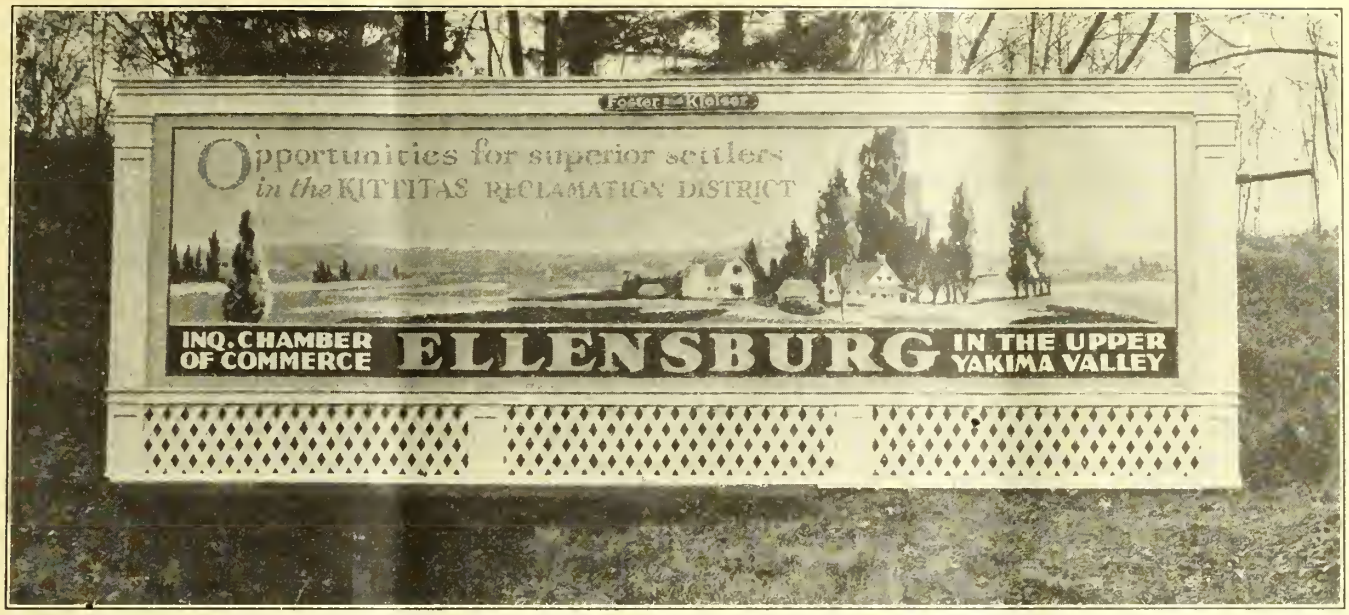
Yakima Extensions Considered by Board

On February 13 an engineering economic board convened in Yakima, Wash., to consider the economic and engineering studies of the Yakima-Benton and Kennewick divisions of the Yakima project. These studies cover (1) the utilization and proper capacity of the Cle Elum Reservoir; (2) the development of the Kennewick and Roza division; (3) the distribution of storage costs.

The members of the board comprise R. F. Walter, chief engineer; P. J. Preston, project superintendent, Yakima project; W. W. Johnston, reclamation economist; Charles J. Bartholet, State supervisor of hydraulics; and Prof. George Severance, of the State College of Washington.

They were assisted in their deliberations by E. B. Debler, hydraulic engineer, Denver office; Asahel Curtis, of Seattle, Wash.; and A. E. Wilson, first vice president, Yakima National Bank.





Kittitas Division Advertises For Superior Settlers

The Ellensburg Chamber of Commerce is making an enviable record as one of the most active advertising agencies of the Kittitas division of the Yakima project. The accompanying illustration shows one of the three road bulletins advertising opportunities for superior settlers in the Kittitas reclamation district. Copy for the bulletins is changed twice a year. The three bulletins are placed in positions where there is an average monthly flow of 123,000 people.

The chamber of commerce has also cooperated with the Bureau of Reclamation in the preparation of a booklet describing the project, and is cooperating with the Kittitas County Dairymen's Association in the preparation of a pamphlet describing the dairy industry and possibilities for its future expansion on the project. In addition, the chamber has arranged for a full page of advertising in the rotogravure section of the Seattle Sunday Times and a motorlogue in the same publication. Publicity material has also been furnished to numerous other publications.

THE stockholders of the Farmers' Cotton Finance Corporation on the Rio Grande project voted to increase the capital stock to $500,000, and reports are to the effect that the stock has all been subscribed. About half of the stock is owned by the cotton growers.

SEVERAL prospective settlers were shown over the Riverton project during the month.

Water Supply Conditions

PRECIPITATION, mainly in the form of light snows, was slightly below normal on the projects as a whole. There was a marked deficiency in precipitation throughout the Northwestern States.

While it is yet too early for predictions concerning the 1930 water supply, indications are that unless precipitation is average or better during the ensuing months, shortages may be expected on the northwestern projects. Water prospects appear to be good for the eastern and southern projects.

Jewish Aided and Directed Settlement

The Jewish Agricultural Society, whose object is defined in its charter as "the encouragement and direction of agriculture among Jews resident in the United States," in its annual report for 1929 states that "the first problem to which we addressed ourselves was the creation of a revolving loan fund through which farmers could obtain needed credits." These loans opened up a source of credit not otherwise obtainable, and this is stated to be the fundamental function of the society. The report continues as follows:

"Our contact with borrowers soon brought us face to face with the fact that the farmer's needs are not solely financial. We realized early that to lend a man money and then to let him shift for himself would not be doing our full duty. So we established an educational service which has, through the years, been enlarged and expanded until now it takes in practically every recognized form of extension work carried on by Federal and State agencies. It includes an advice bureau where farmers can obtain in person or by mail information on the latest and most scientific developments in agriculture; a system of field instruction in which we were the pioneers and which was the forerunner of the county farm bureau; a purchasing bureau through which farmers can buy approved materials and supplies at reduced costs. It fosters agricultural cooperation. It maintains an agricultural night school for farm aspirants. It publishes the Jewish Farmer, until laterly the only Yiddish agricultural magazine in the world, and has published agricultural textbooks and issued numerous leaflets in Yiddish. It awards scholarships and grants student loans in the agricultural colleges of the various States. As a stimulus to greater effort it presents awards of merit to farmers, their wives, and their children for distinctive achievement."

ABOUT 60 per cent of the farm lands on the Rio Grande project have been plowed and several new tracks have been cleared and leveled. Several new homes are being built and other farm improvements are noted.

AN order for the shipment of a carload of peas direct from Powell, Shoshone project, to a European customer came from the head offices at New Haven, Conn., during the month, and shipment was made immediately.

North Platte Project

THE North Platte project, Nebraska-Wyoming, is well organized in its club work, as will be shown by the following account.

There were in 1929 thirty-three 4-H Clubs in Scotts Bluff County with over 300 club members. The work of the clubs is outlined by the extension department of the University of Nebraska, and the work of all clubs, except the Livestock Clubs, is under the supervision of Miss Charlotte Joyce.

The work of the 4-H Clubs in Goshen County is under the supervision of Mr. H. L. Gibson, county agent. There are 156 members enrolled in agricultural clubs and 220 in home economics clubs. All but two of the girls' clubs are clothing clubs, the other two being food clubs, and all but one of the boys' clubs are pig or dairy clubs.

At the Goshen County Fair, held at Torrington, Wyo., from September 5 to 7, 1929, there were over 200 4-H Club exhibitors. Considerable time was spent by the Wyoming clubs in the training of contest teams. The State of Wyoming sends three teams to Denver each year, and this year all three of the teams were from Goshen County. At the Wyoming State Fair, held at Douglas, Wyo., the Goshen County 4-H Clubs had the champion clothing demonstration team, the champion food demonstration team, the grand champion home economics team, the champion livestock team, and the grand champion agricultural demonstration team. The county also had the champion stock judging team, a photograph of which appears on the opposite page.

BOYS' AND GIRLS' LIVESTOCK CLUBS

In Scotts Bluff and Sioux Counties the livestock clubs were under the direct supervision of the agriculturist. The 6 dairy calf clubs and 1 sheep club enrolled a total of 111 members. Of these 96 members finished the year's work and filed final reports.

Exhibits at Goshen County Fair.—At the Goshen County Fair a few of the club members from Scotts Bluff County exhibited pigs and calves. The pig club boys showed the junior and grand champion Duroc litter and first prize Poland China litter.

One of the calf club boys showed the junior champion Holstein female in open competition.

Exhibits at Scotts Bluff County Fair.—Sixty-three members of livestock clubs exhibited at the Scotts Bluff County Fair. The same boy who won grand championship on his Duroc gilt at Torrington was awarded the junior championship at Mitchell in open competition. The same Duroc litter that was placed first at Torrington won first at Mitchell also. The junior champion Holstein heifer at Torrington was made grand champion Holstein female at Mitchell.

Another club boy won senior championship on his 2-year-old Holstein heifer. Both of these heifers were purchased in Wisconsin by the agriculturist for these club members. Their pictures are shown on the opposite page.

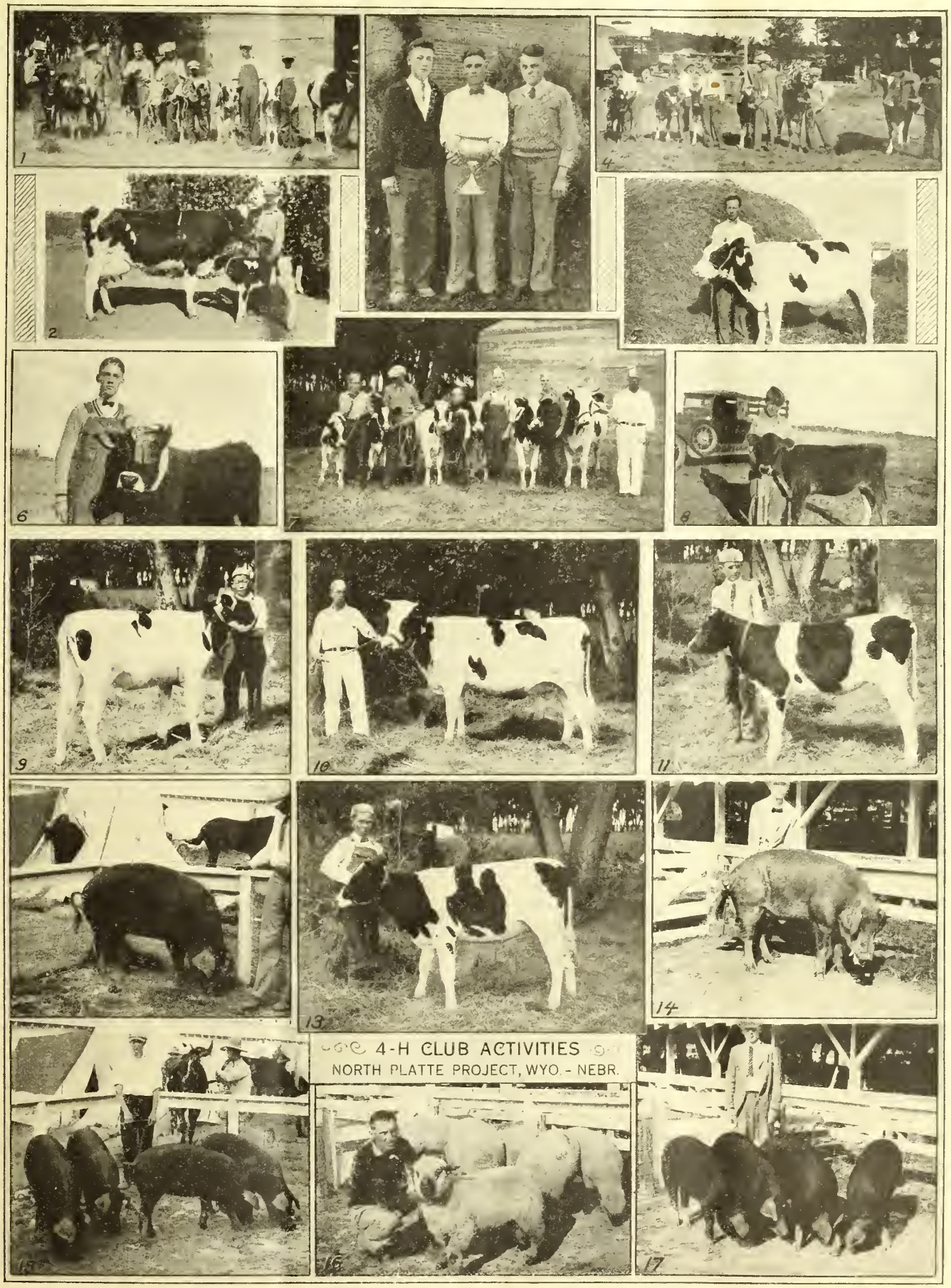
Caretaker-demonstration contest.—The caretaker-demonstration contest was conducted at the Scotts Bluff County Fair again this year. In this contest the club members are awarded cash prizes by the fair association for the way they keep their stalls and pens throughout the fair, the fitness of their animals for show, and the way they show them. The contest makes an excellent demonstration of the results of club work as well as providing a means of keeping the club exhibits in order at all times during the fair.

Judging contest.—In the club-judging contest conducted at the Scotts Bluff County Fair the club members' calves, pigs, and sheep are used for the classes. The official judges at the fair act as judges in the contest. The fair board awards cash prizes to the five club members ranking highest in the contest.

Shipment of club calves.—At the request of the Goshen County Farm Bureau the agriculturist went to Wisconsin to select 2 carloads of purebred heifers, which were distributed among 23 different families in Goshen and Scotts Bluff Counties. The

Titles to Illustrations on Opposite Page

1. *"Go Getter" Calf Club, Minatare, Nebr.*
2. *Senior champion heifer. Scotts Bluff County Fair, 1928. David Davis, Morrill, Nebr.*
3. *Champion stock-judging team, Wyoming State Fair, 1929. Walter Berry, McGregor Lynn, and Jack Reid, all of Torrington, Wyo.*
4. *Royal Rockingham-Guernsey Calf Club.*
5. *Junior champion heifer, Goshen County Fair, 1928. Junior and grand champion, Scotts Bluff County Fair, 1928. Bernard Walker, Segis-Topsy Calf Club.*
6. *Junior champion heifer. Scotts Bluff County Fair. Jennings Childs, Segis-Topsy Calf Club.*
7. *Segis-Topsy Calf Club, Morrill, Nebr.*
8. *Grand champion Jersey female, all ages. Allan Kearney, Segis-Topsy Calf Club, Morrill Nebr.*
9. *First prize Holstein heifer. Scotts Bluff County Fair. George Iwata, Segis-Topsy Calf Club.*
10. *Grand champion purebred Holstein heifer. Bernard Walker, Segis-Topsy Calf Club.*
11. *First prize senior heifer calf. George Glenn, Fill Pail Calf Club, Henry, Nebr.*
12. *First prize Duroc Gilt. Harold Brown, Sunflower Pig Club.*
13. *Junior yearling heifer. Donald Reeder, Sunflower Club.*
14. *Prince of Cols, grand champion Duroc boar. Goshen County and Scotts Bluff County Fairs. Scott Clark, Progress Pig Club.*
15. *First prize litter of Durocs. Goshen County, Scotts Bluff County, and Morrill County Fairs. A total of $131 prize money. Philip Lynch, Sunflower Pig Club.*
16. *Ram Lamb, grand champion. Goshen County and Scotts Bluff County Fairs. Flock of purebred Hampshires in background. James McMahon, Morrill Sheep Club.*
17. *First prize litter of Poland Chinas. Sylvester Kiesel, Sunflower Pig Club.*


4-H CLUB ACTIVITIES
NORTH PLATTE PROJECT, WYO.-NEBR.

cattle have done well and are forming the basis of purebred herds in the different communities in which they were distributed. The champion Holstein heifers showed by the club members in Scotts Bluff County were in this shipment.

Pig Club Bred Sow Sale.—On February 29 the pig club members of Scotts Bluff County conducted a bred sow sale that attracted national attention. The New Breeders Gazette, the Duroc Journal Bulletin, and the National Duroc News each announced the sale and commented on it.

In managing the sale each member of the club was given some responsibility. A committee of club members helped to plan the catalogue and the sale was opened by the club president. Two grand champion gilts at local fairs were among the first three sows sold. The first five brought an average of $87. The top gilt sold for $152.50. The entire offering of 31 Durocs 7 Polands, and 4 Spotted Polands averaged $40.

A feature of the sale was the exhibit of a ton litter from a pig club sow. This litter of 10 Durocs at the age of 5½ months weighed the morning of the sale 2,100 pounds. After the sale of bred sows the litter was sold by the pound bringing the owner $169.12.

The following shows the results obtained by the 4-H Club members at the Morrill County Fair, held at Bridgeport, Nebr.

Seven members of the clubs won prizes on their livestock in competition with adult exhibitors in the same class. These were: Wayne Todd in the Holstein cow class; Gordon Downing, Louis Smith, Ralph Sikes, Enid Rose, Wayne Sikes, and Ivan Lindahl in the sheep division.

Six of the seven members of the Wide Awake Calf Club exhibited the Holstein heifers. The winners were as follows: First, Wilford Johnson; second, Walter Hoerler; third, Leonard Payne; fourth, Archie Haszard.

In the Bridgeport Merchants Calf Club, exhibiting their 3-year old Holstein cows, Wayne Todd was first prize winner; Emil Hoerler, jr., second. Later in open classes Wayne's cow was made a grand champion. Wayne Todd is the son of Mr. Clyde E. Todd, president of the board of directors of the Northport Irrigation District, and Wilford Johnson, Walter Hoerler, Emil Hoerler, jr., Leonard Payne, and Archie Haszard are sons of land-owners in the Northport Irrigation District.

The cooking, clothing, and garden clubs give demonstrations at the annual experiment farm picnic and also at the county fair and one exhibit building at the fair is reserved for exhibits of the various 4-H Clubs, outside of the Livestock Clubs, and a complete list of special premiums is awarded for exhibits by the 4-H Clubs.

Each year a 4-H Club picnic is held, usually at the county fair grounds at Mitchell, Nebr. The picnic lasts three or four days and is attended by the present club members for several of the surrounding counties. The picnic is educational as well as recreational, as schools of instruction are held and demonstrations given and special stock-judging trips are made.

In the canning clubs exhibit the Live Wire Canning Club, with Mrs. C. W. Mount, as leader, won first place, and the Angora Canning Club, with Mrs. H. H. Huett as the leader, was second. Mrs. J. R. Graham is leader of the Worth-While Clothing Club, of Angora, that won first prize in the contest of nine clubs exhibiting at the fair. Mrs. C. W. Mount, the leader of the Live Wire Canning Club, is the wife of one of the property owners in the Northport district.

The displays of the 4-Clubs constituted a large part of the exhibition in the agricultural hall where the articles were displayed, and practically every club in the county entered the contest.

4-H Club Work on Carlsbad Project, N. Mex.

Two girls' sewing clubs were organized. A total of 39 members were enrolled but only 20 finished. As this was the first year for extension work, the girls were required to take first-year sewing work. Some of the older girls did not think they liked this easy work and thus were not kept interested.

Each club held one meeting a week for 2-hour periods. The local leader outlined the work to be finished that week. The extension agent met with the clubs when possible. Parties and picnics were held about once a month.

A local exhibit was held by each club. A county exhibit and demonstration contest was held. The 3 best exhibits from each club were entered in the county contest. Seven demonstrations contested for county honors. Velma Burrows and Mae Bergaus were the two highest-scoring girls and this team was taken to State college and contested in the State contest. In the State contest these girls were listed in the honor roll.

All the girls completing their work were given prizes. The county and club winners were given special prizes.

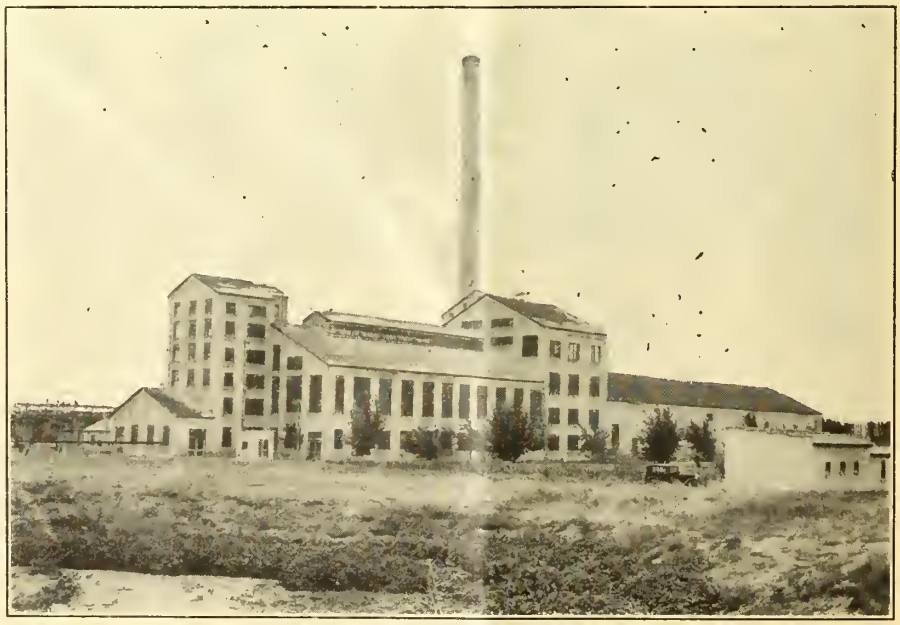
Two boys did poultry-club work. Both boys saved a large percentage of their chickens and kept a number of the pullets. They are now enlarging their flocks.

Linn Dillard won first prize for pullets in the county poultry show in keen competition as he had to show against the white Leghorns of the Acalia poultry farms, this flock never having been defeated in this entry before.

Arrangements have been made to allow the older girls to do advanced club work provided they can do the work that is necessary to carry on the advanced work.

Six clubs are now doing sewing work. There is a membership of 70. Some of the girls have about half of the required work finished.

Eight boys are in the poultry club and seven boys are doing dairy calf club work. The club boys in four communities have organized a baseball league and games are played each week, in season. One group of club boys assisted in putting out a fire and were given $25 by the insurance company. They used this money to buy equipment.



Sugar factory at Paul, Minidoka Project, Idaho

Notes for Contractors

Belle Fourche project.—Bids for the construction of about 67 miles of deep drains and structures incidental thereto will be received at the project office until 2 o'clock p. m., March 18. This work involves about 1,385,000 cubic yards of excavation, the placing of 170 cubic yards of concrete, and the erection of several timber bridges and metal-pipe culverts.

Owyhee project.—Specifications have been prepared for the high-pressure gates and conduit linings required for the Owyhee Dam now under construction. The estimated weight of these gates and the linings is 1,482,000 pounds. The specifications are being issued by the Washington office of this bureau and bids will be received in the Denver office.

After awards are made for the tunnel construction, the first major work on the distribution system, for which bids are being opened March 11, it is probable that the construction of 1 or 2 transformer stations will be required and also the construction of from 5 to 15 miles of 66 kv., 3-phase transmission lines. The definite requirement for this electrical construction work will depend on provisions of the tunnel contracts and the equipment proposed to be used by the contractors.

Rio Grande project.—A ditch-cleaning machine of the caterpillar crawler traction type is required for cleaning canals and laterals.

Sun River project.—The construction of two earth dikes for the enlargement of the Pishkun Reservoir is planned at an early date. This work, which will be done by contract provided satisfactory bids are received, will involve the placing of approximately 340,000 cubic yards of materials in embankments.

Vale project.—Designs are being prepared for the construction of two large siphons on the main canal. These will cross Bully Creek and a branch of this stream, will be 8 feet or more in diameter, and will have a combined length of about 7,300 linear feet. It is planned to issue specifications and call for bids on the basis of two alternative types of construction, viz, riveted plate steel and precast concrete pipe. It is hoped that contracts can be made for this work so that construction may commence this spring.

It is planned to increase the storage capacity of the Warmsprings Dam, above the Vale project, by installing a stop plank structure on the present crest, which will raise the water surface 5 feet. Structural steel for this structure in an amount of about 85,000 pounds will be required.

Yakima project.—In connection with the construction of the Yakima River tunnel, on the north branch canal of the Kittitas division, requirement will be had for 78-inch diameter heavy steel shaft lining and other metal work to a total estimated weight of about 182,000 pounds.

Yuma project.—Plans are being made to purchase ten 12 to 16 cubic yard capacity, steel, air-operated, standard-gage dump cars for levee work.

ANOTHER ALL-EXPENSE TOUR TO ALASKA

THE Alaska Railroad has announced the organization of a 1930 all-expense tour to Alaska for Government employees and their friends scheduled to leave Washington, D. C. on Wednesday, August 23, returning to Washington on September 22.

The route of travel will be: Baltimore & Ohio Railroad to Chicago; Chicago and North Western and Canadian National Railways through Jasper National Park and the Canadian Rockies to Vancouver, British Columbia; Canadian Steamship Co., Vancouver, British Columbia, via Victoria, British Columbia, to Seattle, Wash.; Alaska Steamship Co. via the beautiful inside passage and Prince William Sound, Seattle, Wash., to Seward, Alaska; the Alaska Railroad via McKinley National Park to Fairbanks, Alaska. Returning from Seattle: the North Coast Limited, of the Northern Pacific Railway, will be used to Chicago and the Capitol Limited, of the Baltimore & Ohio Railroad, from Chicago to Washington.

Stopovers will be made at all chief points of interest and side trips by either rail or automobile will be provided at Chicago, Jasper National Park, Vancouver, Victoria, Seattle, Juneau, Cordova, Seward, Anchorage, McKinley National Park, and Fairbanks.

The rates from Washington, D. C., covering every item of expense for the round trip, with the exception of tips to waiters, etc., will range from $564.50 to $632.18, dependent upon sleeping car and steamship accommodations desired. Arrangements have been made for Government employees, their families, and friends to join the party at Seattle, Wash., and other convenient points enroute at proportionately low rates from either their home station or an appropriate junction point.

The entire trip from Washington, D. C., will consume 30 days, requiring but 21 days and 2 hours of annual leave. A descriptive booklet giving detailed itinerary and data concerning rates from various points will be issued shortly, a copy of which may be obtained by addressing Mr. G. C. Dickens, General Agent, the Alaska Railroad, No. 333 North Michigan Avenue, Chicago, Ill. or Mr. C. E. Harris, Traffic Manager, Interior Department, Washington, D. C., through whom additional information may be secured and reservations made.

Cooperative Marketing on Carlsbad Project

Farmers living on the Carlsbad project, New Mexico, have recently manifested an active interest in cooperative marketing with especial reference to the orderly marketing of their cotton. Sentiment in favor of former organized effort was apparently crystallized at a meeting held at Loving, N. Mex., on Friday, January 10, 1930. We are reliably informed that already 37 cotton producers, representing more than 4,000 bales, have signed the standard marketing agreement with the Southwestern Irrigated Cotton Growers' Association, of El Paso, Tex. Their set-up here is now complete. The Southwestern Irrigated Cotton Growers' Association will handle the cotton of all members on this project as it does the cotton produced by its members living on the Rio Grande project; and the Texas Cotton Growers' Finance Corporation, Dallas, Tex., which organization has discount privileges with The Federal Intermediate Credit Bank, of Houston, has approved the area and will furnish members with crop production credit whenever and wherever thay can meet its requirements.

Stephen T. Mather, 1867-1930

It is with sincere regret that announcement is made of the death of Stephen T. Mather, former Director of the National Park Service. Mr. Mather had been in failing health for the past two years and the end came at the Corey Hill Hospital in Brookline, Mass.

As the founder of the National Park Service and the builder of the National Park system, Mr. Mather has left an enduring monument, as well as a host of close personal friends throughout the Nation.

A sugar field of 73 acres in Wailuku, Hawaii, has been growing cane for 85 years.

Construction Costs of Federal Reclamation Projects

WHAT is the Government's investment in Federal reclamation? What is the construction cost of this or that project? The foregoing are two of the more frequent questions which confront the accountants of the Bureau of Reclamation.

In the article appearing in the February, 1930, New Reclamation Era under the head of "Accounts and Finance," the Government's contribution to the Reclamation fund on June 30, 1929, is stated as $147,714,305.92. This amount, together with direct appropriations out of the General Treasury of $5,393,312.35, and the unpaid balance of $11,000,000 of the special loan to the reclamation fund—in all, $162,107,618.27—constitutes the Government's aid or investment for the reclamation of arid, semiarid, swamp and cut-over timber lands under the direction of the Bureau of Reclamation. The accepted economic definition of capital investment is that portion of wealth set aside for the production of additional wealth.

In determining the character of accounting data required it is equally important in Government activities where the construction of public works is involved that expenditures should be known in terms of work done and activities, as well as in terms of funds, resources, other assets, and balances. This is especially true in the Bureau of Reclamation, where the amounts expended are repayable by the beneficiaries, and to apportion equitably the capital outlays or construction cost among the several divisions, districts, etc., of a project, intricate allocations of the costs of joint or common storage, irrigation, drainage and other features are necessary.

The revolving features of the reclamation fund make possible the construction of projects the total cost of which exceeds greatly the $162,000,000 set aside by the Government for the investigation, construction, and operation and maintenance of reclamation projects, as shown by the accompanying statement. Every dollar invested in one project upon repayment is available, upon authorization from Congress for the investigation and construction of another project, or for continuation of the construction, operation and maintenance of the same project. The reclamation law permits the contribution of money by States, municipalities and other organizations for investigations, construction, etc. Where no investment of the Government is involved, it is essential that the work accomplished be expressed in terms of construction cost.

COST ACCOUNTING

Cost accounting is therefore a very important feature of reclamation accounting. It serves a three-fold purpose—(1) detail information of the elements which make up the cost of classes of work or features, which can be made available as the work progresses; (2) detail information of the elements which enter into the cost of a reclamation project, available to the engineer in estimating the cost of new work; and (3) a record of results by divisions, districts, units, and features to serve as a permanent historical record of the cost of the project and permit an equitable apportionment of the capital outlay, as the interests of the several divisions, districts, and units may require.

The capital outlay for the construction of each project is obtained by a standard system of cost accounting. The construction cost is assembled under 12 principal features, defined as follows:

(1) *Examinations and surveys.*—The cost of reconnaissance, investigation of water supply, soils, trial surveys, borings, estimates, etc., for the purpose of determining the feasibility of the project as a whole, and all expense of a general nature not properly applicable to a definite physical feature.

(2) *Storage system.*—The cost of all works incidental to the storage of water.

(3) *Pumping for irrigation.*—The cost of all works to develop water by pumping, either from underground wells or open streams.

(4) *Canal systems.*—The canals and structures used as main distributaries or feeders.

(5) *Lateral system.*—The cost of the smaller distributaries and structures for the final application of the water to the land. The distinction between canal system and lateral system is more or less arbitrary, and will depend greatly on the particular conditions on the project and the judgment of the project superintendent. No definite line can be drawn, but as a general rule the main feeders only will be included under canal system.

(6) *Drainage system.*—The cost of drainage. This should be distinguished from wasteways intended for the control of water deliveries and a protection of irrigation works and from waste-water ditches for disposing of surplus water wasted by irrigators. The latter is a proper charge against the canal or lateral system.

(7) *Flood protection.*—The cost of levees, dikes, or other works designed primarily to protect lands or works from floods.

(8) *Power system.*—The cost of permanent power development.

(9) *Irrigable lands.*—The cost of farm units, survey of irrigable areas, ownership plats, and work incidental thereto.

(10) *Permanent improvements.*—The cost of works utilized for general purposes, such as headquarters office, experimental farms, roads, permanent buildings, real estate not properly classed as right of way, etc.

(11) *Telephone system.*—The cost of permanent telephone installation. This does not apply to a telephone line erected only to facilitate construction work. The latter is a plant facility and should be charged to telephone plant account.

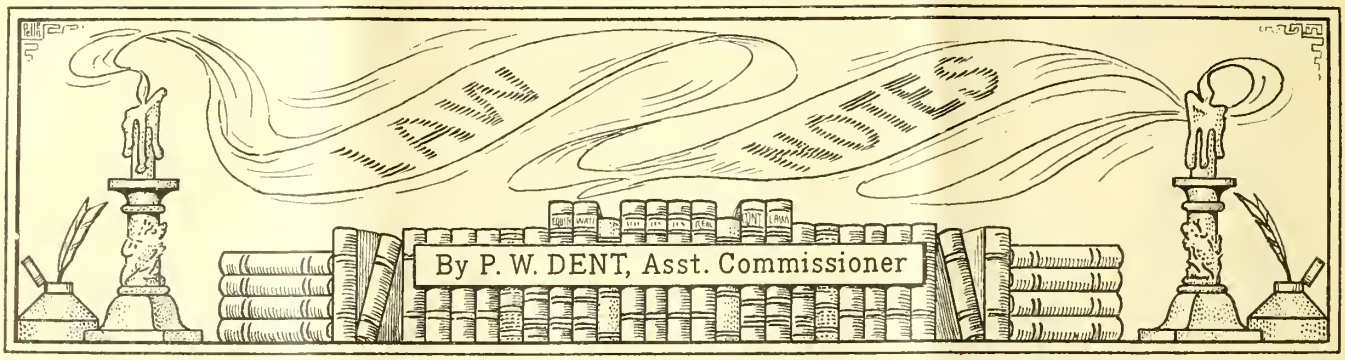
(12) *Operation and maintenance.*—A separation will be made of the cost of operation and maintenance during the construction period and under public notice and reported separately on the principal feature cost report and monthly balance sheet; but the method of assembling cost and the items to be kept will be the same for all work of operation and maintenance.

The accompanying tabulation shows the construction cost of each project classified by the above principal features.

CONSTRUCTION COSTS BY PRINCIPAL FEATURES TO JUNE 30, 1929

State and project	(1) Examination and surveys	(2) Storage: Storage dams	(2) Storage: Other storage features	(3) Pumping for irrigation	(4) Canal system: Diversion dams	(4) Canal system: Canals	(5) Lateral system	(6) Drainage system	(7) Flood protection	(8) Power system	(9) Farm units	(10) Permanent improvements	(11) Telephone system	(12) Operation and maintenance during construction	(13) Miscellaneous	Total
Arizona: Salt River	$83,939.83	$3,890,187.00	$201,765.25	$167,306.38	$793,940.22	$2,148,460.02	$620,071.25	$7,673.05		$3,820,713.12	$31,062.53	$763,686.17	$69,734.13	$2,362,719.51	[1] $145,677.64	$15,106,942.10
Arizona-California: Yuma	225,722.77				2,101,374.00	1,456,470.10	1,501,428.05	765,809.87	$2,729,739.60	317,936.09	32,308.21	205,620.76	14,522.08	724,555.50		10,075,487.03
California: Orland	5,935.90	1,241,885.95	468,212.61		37,060.00	189,653.11	433,208.87		499.72		1,360.59	15,314.19		107,657.23		2,500,788.17
Colorado:																
Grand Valley	73,945.20			102,632.51	495,466.93	2,968,087.00	354,071.28	684,680.56	13,877.77	[2] 360.00	40,361.84	22,469.10	11,794.30	557,927.34	[1] 495.54	5,326,169.37
Uncompahgre	96,541.76		[2] 12,698.92		178,208.00	3,852,542.71	2,215,860.86	3,940.63		[2] 273.85	39,352.88	31,968.82	6,788.48	1,490,584.06		7,928,760.97
Idaho:																
Boise	212,015.09	4,996,388.00	484,222.23	132,439.39	1,606,071.00	2,522,789.54	2,712,330.87	1,027,363.78		624,669.80	47,730.99	157,230.07	44,052.70	1,079,208.13	[1] 13,581.48	15,660,093.07
King Hill	23,798.58					1,579,823.94	248,654.57				6,299.97	34,631.46	8,260.77		[1] 3,849.51	1,905,318.80
Minidoka	170,984.05	1,131,025.00	147,220.59	532,108.08	625,841.00	1,224,049.48	1,117,984.16	794,224.86		996,536.53		146,796.48	28,396.01	330,353.90	[1] 4,386.25	7,249,906.39
American Falls		2,845,521.97	4,495,554.82							293,978.17				9,000.00		7,644,054.96
Gravity extension unit	40,601.96					[3] 33,939.96										374,541.92
Kansas: Garden City	7,618.72			110,743.74		88,546.17				123,993.69	285.66	7,548.12		52,868.10	[3] 4,227.58	395,831.78
Montana:																
Huntley	5,944.19			144,936.88		624,150.84	403,272.72	322,411.97			18,376.18	17,438.39	8,773.01		[1] 16,948.81	1,562,302.99
Milk River	214,916.27	1,028,744.00	85,330.29		787,916.00	3,256,768.91	1,008,200.96	27,766.93	58,262.94		46,874.26	223,033.39	30,865.93	669,363.96		7,438,043.84
Sun River	61,534.12	2,422,945.96	286,998.84		149,366.00	2,452,415.95	1,027,293.15	189,996.03		[4] 445.60	24,982.29	81,311.12	33,007.82	235,839.64		6,966,136.52
Montana-North Dakota:																
Lower Yellowstone	62,643.35			49,970.93	408,331.00	2,059,659.14	451,169.80	341,058.19			2,008.44	40,036.38	22,818.22			3,437,695.45
Nebraska-Wyoming: North Platte	42,785.82	4,428,060.00	492,179.14		307,062.00	7,543,693.33	3,670,652.99	1,421,144.54		878,968.11	74,634.30	117,510.21	49,657.73	1,001,280.74	[1] 136,796.71	20,164,425.62
Nevada: Newlands	458,198.97	1,484,718.00	215,048.26		226,068.00	2,166,169.12	1,585,929.30	1,044,343.22	131,821.37	324,793.52	117,766.32	118,319.27	42,642.45		[1] 40,808.80	7,956,626.60
New Mexico:																
Carlsbad	41,081.56	547,353.00	173,427.19			347,524.28	70,181.17	129,705.87				155,249.50				1,464,522.57
Hondo	4,422.70	154,844.67				93,898.69	38,979.34				19,837.41	23,338.45	4,170.42	42,081.71		381,573.39
New Mexico-Texas: Rio Grande	161,067.18	4,415,267.00	804,396.53		352,259.00	3,049,102.38	2,309,774.35	3,410,547.76	5,995.34		228,288.99	68,532.20	11,778.28	863,217.40		15,680,226.41
North Dakota:																
North Dakota pumping	32,098.44						171,349.37			274,387.87		23,019.48	16,774.93			517,630.09
Buford Trenton							58,406.83			159,166.10		5,850.13				223,423.06
Oregon:																
Baker	62,674.85		[2] 5,659.48													68,334.33
Owyhee	128,946.55	518,961.32	932,969.17			19,053.57							9,179.13			1,609,109.74
Umatilla	115,210.50	2,344,665.00	617,288.54		71,626.00	874,761.85	989,934.97	118,038.75			3,375.08	33,389.85	2,772.57		[1] 5,851.04	5,176,914.15
Vale	56,784.27	331,067.32			38,384.00	866,678.61	12,336.84									1,305,251.04
Oregon-California: Klamath	176,215.99	449,520.00	268,849.55	31,861.11	282,255.00	2,419,874.74	741,295.18	835,552.64	77,019.18	127,357.01	14,326.95	37,323.53	36,414.05	117,170.78		5,615,035.71
South Dakota: Belle Fourche	14,351.83	1,230,922.00	577,668.62			992,700.00	734,346.17	237,635.70			12,141.36	40,970.86	14,583.67			3,855,320.21
Utah:																
Salt Lake Basin	73,483.92	571,826.26	753,718.77													1,399,028.95
Strawberry Valley	48,658.27	406,891.00	1,292,706.46		39,696.00	775,009.95	708,402.92			90,069.50	9,025.68	115,223.25	14,051.19	12,511.90	[1] 7,689.27	3,519,935.39
Washington:																
Okanogan	4,603.27	629,189.00	138,833.24	155,965.24	4,140.00		431,654.24				1,889.92	74,506.90	6,679.10	4,736.36	[1] 4,259.40	1,456,456.67
Yakima	355,382.32	6,356,927.42	1,382,311.15	396,401.12	79,901.00	2,945,418.63	2,480,088.23	11,418.80			22,462.15	329,599.61	53,040.31	10,208.54	[4] 28,951.58	14,452,110.86
Yakima-Kittitas	136,846.30			[2] 270.33	137,392.88	4,555,613.85	76,815.14				64.97					4,907,003.47
Wyoming:																
Riverton	109,062.90	277,260.00	81,787.21		497,019.46	1,807,129.43	475,452.72	30,216.48			25,996.00	22,536.41	28,520.44	17,624.03		3,372,605.08
Shoshone	90,571.01	1,485,139.00	407,664.11		450,416.00	2,689,263.30	1,218,358.49	2,376,672.45		681,969.04	70,388.48	77,687.12	24,445.84	34,874.39	[1] 5,069.52	9,612,518.75
All States: Secondary	2,395,573.06															2,395,573.06
Subtotal	5,794,211.50	43,189,308.87	14,326,510.97	1,824,635.71	9,669,793.49	55,903,254.60	27,867,504.79	13,780,202.08	3,017,215.92	8,715,618.00	891,201.45	2,990,141.22	593,723.56	9,723,783.22	418,593.13	198,705,698.51
Arizona: Yuma auxiliary [5]	33,736.31			159,936.24		271,227.47	325,507.43		9,020.00	9,749.34	837.00	64,958.48	422.16			875,394.43
Total	5,827,947.81	43,189,308.87	14,326,510.97	1,984,571.95	9,669,793.49	56,174,482.07	28,193,012.22	13,780,202.08	3,026,235.92	8,725,367.34	892,038.45	3,055,099.70	594,145.72	9,723,783.22	418,593.13	199,581,092.94

[1] Value of materials, supplies, and equipment turned over to water users.
[2] Preliminary work.
[3] Difference between cost and sale price of unused materials, supplies, and equipment.
[4] Allowances to irrigation districts for prior waret rights.
[5] Expenditures for new construction of Yuma auxiliary project made from the special fund established under the act of Jan. 25, 1917, known as the Yuma auxiliary fund.



Comments on Recent Irrigation Legislation

Utah

OWING to the recent trend in Federal reclamation legislation requiring that contracts for the repayment to the United States of the funds expended by it in the construction and operation and maintenance of new projects shall be made only with irrigation districts and shall provide that the entire amount so expended shall be repaid without regard to default in payment of charges against any individual tract or tracts of land, it has become exceedingly important that the irrigation district law in all States in which Federal irrigation projects are to be built shall be in such shape that irrigation districts will be fully empowered to meet all Federal requirements.

The State of Utah until the past year did not keep pace with the trend of Federal legislation, and it became advisable, owing to the scope of its irrigation district law and interpretations by its supreme court, to urge the amendment of the same sufficiently to meet the requirements of Federal legislation. The principal amendment necessary in the irrigation district law of Utah pertained to the power of assessment as the Supreme Court of Utah in the case of Nelson *v.* Board of County Commissioners of Davis County, et al., 218 Pac. 952, in interpreting the irrigation district law held in effect that the rate of levy necessary to cover deficits resulting from delinquent assessments for any preceding year was limited to an increase of 15 per cent.

The result of this decision was to make it impossible for an irrigation district legally to assume what may be termed a full blanket or general obligation, the only kind which could satisfactorily meet the requirements of the United States in respect to repayment of moneys expended in the construction of a project.

Bills seeking to amend the irrigation district law so as to permit the levy of assessments not so limited to care for deficits resulting from delinquent assessments for any preceding year were introduced at the regular sessions of the Legislature in 1925 and 1927, but met with opposition and failed to pass. Again in 1929 an attempt to amend the law was made, and this time successfully, as amendments were passed which now permit a district when dealing with the United States, but only in such case, to make a contract providing that the contract obligation due from the district to the United States may be a blanket or general obligation of the district and the lands of the district in their entirety, if so provided in the contract, shall become and remain liable to assessment and levy annually until payment is actually made in full.

The amendments so passed looking to that end were confined to changes in sections 16, 17, 18, 19, and 20 of Chapter 68, Laws of Utah, 1919, as set out in chapters 68 and 80 of the Session Laws of Utah, 1929.—*J. R. Alexander, District Counsel.*

New Mexico

Although New Mexico is among the younger States of the Union and has consequently had a vast field of legislation to cover since its statehood in 1912, it has consistently demonstrated its alert appreciation of the necessity of fostering irrigation. as evidenced by its statute books. During its Territorial days New Mexico adopted in 1905 a comprehensive water code, which was amplified in 1907, and which has since been kept well abreast of the changes prompted by an advancing knowledge of the science of agriculture by irrigation and of the complexities presented by group development. It is one of the States broadly classed as wholly arid as distinguished from Texas, its semiarid neighbor to the south and east.

Electrical irrigation districts.—There have existed for some time two complete acts authorizing the formation of irrigation districts in New Mexico, one the act of June 8, 1912, now superseded by chapter 41, Session Laws, N. Mex., 1919, relating to irrigation districts generally, and the other, the act of March 5, 1919 (ch. 20, Session Laws, N. Mex., 1919), relating to districts formed to contract with the United States under the reclamation act. Reclaiming lands by irrigation and drainage as an incident of flood prevention and stream control was the objective sought by chapter 140, Session Laws of New Mexico, 1923, chartering districts to cooperate with the United States Government, for which there was later substituted chapter 44, Session Laws, N. Mex., 1927, extending the law to districts generally.

The past year has produced another comprehensive act of the legislature (ch. 76, Session Laws, N. Mex., 1929) providing for the formation of "electrical irrigation districts," the primary purpose of which is to accomplish irrigation by pumping. The broad outlines of the act follow generally the plan of the Wright Act adopted in 1887 in California, which was the progenitor of most irrigation district codes in the other semiarid and arid States of the West.

Some variations from existing provisions as to procedure for the formation of such districts and creation of district obligations are, however, embodied in the new act. Underground waters continue to be the subject of extensive study in New Mexico and the "electrical irrigation district" act will doubtless pave the way to ultimate organization of districts for the development of various areas such as exist in the vicinity of the Mimbres Valley, in Luna and Grant Counties, N. Mex., and similar basins. At the same time it is conceivable that such districts may some day afford a possible power market in the course of future development of the hydroelectric potentialities of Elephant Butte Dam of the Rio Grande Federal reclamation project.

Cooperative investigations.—By the act of June 21, 1898 (30 Stat. 485) Congress granted a half million acres of land to New Mexico for the creation of a "water reser-

voir for irrigation purposes income fund." The 1929 session of the State legislature continued the policy of making money from that fund available for various investigations relating to irrigation development to be conducted both independently by the State and in cooperation with the Bureau of Reclamation and other agencies of the United States.

Investigations of the Canadian River, the Tularosa Basin, ground-water supply of Hidalgo and Lea Counties, the artesian reservoir of the Pecos Valley, the ground-water supply of Mimbres Valley, and the feasibility of further irrigation development in Sunshine Valley and the San Juan Valley, were authorized, respectively, by chapters 27, 38, 144, 147, 148, and 160 to 163, inclusive, Session Laws, 1929. Practically all of these acts authorized the State engineer "to cooperate with the United States Reclamation Service or other Federal agencies in the conduct of such work."

Chapter 39 provides funds and authorizes a contract on behalf of New Mexico with the Secretary of the Interior and the State of Arizona for cooperative study of the best methods and means of utilizing the waters of the Gila River and its tributaries for irrigation.

Loan from State.—Modelled somewhat upon the theory and practice of the Federal reclamation act, chapter 202, Laws of New Mexico, 1929, extends State aid to the Bluewater-Toltec irrigation district, a non-Federal project in northern New Mexico, in the form of a loan from the State out of the water-reservoirs income fund, to be repaid over a period of 25 years.

Irrigation district taxes.—Where an irrigation district organized for the purpose of cooperating with the United States, under the terms of the reclamation act or other laws, shall take over the levy, assessment and collection of the taxes of the district, the treasurer of such district is, by chapter 88, Session Laws, N. Mex., 1929, vested with the powers and duties imposed by existing law upon the county treasurer, and general provisions of law relating to State and county taxes are made applicable to taxation by such district.—*H. J. S. Devries, District Counsel.*

Idaho

Recent Idaho irrigation legislation of possible interest to readers of the New Reclamation Era involves three subjects.

By chapter 3, Idaho Session Laws, 1929, page 7, the State legislature has given flexibility to the directions for the appropriation of water for irrigation purposes. Previously the time was fixed within which the appropriator was required to make proof of completion of works. Now, upon good cause shown and after an opportunity for protest, the time may be extended by the State commissioner of reclamation. Under the law as it read before amendment, it is conceivable that it may have run into conflict with the injunction of the State constitution, that the "right to appropriate the waters of the State shall never be denied." Irrigation works of large magnitude may possibly not have been completed within the time limit fixed by the previous State legislature, so that the limitation thus imposed would in effect deny the right of appropriation.

The effectiveness of the remedy for nonpayment of water charges, in shutting off the water supply of the delinquent, was recognized by the 20th session of the Idaho Legislature. This is apparent from reading chapter 87, Idaho Session Laws, 1929, which adds a section to section 5615, Idaho Compiled Statutes, and authorizes the water users, by resolution in annual meeting adopted, to—

(*a*) Budget the estimated expense of the district for the ensuing year;

(*b*) Fix a date, different than that fixed by section 5615–A, Idaho Compiled Statutes, at which charges shall mature; and

(*c*) Provide for nondelivery of water to delinquents.

This legislation will prove to be an important factor in the enhancement of irrigation district finances.

Hereafter power projects upon Idaho streams will be granted a permit by the State commissioner of reclamation only after an opportunity for protest has been had.

Chapter 212 of the 1929 Idaho Session Laws lays down the procedure necessary to make a power filing and provides that within 10 days after the application is made the commissioner shall give notice of the pertinent facts of the proposed filing and that protests thereto may be filed within 60 days thereafter. If protests are filed, an informal hearing shall be held by the commissioner, and an appeal may be taken from his decision to the district court within 60 days from the date of the ruling. On appeal, the procedure is that of the State courts.—*B. E. Stoutemyer, District Counsel.*

Penalty and Interest on Taxes

In the States of Montana, North Dakota, and Arizona difficulty has been encountered by irrigation districts in having the county treasurers pay over to the irrigation districts the penalties and interest on taxes levied by the districts. In North Dakota and Montana this difficulty was also encountered by municipalities and school districts. For many years this dispute continued without any cases reaching the Supreme Court of the respective States, it being the claim of the county treasurer and the county commissioners that the county was required to do work and furnish books and supplies without compensation, unless it retained the penalty and interest on delinquent district taxes.

In State ex rel. City of Wolf Point *v.* McFarlan, County Treasurer, 252 Pac. 805, the Supreme Court of Montana decided that the county treasurer, who is the authorized agent for collecting special improvement taxes in municipalities, must collect all special assessments and taxes in the same manner and at the same time as said taxes for general, municipal, and administrative purposes are collected by him. Admittedly, he collected the taxes, penalty, and interest, and having done so, it was his duty to pay them over to the city treasurer.

The Supreme Court of North Dakota, in the case of Rosedale School District No. 5 *v.* Towner County, 215 N. W. 212, decided that the taxes with the penalty and interest must be turned over to the school district as the penalty and interest follow the tax.

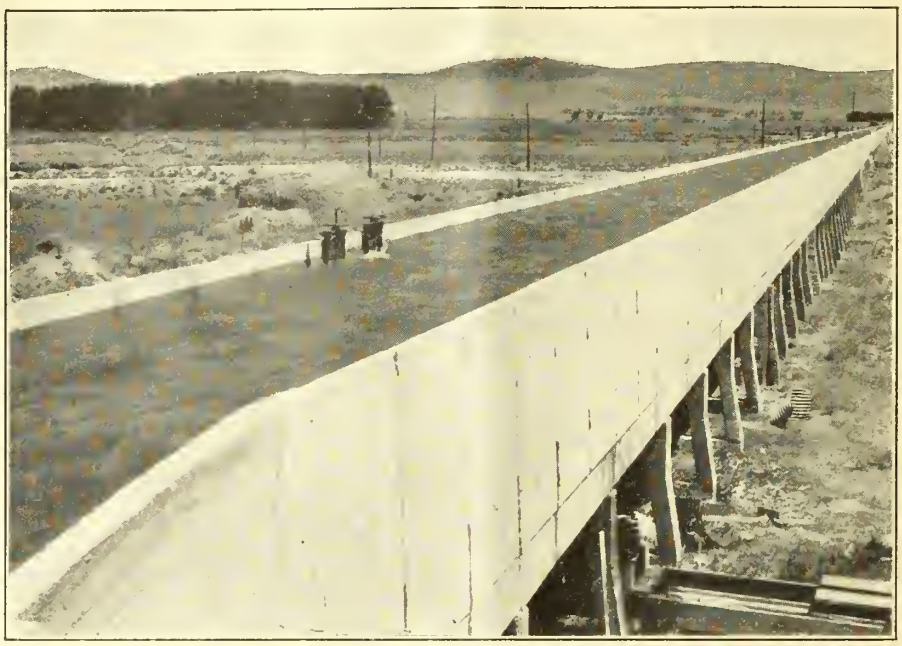
In the case of Maricopa County Municipal Conservation District No. 1 *v.* Ward, 281 Pac. 465, the Supreme Court of Arizona held that it is obvious the defendant, who was the county treasurer, came into possession of the conservation district taxes, the delinquent as well as those paid before delinquency, from the fact that he is treasurer of the district. He accounted to the district for such taxes, and also, as the complaint states, for the interest on taxes paid after same became due. He can not, as ex officio treasurer of the conservation district, surrender any of its rights to himself, as treasurer of the county of Maricopa. If he pays over to the county any of the taxes or interest or penalties due or becoming due to the plaintiff district, it must be because the legislature has expressly and directly authorized him to do so. The following is well supported by the authorities: Unless otherwise directed, interest, penalties, and costs collected on delinquent taxes follow the taxes and go to the State, county, or city, according as the one or the other is entitled to the tax itself, and in such cases where two or more of these are interested in the tax, such interest and penalties should be apportioned among them in the ratio of their respective shares of the tax.—*E. E. Roddis, District Counsel.*

Reclamation Organization Activities and Project Visitors

ON January 24 Doctor Mead addressed a joint session in New York of civil and mechanical engineers under the auspices of the American Society of Mechanical Engineers, his subject dealing with the results of Federal reclamation.

After the conference in Denver, relative to Uncompahgre project matters, to which reference is made elsewhere in this issue, Doctor Mead and Mr. Sanford proceeded to Casper, Wyo., to confer on February 27 with the Governor of Wyoming, members of the Casper Chamber of Commerce, State officials, and others interested in the Casper-Alcova project. Senator W. B. Kendrick also went from Washington to attend this conference.

Walker R. Young, construction engineer on the Kittitas division of the Yakima project, Washington, represented Doctor Mead at the first meeting of the Federal-State Water Resources Commission, California, held in Oakland, Calif., January 13. Membership of the commission is as follows: Federal representatives, Lieut. Col. Thomas Robbins, United States Army; Frank Bonner, Dr. Elwood Mead; State representatives, B. B. Meek, W. J. Carr, Warren Olney, jr., Edward Hyatt, William Durbrow, B. A. Etcheverry, Alfred Harrell, W. B. Matthews, and F. E. Weymouth. George C. Pardee, ex-Governor of California, is chairman of the commission.



Concrete flume, Klamath Project, Oreg.-Calif.

Judge E. B. McClintock, of El Paso County, Tex., was in Denver during the month on business concerning the construction of the Riverside Canal in conjunction with levees by El Paso County for flood protection of lands along the Rio Grande.

Superintendent L. J. Foster, of the Uncompahgre project, has returned to his headquarters at Montrose after a month's illness in a Denver hospital.

E. E. Roddis, for many years district counsel, with headquarters at Billings, Mont., has been transferred to the Washington office. This transfer resulted from a discontinuance of much of the legal work in the northern division, to which he was assigned, many of the projects having been taken over by the water users.

Robert C. Walber, formerly chief clerk on the Belle Fourche project and later accountant in the Washington office, has accepted appointment to a position in the United States Engineer Depot, War Department, Sayler Park, Cincinnati, Ohio. Mr. Walber will be missed by his fellow employees because of his genial personality.

John E. Deno, formerly employed as senior clerk on the Uncompahgre project, has been transferred to the Washington office, effective January 24, to handle the repayment accounting work which has been greatly increased by the transfer of certain projects to the water users for operation and maintenance.

During the month D. W. Aupperle, of Grand Junction, Colo., was sent to Washington, D. C., by the State Cooperative Organization to appear at the conference of the Federal Farm Board for the establishing of cooperative marketing for beans on the Grand Valley project.

American Falls Dam, Minidoka Project, Idaho

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

HON. RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Engineer

S. O. Harper, General Superintendent of Construction; J. L. Savage, Chief Designing Engineer; E. B. Debler, Hydrographic Engineer; L. N. McClellan, Electrical Engineer; C. M. Day, Mechanical Engineer; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Project	Office	Superintendent	Chief clerk	Fiscal agent	District counsel	
					Name	Office
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Mitchell, Nebr.
Boise [1]	Boise, Idaho	R. J. Newell	W. L. Vernon		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Grand Valley	Grand Junction, Colo	J. C. Page	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Huntley [2]	Ballantine, Mont					
King Hill [3]	King Hill, Idaho					
Klamath	Klamath Falls, Oreg	B. E. Hayden	N. G. Wheeler	Joseph C. Avery	R. J. Coffey	Berkeley, Calif.
Lower Yellowstone	Savage, Mont	H. A. Parker	E. R. Scheppelmann	E. R. Scheppelmann		Billings, Mont.
Milk River	Malta, Mont	H. H. Johnson	E. E. Chabot	E. E. Chabot		Do.
Minidoka [4]	Burley, Idaho	E. B. Darlington	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Newlands [5]	Fallon, Nev				R. J. Coffey	Berkeley, Calif.
North Platte [6]	Guernsey, Wyo	H. C. Stetson		Arthur T. Stimpfig	Wm. J. Burke	Mitchell, Nebr.
Okanogan [7]	Okanogan, Wash				B. E. Stoutemyer	Portland, Oreg.
Orland	Orland, Calif	R. C. E. Weber	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	H. N. Bickel	Frank P. Greene	B. E. Stoutemyer	Portland, Oreg.
Rio Grande	El Paso, Tex	L. R. Fiock	Henry H. Berryhill	Henry H. Berryhill	H. J. S. Devries	El Paso, Tex.
Riverton	Riverton, Wyo	H. D. Comstock	R. B. Smith	Erle W. Shepard	Wm. J. Burke	Mitchell, Nebr.
Salt Lake Basin	Salt Lake City, Utah					
Salt River [8]	Phoenix, Ariz					
Shoshone [9]	Powell, Wyo	L. H. Mitchell	W. F. Sha			Billings, Mont.
Strawberry Valley [10]	Payson, Utah					
Sun River [11]	Fairfield, Mont	A. W. Walker	H. W. Johnson	H. W. Johnson		Do.
Umatilla [12]	Irrigon, Oreg Hermiston, Oreg					
Uncompahgre	Montrose, Colo	L. J. Foster	G. H. Bolt	F. D. Helm	J. R. Alexander	Montrose, Colo.
Vale	Vale, Oreg	H. W. Bashore	C. M. Voyen	C. M. Voyen	B. E. Stoutemyer	Portland, Oreg.
Yakima	Yakima, Wash	P. J. Preston	R. K. Cunningham	C. J. Ralston	Do	Do.
Yuma	Yuma, Ariz	R. M. Priest	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.

Large Construction Work

Salt Lake Basin, Echo Dam.	Coalville, Utah	F. F. Smith [13]	C. F. Williams		J. R. Alexander	Montrose, Colo.
Kittitas	Ellensburg, Wash	Walker R. Young [13]	E. R. Mills		B. E. Stoutemyer	Portland, Oreg.
Sun River, main canal construction.	Fairfield, Mont	A. W. Walker [13]			E. E. Roddis	Billings, Mont.
Boise project, Deadwood Dam.	Cascade, Idaho		C. B. Funk		B. E. Stoutemyer	Portland, Oreg.

[1] Operation of Arrowrock Division assumed by Nampa-Meridian, Black Canyon, Boise-Kuna, Wilder, Big Bend, and New York Irrigation Districts on Apr. 1, 1926.
[2] Operation of project assumed by Huntley Project Irrigation District on Dec. 31, 1927. E. E. Lewis, manager.
[3] Operation of project assumed by King Hill Irrigation District Mar. 1, 1926. F. L. Kinkade, manager.
[4] Operation of South Side Pumping Division assumed by Burley Irrigation District on Apr. 1, 1926, and of Gravity Division by Minidoka Irrigation District on Dec. 2, 1916.
[5] Operation of project assumed by Truckee-Carson Irrigation District on Dec. 31, 1926. D. S. Stuver, manager.
[6] Operation of Interstate Division assumed by Pathfinder Irrigation District on July 1, 1926, Fort Laramie Division by Goshen Irrigation District and Gering and Fort Laramie Irrigation District on Dec. 31, 1926, and Northport Division by Northport Irrigation District on Dec. 31, 1926.
[7] Operation of project assumed by Okanogan Irrigation District on Dec. 31, 1928. Joe C. Iddings, manager.
[8] Operation of project assumed by Salt River Valley Water Users' Association on Nov. 1, 1917. C. C. Cragin, general superintendent and chief engineer.
[9] Operation of Garland Division assumed by Shoshone Irrigation District on Dec. 31, 1926, and of Frannie Division by Deaver Irrigation District on Jan. 1, 1930.
[10] Operation of project assumed by Strawberry Water Users' Association on Dec. 1, 1926. Lee R. Taylor, manager.
[11] Operation of Fort Shaw Division assumed by Fort Shaw Irrigation District on Dec. 31, 1926.
[12] Operation of West Division assumed by West Extension Irrigation District on July 1, 1926. A. C. Houghton, manager; and East Division by Hermiston Irrigation District informally on July 1, 1926, and formally, by contract, on Dec. 31, 1926. Enos D. Martin, manager.
[13] Construction engineer.

Important Investigations in Progress

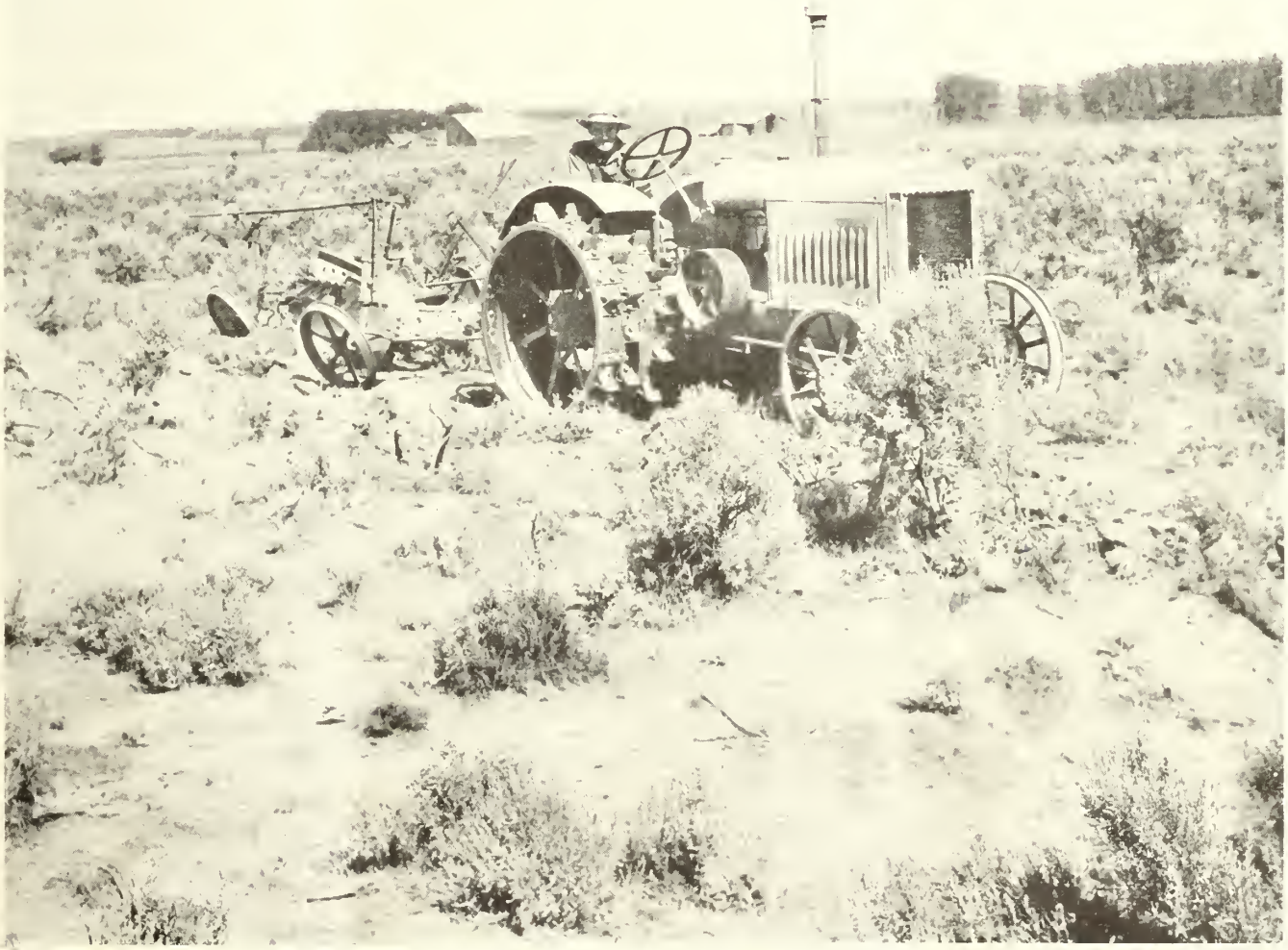
Project	Office	In charge of—	Cooperative agency
All-American Canal investigation	Yuma, Ariz	H. J. Gault	
Gila River cooperative investigations	Safford, Ariz	Orrin C. Smith	Arizona and New Mexico.
Boulder Canyon Reservoir investigations	Las Vegas, Nev	W. R. Young	
Red Bluff (Pecos River) investigations	Washington, D. C	C. A. Bissell	
Salt Lake Basin investigations	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga projects	Casper, Wyo	J. R. Iakisch	

BOISE RIVER DIVERSION DAM AND POWER HOUSE, BOISE PROJECT, IDAHO

U. S. GOVERNMENT PRINTING OFFICE: 1930

NEW RECLAMATION ERA

VOL. 21 APRIL, 1930 NO. 4



TRACTOR DISK PLOW WORKING IN RAW SAGEBRUSH LAND ON THE KITTITAS DIVISION, YAKIMA PROJECT, WASH.

FEDERAL RECLAMATION

WHAT the reclamation projects are contributing to the wealth of the country is a most important index of the worth of the reclamation policy, but the financial returns, the willingness and ability of the people under these projects to pay back the money invested by the Government, are equally important as indicating the fidelity with which the reclamation act is being administered. This showing of payments will equal that of private irrigation projects and also that of banks which provide credit for the farmers of this country. Considering the uncertainties and vicissitudes that go with new development, it is a record in which the whole country can take pride and satisfaction.

ELWOOD MEAD,
Commissioner, Bureau of Reclamation.

NEW RECLAMATION ERA

Issued monthly by the Bureau of Reclamation, Department of the Interior, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 April, 1930 No. 4

Interesting High Lights on the Federal Reclamation Projects

THE use of phosphorus as a fertilizer has attracted the attention of nearly every farmer on the Shoshone project, and a representative of the Great Western Sugar Co. believes that approximately 12 cars of phosphorus will be shipped in for use by the farmers in growing sugar beets. In response to requests from nonbeet growers arrangements have also been made to ship in up to 3 tons of this fertilizer for the use of check plot work on crops other than beets.

A CONFERENCE of the several agencies interested in the development of Montana was held recently in Helena, at which emphasis was placed upon the improvement of the irrigation resources of the State. Plans were formulated for a permanent organization which will deal particularly with a more thorough advertising campaign in an effort to encourage more rapid settlement.

EDWARD FAAST, project water user, was crowned potato king of Montrose County for 1929 at a banquet held on February 21 at Olathe, Uncompahgre project. Five Montrose County farmers, of whom three are project water users, made the 600-bushel club out of a total of nine farmers in the State of Colorado who made the club during the 1929 season.

ON the Belle Fourche project farm rents as a rule are higher and tenants are moving about seeking farms at less cost. Places are well taken up for 1930, although more farmers are needed to make the unoccupied land produce intensively. Forty-three more farms were operated in 1929 than in the previous year.

FIVE farms were sold during the month to local residents on the Carlsbad project, mostly to tenants of the previous year.

JOHN HAYS, who owns a 1,500-acre ranch just north of the diversion dam on the Riverton project, produced last year 60 bushels of barley to the acre on raw sagebrush land. This ground was plowed the latter part of May, 1928, and allowed to lie fallow until the spring of 1929. Seeding on similar soil that was plowed the year it was planted made a yield of 23 bushels per acre.

AT the Annual Parents' Boy Scouts Dinner held at Orland, Orland project, in February, commemorating the Twentieth Anniversary of Boy Scouting in America, merit badge awards were made to 14 Orland boys.

A RECENT report from the Orland project states that the Glenn County Board of Supervisors has received bids for the construction of a memorial hall in Orland, the building site having been selected and purchased. The movement was started by the local post of the American Legion.

IT is estimated that the total shipments of potatoes from the Minidoka project for the past season will be approximately 3,000 cars, of which about 600 cars are still on hand. Of this number, two-thirds are on the south side.

DURING the past month there was renewed activity in the opening of new subdivisions adjacent to the city of Yuma on the Yuma project. These subdivisions contain lots varying in size from 58 by 150 feet to lots containing from 2 to 5 acres. Some are well improved and have pecans or dates planted on them, while others are for residential purposes only. New homes and buildings are noted on these subdivisions, in addition to which several new ranch homes in the Valley division have recently been constructed or are under construction.

A PROMINENT seed house has a representative on the Sun River project who is signing up acreage for the 1930 season, the price offered being 20 per cent above the 1929 prices. The Milwaukee Railroad has suggested the raising of flax on part of the land previously devoted to wheat.

ON THE Lower Yellowstone project reports indicate an increased activity in settlement, 18 families from Nebraska and Colorado having arrived on the project with their household goods and equipment during the month and settled on farms of their own selection. A large number of the new arrivals, all of whom are from irrigated sections, have bought their farms and give every indication of being substantial farmers.

THE Western South Dakota Lamb Feeders Association was organized at Fruitdale during the month for the purpose of cooperating with other western sheep organizations to secure orderly marketing and better finishing of lambs. This organization has members throughout the project.

THE University of Wisconsin has purchased 600 pounds of Grimm alfalfa seed from S. H. Bober, seedsman of Newell, Belle Fourche project, because of the general high quality of the seed grown in that section.

FOUR farms were sold on the Gravity division of the Minidoka project during February. Two 40-acre farms northeast of Rupert were disposed of for $5,000 each, and another 40-acre tract 4 miles southeast of Rupert brought $3,000. A farm of 55 acres near Heyburn was sold for $5,500.

THE Farmers' Cotton Oil Mill at Las Cruces, Rio Grande project, has been sold to the Cotton Industries Co. for $86,500.

Irrigation Problems of Montana

BY H. H. JOHNSON, SUPERINTENDENT MILK RIVER PROJECT

IT has been said that Montana through her liberal endowment of natural resources could if necessary be almost self-sustaining. No doubt the two greatest natural assets of the State are its extensive area of fertile land and its abundant water supply which serves the dual purpose of furnishing cheap power for domestic and industrial use and the necessary moisture to make productive its arid or semiarid regions.

AGRICULTURAL RESOURCES OF MONTANA

The farming land alone of Montana roughly comprises an area larger than the entire State of Iowa. During the past 30 years the revenue from this great area, not inclusive of the industrial revenue which is derived from agricultural sources, has increased from $9,000,000 to over $100,000,000 per annum, and at present accounts for approximately one-third of the entire wealth produced within the State. Of this total tillable area, about 5,500,000 acres are considered to be capable of irrigation, with probably not over 2,000,000 acres under constructed irrigation works and a great portion of this unfarmed. Yet it is estimated that from this relatively small area around $30,000,000 worth of crops were produced during 1929. Reliable data from the four major Federal projects indicate that about 104,000 acres actually irrigated last season yielded a gross crop revenue of almost $3,000,000. Upon these projects, however, only about 40 per cent of the actual irrigable area was farmed, a spread which is no doubt fairly representative of the condition existing upon most of the large projects located in the central and northern portions of the State. These data are presented merely to show the relationship of irrigation to the general agriculture of Montana, and the benefits which might be derived from the full utilization of this combination of the State's two greatest resources.

Before it will be possible, however, to enjoy the maximum revenue from these lands and from the great amount of capital which has been invested to make them productive, there are many problems of a serious nature to overcome. These problems have claimed the consideration of the foremost agricultural economists of the nation ever since the World War. In some localities a partial solution has been reached through legislation and the organized effort of agencies which are vitally interested in irrigation development. In the newer irrigated sections of Montana, which are still virtually pioneering in this field, much remains to be accomplished.

SCOPE OF IRRIGATION PROBLEMS

It is not within the scope of this discussion to attempt to touch upon those features of a general nature, which, of course, have a vital effect upon all agriculture, but rather limit it to the consideration of such things as relate specifically to irrigation development. Even in this relatively small field a wide diversity of problems exists over this State, 600 miles in length by almost 300 in width, with its great range in climatic and general agricultural conditions. Irrigation has been practiced in the Billings district, the Gallatin Valley, and other prosperous and well-developed sections of the State for 40 years or more. While these sections no doubt still have problems, they are of an entirely different nature from those which are particularly vital to the development of the comparatively new projects of central and northern Montana. Such problems were disposed of by these older districts many years ago, but they are, as a rule, infinitely more difficult of solution to-day than at that time. It is to these new projects especially that the efforts of those who are concerned in the development of the State's irrigation resources must now be directed.

AGRICULTURAL PROBLEMS

When irrigation development on a large scale was first undertaken it was considered as strictly an engineering activity. This was correct, as great dams had to be built, difficult canal constuction undertaken, and many problems of a purely technical nature solved. The result was that the large projects generally are now provided with irrigation works of a substantial and enduring character, which should justify and encourage the full development of the lands supplied thereby with water. Experience has shown, not only in Montana but in practically all of the arid States, that, even where the dams were of monumental proportions and where the canal systems embodied the finest in engineering skill and practice, if the lands they supplied with water could not be made to produce profitable crops which could pay irrigation costs and induce permanent colonization by contented home builders, the projects were a social and economic failure. Dr. John A. Widtsoe has said:

> Successful irrigation farming is the joint product of the engineer and the farmer. To the engineer is given the heavy and responsible task of constructing properly a permanent system of dams and canals from which water may be drawn, to the farmer belongs the apparently humble but unending and difficult task of using the water in the best manner for crop production. Both workers are essential for success; but the work of the farmer determines the permanence and extent of agriculture under irrigation.

The principal engineering problems in Montana have been solved for the time being at least, but those of a human and economic nature still deserve the attention of all individuals and agencies interested in the welfare and prosperity of this great State.

COST OF IRRIGATION SYSTEMS

For several years past the efforts of a great portion of the organization of the Bureau of Reclamation in connection with the projects already constructed have been confined to a study of the agricultural and economic phases of irrigation development. Out of such studies has grown much adjustment legislation which is designed to mitigate the financial problems resulting from the necessary obligation of construction cost repayment. The repayment period has been extended from the original 10 years to a maximum of 40 years, without interest. Definite losses to the reclamation fund have been assumed in cases where it was evident that the lands were not capable of paying the irrigation costs. Areas of nonproductive land have been eliminated from the projects, involving further losses. Other areas of questionable agricultural value have been temporarily suspended from payment. Additional drainage and construction programs have been authorized. Everything possible has been done consistent with the reclamation law and good business to promote the rapid colonization and development of the more backward projects. As a result of these things practically all of the Federal projects are now on a fair road to success, which will ultimately justify their construction. The adjustment of this great problem upon the several projects of the State financed by private capital, however, still remains to be accomplished, and is one which is worthy of serious consideration.

Even though the great obstacle of construction cost repayments can be satisfactorily adjusted, yet the human problem still remains. The greatest possible revenue must be derived from the lands already farmed if even low irrigation charges are to be paid. The idle or partially utilized lands must be colonized, improved, and brought into a high state of productivity in order that they also may be able to pay their share of costs, rather than leave them as a burden to be carried by other lands.

LAND AND WATER UTILIZED

The primary requisites for successful farming under irrigation are the proper utilization of land and water. The production of wheat or native hay in large tracts, as a general rule, was long ago found to be an unprofitable practice. Yet the production of such crops under dry farming methods is at the present time the principal source of Montana's agricultural wealth.

The trend in general farming practice of the State as a result of improved tillage and machinized methods is toward larger individual areas and quantity production which will allow profitable returns even with a small net acre profit. On the other hand, the necessity for successful irrigation development is the highest possible acre revenue from the smallest practicable size unit. Such development tends toward increasing rather than diminishing the agricultural population and enhancing the social and economic welfare of the communities and the State. Many Montana counties are now adopting long-time agricultural programs, which involve the merging of the submarginal lands into extensive grazing areas and the smaller dry land diversified farms into larger units from which living incomes are possible. Such programs do not point to agricultural depopulation, but rather encourage the proper utilization of the dry lands and the development of the irrigated sections by settlers who are familiar with the State and usually have the stock and equipment necessary to accomplish the improvement of an irrigated farm.

Naturally upon the irrigated projects crop limitations on account of moisture are not imposed. The higher-priced cash crops suitable to this latitude and adapted particularly to irrigated agriculture, which contribute also to the industrial wealth of the State, can be profitably produced in most localities. Irrigation also has a very definite relationship to stock raising, the second greatest industry within the State. To obtain maximum results from such practices requires careful farm management, improved tillage methods, and planned rotation of crops which tend to upbuild rather than impoverish soil fertility. Yet the increased and stabilized returns which result from this type of agriculture are generally not given proper consideration. In many localities it is difficult for the older residents to abandon the so-called more attractive pursuit of wheat raising for the practice of general farming under irrigation, which involves an additional outlay in capital and labor. These people are not irrigation-minded and can not readily adapt themselves to intensive irrigated agriculture. Often little use is made of the irrigation systems provided at a great cost. Timely and adequate irrigation is not practiced, the general tendency being to wait for natural rainfall to do the work. Insufficient care is given to the preparation of fields for irrigation and to the methods used in the application of water. The result is that in such cases the benefits derived from the use of water are only partial if not negative; hence irrigation is discredited and often ridiculed. Yet the present residents upon our projects are the nucleus for further development. If they do not have faith in their country, if they are not able to develop the potential possibilities of the projects, if they can not show evidence of success and contentment, it will be difficult to attract new settlers.

EDUCATIONAL WORK ESSENTIAL

The great need in accomplishing the rapid development of the lands now farmed is for specialized educational work. The extension service of this State and its personnel ranks with the best of the Nation. It would be difficult to find men more capable or energetic than the county agents of Montana. Much has been accomplished by this excellent agency in the development of Montana's agriculture since the days of "The Pain in the Northwest." The farmers as a rule are of a high type and realize the value of the advice and assistance which is being rendered by this institution and are profiting thereby. Yet it is impossible for one county agent to cover thoroughly a territory as large or larger than the State of Connecticut, as several of our northern counties are, and give much attention to details, which are essential to intensive agricultural development. Everything possible is being accomplished with the limited funds available for this purpose, yet it is believed that the activities of this agency might well be extended to the ultimate benefit of the State and particularly its irrigated sections. During the past year it has been possible through special appropriation to place associate agents upon two of our Federal projects which were in urgent need of agricultural advice and assistance whose efforts are confined entirely to the relatively small irrigated areas. It was possible for these men to establish a personal contact and render personal service to individuals which has inspired confidence, enlisted cooperation, and been productive of results in development along the lines heretofore unattainable. Work of this nature is being done upon other projects of the State and is believed to be of vital importance upon the somewhat backward projects. In this manner the agricultural standards will be raised and a foundation established which will promote rapid colonization and development.

COLONIZATION DIFFICULTIES

The rapid colonization of the partially developed irrigated areas is the present major problem. Desirable settlers are not easy to secure; the trend of population is still away from the farms. The greater percentage of those people seeking a new location do not have the capital necessary to successfully develop an irrigated farm. This is especially true if the land must be purchased and paid for in a comparatively short period. The necessary permanent colonization which is so essential to both the economic and social welfare of these sections can not be accomplished through the more or less itinerant class. Such people are here to-day and gone tomorrow; they usually possess no capital, can establish no credit, and are a liability rather than an asset to any community. To the person who has sufficient capital to purchase, equip, and improve an irrigated farm some commercial or industrial venture is usually more attractive from an investment standpoint. We must depend for new settlers principally upon the younger people with little money, but agriculturally inclined, who desire to establish a comfortable farm home and gradually improve their financial condition by hard labor, and to attract them a real opportunity must be offered. How can such settlers be obtained in Montana?

The law which has been in force since 1924 relative to the selection of settlers upon Federal projects and the regulations promulgated thereunder provide that:

> Applicants must possess good health and vigor and have had at least two years actual experience in farm work and farm practice. The applicant must have at least $2,000 in money, free of liability, or the equivalent thereof in livestock, farming equipment, or other assets deemed by the examining board to be as useful to the said applicant as money.

The selective settlement idea was once considered visionary and unworkable. Yet several reclamation projects of the Northwest which do not offer agricultural or social advantages any better than those of many Montana localities are being rapidly and successfully populated, under a strict interpretation of this law by the boards charged with its administration. Upon these projects many applicants necessarily are refused, but those selected have a promise of being able to successfully carry on farm development, and will ultimately contribute to the wealth and prosperity of the community and the State within which the projects are located.

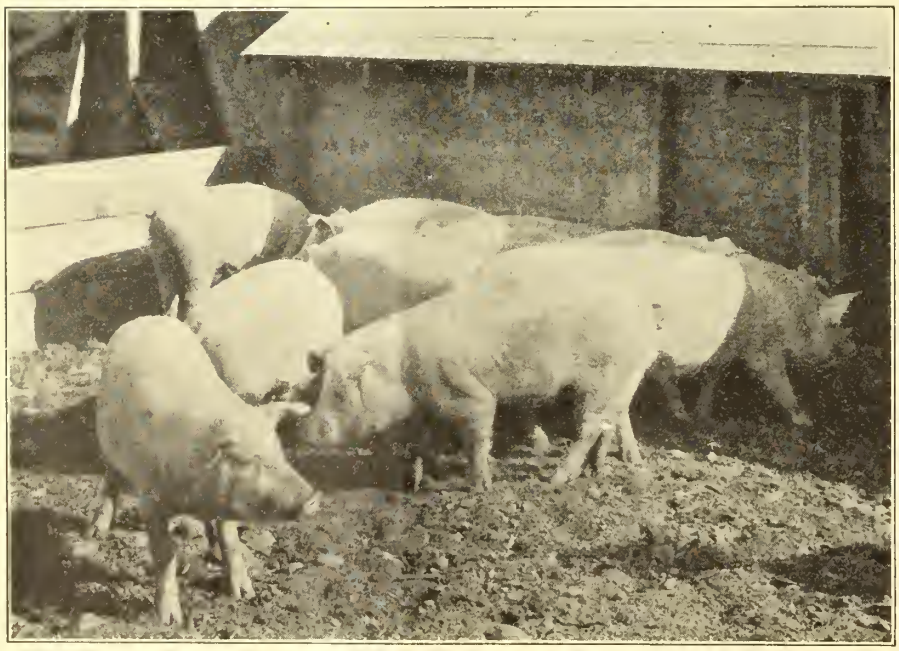
PRIVATE LAND SALES

Of course one of the great inducements offered by such projects is free land. Upon most of our Montana projects, however, the land has already passed from Federal control and therefore is not subject to its laws in this particular. How can the lands, especially the large holdings, which are now in private

ownership, but undeveloped, be made as attractive to a new settler as these small, free public-land farm units? Although the illusion of high speculative values in agricultural lands, especially those under irrigation, which was induced by war-time inflation, has almost vanished, yet the hope still remains, particularly among nonresident owners in some localities, that a general improvement in agricultural conditions may allow the partial recovery of losses in past land speculation. There is not yet a great desire by the owners of large tracts in a few localities to divide their holdings into the more advantageous smaller units and provide the necessary improvements which will attract substantial settlers with limited capital. In the meantime, areas which should be highly productive remain unimproved or with only a small portion of their potential productive power realized. In many such cases delinquent taxes have accrued which exceed the actual land value. Even though such lands are a liability to the owners they are often reluctant to offer them for sale at prices and payment terms which new settlers with limited means can expect to meet and at the same time pay the development costs necessary to make this type of farming profitable. The solution of this problem requires the cooperation of individual land owners, and perhaps the sacrifice of immediate financial benefit for the general improvement of economic conditions and probable ultimate gain.

Here again legislation has taken a hand toward the solution of this problem where it exists upon several projects now under construction. Before any new project can be undertaken which contains private land holdings in excess of 160 acres, such tracts must be appraised by disinterested boards, under departmental regulations, in accordance with their actual bona fide value without reference to irrigation, and sales are controlled by this valuation. This principle has been further extended upon some of the older projects by not only establishing a fair price for the land, but also by providing for long periods of payment carrying reasonable interest rates, which is often the most important feature of purchase. The result has been that a considerable area of idle lands upon such projects has been placed in the hands of responsible settlers and is now on the way to successful development.

On one or two private projects of the State the plan of farm purchase by crop payments has been in operation for about three years by agencies who own large bodies of land and have an interest in the financial status of the districts. Under this plan the settler agrees to pay the landowner a certain share of the proceeds from his crop each year to apply on the purchase price of the land and the interest on deferred payments. Out of his share of the crop the purchaser pays the taxes and operation and maintenance charges. In this manner the land is made to pay for itself from the crops produced without impairment to the settler's original capital. It would seem that individual landowners on other projects having large holdings or acreage not now being farmed under irrigation could well afford to follow the same plan, should opportunity arise, with material benefit to themselves.



Chester White pigs on the Kittitas division, Yakima project, Washington

FINANCE OF SETTLERS

Even with cheap lands available the problem still remains of how to fill the gap between the several thousand dollars required for the complete development of an irrigated farm and the few hundred which the usual settler of to-day possesses. The Federal land banks can not loan on unimproved farm lands, especially those with a prior lien for the payment of irrigation costs. Finance through local banks or credit institutions is impracticable at the high interest rates and short maturities which must be demanded. The intermediate credit facilities of the Federal land bank and the Agricultural Credit Corporation are of great assistance in a specialized way, but for general development purposes there is no source of credit. There has been an effort during the past three years to provide for financial aid in the development of Federal projects through legislation which would permit well secured and supervised loans of long maturity and at low interest rates from the reclamation fund. This movement, although unsuccessful to date, has not yet been abandoned, and its realization will be of material benefit in the rapid development of Montana's larger projects.

Much progress is now being made in the development of two relatively small irrigation districts of the State through the medium of financial aid to settlers by large business organizations either possessing or interested in the construction bonds of the districts. In both of these cases the principles involved in the proposed Federal legislation have been put into actual practice successfully. This financial aid not only promotes rapid settlement, but also facilitates to a great extent the selection of settlers. The strict personal supervision of funds by highly capable men, both in a business and agricultural way allows the direction of development by them along lines which point toward permament, stabilized, and ultimately prosperous communities.

INTEREST OF STATE

The Federal Government through the Bureau of Reclamation has spent in the neighborhood of $25,000,000 in the development of Montana's irrigation resources. This has been done without the expectation of direct financial gain, but only as a means of bringing about the most rapid development possible of the agricultural resources of the State and Nation. Many times this amount will be yielded to the wealth of the State before that great sum is returned to the reclamation fund. An

equal outlay of private capital is probably represented in the construction of other large irrigation projects of the State. The railroads have spent many thousands of dollars in colonizing these projects and assisting in general agricultural improvement in order that their revenue might be increased. Large business interests have considered it good policy to put additional capital into the agricultural development of projects to enhance the value of their securities and guarantee a return of the original investment. All of these activities will result in the increased production of wealth within the State without the direct expenditure of any capital by the State itself. It would seem that the cooperation of the State in the promotion of the more rapid development of this great resource which can be made to contribute so liberally to its growth and prosperity is not only warranted but well within the realms of sound business.

COMMUNITY COOPERATION

The cooperation which is so urgently needed is by no means confined entirely to the State. The civic organizations, the press, and every individual interested in the improvement of the several communities of the State have their places in the picture. If it is impossible to enlist the active and energetic support of the communities in programs which have to do with their general welfare, accomplishment is very difficult. It is absolutely necessary that boosters be had for the community and its interests if new people are to be attracted thereto.

PRESS COOPERATION

Is the usual indirect press advertisement of northern Montana particularly of the nature which will encourage new people to come to that locality? Havre has long been advertised as the coldest spot in the United States, yet an exceptionally cold night still furnishes material for a front-page story. Perhaps it might not be news, but it would be interesting and enlightening to people who are looking toward Montana in search of a future home to know that our long summer days and delightful autumns are particularly advantageous to the growth, maturity, and harvest of profitable crops. We who have lived in northern Montana do not find its winters particularly difficult to endure. Perhaps their invigorating character accounts to some extent for our comparative freedom from serious epidemics of contagious diseases. Certainly such things are worthy of advertisement and offset to a great extent the little discomfort we may suffer from the very few days of extreme temperatures each winter. This is the sort of news and advertising other States play up with the most beneficial results. The thing Montana has been up against in the past has been the advertising of possibly 20 days of cold weather in that season when cold weather is natural, while little if any attention has been given to the 345 days of good weather. Very few localities are entirely free from climatic disadvantages. Perhaps those of northern Montana are no worse than those of the Imperial Valley. Certain activities of the past winter which gained wide publicity have branded northern Montana as an Arctic region of great wide open spaces with habitations separated by days' journeys over trackless snow-swept plains. Such things are inimical to the agricultural interests of the State, and every possible effort should be exerted to counteract the effect of such publicity with the brighter picture of Montana as it is under the more favorable conditions which exist during the greater portions of the year. This is a job in which our newspapers, daily and weekly, and newspaper correspondents can, if they will, render a distinct and valuable service to the State.

INDIVIDUAL COOPERATION

It is essential for the stabilization of conditions that we should be not only able to attract but to keep desirable settlers. The proper development of our irrigation projects is not only an agricultural but also a social development. In this matter our present residents can exert a great influence. I quote the statement made by a new settler to one who is very active in Montana settlements and recently published as an editorial in one of the principal papers of the State:

> I have lived in Montana two years. I did not mind the fact that my nearest neighbor was a mile away, or that I did not have as large a house as that in which I used to live. I like the Montana climate—its wonderful sunshine and its invigorating air. But I can not stand the aloofness of Montana people. Before I came I was told you people were warm-hearted, generous, democratic. But during my stay here no Montana woman ever crossed my threshold. I have been invited to no one's home. We may never be able to make the money back where we came from that we could make if we stayed here, but at least my children and I will have a friendly contact with the community.

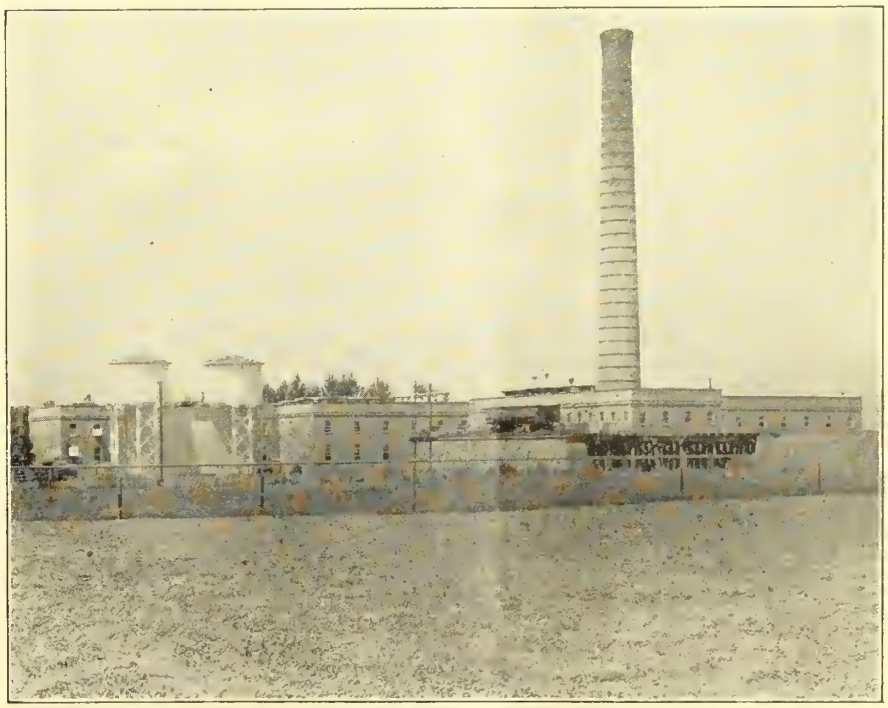
This statement admirably illustrates the point, and the editorial further says,

> The family which is happily and satisfactorily located in Montana can do more toward getting others to come than will result from general advertising and publicity done in the name of the State and its various communities.
>
> It is to the interest of every individual and organization concerned in the social welfare of the State to see that its reputation for friendliness, established in the early days, remains unsullied.

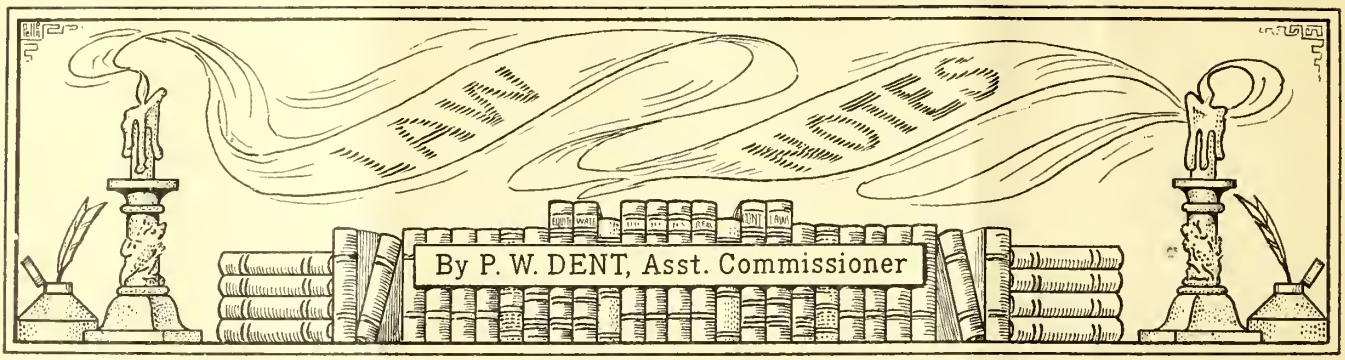
FEDERAL RECLAMATION POLICY

At the present time there is a fairly well organized movement among certain agricultural and other interests of the East and Middle West directed against the Federal reclamation policy. This movement is fostered to a great extent by mis-

(Continued on p. 78)



Plant of the Carnation Milk Co. near Nampa, Idaho



Contracts—Alleged Mistakes in Bids

PARAGRAPH 14 of the standard Government instructions to bidders (construction and supplies), standard Form No. 22, provides:

14. *Withdrawal of bids.*—Bids may be withdrawn on written or telegraphic request received from bidders prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

While paragraph 19 of the same form provides:

19.—*Errors in bid.*—Bidders or their authorized agents are expected to examine the maps, drawings, specifications, circulars, schedule, and all other instructions pertaining to the work, which will be open to their inspection. Failure to do so will be at the bidder's own risk, and he can not secure relief on the plea of error in the bid. In case of error in the extension of prices the unit price will govern.

There have been quite a few cases where bidders, after the time fixed for opening, have alleged a mistake in their bid and have requested relief on the plea of error. Some of the more recent decisions of the Comptroller General with regard to this matter will be referred to.

February 2, 1929 (8 Comp. Gen., 397) the Comptroller General considered a case the main facts of which may be summarized as follows:

The War Department issued circular advertisement April 30, 1928, for two cast-iron discharge elbows and manhole covers. The date of opening bids was May 10, 1928. The low bid was submitted by the United Iron Works, which offered to furnish the two elbows and two covers at $245 each. The contracting officer had had wide experience in these matters and suspected that an error had been made, as the price was unusually low, but the conjecture could have been verified only by asking the bidder to check his figures. The needs of the United States, however, would not permit of this delay. The order was awarded to the United Iron Works on May 14, 1928. Three days later the United Iron Works wrote the War Depatrment as follows:

In going over our estimate, we find that we have made a mistake, and could not execute same without a loss. Under the circumstances, would appreciate your taking this matter up and cancelling this order, if you can possibly do so.

The War Department replied, suggesting that the United Iron Works furnish the articles and then submit the entire matter to the Comptroller General. The United Iron Works furnished the elbows and covers at an agreed expense of $697.06, being $207.06 in excess of its bid.

The Comptroller General approved the larger payment, saying:

The matter of submitting bids for advertised needs of the United States is not one for such neglectful treatment by bidders as to give frequent cause for attempted withdrawals on the ground of alleged error. The business of the Government can not go orderly forward if bidders be encouraged or permitted to submit inadequately considered proposals with understanding they may withdraw by simply alleging error on their part, when, after opening of the bids it should be revealed that the profit is not all that it might have been or that through bidder's carelessness a loss is to be sustained. The purchasing officers of the Government have other business than to act as guardian for those indulging in poor business methods.

No doubt there will be occasions where error will occur even when all reasonable care is exercised and there is precedent for the care of such *bona fide* situations. However, even when such an error is made in submission of a bid and it is not called to the attention of the contracting officer by the bidder until after the bid is accepted, the bidder must bear the consequences thereof unless the mistake was mutual or the error was so apparent that it must be presumed the accepting officer knew of the mistake and sought to take advantage thereof. 26 Comp. Dec. 286; 2 Comp. Gen. 503; 3 *id.* 821; 6 *id.* 526; 7 *id.* 493.

In the instant case the mistake was not clearly apparent from the record and the bidder did not call the attention of the contracting officer thereto until after the bid had been duly and regularly accepted. Due to the wide experience of the contracting officer in such matters, however, it occurred to him that bidder was exceptionally low and had possibly made an error, but this conjecture could have been verified by him only by asking bidder to check its figures. In such situation, and assuming the requirements of the United States, for the supplies would permit of the delay, it would not have been improper for the contracting officer to have asked bidder to check its figures to ascertain whether an error had been committed. If an error was then claimed, the facts of the error—how it occurred and bidder's reasons for seeking relief from its bid—that is, the entire matter—would have been for submission to this office before administrative action on the bids. The requirement of the Government for supplies will not always permit of such delay, however, and in such circumstances the procedure must be as was taken in this case.

The bidder, as directed by the contracting officer to do, furnished the supplies bid upon, and now claims relief because of its said error. The amount of its bid was $490 and it appears to have sustained an actual loss of $207.06 by being required to expend in furnishing the supplies $697.06, which amount it is willing to accept in complete discharge of the United States. It is reported by the contracting officer that the next lowest bid, as to which no error is claimed, was $749.90; that such supplies are regularly purchased by his office; and that the lowest price obtained during the last seven years was $303.30 each.

It thus appearing that an error was actually made and was such as to attract the attention of the contracting officer at the time; that bidder is willing to accept in payment the exact amount expended by it in furnishing the supplies, and that such amount is less than any correct bid received, payment of said $697.06 will be approved by this office.

In the case considered at 8 Comp. Gen. 588, a bidder advised the United States after bids were opened, but before award of contract, that through a mistake its bid was $900 too low, and asked in effect to withdraw its bid. With its bid it had deposited a bid bond, with sureties, agreeing that it would not withdraw its bid for 60 days after the opening, the bid bond containing the following stipulation:

In the event of the withdrawal of said bid within the period specified, if the prin-

cipal shall pay the Government the difference between the amount specified in said bid and the amount for which the Government may procure the required work and/or supplies, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

The following excerpt will show the holding of the Comptroller General:

As was stated in 8 Comp. Gen. 397, the purchasing officers of the Government have other business than to act as guardians for those indulging in poor business methods, and as the bid was not withdrawn prior to its acceptance in this case and as the alleged error was not apparent on the face of the bid it should be accepted. If the contractor fails and refuses to deliver and install the incinerator for the accepted price of $3,372, notice should be given to the Concrete Oil Tank Co. and the incinerator should be purchased from the next lowest bidder, demand to be made accordingly on the Concrete Oil Tank Co. for payment of the difference of $828 in price. The notice to it should inform it to this effect. If the Concrete Oil Co. should refuse to pay the difference in price, all of the papers, including the bid bond, should be transmitted to this office in order that the proper action may be taken to recover from the low bidder and its surety the loss sustained by the Government because of its failure to comply with the terms of its accepted bid and the condition of its bid bond. See 7 Comp. Gen. 193.

In the Comptroller General's decision dated October 17, 1929 (A-28998), shown at 9 Comp. Gen. 160—a case where the sole bidder (the article to be purchased being patented), when awarded the contract, claimed an error had been made in its bid, but where the mistake was not apparent to the contracting officer because comparison of bids was not possible, although a later check-up of previous purchases disclosed a wide discrepancy in price—it was said:

The general rule is that proposals that have been submitted in response to an advertisement for bids may not be withdrawn after they have been opened, even before award is made, and that the bidder is bound to accept the award. 24 Comp. Dec. 534; 6 Comp. Gen. 504.

While the facts as set forth in your submission would not authorize a reformation of the contract or a payment of any amount in addition to the bid price if the supplies had been furnished by the bidder, since it appears to be clearly established that the contractor made a mistake in the submission of its bid, to which the attention of the contracting officer was invited before the signing of the contract or the beginning of performance thereunder, the contract may be rescinded and the bidder released from any obligation thereunder. *Moffett, Hodgkins, etc., Co.* v. *Rochester*, 178 U. S. 373.

In the Comptroller General's decision dated December 21, 1929 (A-29458), shown at 9 Comp. Gen. 256, concerning a case wherein the lowest bidder alleged (after bids had been opened, award made, voucher certified by contractor as correct and just, payment accepted, and contract completed) that it had made a mistake in its trade-in allowance on the Government's used car, although such mistake was not manifest to the contracting officer, because of the wide variation in trade-in allowances, it was said:

The general rule is, even where there is a clear showing of a mistake in the submission of a bid, the contractor must bear the consequences thereof. In this connection, attention is invited to the following statement made by Mr. Justice Holmes in delivering the opinion of the Supreme Court of the United States in the case of *Rock Island, Arkansas and Louisiana Railroad Co.* v. *United States*, 254 U. S. 141, 143: "Men must turn square corners when they deal with the Government."

In order to authorize relief on account of a mistake in an accepted bid, it must appear that the mistake was mutual or that the error was so apparent that it must be presumed that the contracting officer knew of the mistake and sought to take advantage thereof. 26 Comp. Dec. 286; 6 Comp. Gen. 504, 526. See, also, *Moffett, Hodgkins and Co.* v. *Rochester*, 178 U. S. 373.

While the claimant's bid on the old Ford truck was greater than the allowance offered by other bidders, and greater than the reasonable market value thereof, there is nothing therein from which knowledge on the part of the contracting officer that a mistake had been made can be presumed. The bid here differs from the submission of a bid for new or staple articles the prices on which ordinarily are more or less uniform. As stated in the administrative report, *supra*, there is often a wide variance in the allowances offered on used equipment, considerations other than market value being involved. A short time ago an instance came to the attention of this office in which one bidder offered a $50 allowance on a used truck and another bidder offered an allowance of $1,298 on the same truck, both offers being as intended. Furthermore, it is noted that the claimant company, in its letter of April 29, 1929, *supra*, confirmed its offer with respect to the allowance on the used truck after the bids had been opened and it knew or had the opportunity of knowing the offers made by the other bidders.

The allowance quoted was clear and unambiguous on its face and the mistake, if any, apparently was due solely to the negligence of the bidder, and the bid was accepted by the contracting officer in good faith.

As previously noted, the claimant certified the voucher, *supra*, as being correct and accepted payment thereon without protest. The execution of the voucher and acceptance of payment thereon without protest precludes claimant from receiving any additional amount on account of the alleged mistake. *Louisville & Nashville Railroad Co.* v. *United States*, 267 U. S. 395; *Southern Pacific Company* v. *United States*, 268 U. S. 263; *United States* v. *Reading Company*, 270 U. S. 320; *Early & Daniel Company* v. *United States*, 271 U. S. 140; 4 Comp. Gen. 404.

In the Comptroller General's decision dated January 9, 1930 (A-29846), not yet published—concerning a case wherein the lowest bidder alleged, after award, that it had made a mistake in extending the unit prices, and which mistake should have been discovered by the contracting officer before making award—it was said:

In a recent decision, of February 2, 1929, 8 Comp. Gen. 397, I had occasion to say that the matter of submitting bids for the advertised needs of the United States is not one for such neglectful treatment by bidders as to give frequent cause for attempted withdrawals on the grounds of alleged errors. See also in this connection 26 Comp. Dec. 286; 2 Comp. Gen. 503; 3 *id.* 821; 6 *id.* 526; 7 *id.* 493.

In this case, as previously noted, it appears that there was a patent error in the extension of the total on the face of the record which the contracting officer was bound to take notice of, and, had a proper analysis been made of the bids, he must have noted the discrepancy, and he should not have accepted the bid.

The error being apparent and the bid on the basis of the unit price not being the lowest, it can not be held that there was a legal and binding contract either at the unit price or at the total price. If claimant's bid had been properly submitted, that is, if the total had been correct in accordance with the unit price—340 spools at $3.74 each, total $1,271.60—it would not have been the lowest bid received. Hence the acceptance of said bid was not authorized and imposed no legal obligation on the United States to pay any amount in excess of the lowest correct bid. The contracting officer acting for and in behalf of the United States, being authorized to accept only the lowest correct bid on supplies meeting the stipulated conditions, it would necessarily follow that the acceptance of a bid by said officer purporting to obligate the United States for the payment of any amount in excess of the lowest correct bid, would not be authorized as being beyond the scope of his authority. Where an agent of the Government acts in excess of the authority vested in him, his act, from a legal standpoint, is no longer the act of the Government. The Underwriter, 6 Fed. (2) 937. The Government's agents or officers have only limited power and certain prescribed discretion, and persons dealing with such agents or officers are charged with notice of such limitations. The unauthorized acts of such agents can not obligate the Government. *Filor* v. *United States*, 9 Wall. 45; *Whiteside* v. *United States*, 93 U. S. 247, 256; 5 Comp. Gen. 124; 6 *id.* 158. Since the contracting officer in this case was authorized to obligate the Government only to the amount of the lowest correct bid, payment in excess of that amount may not be made under existing appropriations.

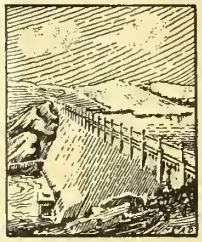
In the Comptroller General's decision dated February 5, 1930 (A-30312), not yet published, there was involved the question whether there had been shown such a bona fide mistake in the preparation of a bid on the part of a bidder for certain construction work as would authorize withdrawal or correction of the bid after the time fixed for opening, and it was there said:

After bids are opened and an opportunity had of knowing the amounts of

(Continued on p. 67)

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Repairs to Concrete Lining of Truckee Canal Tunnels

BY W. H. NALDER, SENIOR ENGINEER, DENVER OFFICE, BUREAU OF RECLAMATION

THE Truckee Canal is the main canal of the Newlands (Federal) irrigation project in Nevada by which water is diverted from the Truckee River near Derby and carried to the Lahontan Reservoir on the Carson River. The canal has a designed discharge capacity of 1,500 second-feet at its head works and is operated throughout the year to irrigate lands under it on the Truckee Bench, fill the Lahontan Reservoir, and incidentally provide water for the operation of the hydroelectric power plant which is located at the Lahontan Dam. The Newlands project has been operated by the Truckee-Carson Irrigation District since January 1, 1927, and the contract, dated December 18, 1926, between the Government and the district, by which the project was turned over to the district, provided that certain repairs and betterments should be made by the Government to the canal. Part of this work consisted of repairs to the concrete lining of tunnels Nos. 1 and 3 of the Truckee Canal.

The canal, including the tunnels, was originally built during the years 1903 to 1906. Both tunnels are lined with concrete and are of rectangular cross section 12 feet in inside width with straight vertical sides and arched roofs. The height of the side walls from the floor to the springing line is 12 feet for tunnel No. 1 and 11 feet for tunnel No. 3. Tunnel No. 1 is 901 feet long and tunnel No. 3 is 1,515 feet long. The construction records of tunnel No. 1 indicate that it was excavated in hard flinty rock with many seams and that it was timbered throughout its length with sets spaced 6 feet center to center. The construction records of tunnel No. 3 indicate that the east 150 feet of this tunnel was excavated through a loose sand which ran freely and caused considerable difficulty in driving and timbering, while the remainder was in Lahontan silt or cemented gravel which worked easily and stood well. Timber sets were spaced at 2-foot centers or closer in the sand, and at 4-foot centers in the remainder of the tunnel. The original lining in the sand was reinforced with steel rails, which have prevented any failure in this section.

Lining of both tunnels developed signs of failure prior to 1920. The failure was indicated generally by a crack varying in width from about ½ to 3 inches and running a zigzag course along the top of the lining. At the points where this crack was widest a slight spreading at the haunches of the arch was evident, which was a maximum of about 2 inches. The side walls, as a rule, showed little evidence of distortion except at the points where the spreading of the haunches was the greatest. At these points the side walls were usually pushed slightly out of plumb above a point about 6 feet above the floor. In nearly all cases, these points were at construction joints between two days' run of concrete, and longitudinal cracks which showed in the side wall were seldom more than one-fourth inch in width. This evidence of possible failure developed in about 100 linear feet of tunnel No. 1 and about 700 linear feet of tunnel No. 3.

The apparent explanation of the difficulty was that, either through decay of the original tunnel timbering or through yielding from other causes or both, the haunches of the arches partially lost their support, whereupon they spread and allowed the top to settle under the load which it carried. In 1921, in order to support the lining and to insure against its collapse, which would have been disastrous, temporary repairs were made to the tunnels. These repairs consisted of installing sets of 12 by 12 inch timbers spaced at 5-foot centers. These sets insured against the collapse of the lining but interfered greatly with the discharge capacity of the tunnels. A review of the records and a careful examination of the tunnel in August, 1927, lead to the conclusion that the progressive action toward failure had practically ceased in 1921, and plans were developed at that time for permanent repairs.

The plans adopted for the repair work are shown on the accompanying drawing and called for the removal of the temporary timber sets and the supporting of the roofs by 60-pound steel T rails, spaced at 5-foot centers. Holes, 12 inches square, at 5-foot centers were cut in the side walls at the springing line, and through these holes the decayed timbers and soft material back of the lining were removed so as to permit the placing of a continuous sill of concrete to support the haunches against the firm material at the sides of the original excavation. As the holes were filled with concrete the ends of the T rails were placed in them and the rails brought up against the roof to support it. The rails were bent to touch the roof at two points only, as shown on the drawing, since, due to the irregularity of the roof from unequal settlement, it was impracticable to bend the rails to the exact contour of the roof. Important factors in adopting this method of repair were that its estimated cost was the lowest of all methods considered, and the repair work could be done with as much as 200 second-feet of water flowing in the tunnel.

Repair work was done by Government forces because of the uncertain nature of the work and in order to avoid undue risk of interference with the continuous operation of the canal. The work was started in January, 1928, and completed March 26, 1928. Timber scaffolding was first provided over the full width and length of the tunnel to be repaired, from which the work was carried on in the dry above the flowing water. A 24-inch gauge track and push dump cars were used for transporting material. A 2-kilowatt electric light plant was provided for lighting the work. Power for operating both the light plant and a saw for framing the timbers was furnished by a Ford engine. An air compressor was used principally in the drilling, concreting, and grouting operations.

Cutting of the 12-inch square pockets in the side walls of the lining was accomplished by first drilling about 24 holes in each pocket and then breaking out the concrete by means of a "rivet buster" and plugs and feathers. In No. 3 tunnel 272 pockets were required, and 54 in tunnel No. 1. After the

pockets were cut out, the débris behind the lining, consisting of rotten timbers, loose sediment, and other material that ravelled down from above, was entirely removed in a continuous line from pocket to pocket. The amount of loose material removed varied widely and in some places it was found advisable not to open up too great a length of tunnel at one time, but to skip some reaches temporarily, coming back to them after the new concrete had been placed on each side. The placing of new concrete in the space behind the pockets and in the pockets was a slow, tedious operation and was done largely by the pneumatic process. The steel rails were placed into each pair of pockets as these were concreted. All shattered concrete in the roofs was removed and replaced with new concrete and all large cracks were "V"d out and filled with mortar placed under pressure.

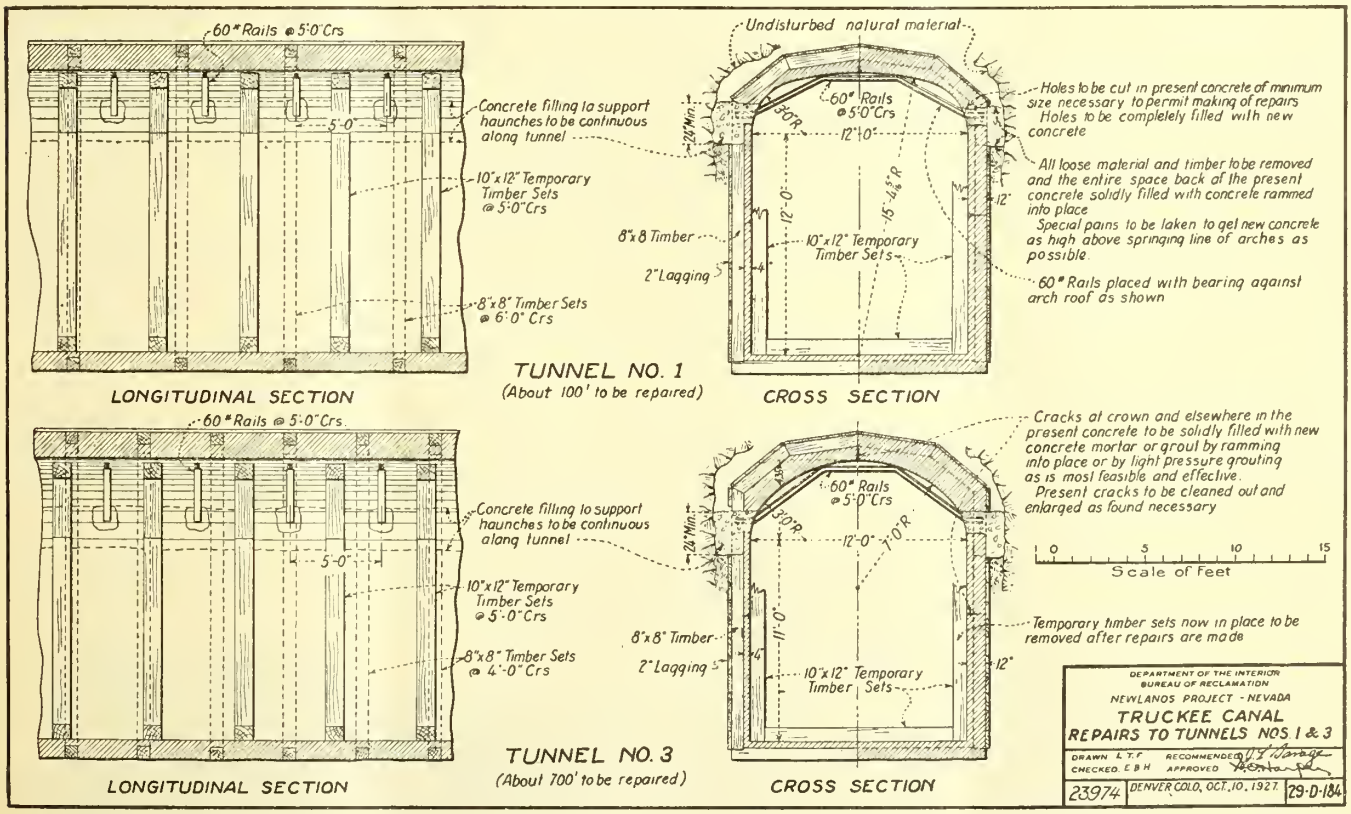
The detailed cost of this work was as follows:

Cutting out pockets, 326 pockets at $10.68 each	$3, 482. 11
Excavating débris from behind pockets 263 cubic yards at $5.04 per cubic yard	1, 325. 69
Concrete in and behind pockets, 100 cubic yards at $41.69 per cubic yard	4, 169. 33
Steel rails in place, 48,900 pounds at $0.09 per pound	4, 434. 05
Grouting of cracks, 453 linear feet at $3.36 per linear foot	1, 522. 47
Other items	1, 622. 47
Camp maintenance	14. 51
Engineering and inspection	541. 67
Total field cost	17, 112. 30
Superintendence and accounts, 2.8 per cent	482. 69
General expense, 6.9 per cent	1, 180. 75
Grand total cost	18, 775. 74

Mexican Dam Completed

The irrigation system supplied with water by the Calles Dam in the State of Aguascalientes, Mexico, has been completed and an area of about 10,000 acres is now ready for cultivation. This land is to be sold to small farmers, students of agricultural colleges who have passed successful examinations, and to Mexican agriculturists now residing abroad who wish to return to Mexico. Prices of land will be as follows: First class, $150 an acre; second class, $142 an acre; third class, $137 an acre. Five per cent of the amount must be paid on taking possession and the remainder in 25 yearly installments, with 4 per cent interest charged on unpaid accounts. Tracts of land vary in size from 20 to 150 acres.

N. B.—For "Notes for Contractors" see page 66.



New Colorado River Bulletin

The United States Geological Survey has recently published a valuable addition to Colorado River literature in Water-Supply Paper No. 617—"Upper Colorado River and Its Utilization," by Robert Follansbee. It is a companion report to Water-Supply Paper No. 618, entitled "Green River and Its Utilization," by Ralf R. Woolley, to be available soon.

The Greek Government has awarded a $30,000,000 reclamation contract to Henry Boot & Sons, of Sheffield, England. The work has been made necessary by the Venizelos Government's policy of reclaiming agricultural land for 1,800,000 Greeks repatriated from Asia Minor. The project includes the drainage of plains in Thessaly and Epirus, and the construction of a 7-mile tunnel to carry away the water through the mountains.

Owyhee Tunnel Bids

Bids for construction of the Owyhee tunnels were opened at Nyssa, Oreg., on March 11. The low bidders were as follows: Schedule 5, T. E. Connolly, San Francisco, Calif., $982,116; Schedules 6 and 7, J. F. Shea Co., Portland, Oreg., $1,569,011; Schedule 8, S. S. Magoffin & Co. (Inc.), North Vancouver, British Columbia, $530,684.

Notes for Contractors

Boise project.—In connection with the construction of the Deadwood Dam, invitation for bids will be issued by the Denver office for approximately 40,000 barrels of Portland cement for delivery as ordered during the fiscal year 1931.

Minidoka project.—Design drawings and specifications are being prepared for the construction of the main canal of the Gravity Extension division across the Little Wood River. The crossing structure will consist of a reinforced concrete siphon and provision will be made for diverting about one-half of the capacity of the canal into the river channel for use in supplementing the water supply for lands farther down the river. The specifications will also include the construction of two large railroad culverts for this canal.

Owyhee project.—Invitation for bids and specifications No. 510 for the high-pressure gates and conduit linings for the Owyhee Dam have been issued by the Washington office. Bids will be received at the office of the Bureau of Reclamation, Denver, Colo., until 3 o'clock p. m., April 25, 1930.

Invitation for bids for the metal work in the various trash rack structures of the dam is being issued by the Denver office. The total amount of metal work in these structures is about 183,000 pounds.

The Denver office plans to call for bids in the near future for approximately 200,000 barrels of Portland cement for delivery during the fiscal year 1931. This cement will be used in the construction of the Owyhee Dam and the concrete-lined tunnels from the reservoir.

Shoshone project.—It is planned during the present year to install a third unit in the Shoshone power plant at the Shoshone Dam near Cody, Wyo. The capacity of this unit will be 5,000 kva.

Yakima project.—In connection with the present construction of the Yakima River tunnel on the Kittitas division requirement will be had for two 42-inch internal differential needle valves. These are to serve as outlets for the wasteway into the river. A pillar crane and other miscellaneous metal work for this wasteway structure will also be required in the near future.

Invitations for bids and specifications covering the construction of the lateral system under the North Branch canal on the Kittitas division are being issued from time to time by the office of the construction engineer at Ellensburg, Wash. The amount of work under each specification is purposely made small so that bids may be received from contractors of small means as well as from the larger contracting companies.

Bids will be opened at 10 o'clock a. m. April 16, at Ellensburg, Wash., for work under specifications No. 508, covering construction of earthwork, tunnels, and structures on division No. 3 of the North Branch canal, Kittitas division.

Sun River project.—Bids will be opened at 2 o'clock p. m. April 16 at Fairfield, Mont., for work under specifications No. 509, covering the construction of dikes 1 and 2 for the Pishkun Reservoir enlargement. The principal item is the placing of about 340,000 cubic yards of materials in the dikes.

THE present work on the Vale main canal and the lateral system of the Bully Creek west bench, on the Vale project, will be continued, and everything will be in readiness for the delivery of water at the beginning of the irrigation season to the Harper and Little Valley lands.

Maps Available

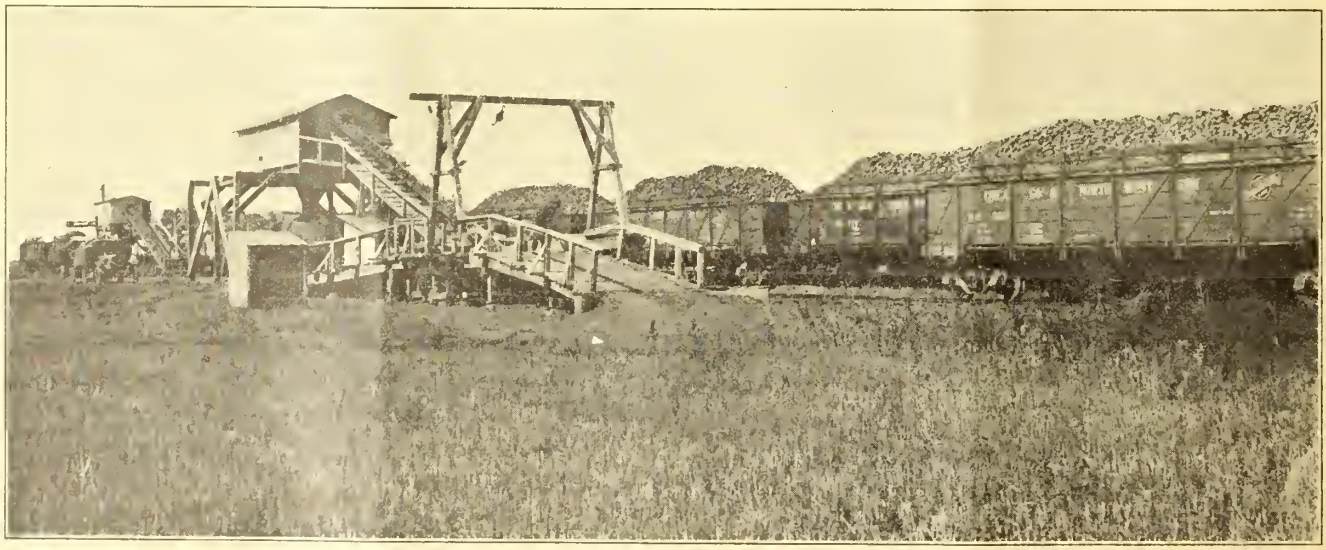
A revised general map (No. 23883) of the Gravity (North Side) and pumping (South Side) divisions of the Minidoka project, Idaho, showing irrigation district boundaries, canals, laterals, drains, etc., is now available. The size of the map is 10½ by 14 inches, and the price is 10 cents.

A revised map (No. 23887) of the Belle Fourche project, South Dakota, showing irrigable area, possible project extensions, canals, laterals, roads and telephone lines is now available. The map is 10½ by 20 inches, and the price is 10 cents.

Holland will reclaim 535,000 acres and thereby add a new Province to its territory by pumping water out of the Zuider Zee. Work on this project, which will ultimately cost $400,000,000, was started on February 10. A dike 12 miles long in the open sea is under construction, which will entirely close the Zuider Zee from the North Sea. Four pumps with a capacity of 1,200 million gallons every 24 hours are now at work on the first district of 50,000 acres. It is said that the centrifugal pump at the Medemblik station is the first to be constructed of reinforced concrete.

Under the most favorable conditions, irrigation management, involved so largely with human relations, is a perplexing matter calling for a certain type of personality to handle it successfully.

The present tendency of farmers' cooperative organizations is toward larger scale operation and the group handling of common problems through state-wide or national service organizations.



Empire sugar-beet dump, Belle Fourche project, South Dakota

Mistakes in Bids

(Continued from p. 63)

the other bids, whereby there might arise a temptation to revise a bid either upward or downward as might best serve the interest of the particular bidder, the permitting of any change in a bid is a matter for most serious consideration. This situation makes necessary strict adherence to the well-established rule that in order to authorize the correction or withdrawal of a bid before acceptance, on the basis of a mistake alleged after the opening of bids, the evidence of mistake must be such as to show conclusively that a mistake was made, in what it consists, and how it occurred. That is to say, there should be presented immediately such convincing proof of the existence and character of the error as to leave no room for doubt that there was in fact a *bona fide* mistake in the bid and to remove any reasonable suspicion that the claim of error is for the purpose of obtaining some undue advantage or of avoiding the consequence of an ill-advised bid.

In the case here presented, there were received 24 bids other than that of the National Construction Co. (Inc.), ranging in amount from $865,800 to $1,035,000. The bid as submitted by the National Construction Co. (Inc.), is $85,800 less than the next lowest bid, and, with the correction or change which said company now asks permission to make, its bid would be $27,380.66 below that of the next lowest bid. In other words, this bidder seeks to alter its bid by adding thereto substantially two-thirds of the difference between its bid and the next higher bid.

The difference between the bid as submitted and as proposed to be corrected is shown by a tabulation as follows:

	As submitted	As corrected	Difference
Excavation	$4,586.50	$4,910.50	$324.00
Concrete	44,883.85	51,692.09	6,808.24
Forms	33,376.23	41,409.83	8,033.40
Roads, etc	28,000.00	40,000.00	12,000.00
Masonry	109,222.09	118,902.30	9,686.22
Waterproofing, etc	3,323.52	3,775.00	451.48
Lathing, etc	44,835.00	52,000.00	7,165.00
Carpentry	26,920.45	29,227.45	2,307.00
Hardware	11,750.00	12,250.00	500.00
Fire doors, etc	57,457.38	59,057.38	1,600.00
Painting	8,576.00	11,900.00	3,324.00
Finished floors	14,800.00	15,295.00	495.00
Overhead	30,150.00	35,875.00	5,725.00
Total			58,419.34

In explanation of this difference of $58,419.34 it is alleged, in substance, that in compiling the bid as submitted Building No. 5, one of the numerous items included in the advertisement, was omitted in arriving at the total quantity of excavation, concrete, forms, etc. It is to be noted, however, in this connection, that the advertisement did not require, nor did the National Construction Co. (Inc.), submit, an itemization of the cost on which the bid of $780,000 was based. The evidence submitted to support the claim of mistake consists merely of two sets of summary sheets attested by an affidavit made by the president of the company. One set of these summary sheets purports to be the original set on which the bid of $780,000 was based and shows, by totals (not by buildings or units of the work), the material and labor costs under the various elements, such as excavation, concrete, masonry, painting, overhead, etc. The other set, made up after the bids were opened, is in the same form but with the quantities and amounts increased as to 13 of the 20 elements, the increase said to be to cover omissions with respect to Building No. 5, there being nothing, however, in the tabulation to show which buildings or units of the work were or were not considered in the computations.

I have to advise that the facts submitted are quite insufficient to warrant or justify the conclusion that there was such a mistake in the bid as to authorize relieving the bidder from its obligation to perform in accordance therewith.

—*Armand Offutt, District Counsel.*

The moment the ground can be worked sweet peas may be planted. Select a sunny spot where the loam is good. Apply a thick layer of well-rotted manure and work it in thoroughly. Dig drills about 8 to 10 inches apart and from 4 to 5 inches deep. Scatter the seeds in the drills generously, but not too thick.

The settler under the irrigation canal needs special knowledge of soils and crops with respect to their relationship to water, in addition to their general behavior for agricultural purposes.

The number and character of the schools on a project determine the educational advantages offered to the children, which in turn react upon the contentment of the family.

Government Employees May Travel by Air

At the suggestion of a number of Government officials transportation rates on the air lines of the Western Air Express have been reduced to a fare equal to rail and Pullman rates, for the benefit of Federal officials and employees.

As a result it will be possible for employees of the Interior Department to travel by air at rail and Pullman rates over the Western Air Express, the Standard Air Lines, West Coast Air Express, and Mid-Continent Air Express. These lines serve Kansas City, Los Angeles, San Francisco, Seattle, Portland, Salt Lake City, San Diego, Agua Caliente, Santa Catalina Island, El Paso, Phoenix, Albuquerque, Pueblo, Denver, Amarillo, Wichita, Cheyenne, and intermediate points.

Agents of these four companies have been instructed to honor the usual transportation requests.

The Soviet Russian Government irrigation bureau for Central Asia is the Sredazvodhoz, which is similar to our Bureau of Reclamation. This bureau has its headquarters at Tashkent in Russian Turkestan and has about 800 employees. The Ferghana Valley, some 200 miles distant from Tashkent, is 60 miles wide, 140 miles long, and has 1,900,000 acres under irrigation. Two-thirds of this area is in cotton, and other principal crops are rice, wheat, corn, and fruits. Some of this valley has been irrigated and cultivated for over 1,200 years.

Irrigating a 65-acre field of potatoes; showing application of water on the Klamath project, Oregon-California

Railroads an Important Factor in Construction and Development of Projects

IT will undoubtedly be in the nature of a surprise to many to learn that nine transcontinental railroads traverse the Federal irrigation projects and extend spur lines to meet the needs of the settlers, the total project railway mileage amounting to 2,360 miles. Several projects are served by two or more railroads and, with one or two exceptions, the transportation needs of the projects are adequately met. Such agricultural products as are not absorbed by local markets can be shipped to other points throughout the United States. Thus Yakima apples and Idaho potatoes are as well known in the East as in the locality where they are produced, although ever-increasing quantities of Yakima fruits are being shipped to an ever-widening range of foreign markets. The accompanying table shows by projects the railroads serving them and the mileage of such roads on the projects.

In addition to the roads serving the projects for passenger and freight traffic, the Bureau of Reclamation has found it advisable as a matter of economy and efficiency to construct its own railroad lines or to contract for their construction in connection with the work of building irrigation structures. It is the exception rather than the rule that the sites of large storage dams are in the vicinity of constructed railroads. Generally these sites can be made accessible by the construction of hard-surfaced roads, over which materials and supplies are brought to the dam site by means of trucks from the railroad siding. Occasionally, however, the bureau has found that a railroad would more adequately meet the particular needs of a proposed development. As a result, the bureau has built at various times 110 miles of railway, as follows:

Project	Feature	Miles
Belle Fourche	Belle Fourche storage	7
Boise	Arrowrock Dam	19
Owyhee	Owyhee Dam	24
Rio Grande	Elephant Butte Dam	13
Uncompahgre	Gunnison tunnel	7
Yuma	Laguna Dam	11
	Yuma Valley levees	29
Total		110

The Boise & Arrowrock Railroad was built from Barberton, Idaho, a junction point on the Oregon Short Line, to the dam site at Arrowrock, where the bureau proposed to construct the 349-foot dam as part of the storage facilities of the Boise project. This Government-built and operated railroad went on an operating basis on December 11, 1911, and up to February 12, 1916, when its operation was discontinued, it carried 13,968,000 ton-miles of freight and 90,000 passengers in running 111,300 train miles. The road cost about $20,000 per mile.

In connection with the construction of the Elephant Butte Dam, a standard-gage railroad 13 miles in length was built by the Government in 1914 from the line of the Atchison, Topeka & Santa Fe Railroad to the dam site. The cost of the road was more than $270,000, or $21,000 per mile. The road was operated by the Santa Fe. The freight handled included rock, sand, cement, and other materials and supplies used in the construction of the dam. An estimated saving of more than $150,000 was effected by the construction of this railroad.

A standard-gage railroad was built on the Yuma project by the Government in 1908 from the California side of the Colorado opposite Yuma to the Laguna Dam, and in 1914 a railroad was built by the Government in Arizona from Yuma south

Cultivating potatoes near Burley, Minidoka project, Idaho

ESTIMATED RAILWAY MILEAGE ON FEDERAL IRRIGATION PROJECTS

Project	Railroads	Mileage: Each road	Mileage: Total
Belle Fourche, S. Dak	Chicago & North Western R. R	23	
	Vale Beet Spur	12	35
Boise, Idaho	Oregon Short Line R. R	177	
	Intermountain Railway	18	
	Boise Valley Traction Co. (electric)	60	255
Carlsbad, N. Mex	Atchison, Topeka & Santa Fe R. R	23	23
Grand Valley, Colo	Uintah Railway	11	
	Denver & Rio Grande Western R. R	32	
	Grand Junction & Grand Valley Electric R. R	13	56
Huntley, Mont	Northern Pacific	25	
	Chicago, Burlington & Quincy R. R	19	44
King Hill, Idaho	Oregon Short Line R. R. (14 miles within district, 28 miles along district, mile or two outside).	42	42
Klamath, Oreg.-Calif	Oregon, California and Eastern Railway	21	
	Southern Pacific Railway	15	
	Proposed Modoc Northern Railway	14.5	50.5
Lower Yellowstone, Mont	Great Northern R. R	31	
	Northern Pacific	35	66
Milk River, Mont	Great Northern R. R	159	159
Minidoka, Idaho	Oregon Short Line R. R	43	43
Newlands, Nev	Southern Pacific Ry	69	69
North Platte, Nebr	Chicago, Burlington & Quincy R. R	145	
	Union Pacific	95	
	North Platte Valley Ry	16	256
Okanogan, Wash	Great Northern	12.5	12.5
Orland, Calif	Southern Pacific Railway	7	7
Owyhee, Oreg	Oregon Short Line Ry	56	
	Construction Railway to dam	24	80
Rio Grande, Tex	Atchison, Topeka & Santa Fe R. R	83	
	Southern Pacific R. R	58	
	National Railway of Mexico	8	149
Salt River, Ariz	Atchison, Topeka & Santa Fe R. R	17	
	Southern Pacific	45	62
Shoshone, Wyo	Chicago, Burlington & Quincy R. R	64	64
Strawberry Valley, Utah	Denver & Rio Grande Western R. R	30	
	Union Pacific R. R	17	
	Salt Lake & Utah R. R. (electric)	23	
	Utah-Idaho Sugar Co. R. R	8	78
Sun River, Mont	Chicago, Milwaukee, St. Paul & Pacific R. R	45	
	Great Northern R. R	87	132
Umatilla, Oreg	Oregon-Washington Railroad & Navigation Co		90
	Within project area	60	
	Partly in Coyote cut-off	12	
	To McKay Dam	18	
Uncompahgre, Colo	Denver & Rio Grande Western R. R	51	51
Vale, Oreg	Oregon Short Line R. R	66	66
Yakima, Wash	Chicago, Milwaukee, St. Paul & Pacific R. R	57	
	Northern Pacific	273	
	Oregon-Washington Railroad & Navigation Co	86	
	Yakima Valley Transportation Co. (electric)	12	428
Yuma, Ariz	Yuma Valley R. R	25	
	Southern Pacific	17	42
Total			2,360

on the river levee to the international boundary for use in the maintenance of the levees. This line is still in operation by the Government for both freight and passenger service.

Two narrow-gage railroads have been built by the Government. On the Belle Fourche project, South Dakota, a temporary line 7 miles in length was constructed to transport gravel and concrete from the Snoma gravel pit to the storage dam. In connection with the construction of the Gunnison tunnel, Uncompahgre project, Colorado, a narrow-gage railroad about 7 miles in length was built through the tunnel. This track was maintained and used for a number of years in inspecting the tunnel and repairing the lining.

The Owyhee Railroad is the most recently constructed road. It extends from Dunaway siding on the Oregon Short Line to the Owyhee Dam site in Oregon, a distance of 24 miles, and cost about $640,000, or $26,600 per mile. It was built in 1928 and is being operated by the General Construction Co., contractors for the construction of the dam, the materials being furnished by the Government. The cost is included in the unit prices bid for the dam.

THIS season total fruit shipments from Unit B land and adjoining groves on the Yuma project amounted to 25,438 boxes of grapefruit and 2,200 boxes of oranges, of which 8,938 were shipped during February. The average price for the first grade fruit was $4 per box, f. o. b. cars, and for second grade fruit $3.50 per box, the prevailing prices at the close of February being $4.50 for first grade and $4 for seconds per box.

THE Women's Club of Carlsbad, on the Carlsbad project, is preparing to submit to the voters of the city a bond issue of $20,000 for the construction of a public library. The voters have also been asked to vote on a $15,000 bond issue for park improvements.

Future Orland Visioned by Leaders

In order to stimulate settlement on the Orland project and to secure farmers of the proper caliber who will stick and help to make Orland what it should be, the Orland Register has invited suggestions from water users who have the interest of Orland's future at heart. The ideas advanced may prove helpful in fostering settlement on other projects. The first few issues of the Register following the editor's invitation contain suggestions from which the following extracts are taken:

James Monroe stresses the point that the present problem at Orland is to "get the facts across to people who would convert our vacant land into productive orange groves and pleasant homesteads."

An unnamed rancher who believes in the possibilities of Orland points out that "Orland has sufficient assets to cause any far-sighted resident to believe in its future, among which are good land, abundance of cheap water, healthful climate, and, not to be overlooked, the best class of people to be found anywhere in America."

J. N. Cook believes that the project does not want "just farmers," but people who specialize in fruit and dairying, and that the latter means the production of more alfalfa. He concludes with the statement that "a fruit farmer can plant his trees and raise enough alfalfa between those trees the first three years to meet his running expenses."

Van Bernard refers to the productive soil on the project "adapted to such a variety of crops that a procession of 12 harvests could easily fall in line and parade the full circle of the year."

In the final article of this series which has come to the attention of the bureau, Superintendent Weber outlines the results of the advertising campaign to place idle lands in the hands of settlers, and concludes that "a continuation of this or a similar and more effective advertising campaign, for the purpose of bringing new people into the project with adequate capital and the necessary farming experience to develop and farm the presently unproductive areas and thus bring them under intensified irrigation agriculture, is one way in which the potential opportunities of the Orland project may be more fully utilized."

OUT of the 1,100 cars of potatoes produced on the Klamath project last year, it is estimated that only 200 cars remain in storage and that about 75 per cent of these are in dealers' hands.

Riverton Project Adapted to Sugar Beet Growing

Sugar beets are now being grown successfully in the areas surrounding Riverton. According to the records published in the Wyoming Agricultural Statistics for 1928 from the office of the commissioner of agriculture at Cheyenne, Fremont County produced 1,800 acres of sugar beets. These were all produced in the area close to Riverton. The average yield was 10.40 tons per acre. This average was exceeded only by three other counties in Wyoming—Park, Goshen, and Platte. It was equaled only by Washakie and Converse Counties, both successful sugar beet-producing counties.

Big Horn County, one of the successful beet-producing counties of the State, had an average of only 9.83 tons per acre in 1928

Temperature.—The temperature, while somewhat cooler than most of the beet-producing areas, is very similar to that of Lovell, where beets are successfully grown. The frost-free dates in Riverton extend from May 21 to September 11. In Lovell they extend from May 20 to September 13. At Riverton the average night temperature is 26° and the average day temperature 58.3°. In Lovell the average night temperature is 24.7° and the average day temperature 59.0°.

These records are from data supplied to the commissioner of agriculture by George W. Pitman, meteorologist of the United States Weather Bureau at Cheyenne.

In general Powell is slightly cooler than Lovell, and in 1928 the Powell district produced the largest average yield of beets for Wyoming.

Opinion of experts.—W. L. Quayle has been director of the substations of the University of Wyoming for more than 10 years. He graduated in agronomy from the Utah Agricultural College, has had charge of the experimental farms in three localities in Wyoming where sugar beets are successfully grown, and is well qualified to judge of the agricultural possibilities of any part of the State. He is of the opinion that sugar-beet production will be successful on the Riverton project.

He also calls attention to the fact that the Riverton area, like all the other beet-producing areas of Wyoming, should be favorable to beet production because the dry cold winters seemingly have made it impossible for the leafhoppers, a bad pest in some beet-producing areas, to get a start.

Don R. Sabin is the extension specialist in agronomy. He is familiar with the climate and soil of the Riverton project and also with the other beet-growing areas of Wyoming. He is of the opinion that sugar-beet production will be successful on the Riverton project.

John R. Neale, formerly a county agent in Wyoming and now livestock specialist, has had wide experience in various farming areas of Wyoming and Montana. He states that the only reason that more beets are not grown in the Riverton area is that the beet land has been located too far from the railroad.

Soil.—Those who are familiar with the soil and its general appearance state that it is quite similar to the soil where beet production is very successful.

The crop value per acre is the factor of prime importance in determining the financial success of an irrigation project. Any devices that tend to increase the acre income should be of first concern to the water user and project builder.

SUMMARY OF CROP RESULTS ON RECLAMATION PROJECTS IN 1929 [1]

NOTE.—These detailed figures are limited to crops covered by census on Government projects proper, excluding all crops in areas served with water under the Warren Act, but including nonirrigated crops grown on the projects

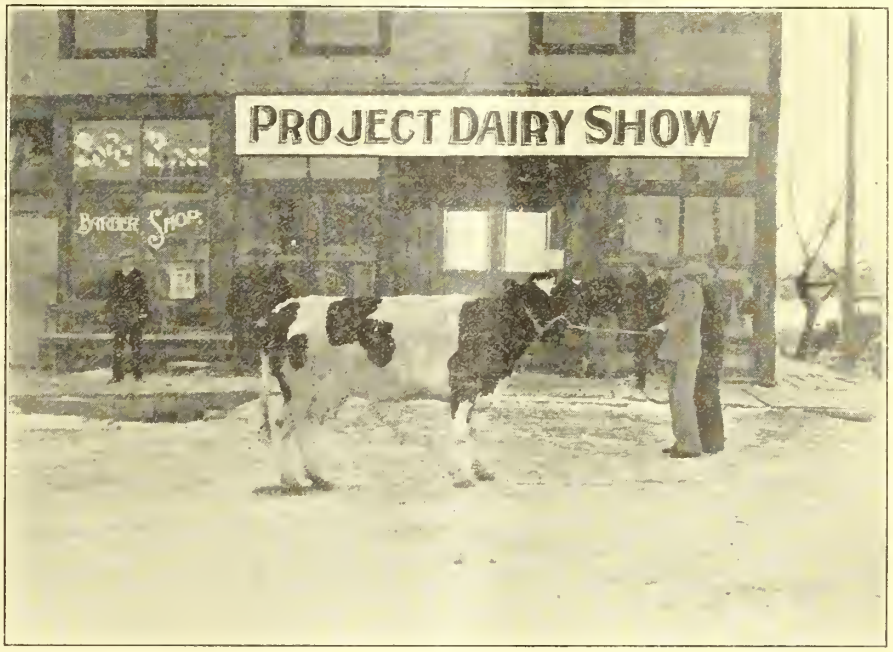
Crop	Acreage cropped		Yields		Crop value		
	Total	Per cent of cropped	Total	Average per acre	Average per acre	Total	Per cent of total value of all crops
Cereals:			*Bushels*	*Bushels*			
Barley	78,920	5.2	2,713,374	34.4	$20.16	$1,590,882	1.8
Corn	46,012	3	1,254,496	27.3	22.38	1,029,613	1.2
Oats	45,417	3	1,709,249	37.6	15.41	699,962	.8
Rye	4,781	.3	66,855	14.0	16.67	79,721	----------
Wheat	144,160	9.5	3,910,036	27.1	26.61	3,836,566	4.4
Total	319,290	21.1	9,654,010	30.2	22.66	7,236,744	8.2
Other grain and seed:							
Alfalfa seed	20,601	1.4	136,328	6.6	37.57	774,103	.9
Clover seed	19,702	1.3	70,502	3.6	25.49	502,194	.6
Flax seed	3,389	.2	25,987	7.7	20.43	69,247	----------
Total	43,692	2.9	232,817	5.3	30.79	1,345,544	1.5
Hay and forage:			*Tons*	*Tons*			
Alfalfa hay	467,176	31	1,303,946	2.8	32.96	15,398,048	17.7
Clover hay	25,089	1.6	22,564	.9	75.25	1,887,267	2.1
Other hay	34,860	2.3	41,067	1.2	12.48	434,951	.4
Corn fodder	4,852	.3	13,714	2.8	22.70	110,143	.1
Other forage	28,280	1.9	74,501	2.6	22.77	643,877	.7
Pasture	324,259	21.4	----------	----------	10.17	3,298,345	3.7
Total	884,516	58.5	1,455,792	1.6	24.61	21,772,631	24.7
Vegetables and truck:			*Bushels*				
Beans	21,050	1.4	390,067	18.5	58.02	1,221,415	1.4
Onions	2,865	.2	1,023,360	357.2	99.94	286,337	.3
Potatoes, white	46,964	3.1	8,302,196	176.8	164.66	7,733,673	8.7
Potatoes, sweet	1,027	----------	138,689	135.0	224.11	230,161	.5
Truck	54,692	3.7	----------	----------	191.15	10,454,390	11.8
Total	126,598	8.4	9,854,312	77.8	157.40	19,925,976	22.5
Fruits and nuts:			*Pounds*				
Apples	24,269	1.6	238,610,372	9,832	259.00	6,285,626	7.1
Peaches	3,512	.2	22,354,531	6,365	164.18	576,602	.6
Pears	6,095	.4	49,343,150	8,095	282.76	1,723,441	2.0
Prunes	2,686	.1	18,668,477	6,950	71.72	192,450	.2
Citrus fruit	8,323	.6	51,373,860	6,172	212.09	1,765,245	2.0
Small fruit	3,055	.2	17,819,501	5,834	269.02	821,861	1.0
Miscellaneous	5,701	.4	15,813,243	2,774	130.40	743,460	.8
Total	53,641	3.5	413,983,134	7,718	225.73	12,108,685	13.7
Miscellaneous:			*Tons*				
Sugar beets	84,183	5.5	956,719	11.3	81.36	6,850,733	7.7
Cotton	271,282	18.0	[2] 86,865,853	320.2	68.95	18,705,391	21.1
Cottonseed			[2] 158,662,445	584.8			
Cane	1,069	----------	2,862	2.7	30.52	32,631	----------
Other crops	52,962	3.5	----------	----------	9.08	481,055	.6
Total	409,496	27.0	----------	----------	63.63	26,069,810	29.4
Duplication	324,983	21.4	----------	----------	----------	----------	----------
All crops for which detailed census was taken	[3] 1,512,250	100.0	----------	----------	58.49	88,459,390	100.0
Warren Act projects	1,204,200	----------	----------	----------	60.46	72,813,040	----------
Total [4]	2,716,450	----------	----------	----------	59.40	161,272,430	----------

[1] Data are for calendar year (irrigation season), except on Salt River, where the data are for corresponding "agricultural year," October, 1928, to September, 1929.
[2] Pounds.
[3] The dry-farmed area of this total amounted to 92,180 acres, with a total value of $899,720.
[4] Totals only available. Acreage, yield, and value not distributed by crops.

Arpan Dairyman Wins Prize at Belle Fourche Dairy Show

A dairy show held at Nisland, Belle Fourche project, in January was a unique demonstration of profits to be derived from proper selection of feeds, housing, and general care of milk cows. This show brought together in one barn 13 of the best cows in the valley, and tests were conducted over a period of one week to determine the highest producer under a uniform care and feeding system. The balanced rations consisted of grain, beet pulp, roots, corn silage, and alfalfa. Mixed grain was fed on a basis of 1 to 4 pounds of milk produced, and the other feeds were supplied in the same proportion. All the cows made consistent gains during the week, the highest increase in milk flow being from 43.9 pounds on the first day to 53.9 pounds on the last day, a gain of 23 per cent. Butterfat produced varied from a high of 15.3 pounds per week to a low of 9.6 pounds per week. The three highest cows in each class were awarded cash prizes, with the sweepstake prize of $55 going to A. J. Roswell, of Arpan, one of the project dairymen. Awards were made entirely on the basis of butterfat produced, regardless of net profits. The tests were conducted during a period when the price of butterfat had reached a low ebb, while if the average price obtained during the past year had been used the profits would have been approximately 25 per cent higher.

The show closed with a banquet and general gathering of farmers and business men, who discussed the benefits of dairying and the results of the test, which was tabulated and presented in detail on a large chart. This was the second annual show of the project and awakened a great deal of interest with an attendance of nearly 300 people. Results are tabulated as follows:



PROJECT DAIRY SHOW, NISLAND, S. DAK., JANUARY, 1930

Breed	No.	Owner	Cost of feed	Milk produced	Average test	Butter fat produced	Skim milk value	Value of products	Profit
Holstein class	1	H. W. Roswell, Arpan	3.02	393.0	3.9	15.34	0.89	5.34	2.32
Do	2	J. E. Lindgren, Belle Fourche	3.10	385.0	3.79	14.6	.87	5.10	2.00
Do	3	Poage & Townsend, Arpan	3.42	408.9	3.28	13.43	.94	4.84	1.42
Do	4	Ed Isto, Newell	3.21	365.6	3.39	12.39	.84	4.43	1.22
Do	5	H. A. Beckham, Newell	3.30	376.6	3.22	12.14	.87	4.39	1.09
Do	6	Wm. Lafferee, Newell	3.19	373.2	3.11	11.60	.86	4.22	1.03
Do	7	Harvey Cooper, Fruitdale	3.27	252.6	4.15	10.49	.57	3.61	.34
Ayrshire class	8	Eli W. Long, Newell	3.10	307.1	3.39	10.42	.70	3.72	.65
Do	9	E. P. Isaacson, Newell	3.26	286.4	3.61	10.33	.65	3.65	.39
Do	10	L. E. Westfall, Nisland	2.87	260.8	3.91	10.20	.59	3.55	.68
Open class	11	C. I. Parks, Nisland	3.16	326.8	3.85	12.59	.74	4.39	1.23
Do	12	Chas. Body, Nisland	2.72	246.7	4.24	10.47	.55	3.59	.87
Do	13	Garrett Williamson, Vale	2.52	234.7	4.11	9.64	.53	3.42	.90

NOTE.—Record covers 7-day test. Butterfat, 29 cent per pound. Feed prices: Alfalfa, $10 per ton; grain mixture, $1.75 per hundredweight; silage, $5 per ton; roots, $5 per ton.

Riverton Project Visited by Officials

At the close of February, nine officials of the Chicago, Burlington & Quincy Railroad and three officials of the Holly Sugar Co. made a detailed inspection of the Riverton project, Wyoming. These officials were as follows:

Burlington Railroad.—E. Flynn, general manager, Omaha; F. G. Gurley, general superintendent, Alliance, Nebr.; J. C. Grisinger, division superintendent, Casper, Wyo.; F. Montmorency, general freight agent, Omaha; F. T. Darrow, assistant chief engineer, Lincoln; J. M. Saxton, land and industrial commissioner, Lincoln; J. B. Lamson, manager commercial department, Chicago; H. L. Ford, agricultural agent, Chicago; G. F. Hamilton, district engineer, Alliance.

Holly Sugar Co.—C. D. Adams, district manager, Sidney, Mont.; L. E. Laird, manager, Worland, Wyo.; Robert Bragg, agricultural superintendent, Worland.

The officials were taken to Pavillion through the valley lying east of Lost Wells Butte and then along the power line north of the butte. After lunch at Pavillion they drove nearly to the Maverick Springs oil field and then back to Riverton for the night. The next morning they drove up Wind River on the road under the LeClair-Riverton Canal, and after reaching the highway south of Pavillion they proceeded through Morton, around the north end of the Pilot Butte Reservoir, past the power plant, through Pavillion east to Five Mile Creek Valley, then down this valley for about 10 miles, where they crossed Five Mile Creek, and then proceeded east on the road following the ridge north of that creek, giving them an excellent idea of the south half of the project.

The officials were accompanied over the project by H. D. Comstock, project superintendent, and Engineers Kemp and Matthews.

It is believed that this inspection trip may have an important bearing on the future development of the Riverton project.

Making the Best Better on the Huntley Reclamation Project, Montana

By Doris I. Anderson and T. B. Holker

SEVERAL dripping bodies climbed out of the main canal which borders the Project Park and United States Experiment Station on the Huntley reclamation project, and, still dripping, scrambled into clothes. It was the day of the project fair and the call had gone out that the 4–H Club pigs would be judged. The crowd had assembled at the ring as eight wet-haired boys with canes in hand guided their gilts up and down past the judge. There were but four places in the premium list, so four could place and four could not; competition was keen. Finally, after careful study, the judge singled out the well-cared for, lengthy, upstanding gilt belonging to George Cox and handed him the blue ribbon. Duane Zeiler received the red on a typey individual; third went to Ancel Bingaman, president of the Raise 'Em Better 4–H Swine Club, and fourth to Gordon Brandon. A general discussion followed as to the relative merits of the class, indicating the interest parents and followers were taking in the work the boys were doing.

The incident is but one in the expanding work of the 4–H Club members on the reclamation project, which is located near Billings, Mont., in the south central part of the State. The Yellowstone River supplies adequate water for the fields and gardens of the club members.

Garden clubs are popular on the project. The season of 1929 saw two active groups carrying on this type of work. One, in the Garnsey community, enrolled seven members under the leadership of Miss Elaine Sherman, for first year work. The other, the Worden Garden Club, continued its work for the second year with 12 members, and was led by Mrs. H. E. Snell. Both of the clubs carried out a fine program. Plans for planting were carefully worked out by the members to fit the piece of ground selected so that a well balanced harvest might be obtained. So thorough was the attention given that several members placed ripe tomatoes on the market as soon as many of the commercial truck gardeners and received quite satisfactory prices as a result. Products from the gardens contributed a good share to the success of the project booth at the Midland Empire Fair at Billings.

Illustrations Appearing on Opposite Page

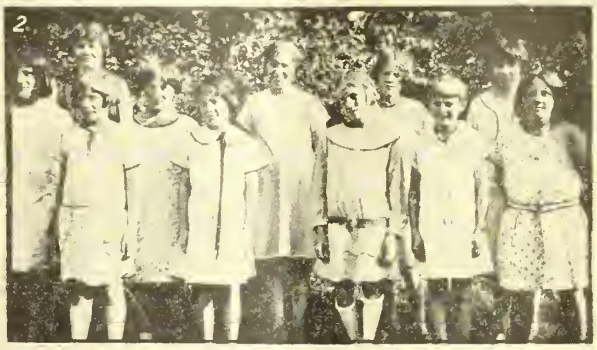
1. *Joint Tour of Garden Clubs.*
2. *Osborne's Jolly Working Band. Dresses made by girls, 1929.*
3. *The dressing table made in demonstration which won State championship for the Swastika Club in 1929.*
4. *Tour of rooms; Swastika Club, 1928.*
5. *Mothers, leaders, and members of 1929 Swastika Club.*
6. *Fitting a cotton ensemble under the direction of Mrs. Frances Fenlon.*
7. *Dorothy Howard leading singing at joint clubs' picnic, 1929.*
8. *Susy's Sewing Circle; leaders, mothers, and members, 1929.*
9. *Business meeting of Swastika Club; Mrs. C. E. Matteson, local leader in right foreground; Mrs. O. E. Wade, assistant leader, standing.*
10. *One of the swine-club boys appraising his litter.*

Tours at the peak of the season were held by both clubs at which the other club was invited. Interesting discussions were aroused at most of the stops as the group observed some outstanding practice carried on by a particular member.

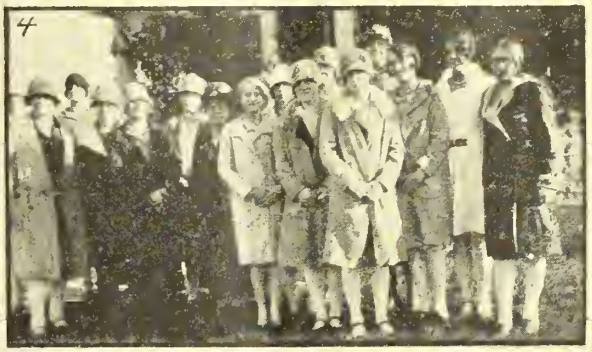
The Worden Club elected to train a demonstration team for State competition at the Midland Empire Fair. It chose the practice of home storage of vegetables, a subject of practical value to the members, and was awarded for its tireless preparation second place among all the agricultural demonstrations of the State. Second place proved to be first, as the champion team was unable to take the trip offered to the Pacific International Livestock Exposition at Portland, Oreg., and the honor fell to Dorothy and Lois Elda Howard, who comprised the Worden team. Achievement days are now being planned and both clubs are setting a "100 per cent completion" as their goal. Harvesting and storing, together with fall plowing to prepare for an even more successful year in 1930, will complete the season's work of the two clubs.

One of the outstanding home economics clubs of the entire State is the Swastika Club, which has completed several successful years of home-furnishing work under the leadership of Mrs. C. E. Matteson and Mrs. O. E. Wade, of Ballantine. For the third consecutive year a demonstration team from this club has been State champion. In 1929 a team, consisting of Grace Smith and Margaret Kittelson, made the winning demonstration of "Making a dressing table," showing in a very practical and thoroughly interesting way how a young lady may furnish her room at a minimum expense and yet carry out her individuality in an artistic manner.

The table constructed in the demonstration was made from two orange crates and a board covered with material to suit tastes. The work carried added interest because several such dressing tables were made during the year by various members of the club. Betty Stout and Edith McIntyre formed the 1928 champion demonstration team and won the distinction showing practical methods of refinishing furniture. Margaret and Marjory Bryson were the 1927 champions. Keeping pace with their club mates in the demonstration work, Betty Stout and



4-H CLUB GROUPS ON HUNTLEY PROJECT MONTANA



Leona Wade won first place for their club in the home economic judging contest. These outstanding examples of fine training in teamwork have been brightened by the individual honors which members of the teams have won. Edith McIntyre in 1928 and Grace Smith in 1929 were State champion demonstrators; Agatha Weidinger and Betty Stout repeated these honors in the judging field. This fall, for the first time, State champion teams have been awarded a trip to the Pacific International. On this initial trip three of the four teams, representing the great State of Montana, are from the Huntley reclamation project and two of these three carry the illustrious banner of the Swastika Club, of Ballantine.

State champion teams are the result of goals and not the goals of this club. The members started with the simple foundation of first-year clothing six or seven years ago and each year have completed their work and reenrolled for more advanced programs. The club in 1928 was the first in the State to be awarded the State's highest official recognition, that of receiving a banner for their accomplishments, and a similar award was received in 1929. The home-furnishing work has seen them accomplish refinishing or outfitting several rooms in their homes with artistic inexpensive appointments. Time alone can write the complete history of this club but imagination may easily follow the present training of the 4–H's to the ultimate goal of better American citizens in happier American homes.

Six years of leadership of the Worden Clothing Club by Mrs. J. E. Baltzell has done more even than the six gold seals on their charter indicate. Montana's clubs are rated on a score card at the close of a year's work. This score card gives detailed requisites for rating the work, including, under the general headings: activities, 30 points; leadership, meetings, and records, each 17.5 points; membership, 10 points; and organization, 7.5 points. A standard club must receive at least 60 points and receives a charter; a silver star club 70 to 79 points; a gold seal 80 to 89 points; and the banner club receives its banner when it reaches 90 points. The six gold seals on the Worden Clothing Club's charter, therefore, tell part of the story of long consistent activities.

Twice has the State champion home economic girl come from this club and received the trip to the National Club Congress at Chicago. Josephine Roseberry achieved the award in 1927 and Katherine Baltzell in 1928. Several of the girls from this club have gone beyond the clothing programs and carried work in home furnishing. Several, too, have completed the clothing work, and, not content without the associations, have gone into canning and food-preservation clubs. At least one of the tests of a successful club—that of developing leadership—is evidenced by the results of this club. Katherin Baltzell has caught the spirit of the organization and now, after completing most of the programs herself, carries the training she has received to the younger girls about her.

The Swastika and Worden Clubs are representative of the home economic work that is being carried on all over the project. Mrs. Frances Fenlon and Mrs. Ida Berg are the leaders guiding the Ballantine San Souci third-year clothing group to success, and in their footsteps comes a second year club who call themselves Susy's Sewing Circle and cheer for their leaders, Mrs. E. A. Bryson and Mrs. R. P. Warden.

At Huntley, where the big canal swings out from the Yellowstone, a group of Bluebirds organized under the ever present 4–H's banner are learning how to work and to play together, while Mrs. M. K. Davis and Mrs. L. A. Wicks help them with their 4–H's foods work. Eleven girls in the community around Osborne are keeping pace with the swine club boys and have lived up to their chosen name, the Osborne Jolly Working Band, by completing 100 per cent their first-year clothing work with the help of Mrs. L. H. Tennyson and Mrs. A. E. Seamans.

Out near the end of the canal where the nonirrigated land borders close to the irrigated are a group of boys and girls which has made club history. This community, known as the Fly Creek district, began swine-club work a number of years ago under the leadership of S. L. Brandon. The members have been particularly successful in balancing the production of feed crops and growing pastures to insure economical production of a type of hogs in strong market demand. Corn raising to provide feed for their herds soon followed the beginning of swine clubs, and the members organized a second club, the Fly Creek Happy Huskers, under the guidance of Jas. G. Morris. These two clubs have carried on a strong program, and out of the training provided by the corn work was developed the State champion corn-judging team of 1929. Gordon Brandon and Dorothy Morris were members of the team.

Along with these clubs the young ladies of the community have found profitable work and healthy pleasure during the three years their canning club has been organized. The present season witnessed each of the girls canning and storing enough fruits and vegetables to provide a variety for their family during the coming winter. And out of the products stored for home use exhibits were selected which monopolized the department at the State fair. Interest of parents in the work perhaps reaches its zenith in this community. Regular parent meetings, picnics, and achievement-day programs see 100 per cent attendance, and the accomplishments of the members show only too plainly the encouragement they have received throughout the routine and less spectacular part of the program. This interest has its own reward. It has knitted the community into a closer relationship and provided a wholesome social atmosphere.

At a joint achievement-day program of all of the clubs Mrs. J. G. Morris, social leader of the Busy Bee Canning Club, received a fine expression of appreciation from the girls by being presented with a local leader's pin. Marian Brandon has been one of the successful members of these clubs and now is accepting the responsibility of inspiring younger girls with the love of the work which she feels. She is the successful leader of the Stitch-in-time Clothing Club, which boasts seven happy members.

Potato and poultry work has been carried on by independent members a number of years. The former has been instrumental in improving the quality of seed used by local demand, and the poultry work has demonstrated the value of better stock and methods in farm flocks. Sheep work, looking forward to farm flocks, has been started and bids well to show steady growth.

The schools and farmers' organizations, together with business houses and individuals, are recognizing the importance of the 4–H Club work and are cooperating in its promotion. Interest is gaining ground for more and better livestock work, while the crops work is being more carefully planned and conducted. Young ladies are completing the home-economics programs and accepting the leadership of younger groups. The years ahead look bright for the growth and improvement of the entire field.

MRS. Willard Hayward, of the Pioneer district, Minidoka project, started in the spring of 1929 with a flock of 17 turkey hens and 1 tom, all pure bred, accredited bronze stock. Her gross receipts for the year were $752.30 and total expenses $235.75, leaving a profit of $517.65. Mrs. Hayward also has left over a breeding flock of 20 hens for 1930 operations.

Whitewash the insides of your window boxes before filling them in the spring to keep out insects and prevent the boxes rotting.

Advantages of Ready-to-Farm Lands on Federal Irrigation Projects

By F. N. Cronholm, Engineer

I DID some land leveling in a small way at Fallon, Nev., some 10 years ago. After 12 years of reclamation work with the Federal Government I spent some 4 years in Imperial Valley in charge of the Colorado River situation and water delivery. I mention this only to give an idea of the experience I have had in observing project settlement problems.

As regards Government reclamation projects, I am inclined to the belief that more should have been done than merely bringing water to the highest portion of a farm unit. If it is reasonable to have the works builded by the Government as efficient, as lasting and dependable as they are, then it seems reasonable that the lands served be as well provided. Truly, they are inseparable; so if there is justification for having excellent dams, diversion structures, canals, and laterals ready to serve, then there is like justification for having the canaled area leveled and, in every particular, ready to farm.

What the Bureau of Reclamation needs, if it does not already possess it, is a policy enough ahead of the times that when a project is completed everything about it will be attractive. An irrigation project is, after all, though indirectly, a sort of plant intended to produce food, and once a project is commenced it is not complete until the land is made ready to farm. Directly from the viewpoint of the State, as well as the Federal Government, the prime purpose of a project undertaking should be the building of a community of happy, wholesome people.

There are vast areas of desert already peopled to the benefit of both State and Government, and such work should by all means continue. There also are vast areas elsewhere long since settled that are dying or that are already dead. It should be the business of the Bureau of Reclamation to plant an example, as it were, here and there throughout such localities and revive crop output by working the land to capacity, making the community scheme of settlement so attractive that people will abandon other places that are hopelessly isolated and impossible to live in happily or to farm profitably. The cost of such community building should be prorated among those benefited, namely, the settler, the State, and the Federal Government. Make the amount to be refunded by the settler such that he can pay both the principal and interest and always feel decently cheerful about his contract as compared with what he might have done elsewhere.

What about the vacant portions of existing irrigation projects or extensions? Must these lands not be made attractive before they can be disposed of? Truly, there is more involved than annual maintenance and the construction charges. A prospective farmer will estimate, as best he can, to what extent he will be obliged to apply what moneys he has toward getting the land ready to produce. Whatever the outcome, there is no sound logic in permitting Tom, Dick, and Harry to hazard moneys invested by the Government by allowing them to level land, even at their own expense. The preparation of the surface by settlers has, in many cases, been against best crop output, against economic application and use of water, and a permanent detriment compared to what would have been the case had leveling been rightly done in the first place.

TIME IS A FACTOR

For instance, if on a farm unit there happen to be surface soils more productive than those of greater depth they are likely to be wasted by finding lodgment in hollows and not saved to spread over the surface as the farm unit is leveled. The foregoing is not of particular moment on the average sun-baked desert land, but every little bit helps. The settler is a great deal like any of the rest of us. He is apt to overlook many things, and, in fact, be obliged to do so because of having to produce something before he "goes broke." Time is a factor. He will eat up what he has before harvest time if he does not hasten planting, so saving topsoil becomes secondary as does methodical preparation of the surface; he plants first, probably an already level patch, irregular in shape; water is brought to the patch by short-cutting across the farm unit—meandering around this hollow and that bump—and thus, in time, endeth the beginning. He has now permanently disfigured and destroyed his unit for future maximum economic crop output, and this has been done with total disregard for adjoining lands.

Water is brought to land for a purpose, and it is the purpose in which we, as a people, are primarily interested. Therefore, while water is indispensable in arid regions, it is but a means to an end, and this objective should be the same in Alabama as it is in Idaho. In the beginning the purpose of the green spots to be created by the Bureau of Reclamation in the deserts of the Western States was, it is said, for food production in given areas, and at the time this was assumed an ample reason for expending moneys for irrigation works. Possibly so. At any rate, it brought about a beginning by creating a department in our Federal Government that should continue in the good it is doing and can do. The objective of food production of long ago must be enlarged on, however, or changed in order that it may be more nationally adapted. Make this purpose as applicable to Alabama as to Idaho. Let the objective be community building, reviving of soils and people. Do work in every State for the purpose of bringing up the average. Make irrigation works, stump pulling, land leveling, draining of swamps, or adding fertility to soils secondary in so far as they are but a means of bringing about the objective. Preparing lands to the point where they are *ready to farm* and offering them to people at a price and on terms that are attractive and well within their ability to pay is an undertaking which, coupled with assistance and guidance needed in the matters of suited crops, market outlets, and so on, would, in its completeness, it seems to me, provide a greater certainty of return of investment to the Government than when the Government undertakes to do but one of the major necessities, such as bringing water to land.

Converting rough, raw land into producing farms has been done by settlers poorly fitted, both in knowledge and money, to do the work. Poor and humble as many of them were, each one must have believed that his progress would be forward. As a matter of fact, many people lost their life savings and quite permanently wrecked themselves. Every one having a part in this first work was forced to a lower standard of living for quite a time and, as a result, no one of them is inclined to bestow gratitude. If it costs $60 to $120 an acre to bring water to a farm, it costs about as much an acre to prepare land ready to farm—that is, on an average, and with the understanding that the work is done as lavishly and completely in one case as in the other. Therefore, it seems that the settler in preparing his land to farm, even though inadequately, has certainly done his part, whether it was on a Federal or a private enterprise.

PRIVATE VERSUS GOVERNMENT PROJECTS

Looking to private enterprises for a solution to problems of Federal Government undertakings is of no use. Policies and methods of merit, differing from those applied by the Government, have always been available and would, undoubtedly, have been adopted forthwith in the beginning

(Continued on p. 78)

Repayment of Construction Charges

PRIOR to the passage of the fact finders act (sec. 4 of the act of December 5, 1924, 43 Stat., 672) practically only one plan of repayment was in effect, i. e., the 20-year repayment plan provided for by the extension act of August 13, 1914 (38 Stat., 686). Only a few water users retained the 10-year repayment plan provided for by the original reclamation act of June 17, 1902 (32 Stat., 388).

At present there are in effect three distinct plans of repayment—the 20-year repayment plan provided for by the extension act of August 13, 1914; the crop-production repayment plan provided for by subsection F of section 4 of the act of December 5, 1924; and the 40-year repayment plan provided for by the adjustment act of May 25, 1926 (44 Stat., 536). Special plans of repayment have been provided by law for the Okanogan project in Washington and the Rio Grande project in New Mexico-Texas. The crop-production repayment plan was repealed by the adjustment act of May 25, 1926. Sixteen projects and divisions of projects had accepted the crop production plan of repayment before it was repealed and are now paying construction charges on that basis; namely, in annual instalments of the constructions charge per irrigable acre, representing 5 per cent of the average gross annual acre income of the cultivated area of the project or division of the project.

Only 10 projects or divisions of projects remain under the 20-year plan of repayment. All of these projects, except one, the Salt Lake Basin project in Utah, for which a supplemental water right is now being developed, are repaying construction charges to the United States. None of these projects share in the benefits of the fact finders act of December 5, 1924, or the adjustment act of May 25, 1926.

During the period 1920 to 1924 many of the projects and divisions of projects advanced to the 4 and 6 per cent basis of annual instalments of construction charges under the 20-year plan of repayment. In several cases these charges exceeded 10 per cent of the average annual gross crop production, and many projects became delinquent in the repayment of construction charges. On June 30, 1925, approximately $6,000,000 of construction charges due remained unpaid.

The adjustment act of 1926 authorized the Secretary of the Interior, in his discretion, to amend any existing water right contract to the extent necessary to carry out the provisions of the act, upon request of the holder of such contract, the amendment of any existing water right contract to provide for increase in the time for payment of construction charges, which had not then accrued to the extent that may be necessary under the conditions in each case, subject to the limitation that there shall be allowed for repayment not more than 40 years from the date the first payment matured under the original contract. Amendment of water right contracts under the above limitation resulted in a variable repayment period for water users on the same project, the date the first payment matured under the original contract limiting the number of instalment years, further limited by number of years, not exceeding 40, granted by the Secretary.

The application of the terms of the fact finders act of 1924 and the adjustment act of 1926 has resulted in various plans of repayment, dependent to a large extent upon the economic conditions of the project. The purposes of these acts are the rehabitation of the several reclamation projects and the insuring of their future success by placing them upon a sound operative and business basis.

The following statement is a classification of the several projects by plans of repayment of construction charges. Contracts for the repayment of amounts charged for furnishing supplemental water supply under the Warren Act are not considered in the following classification:

Twenty-year repayment plan (extension act of August 13, 1914)

Salt River project, Arizona.
Yuma project, Arizona-California.
Orland project, Arizona.
Grand Valley project, Colorado: Orchard Mesa division.
Minidoka project, Idaho: Gravity division.
Carlsbad project, New Mexico.
Salt Lake Basin project, Utah.
Yakima project, Washington:
- Tieton division.
- Sunnyside division.

Crop production repayment plan (act of December 5, 1924)

Boise project, Idaho:
- Arrowrock division.
- Notus division.

King Hill project, Idaho.
Minidoka project, Idaho: South side pumping division.
Sun River project, Montana:
- Fort Shaw division.
- Greenfields division.

Lower Yellowstone project, Montana-North Dakota.
North Platte project, Nebraska-Wyoming:
- Interstate division.
- Fort Laramie division.
- Northport division.

Umatilla project, Oregon.
Strawberry Valley project, Utah.
Yakima project, Washington: Kittitas division.
Shoshone project, Wyoming:
- Garland division.
- Frannie division.

Forty-year repayment plan (act of May 25, 1926)

Grand Valley project, Colorado: Gravity division.
Uncompahgre project, Colorado.
Minidoka project, Idaho: Gravity extension division.
Huntley project, Montana.
Milk River project, Montana:
- Malta division.
- Glasgow division.

Sun River project, Montana: Greenfields division (new lands).
Newlands project, Nevada.
Vale project, Oregon.
Klamath project, Oregon.

Owyhee project, Oregon.
Belle Fourche project, South Dakota.
Strawberry Valley project, Utah.

Special repayment plans

Okanogan project, Washington (31 years).
Rio Grande project, New Mexico-Texas (30 years).

Repayments of construction charges during the fiscal year 1929 amounted to $4,387,813.80, an increase of $932,049.11 compared with the fiscal year 1928. Repayments of operation and maintenance charges amounted to $1,920,500.27, an increase of $77,115.71 compared with the fiscal year 1928. The total payments during the fiscal year 1929 amounted to $6,308,314.37 compared with $5,299,149.55 in 1928, an increase of $1,009,164.82.

Construction repayments showed a healthier condition on June 30, 1929, than ever before. The marked improvement during the past two years indicates that the general readjustment of the financial conditions between the United States and the water users under the acts of 1924 and 1926 is achieving in the majority of cases the purposes of the acts. The activity of the irrigation districts, water users associations, and other organizations in the collection and payment of obligations due the Government has contributed greatly to the present condition.

The accompanying table shows the construction account repayments at the end of the last fiscal year. It is gratifying to note that 15 projects have repaid 95 per cent or more of the amounts due on construction, the table as a whole showing that only 3.2 per cent of the amount due remained unpaid at the end of the fiscal year. This is unquestionable evidence of the willingness and ability of the water users to meet their payments and keep the fund revolving.

Bound Copies of New Reclamation Era

A limited number of sets of the New Reclamation Era for 1929 have been bound and are now available to the project offices upon receipt of sets of unbound copies for the year.

Emerson is credited with having said that whoever would build a better mousetrap than anybody else, though he hid his house in the woods, mankind would make a beaten path to it.

Raymond-Riordon School Hears Reclamation Talk

Hugh A. Brown, Director of Reclamation Economics, addressed the Raymond-Riordon School recently on the subject of "Federal Reclamation, its Origin, Problems, and Accomplishments," illustrated with colored lantern slides.

The Raymond-Riordon School is located in Highland, N. Y., but has been transferred bodily, pupils and teachers, for three months to Washington, D. C., to study at first hand the various governmental activities, executive, legislative, and judicial.

During their stay in Washington addresses are being given to the school by representatives of the Government departments and bureaus and by Members of Congress on various phases of the work of the Government.

The school is located on two floors of one wing of a hotel, where study rooms, class rooms, and sleeping rooms have been provided. All eat together in a special dining room on another floor. The school is an accredited institution, and prepares its pupils for entrance to colleges and universities.

STATUS OF CONSTRUCTION ACCOUNT REPAYMENTS, JUNE 30, 1929

State and project	Construction account, June 30, 1929, repayable	Value of repayment contracts	Amounts of repayment contract due on June 30, 1929	Balance of repayment contract deferred (not due)	Amounts paid on amounts due	Amounts uncollected of amounts due	Per cent repaid of amounts due
Arizona: Salt River	$10,166,021.97	$10,166,021.97	$5,286,331.45	$4,879,690.52	$5,286,331.45		100
Arizona-California: Yuma	9,514,325.54	5,065,287.70	3,257,480.07	1,807,807.63	3,168,945.52	$88,534.55	97.3
California: Orland	2,355,280.79	2,482,342.95	636,714.74	1,845,628.21	620,740.94	15,973.80	97.5
Colorado:							
Grand Valley	4,039,769.78	999,768.00	39,990.72	959,777.28	28,901.72	11,089.00	72.3
Uncompahgre	5,463,113.28	5,510,805.93	585,864.77	4,924,941.16	440,693.72	145,171.05	75.2
Idaho:							
American Falls	7,625,034.66	6,127,795.98	3,379,061.73	2,748,734.25	3,379,061.73		100
Boise	15,726,539.07	14,695,837.38	3,008,279.20	11,687,558.18	2,993,074.78	15,204.42	99.5
King Hill	1,489,968.94	1,489,968.94	8,650.00	1,481,318.94		8,650.00	
Minidoka	5,784,834.73	6,301,229.68	4,187,121.64	2,114,108.04	4,077,323.53	109,798.11	97.4
Minidoka gravity extension	373,541.92	5,223,500.00	140,000.00	5,083,500.00	100,000.00	40,000.00	71.4
Montana:							
Huntley	1,859,757.99	1,790,364.66	527,172.34	1,263,192.32	527,172.34		100
Milk River	5,301,603.30	5,012,010.00		5,012,010.00			
Sun River	6,811,857.34	10,012,837.24	185,527.72	9,827,309.52	184,975.23	552.49	99.7
Montana-North Dakota: Lower Yellowstone	3,904,997.37	4,164,248.92	152,483.53	4,011,765.39	152,177.72	305.81	99.8
Nebraska-Wyoming: North Platte	21,085,683.45	22,265,058.43	2,735,492.00	19,529,566.43	2,558,794.99	176,697.01	93.5
Nevada: Newlands	3,484,709.54	3,299,558.05	886,227.93	2,413,330.12	885,109.09	1,118.84	99.9
New Mexico:							
Carlsbad	1,422,841.31	1,425,182.75	793,714.62	631,468.13	759,431.31	34,283.31	95.7
New Mexico-Texas: Rio Grande	12,971,423.26	13,255,300.00	2,200,769.36	11,054,530.64	2,032,269.36	168,500.00	92.3
Oregon:							
Umatilla	4,452,425.41	3,814,528.94	420,303.81	3,394,225.13	375,911.97	44,391.84	89.4
Vale	1,300,251.04	4,500,000.00		4,500,000.00			
Oregon-California: Klamath	5,246,525.86	3,750,540.69	967,548.88	2,782,991.81	901,447.99	66,100.89	93.2
Oregon-Idaho: Owyhee	1,604,755.13	18,000,000.00		18,000,000.00			
South Dakota: Belle Fourche	4,127,172.01	4,251,433.07	552,811.91	3,698,621.16	552,811.91		100
Utah:							
Salt Lake Basin	1,364,701.22	3,000,000.00		3,000,000.00			
Strawberry Valley	3,331,243.04	3,208,235.57	992,603.94	2,215,631.63	992,603.94		100
Washington:							
Okanogan	424,198.97	424,198.97	120,365.61	303,833.36	120,365.61		100
Yakima	14,098,495.53	11,571,097.77	5,714,477.11	5,856,620.66	5,476,903.24	237,573.87	95.8
Yakima-Kittitas	4,905,902.71	9,000,000.00		9,000,000.00			
Wyoming:							
Riverton	3,354,923.82						
Shoshone	8,135,468.41	5,579,031.90	781,300.65	4,797,731.25	733,457.87	47,842.78	93.9
Total	171,790,701.72	186,386,185.49	37,560,293.73	148,825,891.76	36,348,505.96	1,211,787.77	96.8

Montana Irrigation Problems

(Continued from p. 61)

information and misunderstanding as to the relationship of the production from the usual irrigation project to the present agricultural surplus of the Nation. The produce from most of the irrigated sections does not come into competition with the general produce from the great humid farming areas of the country. Wheat, corn, and like products are not typically irrigated crops except in connection with stock feeding or as they fit into a crop rotation plan. The portion of such crops contributed to the Nation's supply is almost negligible. On the other hand, these projects do produce in considerable quantity many high-priced commodities, the demand for which can not be supplied by the present production of this country. This movement is nevertheless having a very definite influence upon the development of our irrigated areas, and in order that it may not gain momentum, everything possible should be done by the agricultural interests of the West to counteract its effect.

COMPETITION IN SETTLEMENT

During the next few years the settlement of Montana must compete with that of several sections in Idaho, Oregon, and Washington, which are widely advertised as offering excellent possibilities to the new settler in the way of agricultural and climatic advantages. We believe that most of our Montana projects compare favorably with other projects of the Northwest in most respects. Yet if settlers already located are to be retained and new ones attracted, exceptional opportunities must be offered here. It is essential, therefore, that a well-coordinated effort be exerted by everyone interested in the welfare of Montana to overcome to those obstacles that now stand in the way of the settlement of her irrigation projects, to the end that an orderly and permanent development of her resources may be accomplished and her wealth and prosperity thereby be increased.

Ready-to-Farm Lands

(Continued from p. 75)

had such policies and methods been most adaptable. My personal experience is that the Government has always been progressive. The men responsible for making decisions since the infancy of the service are to be commended and, considering the magnitude of the work accomplished, have an enviable reputation in that they made so few mistakes. The Government's most questionable projects are poorly located from the point of view of marketing and climate. Let us not take too seriously the thought that the more private a project, the more successful; or the more public, the more hazardous. Take Imperial Valley for example. This project is what might be termed half and half since it is not entirely Government and not entirely private. It has ample area to be representative, many sunshine hours, exceptional growing climate, fair marketing conditions, and, at that, it has seen many ups and downs and most certainly is not yet "out of the woods." Comparisons are to no end and, as previously stated, of no value.

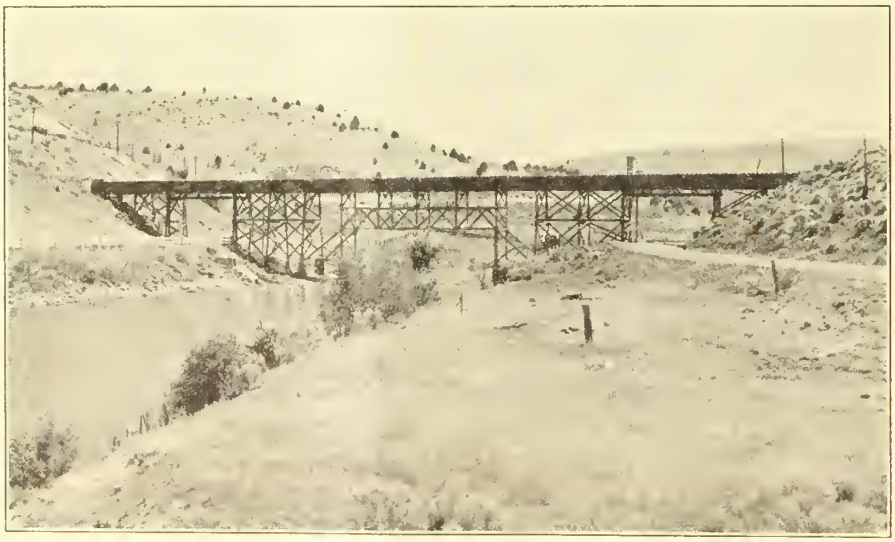
What irrigation projects lacked at the time the Government began its work was scope. Irrigation practice, outside of possible district projects, was strictly commercial, first, last, and all the time. Works were builded with total disregard to future upkeep, and it was the settler who shouldered the burden of paying the cost and a profit to the promoters as well. Salesmanship was a main feature for good and lasting works could be slighted or needed portions eliminated altogether depending on the amount of sales talent. As a consequence, people settled the areas more out of the hope and glowing promises engendered by high-powered sales talk than because of any material thing of worth. Resales resulted, and the next settler was able to benefit somewhat by the labors of the man he succeeded. All of which is irrelevant and immaterial and of no moment, though I believe if private and district projects had gone another step toward making lands ready to farm and had been leveling land when the Government entered the field, the Government would have adopted such a policy also, and to-day all projects would be better off financially and their settlers more prosperous.

Perhaps the most serious lack was the foregoing, namely, the absence of land leveling as a practice in project construction. Besides there was the mistake of using too generously in estimating acre costs the lands within the reach of the projects' distribution systems. Many of these lands, on detailed examination, would have been excluded. The suitability of the rougher lands, from the viewpoint of the prospective settler and his ability to pay, was not gone into as completely as it should have been. Fitness of lands to farm should have been given the same study as was given the building of irrigation works.

It is all right in 1930 to say that 25 years ago project settlers should have been only those with $5,000 or more. That was a lot of money in those days, and people who moved about in covered wagons were, for the most part, hard-working folk glad of employment in the building of project works, and often it was these same people, who later, out of hard-earned savings, became project settlers. Such people are fading out like the buffalo and the antelope.

READY-TO-FARM LANDS

In my opinion, the only solution to land-settlement projects, whether or not the question of water is involved, or whether the work is done by the Federal Government, or by private or district organizations, is to do more toward making lands ready to farm. Even to-day people with five or ten thousand dollars are apt to wear too good clothes for farming. What, in fact, is against helping, or rather, creating opportunity for, the man with $2,000 or



Olene Flume and Lost River, Klamath project, Oregon-California

less? There are many such people and they are worthy people and, generally speaking, if the Government is interested in social uplift and community building, through giving impetus to crop output and organizing marketing, then it is these people who have the greatest need.

If there is ever a time when a man needs all of his allotted land in shape to farm it is in the beginning. For instance, if in a given locality it takes, say, 80 acres to ultimately support a family in an American way of living, then it is imperative that the entire unit be ready to seed as soon after settlement as growing seasons will permit. The size of a farm unit should, in any case, be sufficient to properly support the average family and allow for growth and education. Decent, respectful living with forward progress contingent on honest effort can rightfully be expected by any man willing to work to improve his condition, and under no circumstances should the Government lend itself to an undertaking that would hazard such progress. Most certainly it did this during early project settlement and, in fact, does so now every time it permits a settler on raw land not ready to seed. Such risking of a man's chance is diametrically opposed to what the Government's purpose should be.

HASTENING SETTLEMENT

In spite of the foregoing, the Bureau of Reclamation ranks high in accomplishment. There is no organization in the Nation that is cleaner, or that can show more good per dollar invested. The service must become more human and more national in scope. It must do reclamation work that will draw people from various States to a given locality for a specific purpose and thus create new life and bring hope nearer realization. Let us trust this is to be accomplished in the immediate future. At present the problem is what to do with unsettled portions of existing projects to the end of hastening their settlement. I suggest the following as a beginning:

1. Choose a project having unsettled land that is so geographically situated that additional crop output could be profitably marketed.

2. Have maps showing topography of each farm unit in the rough and others showing how the same land will look when it is leveled, ditched, and dyked and the necessary control structures are in. Show these maps to the prospective settler in order that he may see what is before him as well as choose what particular unit of those available he likes best (allowing progressive settlement only).

3. Level not part of the farm, but all of it and do this, following the most proven method according to soils, in a manner allowing for a reasonable range of crops. Lay out the work so that the farmer may manage without hired help if possible. Keep in mind economy of water for the good of crops.

4. Besides leveling the farm, turn the water on to it. If, in wetting, any portions settle, relevel the area. Make sure the entire unit is ready to plant. Also, provide outlet for surplus irrigation water, and in the farm layout, give some thought to possible future ground water relief should that become necessary.

5. Do not prepare lands to seed until the area has been applied for by a qualified settler who shall be required to put all of the land in crop beginning with the first growing season and keep it in crop for two full seasons before he is allowed to file on the farm unit.

6. Have each prospective settler acquire the necessary credentials to become a conditional settler from a local board intrusted by the people of the project with determining an applicant's fitness, the board not being limited by a prescribed minimum money requirement.

7. Collect in advance project maintenance charges. Add the cost of leveling and otherwise preparing the farm unit to project costs against the land, and of the total take a fair amount to be amortized in a reasonable time by the settler. Have him make the first payment and interest on deferred payments prior to the third season and yearly thereafter without fail. Make the amount to be ultimately repaid the Government of such size that the farmer will not fail because of it, but, at the same time, make it an obligation generally conceded as ample.

8. Do not charge for water used during the first two seasons. If the prospective settler pays all other expenses involved in cropping the entire unit twice, and makes ready to begin paying off the project debt by the third year, he will be doing well. After all, the would-be farmer will compare every location available to him, weighing advantages against disadvantages, before finally deciding on a particular project and what it has to offer. Once a man has become involved in a proposition, it is well that he continue satisfied.

The foregoing resolves itself into a plea for "ready-to-farm lands" and would involve a great deal in the matter of organization, though I suppose the educational work needed for its authorization and the procuring of needed moneys are the more difficult of accomplishment. It is acknowledged that something must be done to settle lands on Government projects now vacant. Personally, I can not help feeling that preparing farm units ready for seeding would bring sufficient settlers of the right kind to these areas.

In further clarification of suggestion No. 7, would it not be possible and equitable to the farmer as well as the Government to fix a rate of interest on deferred payments that will, in the end, make up the amount amortized in the beginning so that, as a matter of fact, the Government will be repaid in full? In this way the Government would not be a money lender charging rental, as it were, for its money, but the farmer would be paying interest nevertheless. For instance, say the project costs $150. The Government would only charge the farmer $75, but it would charge him interest at a rate which, in a certain term of years, will ultimately repay the total project cost to the Government.

If something along the lines suggested could be authorized, I am sure it would succeed. I also would like to see something worked out for the Southern States, and with the two demonstrations or experiments proven I believe an adaptation of the bureau to greater national good could be attained, and, in turn, the objectional political phases lessened as the good the service would then be doing would be more broadly understood and welcomed.

Colorado River Experts Consider Boulder Dam

Secretary Wilbur has requested the Colorado River Board of Engineers and Geologists, consisting of Maj. Gen. William L. Sibert, Daniel W. Mead, Robert Ridgway, Charles P. Berkey, and Warren J. Mead, to meet in Denver, Colo., on April 10 with the board of consulting engineers, comprising Messrs. A. J. Wiley, L. C. Hill, and D. C. Henny, the purpose of the meeting being the consideration of the design of Boulder Dam, the advisability of increasing its height, and of other questions which have presented themselves in connection with the studies that have been undertaken by the Denver office of the Bureau of Reclamation.

Concrete Mixers Used at Owyhee Dam

The General Construction Co., building the Owyhee Dam, is using two 4-cubic yard concrete mixers built by Norros K. Davis, of San Francisco. These giant mixers have capacities of 112 cubic feet of mixed concrete and will be used for 4-cubic yard batches. The drums have an inside diameter of 9 feet 2 inches and are 13 feet long from inlet to discharge spout. Inlet and outlet openings are 34 inches in diameter. Each unit weighs 55,000 pounds and the charging hopper weighs an additional 11,000 pounds.

Reclamation Organization Activities and Project Visitors

On March 18 and 19 Commissioner Mead delivered two lectures, illustrated with motion pictures and lantern slides, on the "Engineering Features of Boulder Dam" and "Water Problems of the Arid Region" at the Carnegie Institute of Technology, Pittsburgh, Pa.

Dr. Elwood Mead, Commissioner of Reclamation; P. W. Dent, Assistant Commissioner; and Hugh A. Brown, Director of Reclamation Economics, attended a hearing on March 6 before the House Committee on Irrigation and Reclamation to discuss the recommendations in the report of the economic survey last summer of certain Federal and private irrigation projects.

R. F. Walter, chief engineer, attended a recent conference at Yakima, Wash., to consider engineering and economic features of the proposed Yakima project extensions and before returning to Denver inspected work in progress on the Kittitas, Vale, and Owyhee projects. The latter part of the month, in company with Doctor Mead, Mr. Dent, and Mr. Sanford, Mr. Walter conferred with interested parties at Casper, Wyo., on the progress of the Casper-Alcova investigations.

Miss Mae A. Schnurr, assistant to the commissioner, attended a testimonial dinner given in Washington, D. C., on February 28 by women in the public service in honor of Miss Annabel Matthews, recently appointed by President Hoover and confirmed by the United States Senate a member of the Board of Tax Appeals in the Bureau of Internal Revenue. Miss Matthews is the first woman member of the board. About 100 women were present at the dinner, including all those prominent in the administrative work of the Federal Government in Washington.

Ray M. Priest, superintendent of the Yuma project, has been appointed a member of the International Water Commission as consulting engineer to make a survey of the entire delta region of the Colorado River below the international boundary. Dr. Elwood Mead, Commissioner of Reclamation, is chairman of the water board.

C. A. Dobbel, executive assistant to the Secretary of the Interior, was a visitor on the Rio Grande project during the month.

Walker R. Young, construction engineer, and C. A. Bissell, chief of the engineering division of the Washington office, have been selected by Secretary Wilbur to make investigations of water conservation in California, under a cooperative agreement with the State. The two Bureau of Reclamation representatives met with State officials in Sacramento on March 20 to outline the work.

J. O. Broek, of Holland, was a recent visitor in the Washington office making a study of settlement and economic conditions on the reclamation projects. Later in the year he expects to visit a number of the projects with a view to a more intensive field of study.

Asa K. Hepperly, assistant agricultural agent for the Chicago, Burlington & Quincy Railroad, was on the Shoshone project early in the month for the purpose of investigating the results of the experiments with red clover on the new land of the Willwood division.

Paul J. Leverone, a former employee in the Washington office of the Bureau of Reclamation, member of the Washington Society of Engineers, and president of the Columbia School of Drafting and Engineering, gave a radio talk on March 25 over WRC on "Drafting" for the vocational guidance committee of the Kiwanis Club.

Effective February 26, Howard C. Stetson was transferred from the position of superintendent, North Platte project, to that of engineer in the Denver office.

George O. Sanford, reclamation economist, is making an economic survey of the Uncompahgre project following the recommendations made at the Denver conference. He also plans an investigation of the Grand Valley project, particularly the Orchard Mesa division, with a view to the payment of construction charges in accordance with the productive value of the land.

Consulting Engineers A. J. Wiley, of Boise, and D. C. Henny, of Portland, were visitors on the Minidoka project during the month.

District Counsel R. J. Coffey spent one day during the month on the Orland project in connection with legal matters.

District Counsel B. E. Stoutemyer, Electrical Engineer L. N. McClellan and Construction Engineer F. A. Banks met at Boise, Idaho, early in the month for a further discussion of the power-transmission contract to the Owyhee project.

Heber J. Grant, president of the Mormon Church, was a recent visitor in the Washington office.

J. M. Patterson, of Putney, Ga.; J. F. Jackson, agricultural development agent of the Central of Georgia Railway, Savannah, Ga.; Ben Stevens, of Richton, Miss.; and S. A. Robert, director of development, Gulf, Mobile & Northern Railroad, Jackson, Miss., were recent visitors in the Washington office in connection with the bills introduced in the House and Senate to provide opportunities for planned group settlement in the Southern States. Favorable reports on these bills have been made by both the House and Senate Committees on Irrigation and Reclamation.

Fact-Finding Commission for Uncompahgre

As a result of the recent meeting in Denver to consider economic and financial conditions on the Uncompahgre project, Colorado, Governor Adams has appointed the following fact-finding commission to investigate the project and recommend a permanent program for its rehabilitation: Dr. Charles A. Lory, president Colorado Agricultural College, chairman; Edward D. Foster, State commissioner of immigration, Greeley; R. F. Walter, chief engineer, Bureau of Reclamation, Denver; W. P. Dale, president, Uncompahgre Water Users' Association, Delta; District Judge George W. Bruce, Montrose.

Three other committees were appointed to aid in rehabilitating the project. George B. Harrison, Denver banker, was named chairman of a committee to revive credit for the farmers; Herman Elliott, Montrose, chairman of a committee to plan drainage for seeped land; and B. H. Taylor, Denver, vice president of the Denver & Rio Grande Western Railroad, chairman of the committee on colonization.

Woman's part in conquering the desert is usually underestimated. The rural-minded man must have a rural-minded wife if the two are to succeed in the building of a household on the land.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

HON. RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department;
E. K. Burlew, Administrative Assistant to the Secretary and Budget Officer;
Northcutt Ely, Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division

Hugh A. Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Engineer

S. O. Harper, General Superintendent of Construction; J. L. Savage, Chief Designing Engineer; E. B. Debler, Hydrographic Engineer; L. N. McClellan, Electrical Engineer; C. M. Day, Mechanical Engineer; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Project	Office	Superintendent	Chief clerk	Fiscal agent	District counsel	
					Name	Office
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Mitchell, Nebr.
Boise [1]	Boise, Idaho	R. J. Newell	W. L. Vernon		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Grand Valley	Grand Junction, Colo.	J. C. Page	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Huntley [2]	Ballantine, Mont.					
King Hill [3]	King Hill, Idaho					
Klamath	Klamath Falls, Oreg.	B. E. Hayden	N. G. Wheeler	Joseph C. Avery	R. J. Coffey	Berkeley, Calif.
Lower Yellowstone	Savage, Mont.	H. A. Parker	E. R. Scheppelmann	E. R. Scheppelmann		Billings, Mont.
Milk River	Malta, Mont.	H. H. Johnson	E. E. Chabot	E. E. Chabot		Do.
Minidoka [4]	Burley, Idaho	E. B. Darlington	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Newlands [5]	Fallon, Nev.				R. J. Coffey	Berkeley, Calif.
North Platte [6]	Guernsey, Wyo.	Claude F. Gleason [7]	Arthur T. Stimpfig	Arthur T. Stimpfig	Wm. J. Burke	Mitchell, Nebr.
Okanogan [8]	Okanogan, Wash.				B. E. Stoutemyer	Portland, Oreg.
Orland	Orland, Calif.	R. C. E. Weber	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg.	F. A. Banks [9]	H. N. Bickel	Frank P. Greene	B. E. Stoutemyer	Portland, Oreg.
Rio Grande	El Paso, Tex.	L. R. Fiock	Henry H. Berryhill	Henry H. Berryhill	H. J. S. Devries	El Paso, Tex.
Riverton	Riverton, Wyo.	H. D. Comstock	R. B. Smith	Erle W. Shepard	Wm. J. Burke	Mitchell, Nebr.
Salt Lake Basin	Salt Lake City, Utah					
Salt River [10]	Phoenix, Ariz.					
Shoshone [11]	Powell, Wyo.	L. H. Mitchell	W. F. Sha			Billings, Mont.
Strawberry Valley [12]	Payson, Utah					
Sun River [13]	Fairfield, Mont.	A. W. Walker [9]	H. W. Johnson	H. W. Johnson		Do.
Umatilla [14]	Irrigon, Oreg. Hermiston, Oreg.					
Uncompahgre	Montrose, Colo.	L. J. Foster [9]	G. H. Bolt	F. D. Helm	J. R. Alexander	Montrose, Colo.
Vale	Vale, Oreg.	H. W. Bashore	C. M. Voyen	C. M. Voyen	B. E. Stoutemyer	Portland, Oreg.
Yakima	Yakima, Wash.	P. J. Preston	R. K. Cunningham	C. J. Ralston	Do.	Do.
Yuma	Yuma, Ariz.	R. M. Priest	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.

Large Construction Work

Salt Lake Basin, Echo Dam.	Coalville, Utah	F. F. Smith [9]	C. F. Williams		J. R. Alexander	Montrose, Colo.
Kittitas	Ellensburg, Wash.	Walker R. Young [9]	E. R. Mills		B. E. Stoutemyer	Portland, Oreg.
Sun River, main canal Construction.	Fairfield, Mont.	A. W. Walker [9]			E. E. Roddis	Billings, Mont.
Boise project, Deadwood Dam.	Cascade, Idaho		C. B. Funk		B. E. Stoutemyer	Portland, Oreg.

[1] Operation of Arrowrock Division assumed by Nampa-Meridian, Black Canyon, Boise-Kuna, Wilder, Big Bend, and New York Irrigation Districts on Apr. 1, 1926.
[2] Operation of project assumed by Huntley Project Irrigation District on Dec. 31, 1927. E. E. Lewis, manager.
[3] Operation of project assumed by King Hill Irrigation District Mar. 1, 1926. F. L. Kinkade, manager.
[4] Operation of South Side Pumping Division assumed by Burley Irrigation District on Apr. 1, 1926, and of Gravity Division by Minidoka Irrigation District on Dec. 2, 1916.
[5] Operation of project assumed by Truckee-Carson Irrigation District on Dec. 31, 1926. D. S. Stuver, manager.
[6] Operation of Interstate Division assumed by Pathfinder Irrigation District on July 1, 1926, Fort Laramie Division by Goshen Irrigation District and Gering and Fort Laramie Irrigation District on Dec. 31, 1926, and Northport Division by Northport Irrigation District on Dec. 31, 1926.
[7] Superintendent of Power.
[8] Operation of project assumed by Okanogan Irrigation District on Dec. 31, 1928. Joe C. Iddings, manager.
[9] Construction engineer.
[10] Operation of project assumed by Salt River Valley Water Users' Association on Nov. 1, 1917. C. C. Cragin, general superintendent and chief engineer.
[11] Operation of Garland Division assumed by Shoshone Irrigation District on Dec. 31, 1926, and of Frannie Division by Deaver Irrigation District on Jan 1, 1930.
[12] Operation of project assumed by Strawberry Water Users' Association on Dec. 1, 1926. Lee R. Taylor, manager.
[13] Operation of Fort Shaw Division assumed by Fort Shaw Irrigation District on Dec. 31, 1926.
[14] Operation of West Division assumed by West Extension Irrigation District on July 1, 1926. A. C. Houghton, manager; and East Division by Hermiston Irrigation District informally on July 1, 1926, and formally, by contract, on Dec. 31, 1926. Enos D. Martin, manager.

Important Investigations in Progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Yuma, Ariz.	H. J. Gault	
Gila River Basin	Safford, Ariz.	Orrin C. Smith	Arizona and New Mexico.
Boulder Canyon	Las Vegas, Nev.	W. R. Young	
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga	Casper, Wyo.	J. R. Iakisch	
California Water Resources	Sacramento, Calif.	W. R. Young C. A. Bissel	State of California.

APPLE BLOSSOM TIME ON AN IRRIGATED FARM

U. S. GOVERNMENT PRINTING OFFICE: 1930

NEW RECLAMATION ERA

VOL. 21 MAY, 1930 NO. 5

IRRIGATING SUGAR BEETS ON THE BELLE FOURCHE PROJECT, S. DAK.

Reclamation's Contribution to the Nation

THERE is no way of measuring accurately the full contributions these enterprises have made to the business and social life of the States and communities in which they are located, and to the national wealth, but the following facts are pertinent: They have greatly aided commerce as the residents of the projects are buyers and sellers af a vast amount of goods and products. The projects have brought about improvement and increase in both highway and rail transportation. They have provided huge revenue tonnage for transcontinental carriers through regions of otherwise sparse traffic, and thus to an appreciable extent have lowered the rate levels on other commodities moving over their entire systems. They have contributed to education and to local government by the payment of taxes. They have made it possible to utilize fully adjacent ranges and to stabilize the livestock industry and dry-land agriculture of the West. They are the main source of food supply for many mining and lumbering camps.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 May, 1930 No. 5

Interesting High Lights on the Federal Reclamation Projects

LETTUCE picking and packing the latter part of the month on the Yuma project was at the season's peak, with peak shipments amounting to 35 cars per day. The market improved and full advantage was taken of the better prices. The top price was $2.50 per crate, f. o. b. cars, while the price at the close of the month was $1.65 per crate. The local season closed the middle of the month.

BIDS have been received and award made for the erection of a War Memorial Building at Orland, Calif. It is expected that the structure will be completed in time for occupation next winter.

ALL livestock on the Uncompahgre project wintered in excellent condition. Lambing operations continued in full swing during the entire month under very good weather conditions. It is estimated that the lamb crop will run around 125 per cent increase.

THE Minidoka project, Idaho, is anticipating large areas devoted to potatoes and sugar beets this year, which will be considerably in excess of the 1929 crops. There still remain about 300 cars of potatoes on the project, all of which will be marketed in the near future, two-thirds being on the South Side, and the remainder in the vicinity of Rupert.

THE Kiwanis Club held its fourth annual flower show at Yuma early in the month. Since the inauguration of these annual flower shows an increased interest in growing and cultivating flowers has been manifested locally, resulting in the beautifying of the grounds around the various city homes.

THE new casein plant at Rupert, Minidoka project, was completed during the month and is now in operation.

THE Mini-Cassia Dairy Herd Improvement Association on the Minidoka project reports that during a recent month 223 cows owned by members produced an average of 705 pounds of milk and 30.7 pounds of butterfat. The cow "Sigis," owned by Haven Leigh of Burley, led all others with a record of 98 pounds of butterfat. Many other herds showed records of from 40 to over 90 pounds of butterfat per cow.

APPROXIMATELY 8,000 packed boxes of grapefruit were shipped from unit B and adjoining groves on the Yuma auxiliary project during the month, bringing the total shipments this season to 33,500 boxes of grapefruit, with an estimated remainder of 9,000 boxes on the trees, and 3,000 boxes in the packing shed yet to be marketed.

AT the end of the month about 6,000 acres of beets were contracted for the 1930 season on the Minidoka project, and it is expected the final area will reach 6,500 acres. This is about equally divided between the two divisions of the project.

THE Alfalfa Seed Growers' Association on the Milk River project, in cooperation with the Livestock Shipping Association, completed plans during the month for the establishment of a seed cleaning and storage plant at Malta.

THE agriculture extension train of the New Mexico Agricultural and Mechanical College, located at Mesilla Park, N. Mex., on the Rio Grande project, was organized and started on a 16-day tour of New Mexico on March 31. The train consisted of 8 cars, and exhibited poultry, livestock, improved kitchen equipment, and many displays of crops, livestock, feeds, and certified seeds. The train, which covered the State, was operated over the Santa Fe lines.

THE sale of seven farms on the Minidoka project was recorded during the month. On the gravity division of a 40-acre tract 3 miles northeast of Rupert sold for $5,390, and 20 acres one-half mile west of Rupert brought $1,250. For 80 acres near Rupert, $6,300 was paid, and for 40 acres near Paul, $5,500. On the pumping division three farms changed hands. One of 40 acres, in the Goose Creek bottom near Burley, sold for $4,000; another 40-acre tract south of Declo was disposed of for $5,000, and the third farm, also of 40 acres, brought $4,500.

TWO new settlers were placed on the Malta division of the Milk River project during the month, purchasing a good tract of land adjacent to the Malta townsite. Preparation is being made for the irrigation during the coming season of several farms which have not heretofore used water.

ON the Yuma project ground was broken and excavations were made for the erection of a 6-story hotel on the transcontinental highway in the heart of the local business district. This hotel will be a member of the San Carlos Hotel Association, and will be a structure of the latest design, equipped with all modern fixtures and furnishings, including a special cooling system for all rooms. This feature should appeal to the traveling public particularly. The cost of the structure and furnishings has been estimated at $500,000.

STONY Gorge Reservoir on the Orland project, California, was filled to capacity on April 16, when water first passed over the spillway gates. Water reached the crest of East Park spillway on the following day. The flashboards, however, had not yet been installed.

SEVERAL prospective homesteaders were shown over the Riverton project during the month. One homesteader qualfied and two made homestead entry.

The Rehabilitation of Irrigation Districts[1]

By W. W. McLaughlin, Associate Chief, Division of Agricultural Engineering, U. S. Department of Agriculture.

THE subject of rehabilitation of irrigation districts is a broad one and will be treated in this paper in but a few of its aspects.

To rehabilitate, as used here, means to bring back into good repute and good standing those districts that are in financial difficulties; to provide for such districts an economic set-up that will make it possible for them to meet their obligations as they fall due, and ultimately permit the settler to become the owner in "fee simple" of his farm.

It must be understood in the first place that all districts do not require rehabilitation, since only relatively few of them are in financial difficulties. Usually the districts that do require rehabilitation are the newer ones, principally those undertaken at the time of the World War.

We are frequently asked "Why attempt the rehabilitation of irrigation districts at this time since there seems to be no immediate demand for irrigated farms?" Most districts have issued bonds, the proceeds of which were and are being used largely for the construction or acquisition of engineering works to be used by the district. These bonds have been sold broadcast, not only in this country but in many cases in foreign countries. The holders of the bonds have a just claim against the district, and, having bought the bonds in good faith, expect every reasonable means will be taken to pay the bonds in full. In some instances in the organization of a district there have been included existing farms, of which the holders went into the district in the same good faith as the purchaser of the bonds. New settlers have come into the district in practically all instances and invested their all, including frequently 5 or 10, or more, years of the best part of their lives. It is, therefore, a public duty to attempt to work out a salvation for these citizens.

DISTRESSED IRRIGATION DISTRICT A LIABILITY

The irrigation district or any other political or semipolitical division of the country that is in disrepute is a liability from the standpoint of the State and of the Nation. It should therefore be the policy of public agencies to clear up an unsatisfactory condition of this kind. In all instances the irrigation districts have been organized under State laws, and in many instances State officials have certified the bonds as just investments for public funds. There is in this latter instance more or less of a moral obligation upon the part of the State to assist the individual purchaser of bonds and the settlers in finding a way out of their difficulties. Distressed irrigation districts, like any other unhealthy situation of a more or less public nature, detract from both the morale and the financial confidence of the people at large, and therefore demand public attention and help in maintaining public confidence.

The division of the Federal Government which I represent first became actively interested in the economic feasibility studies of irrigation enterprises through a request from the Secretary of the Interior to the Secretary of Agriculture to make such an investigation of a proposed Federal project in Oregon. Immediately following this the State Certification Commission of Oregon requested this division, in cooperation with the Oregon Agricultural College, to advise as to the feasibility of a proposed irrigation district on which the State had been requested to certify the bond issue and advance the payment of interest for a period of five years. About the same time we were requested to make investigations of other districts in Oregon that were in financial difficulty, with a view of determining a means of rehabilitating such districts. We have also had similar requests from other States. During the past six or seven years we have devoted considerable time to the general subject of rehabilitation and feasibility of irrigation enterprises.

As an agency in the agricultural development of the West up to the present time, the irrigation district has been an extremely important factor and will be of much greater importance in the future. Probably more than one-fifth of the area irrigated at the present time has been brought under irrigation by means of irrigation districts. The area irrigated at the present time under irrigation district organizations, exclusive of Federal reclamation projects, is between three and four times the area irrigated within Federal reclamation projects. These figures will give some idea of the importance of this form of organization to the development of irrigation in the West.

IRRIGATION DISTRICT BONDS

The total amount of outstanding bonds of irrigation districts in 1929 was $185,000,000 as compared with $105,000,000 in 1922. In Bulletin No. 1177 of the division of agricultural engineering it is stated that 71 per cent of all irrigation district bonds sold to December 31, 1921, had been paid in full, as to both principal and interest. The percentage December 31, 1928, is just a trifle greater. This is a most satisfactory showing since it covers the period of maximum agricultural depression following the World War. Some of the bonds in default in 1921 have paid out in full, while some that were in good standing in 1921 have since defaulted. The same will be true of those in default and in good standing in 1928. As a business venture the buying of irrigation district bonds has not proven as hazardous during the past few years as the buying of stock in independent grocery stores, and not much more hazardous than buying stock in banks. We find in Trade Information Bulletin No. 627 of the Department of Commerce, an estimate that in Louisville, Ky., more than 40 per cent of the independent grocery stores fail annually, and only a small part of those that fail come back again into existence although new stores spring up to offset the failures. This, however, does not alter the percentage of failures. In banking, we find from figures compiled by the Federal Reserve Board that during the period 1921 to 1927 about 4,500 banks, or about 15 per cent of the total in the country, failed; that the capital involved in these failures was about $169,000,000, and the deposits about eight times that amount, or $1,350,000,000. Also, as we know, the stockholders of the banks were liable for double the amount of their investment. If we took up a review of the railroads and their development in the United States, we would probably find that irrigation district bonds were conparatively safe, if we base our conclusions on past performances of the railroad and irrigation district development.

Irrigation district bonds have suffered a depression in the market, until at the present time there is very little sale for such securities. The depression in bond prices is not confined to irrigation district issues. In fact, irrigation district bonds are not the only ones that are hard to sell on the market. During the present month the city of San Francisco, after many months of effort, has just succeeded in disposing $41,000,000 of municipal bonds of unquestioned standing. There seems to be no rhyme or reason to the irrigation district bond market. Edward Hyatt, State engineer of California, in a paper recently delivered at a convention of Western State engineers at Reno, brings out the fact that bonds of one California district, which under a long-

[1] Prepared for semiannual meeting of the American Society of Agricultural Engineers, Kansas City, Mo., December 30–31, 1929.

term power contract with a responsible concern provides for the payment of 80 per cent of its bond interest through sales of water for power, are quoted on the market at 40. In another district in the State, where only one-third of the district is developed and all of the water has been used in this development, the bonds are quoted at 90 and there is no power possibility.

Several attempts have been made by various States to stabilize the price of irrigation district bonds. The State of Washington provided through taxation a fund for the purchase of such bonds, but stopped the levy when about $3,500,000 had been accumulated. The State of Oregon in 1919 amended its constitution to permit the interest on irrigation district bonds to be advanced by the state for a period not exceeding five years. Repeal of this amendment is to be voted on at the next general election. The State of Wyoming has bought irrigation district bonds and to date all such bonds purchased are in good standing. California has never followed a policy of aiding development by purchase of irrigation district bonds, but in a few instances has invested State funds in bonds of selected districts. Utah attempted irrigation development by constructing irrigation works, but with little success. California has devoted its efforts primarily to land-settlement programs on two districts initially financed by the State. Ten of the States have at one time or another provided for the certification of irrigation district bonds by State commissions. In three States these acts have been repealed.

CAUSES OF IRRIGATION DISTRICT FAILURES

Before we can prescribe for irrigation district failures, we must first diagnose the case. Irrigation district failures may be attributed to four general causes:

(1) Engineering mistakes.

(2) Exploitation.

(3) Colonization difficulties.

(4) Changes in the financial and economic situation.

As a result of our studies we found that the principal causes of failure without regard to importance, may be listed more specifically as follows:

(1) Aftermath of the war; that is, many of these districts were started immediately following the war when prices and construction costs were high.

(2) Lack of settlers on the projects, which is probably one of the greatest causes of failure.

(3) The spreading of cost; that is, including within the boundaries of the district land that is not capable of paying its share of the cost. Many of the promoters work on the policy that the greater the area, with the construction cost of the work remaining the same, the less the per acre cost. Yet, if the land is not capable of producing sufficiently to meet this cost it is a liability rather than an asset.

(4) *Lack of sufficient water.*—In one case coming under my personal observation the water supply was sufficient for only approximately one-half of the area included in the district, and yet every acre in the district was assessed the same.

(5) *Improper financing.*—By this is meant terms of repayment beyond the ability of the land to meet. In some instances bonds matured in 10 or 20 years, and yet the proceeds from the land could not meet the bonds and interest unless spread over a term of 40 to 50 or even 60 years.

(6) *Uniform assessments for bond and interest payments.*—That is, every acre of land within the district that was irrigable was assessed upon a uniform basis irrespective of the ability of these lands to produce, or of ad valorem valuation. If the amount to be collected from these lands was on a basis of the return from the poorer lands, then the district could pay out. If, however, as was invariably the case, the basis of payment was on the productivity of the average land or, as it is termed, the average productivity, then those acres below the average could not meet their payments and defaulted because the acres above the average would not share their surplus to make up the deficiency of the poorer acres.

(7) *The development of alkali and water-logged areas.*—In most of the irrigated sections of the world, the lands are prone to become alkaline or water-logged, or both, unless adequate natural or artificial drainage exists. Most frequently in the younger districts there existed no means of legal credit for providing artificial drainage when alkaline or wet areas developed, and land so affected was soon unable to meet the payments.

(8) *Litigation.*—Frequently litigation over water rights occurred and retarded development as well as proving a financial burden which the district could not meet.

(9) *Lack of capital by settlers.*—Since many of the settlers coming to new projects were lacking in capital, and further, since they did not have sufficient collateral for loans to develop their lands, they were not able to make such developments with sufficient rapidity to meet their payments. Credit when it was at all available was at an excessively high rate of interest. In fact, one of the greatest stumbling blocks to the development of new areas where immediate payments must be made for the purchase of land or water, or both, is suitable credit for the settler during the development period.

(10) *Lack of proper economic consideration to the project.*—This is also one of the greatest causes of failure. One district that came under our observation, while a small district of only 8,000 acres, had its financial set-up based upon truck crops. This was an economic mistake for several reasons, principally because there was not a supporting market, and to transport the material to distant markets was prohibitive. In another district of very large area, the basis of financing was presupposing the entire area in fruit and attempting to make fruit growers out of all the settlers. This district was also set up on a basis of 4 per cent interest on bonds, and of course practically none of the bonds were sold.

(11) *Faulty State laws.*—This is not so serious, except in probably one particular, and that is because there is no adequate means provided for settling the affairs of the district that is in financial difficulty.

(12) *Land areas within a district in too large a single holding.*—A single farm unit that is too large to be operated by the owner soon becomes a difficulty, unless the owner can meet his payments from outside sources.

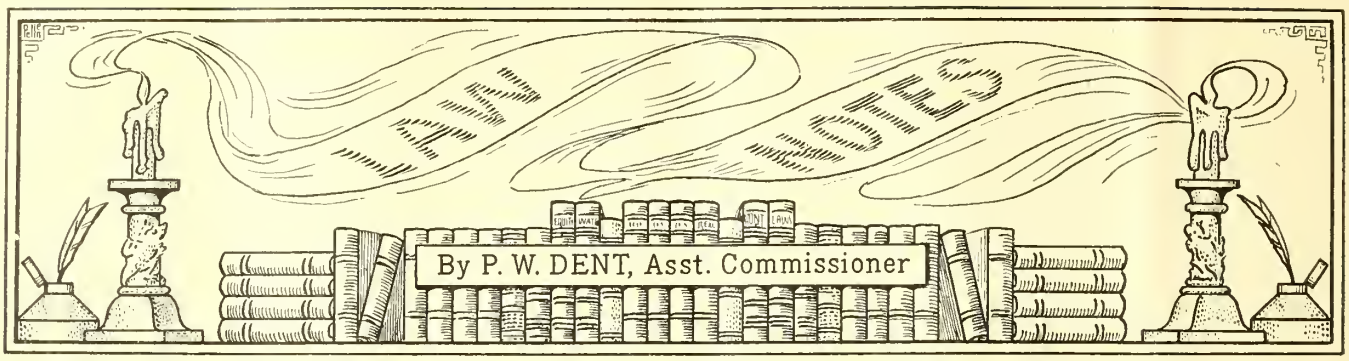
(13) *Unsound engineering.*—For instance, in one district the irrigation period extended over 150 days. The canal and distributing system was designed for a uniform quantity of water throughout the 150 days that would deliver to the land in that period of time the equivalent of 3 acre-feet of water per acre. No account was taken of the fact that probably 60 per cent of the water was required in six weeks to two months' time. This system was therefore inadequate to meet the demands of the district, and neither money nor credit was available to correct this defect.

(14) *Psychological features.*—The principal one among these is the practice in some sections of allowing deferred credit to old settlers for water rights. That is, a settler within an area that is to be organized into a district embracing much additional land is allowed a credit for the water rights he has depending upon the sufficiency of his water right to meet his needs. If he has 85 per cent of sufficient water to irrigate all of his land he could be entitled to a credit of 85 cents on the dollar for all future assessments. Frequently such land is the better land of the district and is a going farm unit that can meet its payments promptly. When the less fortunate neighbor, with new and undeveloped land, has to put down a dollar to the old settler's 15 cents, it has a depressing and deterring effect upon the new settler.

A FEW OF THE REMEDIES PROPOSED

As a result of our experience the following remedies are suggested for some of the causes leading up to district difficulties.

(Continued on p. 97)



Water Rights and Irrigation

Oregon

BENEFITS to lands by reason of construction of irrigation works for their irrigation are difficult of determination; hence the disparity of bases for the assessment of benefits employed in the several jurisdictions of the arid West.

The measure established by the Supreme Court of Washington State, in the case of Union Trust Company *v.* Carnhope Irrigation District (232 Pac. 341), appears to be much better adapted to a city improvement district than to an irrigation district. In that case section 7436, Remington Compiled Statutes, was construed to mean that benefits from irrigation must be determined for assessment purposes by the increase in the market value of the property affected.

The Oregon State Legislature in its thirty-fifth regular session (1929) in amending Section 7328, Oregon Laws, by enacting chapter 70, sought to furnish a measure of benefits in the following words:

Provided, however, That any district issuing bonds hereafter may, after an affirmative vote at any regular or special election called or held pursuant to the irrigation district law, proceed to levy and collect assessments for any or all purposes of the irrigation district on a benefit basis. The valuation of such lands for determination of benefits shall be the valuation placed thereon by three competent, disinterested viewers appointed by the State reclamation commission, who shall classify the lands included in each ownership or smallest legal subdivision and fix the assessments according to the productive value of water and land prepared to receive water, but not including permanent improvements, such as buildings or orchards, and with proper deductions for partial water rights appurtenant to any tract of land within the district not furnished by the district; provided that no change in method of assessment shall be made except with the consent of the holders of outstanding bonds. (1929 Gen. Laws of Oregon, p. 47.)

In so far as irrigation districts of different States are related to the United States by contract, the question becomes academic, for all conflicting views may be reconciled by the inclusion of an article in contracts between the United States and different irrigation districts, in substance similar to that included in all contracts with Washington State irrigation districts since the decision in the Carnhope case. The article referred to reads:

It is understood that the Federal reclamation laws authorize the Secretary to determine and announce construction charges on an acreage basis, and that section 5 of the act of Congress of August 13, 1914 (38 Stat. 686), authorizes operation and maintenance charges upon the basis of the number of acre-feet of water delivered with a minimum charge per acre whether water is delivered or not. It is further understood that the laws of the State of Washington authorize irrigation districts of the State of Washington which contract with the Federal Government under the reclamation laws of the United States to comply with all the provisions of the said Federal reclamation laws and the rules and regulations of the Secretary thereunder. It is agreed accordingly by all parties hereto and all parties who participate in the benefits of this contract and who permit this contract to be confirmed by decree of court, that under the conditions existing in the said irrigation district, assessments for operation and maintenance purposes or for the payment of the construction charges provided for herein on the basis of the number of acres of irrigable lands or on the basis of the number of acre-feet of water delivered may be deemed and considered assessments in proportion to benefits, and that pursuant to the provisions of the said State laws authorizing compliance by the district with the Federal reclamation laws, any method authorized by the Federal reclamation laws for the apportionment of construction and operation and maintenance charges thereunder may be adopted by the district in the assessment and collection of construction and operation and maintenance assessments for the purposes of this contract; and the confirmation of this contract, including the above provisions, shall be considered a confirmation of the authority herein provided for and the consent of all landowners thereto. And all landowners who accept the benefits of this contract or participate in the use of the water provided hereunder shall be considered to have expressly consented to the provisions hereof.

This appears to be an effective solvent of local standards for the assessment of benefits which may be in conflict with that measure which the Government has adopted in protection of its rights under contract with irrigation districts.—*B. E. Stoutemyer, District Counsel.*

Washington

Since the year 1905 all of the unappropriated waters of the Yakima River watershed have been held withdrawn by the State of Washington from appropriation, except by the United States for the Yakima project. Chapter 88 of the Laws of Washington (1905) provides for this withdrawal which is made effective for one year within which, upon completion of investigations determining the feasibility of the project, the Secretary of the Interior may cause the withdrawl to be further extended for a three-year period upon proper certificate of feasibility directed to the State commissioner of public lands (now supervisor of hydraulics). The law aforecited also authorizes State officers further to extend the time upon good cause shown.

The United States has not yet made application to the State supervisor of hydraulics for a permit to appropriate the waters of the Yakima watershed for use upon the Yakima project, as now constructed, or as proposed, but the Secretary of the Interior in pursuance of the provisions of the law herein briefly summarized has in due time filed with the proper State official, the necessary certificate of feasibility and has made timely application for several extensions of the time within which the State law requires the United States to make the necessary water appropriations for the Yakima project; and these several applications have been granted, the last one extending the time to December 31, 1930.

By the year 1928, it had become apparent that the United States would soon complete its investigations with reference to new proposed divisions of the project,

and be in a position to make the necessary water filings for the entire project.

Section 7411, Remington Compiled Statutes, making provision for that purpose, was ambiguous. In order to clearly show the intent of the State Legislature there was enacted into law, chapter 95, Laws of Washington (1929), reading as follows:

CHAPTER 95. *Be it enacted by the Legislature of the State of Washington:*

SECTION 1. That section 4 of chapter 88 of the Laws of 1905 and section 7411 of Remington Compiled Statutes be amended to read as follows:

"SEC. 7411. Whenever said Secretary of the Interior or other duly authorized officer of the United States shall cause to be let a contract for the construction of any irrigation works or any works for the storage of water for use in irrigation, or any portion or section thereof, for which the withdrawal has been effected as provided in section 7410, *or section 3 of chapter 88 of the Laws of 1905*, any authorized officer of the United States, either in the name of the United States or in such name as may be determined by the Secretary of the Interior, may appropriate, in behalf of the United States, so much of the unappropriated waters of the State as may be required for the project, *or projects, for which water has been withdrawn or reserved under the preceding section of this act, including any and all divisions thereof, theretofore constructed, in whole or in part, by the United States or proposed to be thereafter constructed by the United States*, such appropriation to be made, maintained and perfected in the same manner and to the same extent as though such appropriation had been made by a private person, corporation or association, *except that the date of priority as to all rights under such appropriation in behalf of the United States shall relate back to the date of the first withdrawal or reservation of the waters so appropriated, and in case of filings on water previously withdrawn under said section 7410 of Remington's Compiled Statutes, or section 3 of chapter 88 of the Laws of 1905, no payment of fees will be required.* Such appropriation by or on behalf of the United States shall inure to the United States, and its successors in interest, in the same manner and to the same extent as though said appropriation had been made by a private person, corporation or association. The title to the beds and shores of any navigable lake or stream utilized by the construction of any reservoir or other irrigation works created or constructed as a part of such appropriation herein before in this section provided for, shall vest in the United States to the extent necessary for the maintenance, operation and control of such reservoir or other irrigation works."

The italicized portions show the amendments to the law as originally enacted.

The entire lack of opposition to the change in the law is demonstrative of the spirit of cooperation which exists in the State toward Federal reclamation. By the amendment, the rights of the United States are well defined and in addition there has been saved to the reclamation fund and to the water users of the Yakima project, approximately $10,000, which the Government would have been obliged to pay as fees in the making of the necessary water filings for the Yakima project, had the amendment not been made.—*B. E. Stoutemyer, District Counsel.*

Pending Legislation Affecting Federal Reclamation

SOUTHERN DEVELOPMENT

S. 412, introduced by Senator Simmons, of North Carolina, April 22, 1929.

To authorize the creation of organized rural communities to demonstrate the benefits of planned settlement and supervised rural development.

This bill authorizes the Secretary of the Interior to create in each of the 10 Southern States named one organized rural community in order to demonstrate the benefits of planned settlement and supervised rural development. An appropriation from the general Treasury of $12,000,000 is authorized.

The department expressed sympathy with the general purpose of the bill, but stated that it is not clear that it is a proper function of the department to assume all responsible charge and direction of this development; and that the question of the general desirability of this legislation is one to be decided by the Congress.

June 3, 1929, reported without amendment.

April 7, 1930, passed by the Senate without amendment.

H. R. 10475, a similar bill introduced by Congressman Crisp, of Georgia, March 4, 1930, was reported by the House Committee with amendment to include two additional States on March 10, 1930.

PAYMENT ADJUSTMENTS

H. R. 4291, introduced by Congressman Leavitt, of Montana, September 26, 1929.

To amend section 43 of the act of May 25, 1926, entitled "An act to adjust water-right charges, to grant certain other relief on the Federal irrigation projects, and for other purposes."

This bill proposes to authorize credit of any payments made on temporarily unproductive lands to the unpaid balance of the construction charge on productive areas.

December 10, 1929, the Secretary transmitted to Congress memorandum of the commissioner on the bill, concurring in the commissioner's suggestions for amendment of language to provide that credit should be applied on an after approval of the act, which should not be construed as requiring revision of accounts heretofore adjusted under the provisions of section 43 as originally enacted.

January 9, 1930, the House reported the bill with the adoption of the suggested amendments.

February 3, 1930, passed by House with amendments.

February 4, 1930, referred to Senate Committee on Irrigation and Reclamation.

April 14, 1930, reported by Senate committee without amendment.

April 17, 1930, passed by Senate without amendment.

CREDITS TO RECLAMATION FUND

H. R. 5662, introduced by Congressman Smith, December 2, 1929.

Providing for depositing certain moneys into the reclamation fund.

This bill provides that any amounts collected from defaulting contractors or their sureties, including collections heretofore made, in connection with contracts under the reclamation law, shall be covered into the reclamation fund and credited to the project on account of which such contract was made.

March 31, 1930, the department recommended that the bill receive favorable consideration.

March 27, 1930, reported by the House committee without amendment.

PURCHASE OF TAX CERTIFICATES

H. R. 11200, introduced by Congressman French of Idaho, March 27, 1930.

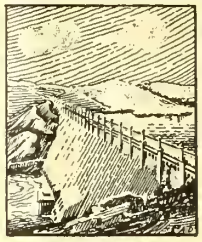
To provide for the acquisition, sale, and closer settlement of delinquent lands on irrigation projects by the Government to protect its investment.

The bill authorizes the Secretary of the Interior, in his discretion, to purchase tax certificates and acquire title to delinquent lands on reclamation projects. After acquisition the lands would be subdivided and sold to settlers at cost including incidental expenses and administration. The lands would be sold to actual settlers upon the payment of not less than 10 per cent at the time of purchase and the balance would be repaid in not more than 20 years with interest at 5 per cent. It authorizes an appropriation of $250,000 from the reclamation fund.

April 1, 1930, the House reported the bill without amendment.

(Continued on p. 99)

ENGINEERING



By C. A. BISSELL, Chief, Engineering Division

Precast Concrete Pile Construction and Use on Yuma Project

PRIOR to the year 1928, flumes and bridge crossings over drainage canals throughout the Yuma project were constructed with creosoted fir piling exclusively. Due to the gradual disintegration and ultimate failure of this type of substructure, it was decided to experiment with a simple type of reinforced precast concrete pile, the object being to minimize maintenance costs and lengthen the life of the structure.

The fir pile, when in a weakened condition, has a tendency to fail during the period of maximum load at the season of heavy irrigation water demand, usually resulting in more or less damage to crops for lack of water. This characteristic makes the wooden pile inefficient for use in connection with irrigation structures, and led to the development of the type of precast concrete pile which is now in general use on both divisions of the project.

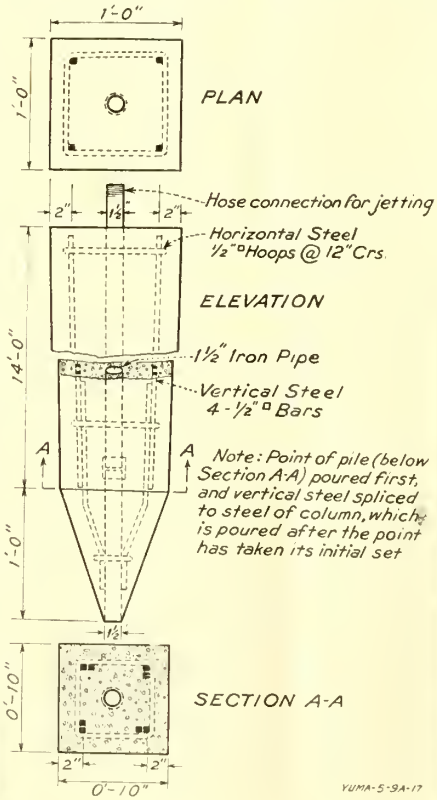
The relatively short life of wooden piles where used across drainage canals may be attributed largely to two factors: the fluctuation in water level from month to month in the drainage canals, usually amounting to a range of a few feet in the course of a year; this condition is aggravated by the comparatively high salt content of the drainage water, which, during the last nine months of 1929, varied from 1,400 to 1,900 parts per million, while in certain districts of the project this content was probably higher.

Both of the above conditions are fatal to the life of wooden piling. It remains to be seen what effect these conditions will have on the concrete piling over a long period of years. None of the concrete piles now in use shown any deterioration to date, such as sometimes occurs under the very severe conditions of marine use when exposed to sea water. The concrete as used in the local product is of a relatively high density, which has a high degree of impermeability, and should give an almost unlimited life under local conditions.

During the month of April, 1929, 40 of these reinforced concrete piles were cast in the headquarters material yard. The construction details are shown on drawing No. 5-9A-17. A length of 15 feet has been found adequate for all purposes. The bottom foot of length consists of a pyramidal point for jetting purposes, the only method of driving thus far employed, and one which has proven very efficient under local conditions.

DETAILS OF CONSTRUCTION

The piles are 12 inches square at the top with a batter of 2 inches in the 14 feet of length to the pointed section. A 1 or 1½ inch pipe is cast in the center of the pile, with the lower end flush with the point of the pile and the upper end projecting from 4 to 6 inches above the concrete, and threaded to receive a hose connection for jetting. The point of the pile is first poured with short lengths of reinforcing steel projecting for splicing purposes, as well as the necessary pipe coupling for connecting to the main section of pipe through the center of the concrete



column. The latter is poured after the point has taken its initial set allowing the removal of the form, and the splicing of the reinforcing steel and coupling of the two pipe sections. The pointed section is cast in a vertical position, and the main column horizontally.

Forms consist of a 1 inch by 12 inch by 16 foot board used for the bottom and two 2 inch by 12 inch by 16 foot boards for the sides. The top is left open and one end of the form is closed while the other is closed with the point which has previously been cast and stripped of its form. After the reinforcing steel and the pipe of the main column have been spliced to that of the point the concrete is poured and the top smoothed off so as to produce the desired batter in the finished product. After the removal of the forms and the undergoing of a curing process of one to two weeks, the piles are transported by truck to the structure site. Loading and unloading is effected by means of a chain block suspended from a tripod. This equipment also is used in handling the piles during the jetting operation.

The equipment used in jetting consists of one or two 2-inch triplex plunger pumps, belt-driven from the rear wheel of a Ford automobile. Any convenient source of water is used, usually a canal or drain, and the pump discharge is connected to the iron pipe through the center of the pile. The weight of the pile itself, approximately 2,000 pounds, together with the action of the water jet, have always proved sufficient to give the required penetration with the types of soil found on this project. Depths of 10 to 14 feet below ground surface are commonly used. With the timber piling 8 to 10 feet usually proved to be the maximum penetration obtained by jetting, the only method practicable in the absence of special driving equipment. Due to the inaccessibility of a major portion of the project flumes it was never deemed advisable to attempt to use any such special equipment.

SOIL CONDITIONS

Soil conditions on this project are very favorable to the jetting operation, and especially so with the concrete pile, which

has the self-contained central jet together with sufficient weight to force itself downward. The presence of quicksand at depths of 4 to 10 feet makes the jetting process quite rapid after the sand is reached; this type of soil has a high-bearing power when overlaid by a layer of dry material, with little or no settlement after a few hours.

It is probable that the jetting method of driving would not prove satisfactory in localities with soil conditions differing materially from those on the Yuma project. This would be especially true in impervious soils or tight subsoils where the jet would be relatively ineffective in opening a channel for the pile, except possibly for a short distance near the ground surface. Under local conditions it is usually very difficult to jet the piling to any predetermined elevation since the action of the jetting operation in quicksand is very erratic; the pile sometimes remains practically stationary for several minutes, and will then drop a foot or two in only a few seconds.

COMPARATIVE COSTS

The cost per linear foot of fir piling in place on three flumes constructed over the central drain in 1928 was $1.53. The 320 linear feet of piling used on the flumes were driven by a Bucyrus 30-B dragline engaged in the excavation of the drain. This cost was undoubtedly lower than the average as the policy generally employed is to jet the piling for these drainage crossings which requires more labor and equipment.

Costs assembled from the construction of six flume crossings constructed during 1929 upon which concrete piling and false wooden bents were used gave an average cost per linear foot in place of $1.72 for the concrete pile. This cost includes both timber caps and posts made necessary with the use of the concrete pile and provides a comparable cost with that of the fir pile used previously.

The additional cost of approximately 11 per cent is believed to be more than justified in view of not only the added life of the structure, but also the elimination of major repairs brought about by failure of the supporting structure and its attendant damage wrought to crops through lack of water while repairs are in progress.

JETTING EQUIPMENT AND METHOD OF PLACING

The accompanying photographs show the jetting equipment and method of placing the pile, together with a view of a completed metal flume supported on precast concrete piles having penetrations of 10 to 14 feet. This view also illustrates the type of substructure used locally in flume construction; this consists of wooden caps connecting each pair of concrete piles, creosoted round fir piling used as posts above the caps, timber girders, and bracing to give complete rigidity in each bent. This type of substructure is well adapted for use in connection with the jetted concrete pile, since the timber posts may be cut to the length necessary to give any required grade, regardless of the elevation of the concrete pile itself. This factor is an important one, due to the difficulty in setting the concrete pile to a definite grade. The latter difficulty is one of the chief reasons for not attempting to use a concrete pile of sufficient length to eliminate the use of false piling. Much more equipment would be necessary in handling a longer and heavier pile, although the same construction methods could be employed in casting a 25-foot pile as for the 15-foot length adopted for local use. A different system of framing and bracing would have to be devised which could hardly prove as simple or as easily constructed as by the use of timber posts.

The usual practice is to sink the concrete pile vertically, and to use a batter of 1:12 for the posts, except on low bents, where the posts also are set vertically. By fitting the projecting pipe of the top of the pile into holes bored in the timber cap which connects the two piles of each bent, the rigidity and permanence of the construction is assured against any condition which can be foreseen.

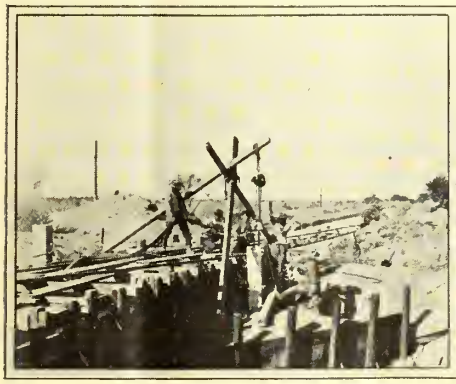
FLUME REPLACEMENT

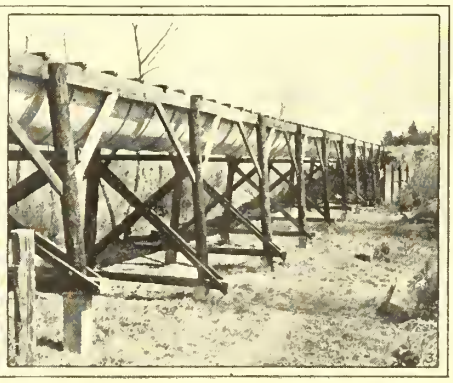
The concrete pile, with the type of substructure described above, is well adapted for replacement purposes on flume crossings. Due to the relatively large acreage of winter vegetables now being grown on this project, there is no season of the year without a demand for irrigation water. It is, therefore, necessary to make replacements in the shortest possible time, especially on the larger laterals which serve a considerable acreage.

The structures to be replaced are box-type wooden flumes which have outlived their period of economical use, or old metal flumes whose supporting structures have disintegrated and the metal rusted out. In many cases it is possible to jet down concrete pile along each side of the old structure, place the caps and cut all stringers and bracing to length while the old flume is still in service; this effects a saving of one-fourth to one-third of the usual construction period.

The possibility of using the concrete pile in bridge construction as well as for flumes has been considered. It is planned to allow the vertical reinforcing steel in the column to project from the end of the finished pile. After jetting the pile to the desired depth, additional steel would be spliced on, and the additional column length necessary to raise the top of the pile to the desired grade would be poured, using small forms giving the same cross section as the pile itself. The grade of the top of the finished pile would be governed by the desired elevation of the timber cap which would be held in place by a drift-pin cast in the center of the top of the finished pile.

Kremer & Hog of Minneapolis, Minn., have been awarded the contract for drainage work on the Belle Fourche project, South Dakota, under specifications No. 507. The work will comprise about 67 miles of open drains and the incidental structures, and the principal item is 1,385,000 cubic yards of excavation. The contract price is about $159,000.





Notes for Contractors

Minidoka project.—Designs are being prepared for 3.5 miles of concrete section to carry the main canal of the gravity extension division across the lava flats between Little and Big Wood Rivers.

Owyhee project.—Contracts have been awarded for the construction of tunnels and roads on the Owyhee project under specifications No. 505. Contract for the upper portion of tunnel No. 1 and the road to the inlet was awarded to T. E. Connolly, of San Francisco, for $982,116; contract for the lower portion of tunnel No. 1 and the upper portion of tunnel No. 5 and the Tunnel Canyon Road was awarded to the J. F. Shea Co., of Portland, Oreg., for $1,569,011.20, and contract for the lower portion of tunnel No. 5 was awarded to the S. S. Magoffin & Co. (Ltd.), of North Vancouver, British Columbia, for $530,684.

Riverton project.—Invitations for bids and specifications covering the construction of laterals and lateral structures on the Pilot Canal lateral system are being frequently issued by the project office at Riverton, Wyo. The work is being divided into comparatively small schedules in order to furnish an opportunity for contractors of small means to bid on the work.

Shoshone project.—Specifications have been issued for the installation of the third unit in the Shoshone power plant at the Shoshone Dam near Cody, Wyo. The capacity of the unit will be 5,000 kilovolt-amperes.

Vale project.—Specifications have been prepared for the construction of the Bully Creek and Fairman Coulee siphons on the Vale main canal with a connecting section of concrete-lined canal. Alternative bids are requested for the construction of the siphon of 101 inch diameter riveted plate-steel pipe and of 96 inches diameter precast reinforced concrete pipe. The Bully Creek siphon is approximately 6,270 feet long and the Fairman Coulee siphon is approximately 1,083 feet long. The concrete-lined canal section connecting the outlet of the Bully Creek siphon with the inlet of the Fairman Coulee siphon is 1,300 feet long.

Yakima project.—Bids will be received at Denver, Colo., at 3 o'clock p. m., June 3, for furnishing two 42-inch internal differential needle valves for the Yakima River crossing-wastway, Kittitas division, specifications No. 511.

At the end of the month the contract for the Owyhee Dam was 29.8 per cent completed.

Cauvery-Mettur Irrigation Project, India

The Cauvery Mettur irrigation project now under construction in the Madras Presidency in India, presents several interesting comparisons with similar work in the Western States of this country. Acre cost will be about $83 an acre, while older irrigation systems like the Godavery and Kistna, requiring no storage, have cost about $9 an acre. Mr. C. T. Mullings, consulting chief engineer, in a recent address said "Most future projects in Madras involve storage and many will be unable to pay their way in the commercial sense, and must depend for sanction on their value as famine preventers."

It is possible to utilize a large part of the flow of the Cauvery River, which is a notable exception to the average Indian river. After irrigating lands along its course, it ends in the Cauvery delta, where there are about 1,500,000 acres suitable for rice crops. The Mysore Presidency has already dammed the river at Kannambadi, and at Mettur, 96 miles nearer the sea, the Madras Presidency is now to build a second reservoir. With the two reservoirs in operation, 80 per cent of the river water supply will be usefully employed.

The Mettur project is limited by an agreement with Mysore to an extension of 301,000 acres of new irrigation to the existing 1,000,000 acres of delta land, and the reservoir is limited to a capacity of 2,150,000 acre-feet. A 70-mile canal, 180 feet wide, will be constructed to carry water to the new lands on the Tanjore plains. The canal system will cost $7,200,000, of which about $3,000,000 has already been spent. Construction of the canals is giving employment to about 6,000 coolies and 600 artisans, more than half of whom had to be imported, as the Tanjore section did not have enough labor. To save importing another 3,000 coolies, two drag-line excavators are in use and working three shifts of six hours each a day.

LARGEST MASONARY DAM

In the construction of the storage reservoir, which will form a lake of 59 square miles in area, a dam containing 1,850,000 cubic yards of masonry will be required. This will be the largest masonry dam in the world, exceeding the Wilson (Muscle Shoals) Dam in Alabama with its volume of 1,400,000 cubic yards. As the building of this immense structure requires a large labor force, and since the Mettur Valley had a bad reputation for malaria, a healthful location for the camp was necessary. A camp was completed in 1928 which now has a population of 14,000. It contains office buildings, magisterial and police buildings, hospital, health laboratory, a filtered and chlorinated water supply and drainage and electric lighting systems. Fifty miles of bridged roads for heavy traffic have been built and about 50 miles of narrow-gage railroad with a railway bridge over the river. Twenty-six locomotives and 1,000 cars comprise the railroad equipment. Other buildings include a workshop, locomotive repair shop, shorehouses, and a power house, with a connected load of 6,000 horsepower, which is obtained from Sivasamudram by a 62-mile transmission line. Three batteries of stone crushers are used, having an output of 3,750 tons a day.

CONSTRUCTION METHODS

There is an excellent charnockite rock foundation right across the valley, similar to granite gneiss, very strong and durable. Placing of masonry was begun in July, 1928, and eventually will be all of cement concrete. Below ground level masons have built rubble masonry walls and filled in concrete between. Two steel towers 306 feet high are now being erected, each of which is capable of pouring 1,660 tons of concrete in a day of 10 hours. Each tower weighs about 1,400 tons and travels along rails along the downstream toe of the dam, and can build a length of dam 126 feet long up to the full height without moving position. They form the principal part of the construction plant and are unique in engineering practice. Materials arrive by train, at the foot of the tower, are tipped into skips which hoist them 70 feet up, where they are distributed into bins. Below the bins is apparatus for measuring out exact quantities of materials and water into concrete mixers. Each mix is discharged into a skip which is then raised the required height to pour into a hopper at the top of the chutes, down which it flows into place in the dam wall. The explosive used for quarrying and excavation is liquid oxygen.

The Mettur Dam is almost exactly the same in section as the New Croton Dam in New York, built about 30 years ago. In design the dam has been made safe for a stress of 10 tons per square foot. The quantity of cement to be used is estimated at about 170,000 tons, and will cost $3,240,000. In terms of Portland cement this would be about 1,000,000 barrels, costing $3.24 a barrel, of which $1.30 is for freight. Outlet pipes will be placed

in the dam and when a market is available it will be possible to generate a minimum of 15,000 horsepower all the year round. There are no labor troubles experienced on the project, except during a cholera outbreak when the laborers decamp. Wages paid to coolie laborers are about 18 cents for an 8½-hour day. Skilled laborers and mechanics, such as locomotive drivers on the small Sentinel engines, receive from 45 to 90 cents a day.

Boulder Canyon Project

PRIMER

(Continued from February and March issues)

Q. What is the allocation of water under the Colorado River compact?

A. Based on a mean annual run-off of 16,000,000 acre-feet, the compact allocates 7,500,000 acre-feet to the upper basin States, and 7,500,000 acre-feet to the lower basin States, with the right of the latter to increase their beneficial consumptive use of such water by 1,000,000 acre-feet per annum.

Q. How much of the water allocated to the lower basin States does California get?

A. California has agreed that the aggregate annual consumptive use of the river water shall not exceed 4,400,000 acre-feet of the 7,500,000 allocated to the lower basin by article 111 (a) of the compact.

Q. How much water is allocated to Nevada and Arizona?

A. The Boulder Canyon project act authorizes Arizona, California, and Nevada to enter into an agreement which shall provide that Nevada gets 300,000 acre-feet and Arizona 2,800,000 acre-feet for exclusive beneficial consumptive use; also, that Arizona may annually use one-half of the surplus water unapportioned by the compact, and in addition shall have the exclusive beneficial consumptive use of the Gila River and its tributaries within the State. No such agreement has yet been made.

Q. What has been the greatest measured discharge of the Colorado River?

A. Two hundred thousand cubic feet per second, measured at Yuma, Arizona.

Q. What has been the smallest measured discharge?

A. One thousand two hundred cubic feet per second, measured at Yuma, Arizona.

Q. How much irrigable land is there below the Boulder Canyon reservoir, in the United States?

A. About 1,900,000 acres, according to preliminary estimates.

Q. How is this area divided between the States?

A. Arizona 900,000 acres, California 950,000 acres and Nevada 15,000 acres. These are gross areas and may be materially changed when irrigable area surveys are made.

Q. What are some of the possible projects in Arizona?

A. The Parker-Gila Valley project with a gross area of more than 600,000 acres in the southwestern part of the State, an investigation of which was authorized by Congress under the act. The Parker project of about 116,000 acres near Parker, Mohave Valley with an irrigable area of 33,000 acres near Needles, Calif., and the Cibola Valley of 16,000 acres in Yuma County. The Yuma project, adjacent to the city of Yuma, is an active Federal project, with about 55,000 acres irrigated at the present time, and a total ultimate irrigable area of 112,000 acres, including about 45,000 acres of undeveloped mesa lands.

Q. What are the principal California projects which may be benefited?

A. The Imperial Valley has a present irrigable area of 515,000 acres and 713,000 acres could be irrigated under the All-American canal. The Coachella Valley near Indio has an irrigable area of 72,000 acres, which can be served by a branch of the All-American canal. There are 79,000 acres in the Palo Verde Valley project near Blythe.

Q. Where is the irrigable acreage in Nevada?

A. Cottonwood Island on the Colorado River, located due west of Chloride, Ariz., has an area of 3,000 acres. The State engineer plans to develop additional areas by pumping.

Q. What is the approximate classification of the irrigable lands?

A. Public, 44 per cent; private, 40 per cent; State, 1 per cent; railroad, 2 per cent; Indian, 8 per cent; and entered, 5 per cent.

Q. When will the vacant lands be opened to entry?

A. Not for several years. All public lands which will be irrigable under the project have been withdrawn from entry and will not be available for settlement until the dam is completed and water can be furnished for irrigation. They will then be subject to entry under the reclamation law, with preference right of entry given to ex-service men.

The total repayments to the Government by the water users on construction and operation and maintenance during the fiscal year 1929 were $6,308,314, of which approximately $4,388,000 was for construction. The construction repayments in 1928 were $1,108,000 more than in 1927, and in 1929 were $1,142,000 more than in 1928, or an increase of $2,250,000 in two years.

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Growth of Irrigation Projects Facilitated by Railway Service, by Dr. Elwood Mead, Commissioner, in the United States Daily, March 17, 1930.

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Current View of Boulder Dam, by Dr. Elwood Mead, Commissioner, in the United States Daily, March 1, 1930.

Growing Specialized Crops on Government Irrigation Projects, by Dr. Elwood Mead, Commissioner, Bureau of Reclamation, in the United States Daily, April 8, 1930.

Irrigated Areas not Adding to Surplus of Farm Crops, by Dr. Elwood Mead, Commissioner, Bureau of Reclamation, in the United States Daily, April 14, 1930.

Legal Problems of Irrigation, by P. W. Dent, Assistant Commissioner, in the United States Daily, December 17, 1929.

Story of Desert Reclamation by Irrigation, by Dr. Hugh A. Brown, Director of Reclamation Economics, in the United States Daily, March 8, 1930.

Conversion of Desert Wastes into Busy Markets, by Dr. Hugh A. Brown, Director of Reclamation Economics, in the United States Daily, December 6, 1929.

Lure of Wild Life for Tourists in Reclaimed Areas, by Dr. Hugh A. Brown, Director of Reclamation Economics, in the United States Daily, March 21, 1930.

Activities of Four-H Clubs, by Mae A. Schnurr, Assistant to the Commissioner, in the United States Daily, February 1, 1930.

Initiative of Pioneer Women in Community-building, by Mae A. Schnurr, Assistant to the Commissioner, Bureau of Reclamation, in the United States Daily of March 28, 1930.

Repayment of Reclamation Costs, by Wm. F. Kubach, chief accountant, in the United States Daily, January 21, 1930.

Gravity Extension Division, Minidoka Project, Idaho, by E. B. Darlington, Superintendent Minidoka Project, in Western Construction News, March 25, 1930.

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Turkey Raising and Cooperative Marketing on the Orland Project, California

By R. C. E. Weber, Superintendent

IN years past the Eastern States practically raised all the turkeys of the United States, but gradually the center of the industry has shifted westward. Contributory causes were crowded conditions, together with soil contamination, and the producing center has changed so that now the Dakotas and Iowa on the north, Texas on the south with Oregon, California, and Nevada on the west are producing and marketing vast quantities of this variety of poultry. The three Pacific States are particularly favored by climatic conditions, which permit turkeys to be successfully and economically raised; and as they are largely grain producing States, little, if any, importation of feed is necessary. The spring climate of the Sacramento Valley is particularly conducive to turkey raising in that little shelter is required except for the first two weeks after hatching.

The Orland project and the immediate surrounding dry-farmed areas are especially favored climatically and otherwise for the successful production of turkeys. The importance of this branch of the poultry industry has materially increased in the last few years; from a relatively small percentage of the total livestock on the project, it has since 1921 expanded until now it constitutes from over one-fourth to nearly one-third of the value of the livestock on the project. The following table, prepared from the crop census compiled annually by the Bureau of Reclamation, indicates the extent of the increase in this industry:

Year	Number of turkeys	Valuation	Total valuation of livestock on project	Per cent of total represented by valuation of turkeys
1921	8,570		$519,269	
1922	12,188	$18,752	542,604	9.0
1923	18,530		525,478	
1924	12,719		322,857	
1925	10,379	51,895	433,195	12.0
1926	26,677	138,385	539,208	25.7
1927	40,505	202,525	635,282	32.0
1928	46,977	187,988	637,670	29.5
1929	34,738	165,005	627,139	26.4

TURKEYS COMBAT GRASSHOPPERS

Not only are turkeys a source of considerable revenue to project farmers, but they are profitably utilized during the summer months of June and July to successfully combat the annual infestation of alfalfa and orchards by grasshoppers. In earlier years these pests were fought at no inconsiderable expense by means of poisoned bran; now they have been converted into an asset as the source of several weeks excellent food supply for large bands of turkeys. Orland birds are noted for their superior quality, which is obtained by proper methods of raising during the growing season together with special care in killing and grading in order to maintain a high standard.

TURKEYS IN EARLY STAGES

While Orland turkeys are raised from both incubator and hen hatching, the latter method predominates. Hatching is scheduled for completion from May 10 to 15. For the first week or two the hens with the young turkeys are kept in individual coops, after which they are turned on the range in bands up to as many as 2,000, depending upon the number each individual raiser owns. The dry pasture range land adjacent to the project on the north and west is admirably adapted for turkeys during this stage. Here they are kept until about July 1, at which time they are taken to the stubble fields of dry-farmed grain lands, of which there are large acreages surrounding the Orland project. During this period some green feed is essential and it is supplied in two ways, one by freshly mown alfalfa or other green vegetation, and also by running the bands in the orchards and alfalfa fields of the project. It happens that the early part of this stage of turkey raising coincides with the annual infestation of alfalfa fields and orchards by grasshoppers, and it is here that the turkeys render valuable service in exterminating the pests, at the same time obtaining a proper food ration for their rapid growth. The birds are left on grain stubble until the first part of October, when they are taken to the rice stubble fields for finishing. The southern portion of Glenn County, together with the adjacent sections of the neighboring counties of Butte and Colusa, are all within easy reach of Orland and furnish the fall rice range for finishing most of the project turkeys for market.

MARKET VALUES FLUCTUATE

The industry has not, however, been without its periods of prosperity and adversity; among the latter—in addition to the high mortality of the young birds and the loss by epidemics of disease—was that of prices offered the growers, which left them little or no margin over the cost of production. Prices have varied from 20 to 45 cents per pound over the period of years since the raising of turkeys has assumed an item of importance in the poultry industry of the project. With minimum production cost under normal conditions at from 25 to 30 cents per pound, the necessity for stabilized prices, that will yield the growers remunerative

Map No. 23886, Carlsbad project, New Mexico, has just come from the press. It is printed in colors and shows canals, laterals and irrigable area. Size 10½ by 14 inches. Price 10 cents per copy.

returns, is readily apparent; during 1929 it crystallized in the formation of a cooperative marketing organization.

The movement for the formation of a Sacramento Valley organization for the cooperative marketing of turkeys had its inception early in 1929, and was the direct result of the dissatisfaction on the part of the growers for the prices received for their turkeys in the holiday markets of 1928. During the Thanksgiving and Christmas seasons of that year growers were paid from 31 to 36 cents per pound for dressed birds (about 6 and 9 cents per pound less than during the previous year), while turkeys were retailed in the San Francisco Bay region at prices ranging from 50 to 60 cents per pound, indicating an abnormally wide margin of from 65 to 80 per cent for marketing; this large spread of prices is especially striking when it is considered that dressed poultry can be shipped in carload lots from Orland to San Francisco at a little over one-half cent per pound.

COOPERATIVE MARKETING

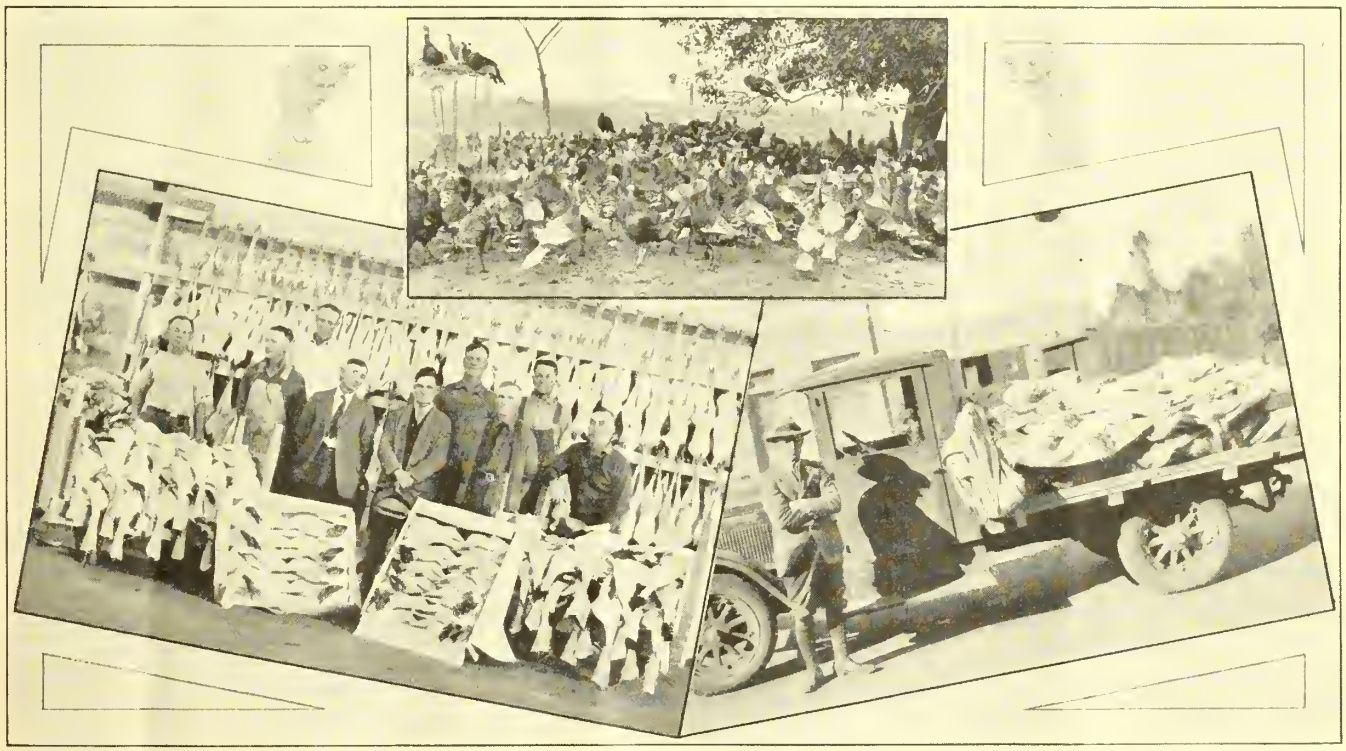
The formation of a cooperative marketing organization was initiated at Orland in January, 1929, by a meeting of growers, representing not only the project but also a number of adjoining counties in the Sacramento Valley, called for the purpose of forming a selling organization for the marketing of turkeys at stabilized prices which would yield the growers remunerative returns. The meeting was held under the auspices of the Orland Grange, to which in no small degree credit is due for the inauguration and guidance of the organization through its preliminary stages. At the January meeting a committee was appointed to cooperate with the division of markets of the California State Department of Agriculture and submit a complete report at a subsequent general meeting. The committee reported in March after an extensive survey of turkey marketing in the Western States had been made by the California division of markets, which furnished the basis for the organization program incorporated in the committee's report. The proposed set-up consisted of the organization of local county or district associations of turkey growers, which in turn were units of the central marketing organization that handled turkeys on a pool basis. Temporary officers were elected to carry out the organization plan during the ensuing 90 days.

Rapid progress followed with the organization during April and May of 9 local county or district associations, including, in addition to 6 Sacramento Valley units, 3 from the north San Joaquin area. Valuable aid was rendered by members of the staff of the California division of markets, which worked out the legal and organization set-ups. In May representatives of the local associations, as well as the leading turkey growers from 12 California counties, convened and perfected the formation of the California Turkey Growers Association—the central marketing organization—by the adoption of articles of incorporation in accordance with the provisions of that portion of the Civil Code of California (commonly known as the California cooperative marketing act) relative to the formation of nonprofit cooperatives; at the same time, 15 directors were elected and by-laws were adopted. Organization was effected in ample time for the marketing of the turkeys raised during 1929.

Briefly, the objects of the association, as extracted from its by-laws, are to grow and market turkeys and turkey products in such manner as to obtain the maximum net returns to the individual members; to develop better market facilities; to study local, State, and National poultry marketing problems which affect the welfare of the association members; to foster and develop the cooperative spirit in the community; to improve the types, quality, and breeding of standard birds for show, sale and for egg production; and to perform any other work which may tend to the betterment of the members and the general benefit to the community neighborhood.

BIRDS SOLD ON POOL BASIS

Under the plan of organization of the California Turkey Growers Association, the association functioned as the marketing agency, which sold turkeys during the lat-



Top center: Flock of turkeys. Lower left: Turkeys ready for shipment. Packed boxes in foreground. Members of local unit of California Turkey Growers' Association, in group. Lower right: Dressed turkeys being trucked to Orland for grading and shipment. (Turkey herding dog in cab of truck.)

ter part of 1929 and early in 1930 on a pool basis for its constituent local county and district units. Under it, Federal and State grading service was furnished. Growers delivered dressed turkeys at various receiving points for the three different pools, that were arranged by the directors of the central association. A policy of f. o. b. sales on a packed basis was adopted and 2 cents per pound were deducted from the packed price to defray the expenses of the central selling organization. Bids were received by the association for each of the Thanksgiving, Christmas, and "freezer" pools of turkeys, and awards were made to the highest bidder. A manager was employed, whose salary depended upon the volume of business.

Orland was designated as the receiving point for packing and shipping most of the turkeys raised by members of the Glenn County unit. Here, as with most other receiving stations, the growers of the local unit did most of the receiving and packing. Shipments from Orland for the season aggregated nearly one-quarter million pounds and were distributed to the various pools as follows:

	Pounds
Thanksgiving pool	43, 000
Christmas pool	75, 000
Freezer pool	126, 500
Total	244, 500

These amounts constituted most of the shipments made to the central association through the Glenn County unit, the total of which was about 300,000 pounds. Final figures for the season showed that there were packed and shipped through the local county units nearly one and one-half million pounds of dressed birds, which were sold by the California Turkey Growers Association. Statistics are not available to indicate the relation between the number of turkeys marketed by the central association and those sold through other independent agencies, but at Orland the local cooperative marketed about 40 per cent of the total shipments for the season.

COMPARATIVE SALES METHODS

Exact information for comparative purposes as to the results of the season's operation of cooperative marketing of turkeys through the California Turkey Growers Association in the way of increased prices is rather difficult to obtain. Taking, however, as an index the prices received by the Nevada Turkey Growers Association (which has been in operation several years), the general opinion has been that growers in California before organization had received from 5 to 8 cents per pound less than the price paid members of the Nevada pool. This year the sales of the

(Continued on p. 93)

Dedication of First Unit, Vale Irrigation Project

By H. W. Bashore, Construction Engineer

An important event in the history of irrigation in Oregon and of particular gratification to the people of eastern Oregon was the celebration held on March 16, 1930, to appropriately dedicate the completed irrigation works which are necessary to supply water to the Harper and Little Valley unit of the Vale irrigation project, Oregon. The celebration was sponsored by the Harper Commercial Club, assisted by the Vale-Owyhee Land Settlement Association, which organization has been actively engaged for the past year in the work of securing suitable settlers for the 4,000 acres of land in the Harper and Little Valley unit, to be irrigated this season, and has carried out a campaign of more than ordinary success. The members of the association are quite properly elated over the fact that water for irrigation purposes will be supplied to settlers which it has secured for 85 per cent of the two areas mentioned above.

Early in 1927, after passage of the initial appropriation, construction work was started, and the celebration above mentioned marks the completion of the first unit. Preparations had been made by the people of the Harper community to serve lunch at noon on March 16 and to have the ceremonies at the Harper Dam. However, rain which fell during the night of the 15th made travel unpleasant over the unsurfaced 10 miles of road between Harper and the diversion dam, but this condition was met with efficiency and resolution by the people of the Harper community, who carried out their plans to serve lunch to all visitors in the town of Harper. Over 2,000 persons, part of whom arrived on a special train from Burns, Oreg., attended the celebration and were served a well-prepared lunch by the ladies of the Harper community. Mr. J. D. Fairman, the leading citizen of Harper, who has been engaged in furthering the interests of eastern Oregon and the development of its irrigation enterprises for the last 25 years, acted as master of ceremonies in a very pleasing manner. Rev. Edgar Pollock, of Vale, rendered the invocation. The American Legion Drum Corps of Ontario, Oreg., and the bands of Vale, Nyssa, and Ontario furnished music for the occasion. After lunch Mr. Fairman introduced Governor Norblad of Oregon and other State officials who have been interested in promoting Federal irrigation for eastern Oregon. The governor made an address stressing the importance of irrigation in the State and the resulting increase in population and wealth. The visitors then proceeded to the Harper Dam, where the ceremony of turning water into the main canal of the Vale project was carried out in an impressive manner.

The Vale irrigation project, as a part of the old Malheur project, was one of the first to be investigated by the Reclamation Service after the passage of the reclamation act. Investigations were started as early as 1904, but at that date, with the facilities which were available for building irrigation works, the construction difficulties seemed very formidable and the economic feasibility of the project was doubted on account of what seemed an unreasonably high estimated cost per acre. After years of effort with no appreciable results during which a reservoir was constructed by the Warmsprings irrigation district on the Middle Fork of the Malheur River some of the land originally considered a part of the old Malheur project, was irrigated, interest was revived in the Vale project in 1925, and after a further searching investigation by the Bureau of Reclamation a favorable conclusion was reached regarding the project's feasibility and a recommendation was made by Secretary Work for Congressional appropriation.

After the completion of this ceremony the visitors proceeded to Vale by way of the road on the bank of the Vale main canal, a distance of about 28 miles, where they saw in operation the 4-cubic yard Page drag line of the W. H. Puckett Company skillfully handling a very heavy and difficult piece of canal excavation. The contractor had of his own volition put the road on the canal bank in perfect condition in order that the visitors might with greater comfort to themselves view the results of his several years of work on the project.

The celebration was concluded in the evening at Vale, where the visitors were guests of the Vale Commercial Club at a banquet given at the Drexel Hotel, and were welcomed by Attorney R. D. Lytle of Vale. At this time Governor Norblad again made an address pointing out the value of advertising Oregon history in literature intended to attract settlers. He stressed particularly the history of the Old Oregon Trail, which was the main transportation route along which civilization traveled westward in the early colonization of the Western States. A number of other addresses were made during the evening, the principal of which were by Mr. Ide of the State Chamber of Com-

merce, Doctor Powers of the Oregon State Agricultural College, and B. E. Stoutemyer of the Bureau of Reclamation. Mr. Ide and Doctor Powers stressed the importance of the local community extending its assistance and neighborly cooperation to the settlers who have been placed on the new lands of the Vale project. Mr. Stoutemyer pointed out that the revolving nature of the reclamation fund has made possible the construction of Federal irrigation projects in Eastern Oregon, and that the principal source of income is from repayments to the fund by the older projects, concluding with the prediction that the Vale project will be able to do its share in keeping the fund revolving and assist in developing the West by exhibiting the same spirit of cooperation and determination in repaying the money invested by the Government in the Vale project as was put forth in securing the project and in the celebration of the completion of the irrigation works for the first unit.

Turkey Industry on Orland Project

(Continued from p. 92)

California Turkey Growers Association have been at prices substantially the same as received by the Nevada organization. In this, however, exact comparison is difficult on account of variations in grading, but after allowing for such differences, the consensus of opinion among the leading grower members of the association is that they received at least from 3 to 5 cents per pound more for their turkeys this year through their being organized than they would otherwise have realized. In addition to the increased returns received for their turkeys, the growers in 1929, through their cooperative marketing organization, improved the grade and quality of their stock, the results of which will be reflected in next and subsequent years' birds.

In several ways, the season was one beset with more than the usual amount of difficulties which confront a new organization during the first year of its existence. In the first place, the amount of dressed poultry in cold storage on November 1, 1929 was about 30,000,000 pounds in excess of that on the same date for the year previous. There was also about a 9 per cent increase in turkey production for 1929 over that for 1928, and lastly the stock market collapse of October and November of last year materially added to the trials of the new organization. Considered in the light of these difficulties the results of the initial year's operation of the association were highly satisfactory and predict a profitable field of endeavor and work for the members in connection with future cooperative activities.

Members of American Legion Drum Corps of Ontario, Oreg., and part of crowd attending celebration at Harper, Oreg., March 16, 1930

The Orland of the Future

Last month's issue of the Era carried a few suggestions which were contributed to the Orland Register by water users on the Orland project who have faith in the future prosperity of the project. It is believed that these suggestions may act as a stimulus not only to Orland, but to other projects, and it may be helpful to give a few additional ideas from other settlers who have indicated an interest in the development of the project.

N. C. Nielson has spent many years abroad and later in southern California, and has finally settled in Orland, which he believes to be on the eve of its greatest prosperity since 1920, owing partly to the good work of the Federal Farm Board. Mr. Nielson has made a fine living on a 20-acre ranch, and although some lean years have been experienced by the settlers, these have been offset by the profits of other years due in large measure to the cheapness of the land and irrigation. Alfalfa does well on the Orland project, with five crops a year; the project is fine for dairy cows; chickens and turkeys are profitably grown; and climatic and soil conditions make this an excellent fruit country.

A. E. Lindstrom compares the Orland of 18 years ago with its old wooden shacks, dirt streets with ruts deep enough to bury a calf, grass growing in the streets, no lights, no water except out of individual wells, and no sewage system or other conveniences, an irrigation ditch running through the principal business street, and everything in keeping therewith, with the Orland of to-day, which is made up of substantial concrete business blocks, paved and lighted streets, and every modern convenience. He mentions particularly the improvement in the school system. The old wooden grammar school of 4 rooms was in use 18 years ago, but this was soon supplanted by a new 8-room school, which also proved inadequate, and later required an addition which practically doubled its size. The high school, which 18 years ago was housed in a little 1-story frame building, has been superseded by four big modern concrete structures covering ground by the acre. Mr. Lindstrom concludes with the statement that he knows of no place where he could mingle with a more friendly or genial people than on the Orland project, nor where the settler could be more certain of a return on his efforts, nor where there is a surer prospect of a steady advancement as time goes on.

R. W. Guilford stresses the importance of improving the appearance of the lawns and outer approaches to the project homes by planting trees along the road on the boundaries of the property, suggesting as peculiarly adapted to the Orland section the California black walnut, the oriental plane, Arizona ash, poplars, elms, umbrella, honey locust, and weeping willow, and especially the orange, lemon, and grapefruit trees, which are very ornamental in character.

THE four-leaf clover as it appears on this page is the emblem of a very fine organization initiated, stimulated, and fostered by agents of the Department of Agriculture and the land-grant colleges.

With very few exceptions there is a unit on each of our projects and a recent survey showed this to be a very wide-awake organization that probably does more than any one thing to arouse interest in new and approved methods of agriculture, raising of superior livestock, and the science of home making. It not only teaches the young, but, in effect, the young people of the organization carry the practices into their homes, and mother and dad are found taking counsel from the 4–H club members and benefiting by the projects undertaken by them on the farm and in the home.

Another phase of the organization that is not to be underestimated is the wholesome social atmosphere and advantages to be attained by contact with members and leaders, the broadening influence of cooperating with them, and the awakening of interest in community problems.

4–H Club Work Activities

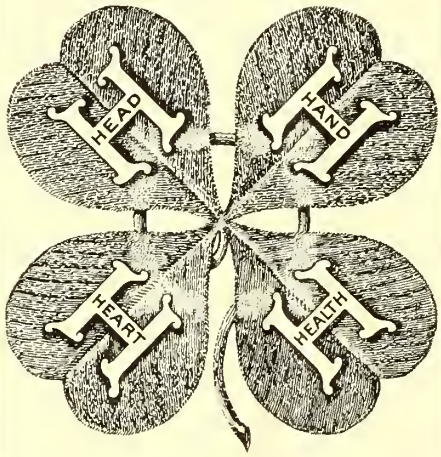
Grand Valley Project, Colorado

That the National 4–H Club is gaining in popularity and interest is evidenced by its steady growth the last three years on this project. In 1927 there were a little over 100 members enrolled; after the final cancellation date, in 1928, there were 259, and in 1929 there were 312. In 1927 there were 16 club children and 3 leaders sent to 4–H Club work at the State Fair. In 1928 there were 25 members and 7 club leaders. In 1929, because of a different arrangement, our quota for the State Fair was 19 club children and 2 club leaders.

In the two former years the transportation was paid by the county commissioners, allowing the expense of leaders who would take their own cars, and the State Fair furnished board and sleeping quarters. This worked a hardship on outlying counties. Through the efforts of one of the club leaders in Mesa County and the county agent, the matter of transportation equalization was indorsed and recommended to the State Fair Board by the State County Agent's Association and the General Conference of the Extension Service of Colorado.

In 1929 the State Fair Board paid railroad transportation of club members and leaders from all parts of the State and each county was asked to pay for meals and lodging, to the extent of $5, for each club member and leader. Heretofore the club camp had been overcrowded. Now each county is given a quota to fill.

In 1929 Mesa County had 15 club champions, two demonstration teams, and two chaperons of club leaders. The club lines represented by the champions are: First and second pig, first and second dairy calf, first and second sheep, first and second rabbit, turkey, poultry, corn, and forestry clubs, for the boys, and first, second, third, and fifth clothing and meal preparation,



canning, and baking club work for the girls. A few girls are taking rabbit and poultry work.

RED-LETTER DAYS DURING THE 1929 CLUB YEAR

On February 2, achievement day for 1928 was held at the Pear Park School. Reports of the past year's work and plans for 1929 were discussed. June 6 a county-wide meeting was held at Collbran for farmers, rural home makers and 4–H Club members. At this time the club members held their annual county 4–H Club meeting. Plans for the rest of the season were discussed and indorsed.

August 7 a county club picnic was held at Lincoln Park where 250 of the total enrollment came in for a frolic and instructions. At this time Dr. Charles A. Lory, president of the Colorado Agricultural College, and Mary G. Collopy, home management specialist, gave excellent inspirational talks. The club members had access to Moyer swimming pool and the park playground equipment. An old fashioned picnic dinner, where free ice cream and lemonade were served, cared for the inner man.

August 20, the boys in the livestock clubs were taken to Plateau Valley on a livestock judging tour visiting pure-bred Holsteins, Jerseys, milking Shorthorns, hogs, Hampshire, Rambouillet, and Lincoln sheep, Belgian and Percheron horses, Angora goats, and Hereford beef cattle.

August 31 the three canning club teams gave three distinct canning demonstrations at Montgomery Ward & Co. store as follows: Canning corn, canning chicken and beans.

September 2 Plateau Valley Boys' and Girls' Clubs held a community exhibit and gave demonstrations at the time of the community flower show.

September 6 and 7 were club exhibit days when all club members were required to make an exhibit of their enterprise in club work, including record books, health record books and exhibit.

September 10, champions in boys' 4–H Club work were taken to the Delta County Fair for stock judging instruction. At this time the four champions with the highest score represented the county at the State fair as stock judging team and alternate.

The project program of the Mesa county extension service and the department of vocational agriculture of the Fruita Union High School correlating the activities of the 4–H clubs with the future farmers of America

Enterprise	Grade school			
	Fifth grade (10 years)	Sixth grade (11 years)	Seventh grade (12 years)	Eighth grade (13 years)
Swine	Fatten 2 barrows	Raise 1 gilt; may fatten 2 barrows	Sow and litters	2 sows and litters.
Dairy cattle	Raise 1 heifer calf	1 yearling heifer calf	Cow and calf	Cow, calf, and yearling.
Chickens	75 baby chicks; raise to 25 pullets	10 hens, 100 baby chicks, 35 pullets	30 hens, 150 baby chicks, 50 pullets	500 baby chicks, half-unit laying house.
Turkeys	32 eggs, 1 turkey hen, 2 chicken hens.	8 hens, 1 tom	16 hens, 2 toms	24 hens, 3 toms.
Sheep	2 fat lambs	2 fat lambs, 1 to 10 ewe lambs	1 to 10 ewes and lambs	2 to 10 ewes and lambs.
Beef cattle	Fatten 2 weaner steers	Fatten 2 steers	Fatten 2 to 5 steers or 1 to 5 beef heifers.	2 to 5 steers or 1 to 5 yearling heifers.
Rabbits	1 doe	2 does	2 to 5 does	2 to 10 does.
Corn		Grow small plot for feed	Grow and market small plot	1 to 3 acres.
Small grains				
Alfalfa				
Field beans				
Potatoes				
Vegetables, fruits and trees.				
Farm management				
Farm mechanics			Simple woodwork; care of tools	Making simple project equipment.
Judging		Elementary judging	4–H Club judging team	4–H Club State contest.
Farm organization	4–H Club elementary demonstration instruction.	4–H Club demonstration team	4–H Club demonstration team officer.	4–H Club demonstration team officer.

Enterprise	High school				In occupation of farming
	Ninth grade (14 years)	Tenth grade (15 years)	Eleventh grade (16 years)	Twelfth grade (17 years)	
Swine	1 to 3 sows and litters	1 to 6 sows and litters	1 to 10 sows and litters	1 to 20 sows and litters	Manage a herd of from 3 to 50 sows and litters.
Dairy cattle	2 cows	3 cows	4 cows	5 cows	Manage dairy herd of from 3 to 16 cows.
Chickens	250 layers	250 to 300 layers	250 to 275 layers	250 to 1,000 layers	Manage farm flock in unit of 250 hens.
Turkeys	8 to 24 hens, 1 to 3 toms	8 to 40 hens, 1 to 5 toms	8 to 60 hens, 1 to 8 toms	8 to 75 hens, 1 to 10 toms	Manage flock of 8 to 75 hens.
Sheep	5 to 10 ewes and lambs	8 ewes and lambs	12 ewes and lambs	20 ewes and lambs	Manage farm flock of 5 to 50 ewes.
Beef cattle	2 to 10 steers or 1 to 5 cows and calves.	Feed 5 to 10 beef or cows and calves.	Feed 10 to 30 beef or cows and calves.	Feed carload of beef or cows and calves.	Feed beef in car lots or raise beef on the range.
Rabbits	6 to 15 does	6 to 20 does	6 to 30 does	6 to 50 does	Manage fur farm.
Corn	1 to 5 acres	3 to 5 acres	3 to 8 acres	3 to 10 acres	Raise enough corn for feed on the farm.
Small grains		2 to 3 acres	3 to 5 acres	do	Raise enough small grain for feed on the farm.
Alfalfa		2 acres	do	do	Raise enough alfalfa for feed on the farm.
Field beans		2 to 5 acres	2 to 8 acres	5 to 15 acres	Major cash crop.
Potatoes		do	do	do	Do.
Vegetables, fruits, and trees.		¼ to 5 acres	¼ to 10 acres	¼ to 10 acres	Home use and minor cash crop.
Farm management			Apply principles of farm management to a group of farm enterprises.	Apply principles of farm management to a group of farm enterprises.	Manage a farm business.
Farm mechanics	Farm Mechanics I	Farm Mechanics II	Farm Mechanics III	Farm Mechanics IV	Manage farm buildings and equipment.
Judging	Elementary judging of livestock and poultry.	Livestock, poultry, and crops.	Judging team	Judging team	Select high-producing animals and seed.
Farm organization	Future Farmers of America, green hand degree.	Future Farmers of America, future farmers degree.	Future Farmers of America, State farmer degree.	Future Farmers of America, American farmers degree.	Farm organization committeeman or officer.

September 16 to 21, club champions, one boys' demonstration team and one girls' demonstration team visited the Colorado State Fair for instruction, team demonstrations, stock judging, and a good time.

During November an achievement day was held for those completing the year's work when club pins and minor prizes were awarded.

Beginning with September a correlation of 4–H Club work and vocational instruction in the Fruita grade and high schools was undertaken. The accompanying program was proposed and made available to the children of from 10 to 18 years. This is an 8-year course in practical agriculture.

Milk River Project, Montana

Phillips County, Mont., within which the greater portion of the Malta division of the Milk River project is located, although rather sparsely settled contains 13 active 4–H Clubs with a membership of 130 boys and girls. These clubs work under the supervision of County Agent H. L. Lantz with the aid of local leaders in each community. Dry-land farming is the principal agricultural activity of this county, and 26 club members are enrolled from homes upon the project. The accomplishments of two project groups may be of interest, not only as an evidence of the enthusiasm displayed by boys and girls for club work, but also as an example of how Montana certified seed potatoes are developed and effort being exerted to maintain the high standard of quality for this product.

The South Wagner potato club was organized in 1925 with a membership of 7, which increased to 10 in 1926, 6 of whom resided on the project. The work of this group is carried on under the direction of local leader W. E. Thompson. During 1925 each of four members planted one-eighth of an acre of certified Bliss

Triumph potatoes. One crop failed entirely, while three were harvested with a net profit of $70.60.

The same program was followed in 1926 by six project members, who realized a total net profit of $366.26. These same six in 1927 grew 9½ acres which returned a profit of $962.95, including 2½ carloads of certified stock shipped to Louisiana. During 1928, 15½ acres were grown, which under average conditions would have yielded a handsome profit. However there was practically no demand for certified seed and the produce was either sold on the commercial market at a very low price or fed to livestock. Three farsighted boys planted 20 acres during 1929, which made excellent yields and should sell for at least $2.50 per hundredweight during the early spring of 1930.

In the carrying out of a 4-year program this club has made a record well worth emulating. Four members have entirely completed the 4 years' work, and two 3 years' work. Some of the members also participated in the work of other clubs during the past year.

In the Strater community a second potato club was organized during 1928, called the "Strater Potato Bugs." The group consists of four boys and two girls under the direction of local leaders, Mrs. F. L. Camp and Mrs. Leo Geeting.

The first year each member planted a small plot comprising a total area of 2.42 acres; 33,750 pounds of marketable potatoes and 11,190 pounds of culls were yielded, although no sales were made. Each member however carefully selected 200 hills of potatoes, bagged and numbered each hill separately, and from each hill sent a tuber, properly labeled, to the State agricultural college at Bozeman for greenhouse propagation. The plants produced were carefully inspected by college specialists, the results reported to club members who discarded all hills that the greenhouse record showed to be diseased or inferior.

During the spring of 1929 the seed thus selected was carefully planted after treatment. Two members mixed their seed and lost the identity of the tested hills. The others planted all of the tubers of each hill consecutively in a row, properly identified. During the growing season careful inspection of the plots was maintained and if any plant in a hill unit showed disease the entire unit was rogued out. All members of the group accompanied the potato specialist on each inspection tour, in order that they might become thoroughly informed upon potato culture generally and identification of diseases in particular.

Five of the seven plots planted in 1929 passed the certification requirements of the Montana Potato Improvement Association. Two and one-third acres were harvested by the club, which would, at present market prices, return a net profit of $318.75 to the growers. Seed is being raised from three of the hill-unit planted plots, which will be proven in the Bozeman greenhouse before the spring of 1930.

Further plans call for a small tuber-unit or hill-unit seed plot each year, planted from seed proven by greenhouse tests to be disease free. This seed plot will be heavily rogued during the growing season and a few selected hills tested each year as a source of seed for the coming year's seed plot. The balance of the seed plot will furnish the seed for the larger field which produces the certified stock to be marketed.

The Strater Potato Bugs know how to play as well as work. Six members and the club leader, Mrs. Camp, attended the 4–H Club camp held at Fort Assinniboine, July 8–11. At the annual Phillips County Farm Bureau picnic held at Malta they won the 4–H Club yell contest. Following the season's work they presented a play at the community school and raised sufficient money to defray certification charges.

Achievement Story

By Tom Camp

Last spring I started out with 100 hills of potatoes that had been tested out at Bozeman for seed. I plowed, harrowed, and disked my ground the last of May. I marked off the rows with a lister cultivator. I treated my potatoes, each hill separately. When they were treated I planted them. I planted each hill by itself and numbered it. As soon as they were big enough I started to hoe them; I cultivated them three times. The last time I got too close to the plants and uncovered part of the potatoes, so I had to hill them up to keep them from getting sunburned.

They were inspected three times. At the first inspection they found a big spindle tuber, but I culled them out, so my potatoes were almost clear of disease.

I irrigated twice. The first time I didn't watch the water very close, so it drowned out a few potatoes.

I dug my potatoes on October 5. They yielded 10⅝ bushels. I selected 33 hills to have tested out in the greenhouse at Bozeman, so I can have perfect seed for next year.

Sun River Project, Montana

Six husky, thick-fleshed, white-faced calves found new homes Wednesday, November 20, with six husky, young 4–H Club members on the Sun River irrigation project, who are going to demonstrate the value of feeding livestock on the farm and of using home-grown feeds.

The calves averaged 465 pounds each and were selected from the herd of the Teton Land Co. at Lowry, Mont. Mr. A. C. Gough, manager of the Teton Livestock Co., who is very much interested in seeing a strong livestock feeding program developed on the project, made

Left: South Strater potato bugs. Boys and Girls Club Parade, Phillips County Farm Bureau Picnic, Malta, Mont., July 20, 1929. Right: Inspection Tour. The inspector finds a spindle tuber

it possible for the young farmers to secure these fine animals.

Boys who are members of this club are Gerald Molen, Vaughn, Mont.; A. L. Meyers, jr., James Graves, and Harold Kelsey, of Fairfield, Mont.; and James and Albert Barce, of Bole, Mont.

The plan is to carry the calves through the winter on a ration of 5 pounds of grain per day and all the good alfalfa hay they will eat. Next summer they may be turned on grass pasture or continued on the hay and grain ration, gradually increasing the amount of grain toward the end of the feeding period. It is planned to show the calves at fairs next fall and then market them in cooperation with other club calves from Teton and Cascade Counties. The primary object of the feeding work is to obtain the most economical gains and produce a prime baby beef, the kind the market demands and is willing to pay a premium for.

Rehabilitation of Irrigation Districts

(Continued from p. 83)

(1) A careful economic and feasibility study by competent disinterested persons.

(2) A careful supervision by a public agency of the district expenditures during construction.

(3) A well defined and properly financed settlement program.

(4) Individual liability with a small general liability.

At the present time nearly all irrigation district bonds are on the basis of what is known as blanket liability. In other words, all of the lands within the district are held as security until all of the bonds and interest are paid. Under individual liability, with a small additional general liability to care for contingencies, the settler can almost entirely relieve himself of his neighbor's liability, with therefore a great incentive to meet his own payments. Upon the other hand, in case of financial difficulty under general liability, the incentive is for the settler not to pay, because the pyramiding of delinquencies will soon put him out of business. Under individual liability the bond is in effect a general liability to this extent—it does not cover any specific piece of land and all payments made by individuals are prorated among the bondholders, but when a settler has met all his assessments plus the small penalty, his land is no longer subject to the bonded debt.

(5) Ad valorem and benefit basis of assessment. In other words, it is the return from the land that must pay the bonds and the interest. The basis of assessment should be therefore the ability of these lands to produce, with due credit being given for location.

(6) Terms of repayment of bonds and rates of interest that can be met from the proceeds of the land.

(7) There should be provided in the state laws a means of foreclosing on irrigation districts, and for the district to go into receivership, either voluntarily or by court order.

(8) Provision should be made for the collection of operation and maintenance charges separately from the collection of general taxes and taxes for bond and interest payments, because if the district can not operate it soon deteriorates and the settlers soon move away.

(9) Adequate protection of settlers. In drafting state laws providing for bonds in irrigation districts the great effort has been to provide ample protection to the bond holder. It is the settler who out of the products from the land must meet bond payments, taxes, living costs, farm operating expenses, and the like. Therefore, protection must be given settlers that will make it possible for them, with reasonable industry, to meet payments when due and ultimately acquire title to their farms, without total liability for failure of their neighbors. It must be possible for the settler to live with reasonably high standards or he will not stay on the project ,and if he leaves there is default to that extent.

The question naturally arises as to what is involved in revamping or rehabilitating an irrigation district.

(1) The bond of a district is a contract between two parties and can be broken legally only by and with the consent of the two parties to the agreement.

(2) It is therefore necessary to provide a bondholders committee and a landholders committee that negotiations may be successfully undertaken.

(3) There is involved the consideration of agriculture, engineering, and economic problems in addition to the human element.

(4) In many cases it takes amendments to State laws and therefore requires an intervening legislative session before such readjustment can be put into effect.

(5) A ratification of the findings of the committees, in the case of the landowner by a popular vote, and in the case of the bondholder by written consent.

(6) Usually a loss upon the part of both the bondholder and the settler. The revamping and reorganization of an irrigation district that is in difficulty requires a diversity of highly specialized technical training and experience as well as a world of patience and ability to deal with the public. Each district is different in its problems, and there is therefore a fascination about such studies and a great satisfaction when the affairs of the district have been satisfactorily adjusted, and one can see the settlers once again prospering and meeting in full the terms of their obligations.

Boulder Dam Separates Now Available

Reprints of the two articles in the Enginneering News-Record of February 6 by Dr. Elwood Mead, Commissioner of Reclamation, and R. F. Walter, chief engineer, on the economic and engineering phases, respectively, of the proposed construction of Boulder Dam, are now available in the Bureau of Reclamation and may be obtained by application to the Commissioner, Bureau of Reclamation, Washington, D. C.

Only by intensive culture and properly improved and equipped farms can the costs of reclamation be met.

Main street of Nyssa, Owyhee project, Oregon-Idaho

Extracts from First Deficiency Act, Fiscal Year 1930

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums are appropriated, out of any money in the Treasury not otherwise appropriated, to supply urgent deficiencies in certain appropriations for the fiscal year ending June 30, 1930, and prior fiscal years, to provide urgent supplemental appropriations for the fiscal years ending June 30, 1930, and June 30, 1931, and for other purposes, namely:

DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

Secondary projects: For an additional amount for cooperative and general investigations, fiscal years 1930 and 1931, $275,000, payable from the Reclamation Fund, of which amount not to exceed $25,000 may be used for personal services, and not to exceed $10,000 for other expenses, in the office of the chief engineer.

DEPARTMENT OF STATE

INTERNATIONAL OBLIGATIONS, COMMISSIONS ETC.

International Water Commission, United States and Mexico: The unexpended balances of the appropriation of $35,000 for the International Water Commission, United States and Mexico, contained in the act making appropriations for the Department of State for the fiscal year 1929, approved February 15, 1928, and continued available until June 30, 1930, and of the appropriation of $15,000 contained in the act making appropriations for the fiscal year 1930, approved January 25, 1929, shall remain available for the same purposes until June 30, 1931.

SEC. 7. This act may be cited as the "First Deficiency Act, fiscal year 1930."

Approved, March 26, 1930.

Acceptance of Personal Checks

In decision of March 14, 1930 (A–26527), regarding the receipt and deposit of public moneys in the United States Treasury, the Comptroller General stated:

To the extent that the deposits include checks, etc., for collection, this office recognizes the necessity of having the receipts show the character of the deposits and that same are accepted "subject to collection" and in proper cases where the depositor has not receipted for the checks, etc., as payment of the obligation, and no material right or interest of the United States has been surrendered, credit may be allowed in the depositors' accounts for the amounts of checks, etc., returned because collection could not be readily effected through banking channels.

The above-quoted paragraph from the decision cited gives specific recognition to a practice that has been followed in the Bureau of Reclamation for a great many years. There is no authority of law for fiscal agents of the bureau to accept personal checks in payment of obligations due the United States, but for the convenience of the water users in making remittances and in conformity with common business usage, personal checks have been and are accepted, subject to collection, conditional receipts being issued therefor which do not become an acquittance of the obligation until collection is made on the check or other negotiable paper tendered in payment. Such checks are deposited promptly in the designated depositories and if, for any reason, collection is not made through the regular banking channels, the conditional receipt issued by the fiscal agent is canceled, credit is claimed and allowed in his accounts, and the administrative officers proceed to collect the amount due the United States from the debtor as if no check had been tendered in payment. No right or interest of the United States is surrendered when the conditional receipts are issued, because the obligations due the Government represent, as a general rule, water-right charges which are secured by a lien upon the water user's land and that lien is not released until all water-right charges thereon have actually been paid.

Correction of Vouchers

All claims against the United States for miscellaneous services; that is, services other than that rendered by employees, as well as for equipment, materials, and supplies furnished, must be certified by the claimant as being "correct and just and that payment therefor has not been received," and the Comptroller General has ruled that where, in a voucher so certified there is an error favorable to the Government, there is no authority for correction of the error to be made either in the administrative office or in the General Accounting Office. In other words, the Government disbursing and accounting officers can not, in any case, pay more than the amount claimed and certified as correct by the claimant. Of course, if the voucher is stated for more than the amount due under contract or other provisions, the disbursing and accounting officers have authority to and must make deduction for the excess amounts claimed, but in such cases the claimant has a right to appeal to the Comptroller General if he is not satisfied with the settlement as made.

Where an error is apparent in a voucher or certified invoice and it appears that the claimant is entitled to more than the amount claimed, the voucher or invoice should be returned to the claimant, inviting attention to the apparent error with request that it be explained or if necessary corrected. The claimant, however, should not be instructed to correct the voucher.

In commenting upon this matter in the decision of March 31, 1930 (A–29699), the Comptroller General stated:

The decision in question does not hold that when there appears to be an error in the Government's favor the voucher "is to be returned to the vendor with instruc-

tions to issue a new voucher or invoice." While it is proper in such cases to return the voucher to the creditor, inviting attention to the apparent error with a request that it be explained or, if necessary, corrected, the vendor or other creditor should not be *instructed* to increase the amount claimed on a voucher.

Pending Legislation

(Continued from p. 85)

CHINOOK DIVISION ADJUSTMENTS

H. R. 8296, introduced by Congressman Leavitt, of Montana, January 8, 1930.

To amend the act of May 25, 1926, entitled "An act to adjust water right charges, to grant certain other relief on the Federal irrigation projects, and for other purposes."

The bill authorizes the suspension of charges against certain temporarily unproductive lands in the Chinook division, Milk River project, and the remission of charges against certain other areas found to be permanently unproductive, provided that each district affected execute satisfactory contract for repayment of construction charges within 20 years.

January 7, 1930, the Secretary expressed approval of proposed bill conditioned upon execution of required contracts.

January 9, 1930, House reported without amendment.

January 20, 1930, passed by House.

January 21, 1930, referred to Senate Committee on Irrigation and Reclamation.

April 14, 1930, reported by Senate committee without amendment.

CONVEYANCE OF LAND

H. R. 10174, introduced by Congressman Butler, of Oregon, February 21, 1930.

Authorizing the sale of a certain tract of land in the State of Oregon to the Klamath irrigation district.

The bill directs the Department of the Interior to convey to the Klamath irrition district a tract of land on the Klamath project, locally known as the McCormick tract, upon the payment by the district to the United States of the book value of the tract.

March 8, 1930, the Secretary of the Interior reported upon the bill stating that he was in agreement with memorandum of the commissioner suggesting certain amendments.

March 19, 1930, the House reported the bill with amendments.

THE turkey growers of the several counties on the Milk River project recently organized a permanent body to cooperate with the regional organization of the Federal Farm Board for the marketing of this product.

Seville Exposition

Honors Department

A GRAND prize has been awarded to the United States Department of the Interior by the Ibero-American Exposition at Seville, Spain, according to information recently received from Commissioner General Thomas E. Campbell, who is representing the department at the exhibition.

In addition to this grand prize, diplomas of honor were awarded to individuals and agencies of the department as follows: To H. M. Gillman, jr., contact officer for the department; to John H. Pellen, for his work as contact officer; to the National Park Service; to the Bureau of Reclamation; to the Geological Survey; to the Bureau of Education, a gold medal; and to the General Land Office, a silver medal.

The American exhibit at Seville contains such items as a model of the Grand Canyon, a model of Sequoia and Yosemite National Parks, a model of an irrigated farm in the West, a panorama of Salt River Valley in Arizona, a model public school American style, cases comprising collections of geologic specimens, and many enlarged and colored photographs depicting natural and developmental scenes in the West.

Exports of fresh fruits from the United States last year were valued at $69,000,000, an increase of $13,000,000 over those of 1928.

Mae A. Schnurr Acts As Bureau Commissioner

During a recent absence of about 10 days from the Washington office of both Commissioner Mead and Assistant Commissioner Dent, Miss Mae A. Schnurr, assistant to the commissioner, was designated Acting Commissioner of the Bureau of Reclamation.

So far as is known, this is the first time in the history of the Federal Government that a woman has acted as head of a major bureau normally directed by a man. This breaking of the ice of conservative Government practice was followed shortly after by another woman assuming the reins in a similar situation. These are only indications of the increasingly important place that women are assuming in the affairs of government and of their ability to step into executive positions at a moment's notice and keep the wheels moving.

Farmer Buys and Improves Orland Property

Fred L. Ehrk, an enterprising farmer, has bought a piece of property on the Orland project, California, which had been in arrears for a number of years. The present owner is interested in developing the property, and last summer leveled the land, erected the improvements shown in the accompanying illustration, and in the fall seeded the premises to alfalfa. The farm is now a going concern as contrasted to the property in its arid state as it would have appeared had it been necessary to cancel the water-right application.

Improvements on Fred L. Ehrk's newly acquired Orland farm

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, left Washington for Sacramento, Calif., on April 11, to be gone about 10 days in connection with a study which the State of California and the Federal Government are making of how to conserve and utilize to the best advantage the surplus waters of the Sacramento and San Joaquin Rivers. The commission created is called the Hoover-Young Commission, of which ex-Governor Parsee is the chairman. The commission wired asking that Doctor Mead attend a conference in Sacramento relative to the general conduct of this investigation and the part the Bureau of Reclamation would take. Doctor Mead's connection with the University of California as professor of irrigation institutions makes him unusually familiar with both valleys.

Charles A. Bissell, engineer of the Bureau of Reclamation at present engaged on the Sacramento and San Joaquin River investigation, gave an address on the work of the Bureau of Reclamation before the Sacramento section of the American Society of Civil Engineers at a recent weekly luncheon.

H. T. Cory, formerly connected with the Bureau of Reclamation in the capacity of consulting engineer, called at the Washington office while on a recent business rip in the East.

Among the recent visitors to the Milk River project were C. D. Greenfield, agricultural development agent, Great Northern Railway; Mark and Heber Austin, agriculturists, Utah-Idaho Sugar Co.; and A. C. Cooley, director of extension work, Indian irrigation projects.

The office of the district counsel at Mitchell, Nebr., has been discontinued, and District Counsel William J. Burke and all official records of the Mitchell office have been transferred to Billings, Mont., from which point Mr. Burke will supervise the legal work of the following projects: Milk River, Sun River, Lower Yellowstone, Belle Fourche, Riverton, and Shoshone.

George O. Sanford, Reclamation economist, has returned to Washington after several weeks in the field investigating economic conditions on the Uncompahgre project and the Orchard Mesa division of the Grand Valley project.

Col. Noel M. Brazier, of West Australia, who is interested in irrigated agriculture and irrigation structures, was in the Washington office during the month. He expected to visit a number of the projects, including Yakima, Rio Grande, and Yuma.

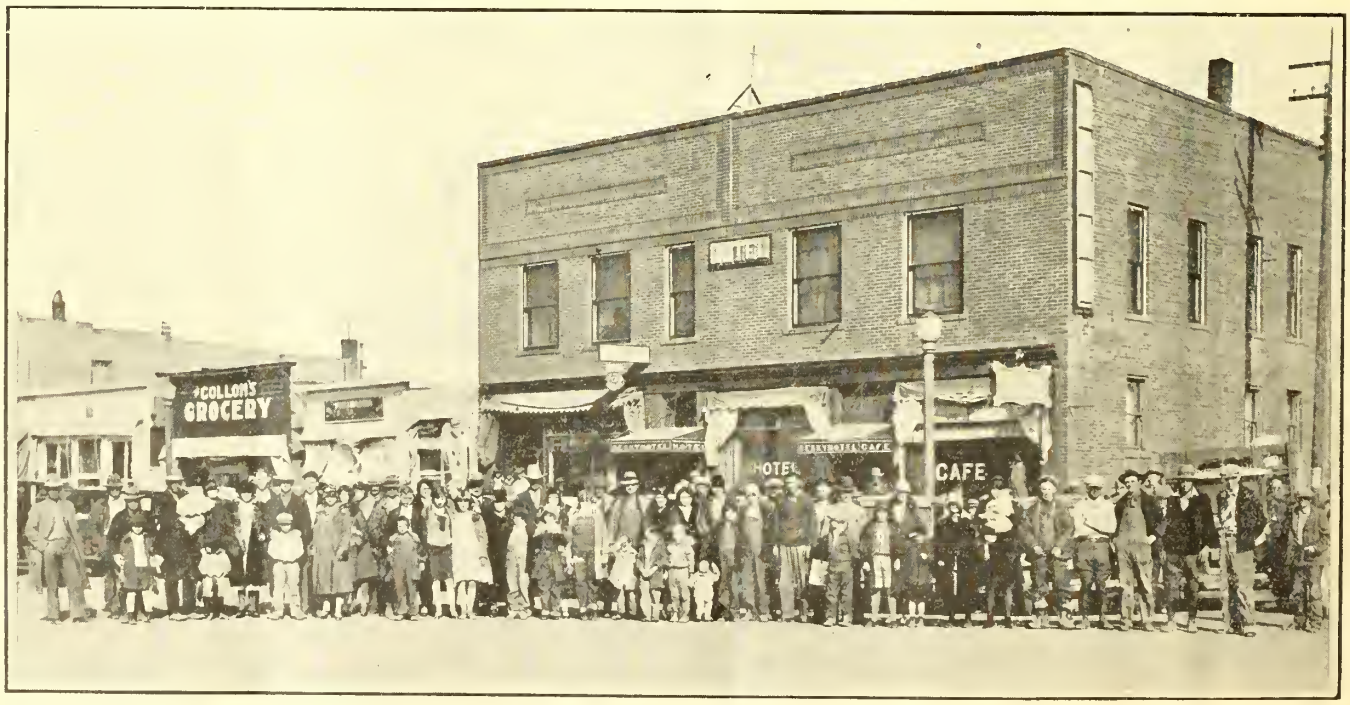
Dr. Charles A. Lory, W. P. Dale, and Edward Foster, a committee appointed to consider betterment conditions for the Uncompahgre project, met at the Denver office the latter part of the month.

Yoshio Machiyama, civil engineer of the Public Works Department of Japan, was in the Denver office on March 31 obtaining information on the engineering works of the bureau.

Herbert N. Eaton, engineer of the Bureau of Standards, called at the Denver office during the month in connection with the construction and operation of a proposed hydraulic laboratory at Washington.

Toshikazu Hagiwara, a Japanese engineer from the Bureau of Public Works, Department of Home Affairs of the Japanese Government, Tokyo, was in the Washington office during the month and was furnished available information regarding the engineering works under construction by the bureau.

J. A. Whiting, State engineer of Wyoming; Floyd Roush; R. H. Willis, chief of the bureau of irrigation, power, and drainage, Nebraska; and A. W. Hall, visited the North Platte project early in the month to discuss water distribution problems for the coming season.



Party of 55 new settlers obtained for the Lower Yellowstone project, Montana-North Dakota, through the efforts of the Lower Yellowstone Development Association

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissoiner
C. A. Bissell, Chief of Engineering Division

Hugh A Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.: C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Orland	Orland, Calif	R. C. E. Weber	do	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	J. C. Page	do	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	do	F. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Acting supt	H. W. Johnson	Denver office	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent			do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	Denver office	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Voster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	H. W. Bashore	Constr. engr	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	Denver office	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	do	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	P. J. Preston	Superintendent	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	W. R. Young	Constr. engr	E. R. Mills	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	E. W. Shepard	Wm. J. Burke	Billings, Mont
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gravity Extension division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. dist	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Geo. A. Haycock	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation dist	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. dist	Chinook, Mont	W. B. Sands	do	J. F. Sharpless	Chinook, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Zurich, Mont.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Scottsbluff, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo	A. B. Reeves	do	Mrs. Nelle Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. dist	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. dist	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Laugell Valley	Langell Valley irrig. dist	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry Valley W. U. A	Provo, Utah	Kenneth Borg	Project irrig. engr	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irriga. supt	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

White Gold — King Cotton on the Rio Grande Federal Irrigation Project — New Mexico Texas

U. S. GOVERNMENT PRINTING OFFICE: 1930

NEW RECLAMATION ERA

VOL. 21, NO. 6 JUNE, 1930

A TYPICAL FARM HOME ON AN IRRIGATION PROJECT, SUNNYSIDE DIVISION
YAKIMA PROJECT, WASHINGTON

FEDERAL RECLAMATION

THESE Government projects have given untold taxable values to worthless deserts, and of equal importance have been the markets they created for the manufacturer of Alabama pipes and fittings; Arkansas hardwood; Colorado fence and iron products; Connecticut hardware and ammunition; Florida grapefruit and oranges; Iowa canned corn and cereals, pumps, and washing machines; Illinois furniture, hardware, sirup, enamel ware, and cereals; Indiana pork and beans, autos, windmills, kitchen cabinets, and building stone; Kansas salt, cereals, and eggcase fillers; Kentucky soap and iron roofing; Louisiana molasses and rice; Maine paper bags; Michigan autos, paint, and wire fence; Minnesota flour, cereals, and sirup; Mississippi cotton cloth; Maryland oysters and clothing; Massachusetts watches, textiles, chocolate, and fish; Missouri tinware, stoves, and shoes; New York electric supplies, radiators, chemicals, and clothing; North Carolina tobacco products; New Jersey electrical supplies and drugs; Oklahoma fruit jars; Ohio auto tires and farm machinery; Pennsylvania iron and steel plates; Tennessee stoves; Virginia tobacco and peanuts; Vermont marble and granite; Wisconsin bathtubs and furniture; and hundreds of other items that give employment and prosperity to the East and South.

The people on Government irrigation projects, and supported by them, buy at least $125,000,000 of those products every year.

JOSEPH A. SWALWELL,
President Columbia Basin League.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 June, 1930 No. 6

Interesting High Lights on the Federal Reclamation Projects

THE C. B. & Q. Railroad has been for some time engaged in a campaign looking toward a more rapid settlement of the remaining uncentered farm units on the Willwood division of the Shoshone project, and through Mr. Val Kuska, its colonization agent, has employed various methods of advertisement, the results of which are very encouraging. Mr. Kuska expects a large number of prospective settlers to make a personal inspection of the project during the coming summer with a view to filing application for suitable farm units.

THE superintendents of the Grand Valley and Uncompahgre projects have been appointed representatives of the director of markets for Colorado on a committee to attempt the merging of the three poultry and turkey organizations which are now operating on the projects, and thus remedy the present system of marketing and duplication of overhead existing in the operation of the three competing organizations now doing a combined gross business of $500,000.

WITH colonization, land settlement, credit for settlers, and dissemination of information to farmers as its main objectives an agricultural development committee, with headquarters at Fairfield, has been formed on the Sun River project. This committee is composed of the project superintendent, the associate county agent, the local representative of the Milwaukee Railway, the cashier of the Fairfield National Bank, the manager of the principal grocery store, and six representative successful farmers.

A NUMBER of sales of farm property have been reported on the Minidoka project, most of which are on the pumping division. Four 40-acre farms were sold at prices varying from $4,000 to $8,000; 2 farms of unknown area were disposed of at $5,500 and $6,300, respectively; and 10 acres south of Burley brought $1,500.

AT a recent meeting of the Powell Wool Growers' Association, an organization established last year for the purpose of pooling wool from the farm flocks on the Shoshone project, the board of directors unanimously decided to combine their organization with the National Wool Marketing Corporation.

THE new families on the Lower Yellowstone project are very enthusiastic about local conditions, and are particularly impressed with the excellent soil and weather conditions for spring work.

DURING a recent month the Mini-Cassia Dairymen's Association received 1,006,315 pounds of milk, from which 37,312 pounds of butterfat were obtained. In addition 23,375 pounds of cream butterfat were purchased, making a total of more than 60,000 pounds of butterfat handled, an increase of 23 per cent over the corresponding month last year. The association paid 43 cents per pound for milk butterfat and 35 cents for cream butterfat. At the Burley casein factory 3,354 pounds of casein were manufactured from skim milk.

THE Alfalfa Growers' Association and Farm Bureaus on the Rio Grande project are contemplating the building of an alfalfa meal mill at Clint, N. Mex.

AS a result of the work of the colonization agent employed by the railroads and the sugar company on the Lower Yellowstone project at least two families moved to the project during the month.

THE increased acreage planted to beets, potatoes, and corn on the Uncompahgre project will cause a correspondingly smaller acreage to be planted to wheat and oats during the present season.

A SHIPMENT of 140 lambs, having an average weight of 85 pounds, was made early in the month by the Minidoka County lamb pool on the Minidoka project. The price received for these lambs in Seattle was 13 cents a pound.

THE parent-teachers' organization at Fairfield, Sun River project, Mont., has just closed one of the most successful years in its history.

THE unsatisfactory prices received for the cotton crop on the Yuma project last year has resulted in a decrease of 17 per cent in the area planted to this crop during the present season, which will mean a larger area devoted to alfalfa, lettuce, and melons during 1930.

THE new potato-meal factory, which was built by the Otato Corporation at Burley, Minidoka project, has been completed and is now in operation.

BASED on gross contract earnings the percentage of completion at Echo Dam, Salt Lake Basin project, at the close of the month was 87.8.

THREE additional applications were received by the local office during the month for farm units on the Vale project. There now remain but four farm units of public land open to entry in the Harper and Little Valley unit of the Vale project.

THE Tri-State Milling Co. of Belle Fourche is making improvements and an extension to their flour and elevator plant. The new elevator will be 125 feet high, the tallest structure in western South Dakota, and when completed it will provide a storage capacity of 70,000 bushels.

114098—30——1

Pumping Plants of the Bureau of Reclamation

By H. F. McPhail, Engineer, Denver Office

THE Bureau of Reclamation, in connection with its irrigation projects in the arid regions of the western United States, makes extensive use of pumping plants for irrigation and drainage. In some instances a combination of the two uses is effected in a single installation with water pumped for drainage purposes being reused for irrigation.

Any attempt to describe general types of pumping plants for either of the above uses, or a combination of the two, as being of any definite use for contemplated developments is rather difficult, as each development requires a careful engineering study by itself, depending upon pumping head, pump capacity, length of discharge pipe, foundation conditions and source of power available for driving the pumps.

TYPES OF PUMPS

The larger part of the major pumping installations made by the Bureau of Reclamation has been for strictly irrigational purposes where the water is lifted from a canal or river to a higher level and discharged into an irrigation canal. Three types of pumps have been used in these installations; scoop wheels for low heads and small capacities, screw pumps for low heads and larger capacities, and centrifugal pumps for higher heads.

TYPES OF DRIVES

Many types of drives have been employed, including direct-connected and belted gasoline and oil engines, direct-connected and belted horizontal motors, direct-connected vertical motors and hydraulic turbines. All of the more recent plants have employed the last two mentioned types of drive which have proven to be the most economical in construction, operation, and maintenance with distinct advantages in favor of the hydraulic turbines where the physical characteristics of the site are suitable for such installations.

Cross sections of several typical installations are shown on the accompanying drawing. These represent four different types of plants for pumping irrigation water and three for pumping drainage water, one of which, Figure 5, is quite generally used for a combination of both purposes.

LOWER YELLOWSTONE DEVELOPMENT

Figure 1 is a cross section of the Thomas Point pumping plant on the Lower Yellowstone project in Montana. The pumps are direct-connected to horizontal hydraulic turbines and have a capacity of 25 second-feet each against a total head of 35 feet. The power head available for the turbines is 28 feet and the pumps raise the water 31 feet above the elevation of the supply canal. The pump house is 45 feet long and 18 feet wide. Each pumping unit is fed by a 48-inch concrete penstock 62 feet long. Each turbine is rated at 110 horsepower. A small electric generator is belt-driven from either of the pumping units to furnish power for lights and a 5-ton traveling crane is installed to handle the machines. A pressure settling tank is required to supply clear water for the stuffing boxes. The pump discharge line consists of 348 feet of 36-inch riveted steel pipe, 55 feet of reinforced concrete pipe, and steel manifolds for connecting with the pumps.

The principal items of cost were as follows:

Class of work	Quantity	Cost	Unit cost
Excavation, dry, class 1 (drag line) cubic yards	5,564	$1,713.77	$0.31
Piling, round timber linear feet	2,298	1,850.44	.80
Concrete, reinforced (65 pounds per cubic yard) cubic yards	485	8,600.38	17.73
Building (except concrete)		1,164.88	
Pipe, 36-inch riveted steel (discharge) linear feet	348	2,830.74	8.13
Pipe, 20-inch to 48-inch steel (manifold) linear feet	153	1,349.06	8.81
Back fill, puddled (drag line and teams) cubic yards	3,685	698.95	.19
Machinery, hydraulic pounds	42,540	20,035.16	.47
Machinery, miscellaneous (traveling crane) pounds	3,900	564.03	.14
Lighting system (generator and conduits)		131.64	
Gates and lifting devices (headworks) pounds	4,165	656.26	.16
Subtotal		39,595.31	
			P. ct.
Engineering and inspection		6,472.08	16.3
Total field cost		46,067.39	
General expense		3,790.33	8.2
Grand total cost		49,857.72	

THE BLACK CANYON LAYOUT

Figure 2 is a cross section of the Black Canyon pumping plant on the Boise project in Idaho. The pumping units consist of vertical pumps direct connected to hydraulic turbines with each pump having a capacity of approximately 150 second-feet against a head of 28.5 feet. The minimum power head for the turbines is 85 feet. The building is a reinforced concrete structure 32 feet wide by 41 feet long with a crane installed for handling the machinery. Each pumping unit is fed by a 60-inch diameter plate-steel penstock and both pumps discharge into a common 84-inch diameter plate-steel pipe which leads into a conduit through the dam of the same diameter. A 48-inch balanced plunger, mechanically operated valve of the needle type is installed in the discharge of each pump. The plant building adjoins that of a power plant and both are operated by the same operating crew.

The principal items of cost were as follows:

Class of work	Quantity	Total cost	Unit cost
Cofferdams		$963.20	
Excavation, dry, all classes cubic yards	1,895	5,656.78	$2.98
Backfill, dry do	170	301.28	1.77
Concrete, plain do	46	656.29	14.27
Concrete, reinforced cubic yards	567	18,830.25	33.20
Building, except concrete		4,796.83	
Hydraulic machinery		35,114.19	
Balanced valves		18,143.65	
Pipes, steel plate		19,800.89	
Machinery, miscellaneous		2,352.77	
Subtotal		106,616.13	
			P. ct.
Engineering and inspection		3,655.83	3.4
Camp maintenance		1,386.01	1.3
Total field cost		111,657.97	
Superintendence and accounts		1,898.19	1.7
General expense		5,806.21	5.2
Grand total actual cost		119,362.37	

MINIDOKA PUMPING PLANT

Figure 3 is a typical cross section of the pumping plants for the Minidoka pumping project in Idaho. The First Lift plant is the largest of three on this project and contains five vertical, synchronous, motor-driven units. Four of these have a capacity of 180 second-feet each and the fifth a capacity of 100 second-feet against a head of approximately 30 feet. The driving motors are of the synchronous type and are rated at 600 horsepower each for the large units and 360 horsepower for the small units. The building is of reinforced concrete, 141 feet long and 18 feet and 30 feet wide, for the pumping and switchboard sections. Each pump discharges into a 66-inch diameter concrete discharge pipe leading to the upper canal. The pumps are of the wet-pit type and are always primed ready for starting. A traveling crane, switchboard, transformers, and all electrical control apparatus for the units are installed in the same building.

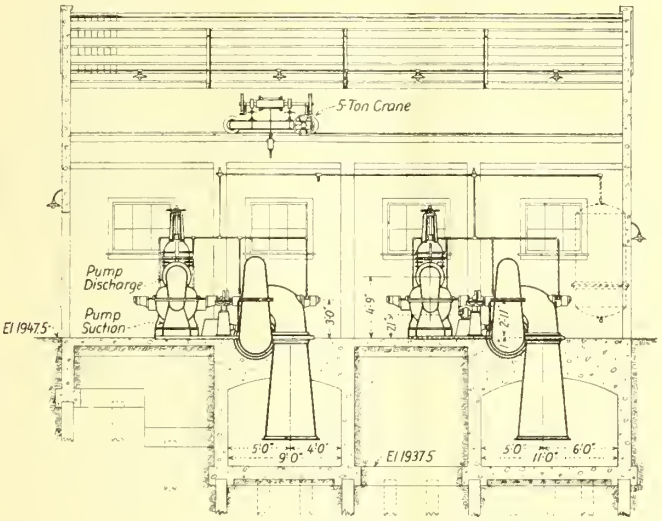


FIGURE 1

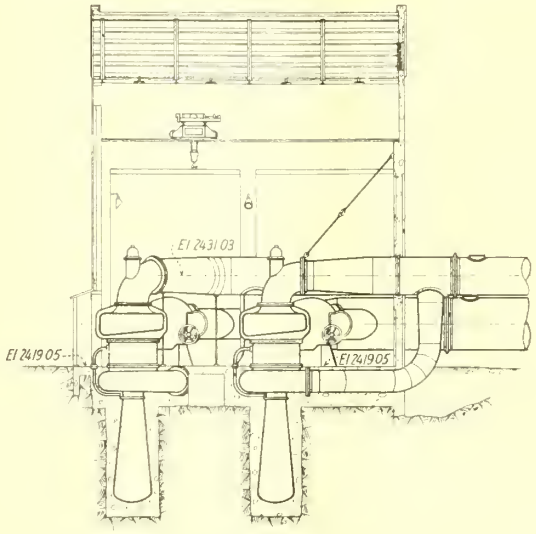


FIGURE 2

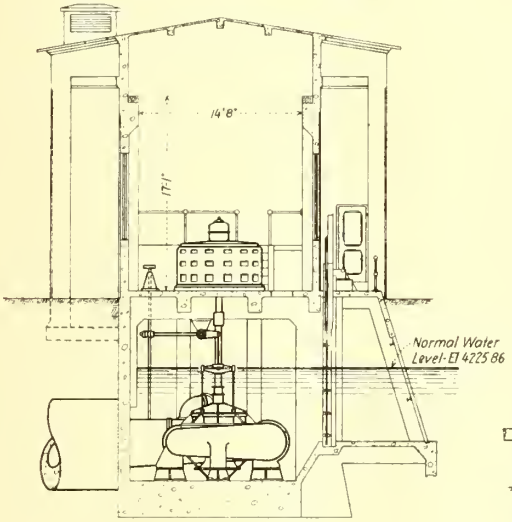


FIGURE 3

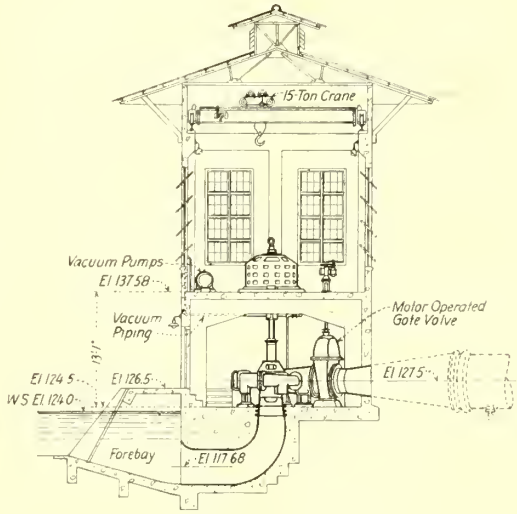


FIGURE 4

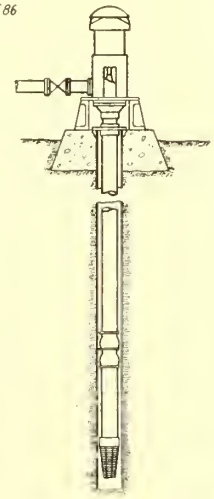


FIGURE 5

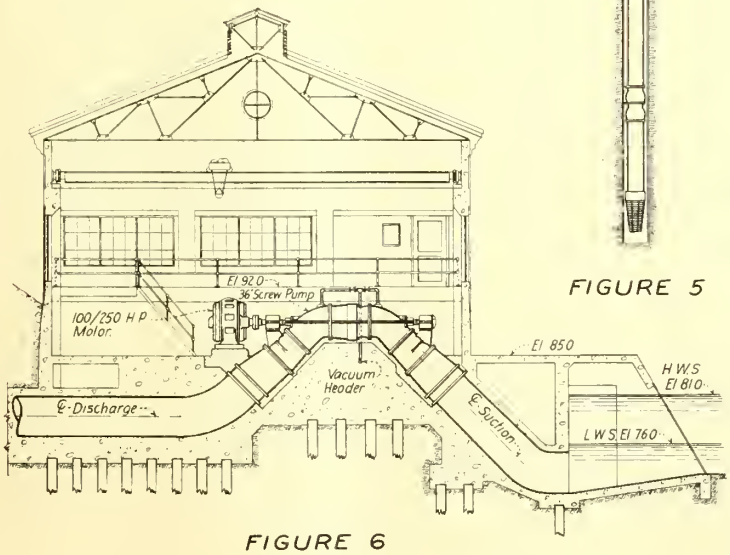


FIGURE 6

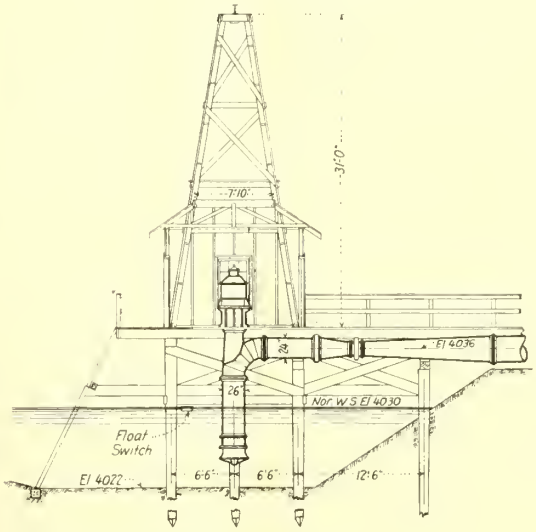


FIGURE 7

Pumping plants operated on Bureau of Reclamation projects during fiscal year 1928–1929

Project	Name of plant	Type of unit	Plant capacity		Number of units	Static lift (feet)	First cost of plant	Cost of operation and maintenance	Estimated depreciation	Energy used for pumping (kilowatt-hour)	Acre-feet pumped	Cost per acre-foot without depreciation	
			Horsepower	Second-feet								Per acre-foot	Per foot lift
Boise	Black Canyon	V. T. D. S.	1,244	266	2	25	$149,901.39	$1,558.54	$6,621.96		95,555	$0.01631	$0.00065
Grand Valley	Price Stub	V. T. D. C.	125	28	1	31	46,697.83	445.78	1,000.00		4,550	.098	.00317
Huntley [1]	Ballantine	do	620	60	2	45	73,833.32	1,255.10	2,000.00		16,143.90	.078	.00173
	Ballantine Auxiliary.	O. E. D. C.	400	46	2	45	71,103.56	513.09	3,500.00		160	3.20	.071
Klamath	Dry Lake	V. T. D. C.	75	19.3	1	51	31,861.11	175.00	1,200.00	15,780	3,475	.053	.00104
	Tule Lake, No. 1	V. M. D. S.	120	60	2	5.1	[2] 41,529.60	3,672.66	2,000.00	306,440	18,969	.194	.041
	Tule Lake, No. 2	do	60	30	1	5.5							
	Tule Lake, No. 3	do	85	42	2	4.1							
Lower Yellowstone.	Thomas Point	H. T. D. C.	220	45	2	31	49,970.43	235.98	1,000.00		4,218	.056	.00187
Minidoka [1]	Pumping plant, No. 1.	V. M. D. C.	3,800	825	5	29	186,020.00	28,944.07		10,810,800	231,490	.053	.00179
	Pumping plant, No. 2.	do	3,280	700	4	30.7	184,920.00			9,340,000	195,332		
	Pumping plant, No. 3.	do	1,900	417	3	29.9	103,107.00			5,672,200	116,824		
	Boersch Lake	do	200	50	2	20.0	32,947.72	8,350.05		632,600	20,885		4
	West End	H. M. D. C.	150	40	2	21.25	18,745.61			480,740	10,252		
	A-4 pumping station.	Scoop wheel	25	20	1	3.5	3,328.43			25,500			
	1817 pumping station.	do	10	11	1	4.8	3,634.71			10,580			
	C-2 pumping station.	do	10		1	2.5							
	114 pumping station.	H. M. D. C.	7.5	4	1	7.0	2,803.97			11,018			
	1812 pumping station.	do	7.5	2	1	4.0	1,008.76			31,130			
	MacRae pumping station.	do	7.5	2	1	14.0	864.77			13,458			
	D-2 pumping station.	do	15	4	1	14.0	1,696.56			31,060			
	3 drainage pumping plants.	do	45	17	3	13.0	17,011.91			177,668			
Newlands [1]	Lahontan	do	400	60	2	54.1	36,289.62	(3)					
North Platte [1]	Dutch Flats drainage pumps.	V. M. D. C.	100	8	3	30–52	23,393.94	3,064.00	1,500.00	115,968	846	3.62	.084
	Duck Lake	H. M. D. C.	125	10	2	56–79	17,201.92	[4] 1,148.20			1,472	.78	.011
Okanogan [1]	Government wells Nos. 1 and 2.	V. M. D. C.	30	2	2	51.25	18,588.21	(3)					
	Robinson Flat	H. M. C. D.	400	12	2	188	30,077.24	[4] 4,618.35			1,957	2.35	.013
	Salmon Lake	G. E. D. C.	275	18	1	27.2-60	17,842.16	(3)					
	Dobbins pumping plant.	V. M. D. C.	75	4	1	68.3	[4] 301.85		21.12	(5)			
Salt River [1]	Chandler division	H. M. D. C. and V. M. D. S.	820	91.96	11	40.75	148,084.21	31,606.55	10,365.89	1,944,585	20,020	1.43	.0352
	High Line	H. M. D. C.	900	105	4	50	66,656.83	36,302.45	4,551.94	2,611,750	27,195	1.33	.0267
	Tempe pumping plant.	do	150	13	1	50	[4] 5,729.84	12,308.90	401.09	746,138	6,677	1.84	.0368
	Mesa division	V. M. D. C. and S.	2,030	185.17	25	49.78	205,192.63	121,107.38	14,363.48	7,718,581	66,655	1.82	.0365
	Laveen division	do	70	3.2	3	52.44	18,328.45	8,254.65	1,282.99	152,665	1,192	6.92	.132
	Phoenix division	do	1,970	113.59	48	66.85	253,460.40	112,596.82	17,742.23	6,807,274	42,230	2.66	.0399
	Tempe division	H. and V. M. D. S.	1,480	165.14	20	46.46	130,323,80	87,991.87	9,122.66	5,831,734	70,282	1.25	.0269
	Salt River division.	V. M. D. C. and S.	950	160.16	[6] 21	38.72	143,033.45	47,565.63	10,112.34	2,845,544	36,513	1.30	.0336
	San Francisco	H. M. D. C.	50	3	1	50	29,978.90	2,756.91	2,997.89	185,878	991	2.78	.0556
	Tolleson division [7]												
	Maricopa Garden Farm.	V. M. D. C.	75	12	1	36.08	12,444.24	2,665.19	871.10	300,475	4,655	.5725	.0159
	New States Canal	H. M. D. C.	125	15	1	25	9,053.72	2,057.04	633.76	100,963	1,297	1.586	.0634
	Joint head booster pump.	V. M. D. C.	250	100	2	20	23,000.00	6,005.03	1,610.00	350,316	8,015	.7492	.0374
	Fifteenth Avenue booster pump.	H. M. D. C.	8	4	1	8	1,000.00	94.88	70.00	8,030			
	Grandview	1 V. T. D. C.; 2 H. M. D. C.	365	36.5	3	35,78	72,500.00	2,827.37	3,120.00		11,742	.241	.0037
Yakima-Sunnyside [1]	Hillcrest	V. T. D. C.	35	1.56	1	103	5,800.00	255.86	300.00		300	.85	.008
	Little Snipes Mountain.	H. T. D. C.	5	0.33	1	50	1,065.00	75.00	68.71		105	.71	.0142
	Outlook	V. T. D. C.	800	48	2	100	92,000.00	3,185.16	2,480.00		14,711	.216	.00196
	Prosser	H. T. D. C.	190	12	1	105	31,968.00	1,090.43	1,500.00		3,264	.334	.00318
	Snipes Mountain	V. T. D. C.	850	22	3	200	78,000.00	3,055.76	1,890.00		6,222	.49	.0024
	Spring Creek	H. T. D. C.	160	11.6	1	90	28,056.00	1,129.69	1,500.00		3,638	.310	.00344
	B lift	1 V. M. D. C.; 2 H. M. D. C.	1,100	105	3	71	159,936.24	[8] 8,707.23	4,000.00	[8] 818,100	[8] 6,251	1.39	.02
Yuma	Reservation	G. E. D. C.	130	56	2	3.79	6,775.00	[8] 2,320.00	325.00	[9] 8,165	[8] 2,786	.832	.203
	Valley drainage	1 O. E. D. S.; 2 H. M. D. S.	525	300	3	12.44	168,770.00	[8] 14,717.00	4,219.00	1,139,500 [10] 544	54,976	.268	.022
	West Yuma	H. M. D. C.	20	46	1	7	1,800.00	[8] 79.44	90.00	4,567	117.63	.67	.096

[1] Operated by districts or water user's association.
[2] Includes cost of moving 16-inch pump from plant No. 2 to plant No. 3, and temporary installation of 24-inch pump at plant No. 2.
[3] Not operated.
[4] Incomplete cost.
[5] Plant did not operate during year.
[6] 11 additional units under construction.
[7] Combined with Salt River division.
[8] Estimated.
[9] Gallons of gasoline.
[10] Gallons of fuel oil.

NOTES.—Legend for type of units:
H = horizontal unit.
V = vertical unit.
GED = gas engine driven.
MD = electric motor driven.
OED = oil engine driven.
TD = hydraulic turbine driven.
C = centrifugal pump.
S = screw pump.

The principal items of cost of this pumping plant were as follows:

Item	Total cost
Building	$43,318.71
Hydraulic equipment:	
Centrifugal pumps	29,842.00
All others	10,471.30
Electrical equipment:	
Switchboard and cables	10,929.94
All other	48,950.88
Miscellaneous equipment	4,120.56
Machine shop	1,105.40
Pressure pipes	21,466.57
Total	170,205.36

YUMA MESA DEVELOPMENT

Figure 4 is a cross section of the B Lift pumping plant on the Yuma project, Arizona. The building is of reinforced concrete having two main floors and is built for installing three units, each having a capacity of 65 second-feet against a head of 69 feet. All units will discharge through a steel manifold into one 72-inch circular concrete discharge pipe about 1,100 feet long. Each permanent unit will be direct connected to a 700-horsepower synchronous motor. A 36-inch motor-operated gate valve is installed on the outlet of each pump. At present, only one large permanent unit is installed and two temporary units of 20 second-feet capacity each. The principal items of cost of the plant as now constructed are as follows:

Feature	Total cost
Substructure and fore bay	$11,094.17
Superstructure	26,230.05
Grounds and well	1,371.37
Switch yard	765.61
Machinery	56,999.48
Force main	26,859.21
Subtotal	123,319.89
Camp maintenance	4,430.24
Engineering and inspection	12,651.23
Subtotal, field cost	140,401.36
Superintendence and accounts	8,440.54
General expense	11,047.21
Grand total, actual cost	159,889.11

SALT RIVER TYPE

Figure 5 is representative of a type of installation used very generally for drainage work where it is undesirable to cut up the land with open drains or where it is desired to reuse the drainage water for irrigation purposes. Very wide use has been made of this type of pump on the Salt River project in Arizona, where the cost of development has averaged about $2,900 per second-foot of water.

YUMA DRAINAGE INSTALLATION

Figure 6 is a cross-section of the Valley drainage pumping plant on the Yuma project in Arizona. This plant pumps drainage water from approximately 50,000 acres through a levee into the Colorado River. At normal stages of the river, the head under which the pumps operate is about 9.25 feet; but when the river is in flood stage, the pumping head is increased to 14 or 16 feet. The pumping units are of the horizontal screw type, constructed to form a siphon, two having 36-inch pumps and one a 30-inch pump. One 36-inch pump is driven by a 100/250-horsepower motor and one by a 100-horsepower semi-Diesel oil engine. The 30-inch pump is driven by a 75/175-horsepower motor. The motors are 2-speed units, with the slower speed being used for operation at the normal pumping head and the higher speed at flood stages in the river. The motors are automatically controlled by means of float switches in the fore bay. A vacuum pump is provided to prime the pumps when they are put in operation. The building is a reinforced-concrete structure built into the levee, with door and window sills 7½ feet above the operating floor, arranged so that in case of a break in the levee, with consequent flooding of the low lands, the plant can still be operated.

The principal items of cost of the plant are as follows:

Class of work	Quantity	Total cost	Unit cost
Cofferdams		$295.87	
Building (except concrete)		6,697.89	
Excavation, dry, class 1 cubic yards	5,600	2,220.89	$0.40
Excavation, wet cubic yards	6,215	12,969.13	.21
Flume timber		167.07	
Piling, round timber		5,924.16	
Piling, sheet		581.40	
Concrete, reinforced cubic yards	1,315	36,236.37	27.60
Structural steel		18.37	
Woodwork		454.52	
Backfill, dry, cubic yards	5,630	3,646.85	.65
Paving, rock		61.54	
Machinery, electrical pounds	66,924	20,161.22	.30
Machinery, miscellaneous		62.99	
Gates and lifting devices		1,759.98	
Transmission line, mile	18	19,163.65	1,065.00
Telephone		613.85	
Subtotal		160,841.16	
			Per cent
Camp maintenance		3,052.40	1.9
Engineering and inspection		7,716.26	4.8
Subtotal		171,609.82	
Superintendence and accounts		4,890.50	2.8
General expense		15,630.25	9.1
Grand total, actual cost		192,130.57	

TULE LAKE DRAINAGE PUMPS

Figure 7 is a typical cross section of the Tule Lake drainage pumping plants on the Klamath project in Oregon and California. Four similar plants have been constructed on this project. The costs of plant No. 4 are shown in the following tabulation. This plant contains two vertical screw-type pumps of 25 second-feet capacity, each direct connected to 75-horsepower motors. The motors are automatically controlled by float switches in the sump and also by time switches to keep the load off during peak periods. The building is wood frame, mounted on wood piling with a removable roof to allow lifting out the units.

The principal items of cost were as follows:

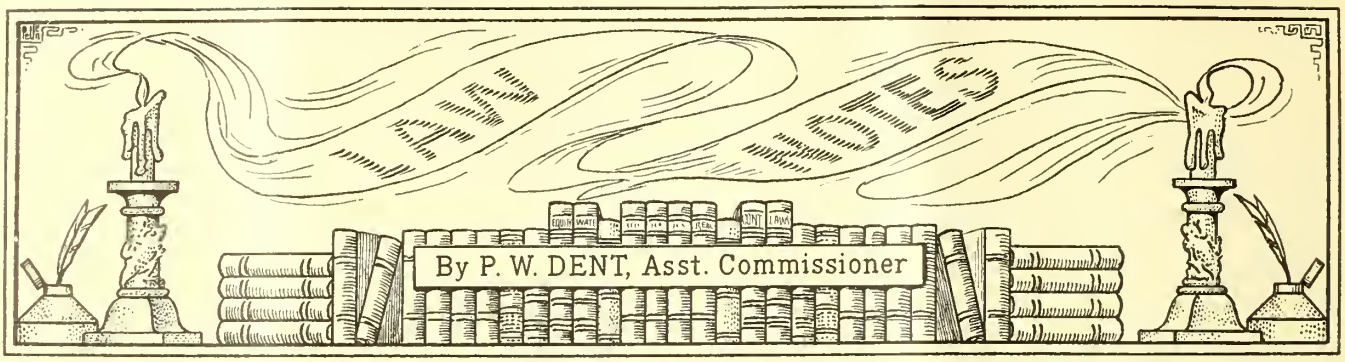
Class of work	Quantity	Total cost	Unit cost
Building		$651.52	
Excavation, wet cubic yards	409	345.74	$0.85
Excavation, class 1 do	1,933	497.71	.26
Piling, round timber linear feet	480	452.86	.94
Piling, sheet M feet board measure	10.5	709.82	67.80
Structural steel pounds	4,268	327.93	.08
Woodwork M feet board measure	9.9	543.66	55.20
Backfill, wet, cubic yards	35	21.70	.62
Machinery pounds	14,370	4,297.26	.30
Discharge pipe, linear feet	237	1,906.18	8.50
Subtotal		9,754.48	
			P. ct.
Engineering and inspection		863.21	8.8
Subtotal		10,617.69	
Superintendence and accounts		449.69	4.2
General expense		583.33	5.5
Grand total, actual cost		11,650.71	

A list of all pumping plants operated on Bureau of Reclamation projects during the fiscal year 1928–29, together with construction, and operation and maintenance costs of a majority of them, is given in the accompanying tabulation.

In all except the very largest pumping plants it is customary to handle the operation by frequent daily inspections by ditch riders or other employees, who spend the larger part of their time on other work. Maintenance work is usually handled by completely disassembling and overhauling each unit during the nonirrigation season so as to insure its being in the best possible condition for the coming season. Such overhauling usually consists of welding up any runner cavitation or wear on shafts, rebabbitting of bearings where required, and a general cleaning, painting, and testing of the unit. Such a procedure results in a very minimum of interruptions during the irrigation season when steady delivery of water is important.

SEVERAL prospective homesteaders were shown over the Riverton project during the month.

In 1929 the cultivated area receiving water from Government works was 2,705,240 acres, producing crops valued at $161,179,880. From the time that water was first available in 1906 for crop production, the cumulative value of crops grown on land furnished water from the works of the bureau has amounted to $1,642,267,680.



Summary of 1929 Irrigation Legislation in Arizona, California, Nevada, Wyoming, and Nebraska

ARIZONA

The 1929 session of the legislature of the State of Arizona passed no general laws of special interest to the Bureau of Reclamation, but attention may be directed to the following:

The act of February 4, 1929 (ch. 3, 1929 S. L.), created the Colorado River Commission and provided that it should be the duty of the commission to enter into negotiations with appropriate representatives of the States of Colorado, California, Nevada, New Mexico, Utah, and Wyoming, and the Federal Government, with a view to effecting an equitable and amicable agreement respecting the allocation of the waters of the Colorado River and its tributaries. Previous thereto, however, House Joint Resolution No. 2, approved January 25, 1929, petitioned the State of Utah to withhold ratification of the Colorado River compact until a tri-State agreement be negotiated between the States of Arizona, California, and Nevada.

The act of March 22, 1929 (ch. 102, 1929 S. L.), provided for supervision and regulation of dams, reservoirs, and appurtenances, and electrical and irrigation district projects by the State engineer, and attempted to make the act applicable to irrigation works of the United States by the following language:

"All dams heretofore or hereafter built or now under construction shall be under the jurisdiction of the State engineer. Dams of the State, or of the United States, or any of their political subdivisions or dams of public utilities, and all dams without exception are included within the jurisdiction hereby conferred."

CALIFORNIA

Reference may be made to the following legislation in California regarding the Boulder Canyon project act (S. L. 1929):

Chapter 1. Ratification of Colorado River compact, to become effective when approved by each of the signatory States and by Congress.

Chapter 15. Waives requirement for signature of compact by all signatory States and provides that ratification of California may become effective upon a 6-State basis.

Chapter 16. Provides for limitation of use of Colorado River water by California in case the Colorado River compact be not approved within six months from date of passage of the Boulder Canyon project act.

The act of May 29, 1929 (ch. 561, 1929 S. L.), provides for the creation of a water commission to cooperate with the United States in respect of water conservation, flood control, or navigation.

The act of April 10, 1929 (ch. 81, 1929 S. L.), validates proceedings for formation of irrigation districts which have been functioning for a period of one year previous to the date of the act.

The act of April 10, 1929 (ch. 85, 1929 S. L.), adds to and amends the irrigation district act, as follows:

New section 35a, defining assessment book as any substantial record of assessments.

Section 42 amended, relates to publication of delinquent tax list.

Chapter 139 of 1929 session laws adds section 19c to the irrigation district act and relates to appointment of district officers.

The following amendments of the irrigation district law were also made by the 1929 legislature:

Chapter 333 amends section 18, relating to the apportionment of water and providing for sale or lease of surplus water.

Chapter 363 amends sections 7, 26, 27b, 84, and 90, relating to directors of irrigation districts, and inclusion of public lands within a district.

Chapter 680 amends sections 41, 43, 44, 45, and 46, relating to delinquency of assessments and sale and resale of property therefor.

Chapter 136 of 1929 session laws provides for change of name of an irrigation district, by resolution of the board of directors, in case a district is organized under a name already given to a district organized under the same act. In pursuance of authority granted by this act, the name of the Laguna irrigation district in Imperial County, was changed to Bard irrigation district.

Chapter 122 of 1929 session laws authorizes irrigation districts to contract and cooperate with the United States for water supply, or construction, operation, or maintenance of irrigation works, or for the assumption of indebtedness to the United States on account of district lands and for judicial determination of validity of proceedings, etc.

Chapter 189 of 1929 session laws provides for the creation of improvement districts within irrigation districts.

Chapter 796 of 1929 session laws amended the act of May 10, 1927, entitled "An Act providing for the incorporation, government, and management of metropolitan water districts, authorizing such districts to incur bonded debt, and to acquire, construct, operate, and manage works and property, providing for the taxation of property therein and the performance of certain functions relating thereto by the officers of counties, providing for the addition of area thereto and the exclusion of area therefrom, and authorizing municipal corporations to aid and participate in the incorporation of such districts.

NEVADA

In Nevada the 1929 legislature amended the irrigation district act as follows:

Chapter 54 amends section 1 relating to organization.

Chapter 175 makes the following additions:

Section 10c, providing that in case of damage to irrigation works by a water user, cost of repairs may be added to and

collected as operation and maintenance charges.

Section 10d, providing for the deposit of district funds in banks and the giving of a bond to secure such deposits.

Section 51a, providing for publication of list of claims allowed each month.

Section 72, providing for guaranty of tax levies.

Section 73, providing that procedure for election of directors may be changed.

Section 74, providing that directors shall not be employed by the district.

Section 75, providing that funds may be spent for recreational grounds.

Section 78, empowering board to expend not exceeding $1,500 in any one year for purpose of exploiting irrigation district.

Section 79, authorizing board of directors to issue notes after tax levies are made.

Chapter 175 also makes amendments as follows:

Section 16, relating to designation and issuance of bonds.

Section 22, relating to redemption of bonds.

Section 23, relating to creation and distribution of funds.

Section 29½, relating to sale and disposal of lands.

Section 49½, relating to construction of works.

Chapter 176 amends section 54 of the water law act of Nevada, and authorizes the State engineer to insure proper distribution of the waters of the State.

By act of March 26, 1929 (ch. 148, 1929 S. L.), the governor of the State of Nevada was authorized and empowered to appoint a commissioner to act for Nevada in an advisory capacity to and in cooperation with the Secretary of the Interior in the exercise of any authority under sections 4, 5, and 14 of the Boulder Canyon project act.—*Richard J. Coffey, District Counsel.*

WYOMING

The 1929 session of the Wyoming Legislature enacted five acts affecting irrigation districts organized and operating under the laws of the State of Wyoming. The enactments will be referred to by their respective chapter numbers as they appear in the Session Laws of Wyoming, 1929.

Chapter 53 is an act authorizing the State treasurer to accept payment of unmatured installments of the principal indebtedness evidenced by irrigation district and drainage district bonds owned by the State of Wyoming, and further authorizes county treasurers to accept payment upon unmatured installments of construction assessments levied by the irrigation and drainage districts to provide funds for the payment of irrigation or drainage district bonds owned by the State of Wyoming.

Chapter 58 is an act to provide for examination of the books and accounts of irrigation and drainage districts by the State examiner. The examination shall be made upon the request of the board of commissioners of any irrigation or drainage district and shall be at the expense of the districts.

Chapter 65 is an act relating to the time within which the organization of irrigation or drainage districts or assessments made by such districts may be questioned in any suit or proceeding. The act is in two sections. Section I is in the nature of a statute of limitations and provides in substance that as to districts heretofore organized the legality of their organization must be questioned by proceedings in *quo warranto* or otherwise within one year from the effective date of chapter 65, or February 15, 1929, otherwise it shall be conclusively deemed to be a legally established district, and its lawful organization shall not be questioned in subsequent suit or proceeding. As to districts organized after the passage of the act, the period of limitation for attacking the legality of the district organization is within two years from the date of entry of the order of court establishing the district and appointing commissioners therefor. Section II limits the time within which an irrigation or drainage district levy or assessment shall be questioned in any suit or proceeding as on or before the second December 31 following the levy or assessment.

Chapter 74 is an act relating to confirmation proceedings for contracts entered into between irrigation districts and the United States and providing for confirmation of assessments for benefits and construction required therein. The act is in two sections. Section I authorizes the incorporation of a provision in any contract between the United States and a Wyoming irrigation district dispensing with the assessment or assessments for benefits and construction against the individual tracts of land in the district as required under section 973, Wyoming Compiled Statutes 1920, as amended by chapter 14, Session Laws of Wyoming, 1923, and chapter 52, Session Laws of Wyoming, 1925. In the case of a contract providing for dispensing with the assessments of benefits against the individual tracts of district land, Section I further provides that after the contract has been submitted to the electors of the district and approved by them, the board of commissioners of the district may file in the district court of the county embracing the largest acreage of the district a petition praying that the contract and proceedings leading up to the execution of the same and the assessment for benefits and construction as provided in the contract may be examined, approved, and confirmed by the court. The practice in such a special proceeding is also provided for in Section I of the act. Section II of the act makes the order confirming and approving the proceedings taken to ratify and confirm a contract between the United States and an irrigation district conclusive as to the legality of all proceedings relating thereto, unless appealed from within 30 days after the entry of the order.

Chapter 83 amends section 953 Wyoming Compiled Statutes, 1920, which section relates to the duty of the court in fixing a hearing on a petition for the creation of an irrigation district. The amendment consists in dispensing with the posting of notices of the time and place of the hearing on a petition for the organization of an irrigation district.

The 1929 session of the Nebraska Legislature passed three acts affecting irrigation districts organized and operating under the laws of Nebraska. The acts will be referred to by their respective chapter numbers as found in the Session Laws of Nebraska, 1929.

Chapter 131 authorizes the board of directors of an irrigation district to issue warrants against the general fund of the district in denominations not greater than $1,000 to the aggregate amount required by the district, but in no case in an amount greater than 90 per cent of the general fund levy for the current year, and to sell or discount the same to the best advantage possible, but not at a discount to exceed 5 per cent.

NEBRASKA

Chapter 134 amends section 2874 Compiled Statutes of Nebraska, 1922, by increasing the length of time the directors of an irrigation district shall sit as a board of equalization from "not to exceed six days, exclusive of Sundays" to "not to exceed ten days, exclusive of Sundays," and further amends said section 2874 by providing that the valuation of property of the irrigation district for taxing purposes shall not be raised without notice to the owner thereof.

Chapter 133 amends section 8430 Compiled Statutes of Nebraska for 1922. Prior to the passage of chapter 133, section 8430 reads as follows: "No allotment for irrigation shall exceed one cubic foot per second of time for each 70 acres of land, * * *." The language above quoted was amended by chapter 133 to read as follows: "No allotment from *the natural flow of streams* for irrigation shall exceed

one cubic foot per second of time for each 70 acres of land, * * *." In addition to defining limitations of appropriation as above indicated, chapter 133, also, provides for regulating the withdrawal of storage water in the following language: "Provided that these limitations (limitations of appropriation from the natural flow of streams) do not apply to storage waters and provided further that where storage water is being used in addition to the natural flow that the water superintendent shall, upon his request and within 24 hours thereof, be notified in writing by the users of such storage waters of the time of withdrawal from natural streams to be distributed according to law."—*W. J. Burke, District Counsel.*

Pending Legislation Affecting Federal Reclamation

YUMA AUXILIARY PROJECT, ARIZONA

S. 261, introduced by Senator Ashurst, of Arizona, April 18, 1929, amending the act of January 25, 1917 (39 Stat. L., p. 868), and other acts relating to the Yuma auxiliary project, Arizona.

This bill authorizes the sale of lands with water rights in tracts of 10 to 160 acres, payment to be made in 40 equal annual installments with interest represented by installments 12 to 40, inclusive. The bill also authorizes amendment by the Secretary of the Interior of uncompleted contracts made under the act of February 21, 1925, so as to provide for payment of the amount remaining unpaid on the same terms as those indicated as the basis of new contracts.

May 1, 1929, the Secretary recommended favorable consideration of the bill.

April 14, 1930, reported by the Senate committee without amendment.

April 17, 1930, passed by the Senate.

April 21, 1930, referred to the House Committee on Irrigation and Reclamation.

May 14, 1930, reported by House without amendment.

EXCHANGE OF LOTS, AMERICAN FALLS, IDAHO

S. 3196, introduced by Senator Borah, of Idaho, January 20, 1930, for the relief of the owners of lots in the unflooded portion of the old town site at American Falls, Idaho.

The Secretary of the Interior is authorized and directed to provide (1) for the conveyance to the owners of lots in the unflooded portion of American Falls of lots in the Government town site of a value equivalent to the value (without improvements) of the lots now held by such landowners, and (2) for the removal at the expense of the United States to the new lots in the Government town site of buildings and improvements on the present lots. The expense incurred by the Bureau of Reclamation in moving such buildings and improvements would not be reimbursable under the reclamation laws, which means that the reclamation fund would be depleted to the extent necessary for such expenditures. An appropriation is authorized from the reclamation fund, the amount of which is left blank.

February 4, 1930, the Secretary transmitted to the Senate Committee an unfavorable memorandum of the commissioner, with which he expressed agreement.

A similar bill (H. R. 8811) was introduced January 18, 1930, by Representative Smith, of Idaho.

TEMPORARILY OR PERMANENTLY UNPRODUCTIVE LAND

H. R. 156, introduced by Congressman Leavitt, of Montana, April 15, 1929, to authorize the disposal of public land classified as temporarily or permanently unproductive on Federal irrigation projects.

This bill authorizes the Secretary of the Interior to sell unproductive lands on Federal irrigation projects to resident owners and entrymen under terms and conditions to be fixed by him. No landowner would be permitted to purchase more than 160 acres, or an area which, with land already owned on any one project, would exceed 320 acres.

December 9, 1929, the Secretary submitted to the House committee memorandum of the commissioner expressing the hope that the bill would receive favorable consideration, with certain amendments. The Secretary concurred in the commissioner's views.

December 18, 1929, reported by the House committee with amendments.

January 20, 1930, passed by the House with amendments.

January 21, 1930, referred to Senate Committee on Irrigation and Reclamation.

April 30, 1930, reported by the Senate committee without amendment,

May 12, 1930, passed by the Senate without amendment.

May 14, 1930, presented to the President.

May 16, 1930, approved by the President.

A similar bill (S. 3037) was introduced January 8, 1930, by Senator Wheeler, of Montana.

SIZE OF FARM UNITS

H. R. 1186, introduced by Congressman French, of Idaho, April 18, 1929, to amend section 5 of the act of June 27, 1906, conferring authority upon the Secretary of the Interior to fix the size of farm units on desert-land entries when included within national reclamation projects.

Section 5, referred to, deals with desert-land entries, which, after being allowed, are included within the exterior limits of a withdrawal of land for the construction of a reclamation project. The Government development in the vicinity of desert-land entries often interferes with the entrymen's plans for improvements, or for reclaiming their land, and section 5 of the act of June 27, 1906, allows such entrymen to obtain an extension of time, and later to obtain a water right from the Government project. H. R. 1186 would require desert-land entrymen to reduce their holdings to the area fixed by the Secretary as sufficient for the support of a family.

December 14, 1929, the Secretary concurred in the commissioner's recommendation for favorable report upon the bill.

February 1, 1930, reported by the House committee with amendment.

April 11, 1930, committee amendment agreed to and bill passed by House.

April 14, 1930, referred to Senate Irrigation Committee.

BITTER ROOT PROJECT, MONT.

H. R. 9990, introduced by Congressman Leavitt, of Montana, February 17, 1930, for the rehabilitation of the Bitter Root irrigation project, Montana.

The bill authorizes the transfer from the reclamation fund of the sum of $750,000, or as much as necessary, to be used (1) for funding or liquidating bonded indebtedness of the project, (2) for any necessary construction, betterment, or repair work, and (3) for advancing or loaning to the project any funds which in the Secretary's opinion are necessary for the rehabilitation of the project. Funds advanced are to be refunded in not more than 40 years with interest at 4 per cent.

March 27, 1930, the Secretary transmitted to the House committee memorandum of the commissioner recommending favorable report. The Secretary expressed agreement with Commissioner Mead.

April 7, 1930, reported by the House committee with amendment.

May 5, 1930, passed over without prejudice.

May 19, 1930, passed over without prejudice.

A similar bill, H. R. 10034, was introduced by Representative Evans, of Montana, February 18, 1930.

A similar bill, S. 3826, was introduced in the Senate by Hon. B. K. Wheeler, of Montana, March 6, 1930.

Land Settlement in Germany Aided by Government

At the hearing before the House Committee on Irrigation and Reclamation to consider the bills providing for the establishment of planned group settlements in the South Dr. Elwood Mead, Commissioner of the Bureau of Reclamation, made the following statement concerning aided and directed settlement in Germany:

Germany after 1870 started on a marvelous industrial expansion. They built better homes for workers. They gave higher wages. They gave concerts in the parks. As a result tenants left the farms. There was an exodus similar to that going on in this country, reaching such an extent that they had to import farm workers from Russia to harvest the crops.

Then Germany began with great thoroughness one of the greatest agrarian advances of centuries. The nation began the purchase of large estates. The aid of their best agricultural and economic minds was enlisted to work out in each purchase a plan of development that would make the most of soils, crops, and conditions. Settlers were required to have some capital, but the greater part of the money needed to improve and equip these farms so that they could be handled to get the best results was provided by the Government.

The settler was given 50 years' time in which to pay for the farm, with a low rate of interest. So long as he met these payments he had a security of tenure equivalent to ownership. He was content. He was secure and felt he was a permanent and respected member of the community. Between 1886, when this movement began, and 1914, when the great war began, the German Empire had spent over $400,000,000 in this movement.

An interesting report received recently from the Berlin office of the Bureau of Foreign and Domestic Commerce, tells what Germany is doing at present to further planned rural development. Funds for the work are provided by the Reich and the States, amounting annually to nearly $24,000,000. With these funds, the officially organized settlement associations purchase estates which are subdivided and upon which suitable dwelling houses and farm buildings are erected. These comprise usually a stone dwelling house, a stone stable, and a wooden barn on a farm of about 37 acres.

Steps are also taken to improve the land, if necessary, by drainage and road improvement, and to provide proper school and church facilities. The cost of an average farm of 37 acres is approximately as given in the accompanying table.

Since the settler has to pay at least $1,100 in cash when taking over the farm, there remains a debt of $7,325. The settler has to assume a mortgage of $1,428 at 1 per cent per year, or $14.28, and pay for the balance of $5,902, 3½ per cent interest, and ½ per cent amortization and ⅛ per cent administration costs, hence 4⅛ per cent in all, or $243.47; total, $257.75.

For buildings, well, fences, manure tank, electrification	$4, 284
For the land proper	3, 284
For road improvement, melioration, fees, interest, etc	857
Total	8, 425

The settler must make an advance payment of at least $1,190. He must further be in possession of $952 to $1,190 for implements, etc., so that in all he must have about $2,390 to start with. This will apply to a farm of about 37 acres with complete harvest and buildings thereon. The latter comprise a stone-built dwelling house containing 690 to 790 square feet of room area and being provided with a cellar, a stone built stable of 1,086 to 1,184 square feet area, and a wooden barn of 31,000 cubic feet.

No advances are granted to settlers for effecting permanent improvements. For the purchase of equipment and livestock when taking over the farm a credit of $952 may be granted in exceptional cases, if the settlement organization guarantees repayment of this sum. This credit is exempt from interest and from amortization for the first three years. After the expiration of this period he has to pay—

From the fourth to the sixth year 1 per cent interest and 3 per cent amortization.

From the seventh to the tenth year 1 per cent interest and 4 per cent amortization.

From the eleventh to the fifteenth year 2 per cent interest and 4 per cent amortization.

From the sixteenth to the twentieth year 3 per cent interest and 4 per cent amortization.

From the twentieth to the twenty-fourth year 4 per cent interest and 3 per cent amortization.

This advance would reduce the initial amount the settler has to produce from $2,380 to $1,428.

More than $20,000,000 worth of apples were exported from the United States last year.

Boulder Dam Engineer Appointed

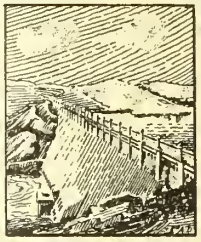
Walker R. Young, who has been in charge of important construction work on the Kittitas division of the Yakima project, Washington, since April, 1926, has been appointed construction engineer on the Boulder Canyon project, with present headquarters at Las Vegas, Nev. Mr. Young is well qualified for the position through training and experience, and is familiar with Colorado River problems by reason of making the investigations for this bureau in the lower river basin. He is 45 years old and a graduate of the University of Idaho. From 1911 to 1915 he was employed on the construction of the Arrowrock Dam; 1916 to 1920, attached to the Denver office designing force; 1921 to 1924, in charge of investigations of development of the Colorado River; 1924 to 1926, in charge of investigations of a proposed salt water barrier dam below the mouth of the Sacramento River and also the Iron Canyon project; 1926 to date, construction engineer on the Kittitas division of the Yakima project. Mr. Young will now have charge of the most important project undertaken by the Government since the Panama Canal.

The first work to be undertaken will be a branch railroad from the main line to the dam site. An interesting engineering problem will be encountered in constructing a branch railroad down to the bottom of the canyon, both above and below the dam site. Detail topography at the dam site and town site is now being taken and the town site will be surveyed and the services of a town planner utilized. A certain number of Government buildings will be required and provision made for commercial houses and quarters for contractor's forces. Consideration is being given to creating a national monument to include the lake behind the dam, which will be 115 miles long and have an area of about 150,000 acres. By Executive order of April 25, about 4,212 square miles in the Boulder Dam region have been withdrawn from settlement, until an examination of the lands can be made.

About 44 families are now located on the Harper and Little Valley lands of the Vale project. The greater number of the settlers have built houses and have a large part of their lands cleared of sagebrush. A number of places have been leveled, plowed, and harrowed. Approximately 1,000 acres have been seeded to alfalfa and grain.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Mormon Flat Dam, Salt River Project, Arizona

By C. C. CRAGIN, General Superintendent and Chief Engineer Salt River Valley Water Users Association

THE Mormon Flat Dam, on the Salt River (Federal) irrigation project, Arizona, operated by the Salt River Valley Water Users' Association, is the major feature of the first unit of a 3-stage construction program in a comprehensive plan for development of the power resources and storage possibilities on Salt River between Roosevelt Dam and Granite Reef diversion dam, the preparation of which was completed by the association in February, 1922. It is the smallest of the three dams built by this organization in the last six years, and is located practically midway between the Horse Mesa Dam, above it, and the Stewart Mountain Dam, below it.

PURPOSE OF THE DAM

Mormon Flat Dam was originally constructed for the primary purpose of providing regulating storage so that the Roosevelt and Horse Mesa plants could be operated when water was not needed for irrigation, the released water being held at Mormon Flat until needed. A 10,000-horsepower generating plant was added the year after the dam was built. With the completion of the Stewart Mountain Dam, in March, 1930, the main function of regulation is performed by the new structure, Mormon Flat becoming primarily a power dam. The upper part of the 63,000 acre-foot reservoir, however, is still available for regulating storage. The dam impounds run-off from 300 square miles of watershed below Roosevelt, and provides a water supply for 10,000 acres of additional project land.

FINANCING

The construction of the dam and certain work at Roosevelt was financed by the Water Users' Association by a bond issue of $1,800,000 sold March 26, 1923. The power plant was financed later by means of a power contract with the Central Arizona Light & Power Co., through which company the sum of $410,000 was advanced for this construction.

CONSTRUCTION FORCES

The dam was built entirely by association forces. It is believed that savings were effected in excess of 25 per cent of contract costs, due to the engineering, construction, purchasing, and other organization maintained by the association, and the availability of camp and commissary equipment, trucks, excavating machines, pumps, hoists, derricks, electrical equipment, shop facilities, warehouse, storage yards, and miscellaneous items.

TIME OF CONSTRUCTION

Preliminary work was begun in the spring of 1923, before the bond money was available, but was not carried on with full force until the proceeds of the bonds were received in August. The Mormon Flat Dam was finally completed in April, 1925. Construction of the power plant was begun immediately upon completion of the contract on June 29, 1925, with the Central Arizona Light & Power Co., by means of which this feature of the development was financed. The plant was completed and put in service May 12, 1926.

PRELIMINARY WORK

The preliminary work consisted of construction of approximately 1½ miles of road into the dam site, the building of the necessary camp, provision for water supply, construction of 1½ miles of temporary 45,000-volt transmission line from the main Phoenix-Roosevelt line to the dam site, with necessary substations, etc., transportation of excavating and other equipment and additional exploration at the base of the dam with diamond drills. Approximately 3½ miles of the Apache Trail, and also of the main Roosevelt power line, were within the area which would be submerged by the reservoir, and it was therefore necessary to arrange for reconstruction around the lake. Pending the permanent reconstruction of the transmission line, a temporary A-frame wood line was built through the reservoir to make possible the removal of the steel poles to the permanent location without interrupting service. A telephone and air compressor were installed, excavation for a flume to by-pass the river around the base of the dam was begun, and work on the permanent camp was in progress in May, 1923. Water for domestic supply was pumped from the river to a tank on the hill immediately above the camp site, 370 feet vertically above the river. The supply was chlorinated.

A 2-yard Monighan drag-line excavator was moved from the recently completed widening of the Eastern canal and used in the excavation at the base of the dam, and later in digging and loading gravel in the river bed for concrete. A 1-yard P. & H. gasoline power shovel was used in spillway excavation.

CARE OF RIVER DURING CONSTRUCTION

A wooden flume 30 feet wide on the bottom, 15 feet high, and 350 feet long was constructed on a bench excavated on the river's edge at the base of the slope on the south side of the canyon. It was designed for 7,500 second-feet capacity. The lowest bedrock was 70 feet below the stream bed, and this necessitated installation of pumps of considerable capacity to handle seepage water which percolated through the gravel and sand of the river bed and cofferdams at the upper and lower ends of the by-pass flume. An advantage in handling the river was the ability to interrupt the flow by closing the gates at Roosevelt as required by construction operations. The presence of the Roosevelt Dam was also an important factor in removing hazard by assuring control of any large flood. One small flood occurred, however, from run-off below Roosevelt on Christmas Day, 1923, when the men were not working. The damage was small, consisting of a break in the flume and the submergence of the Monighan drag line.

LOCATION AND GEOLOGY

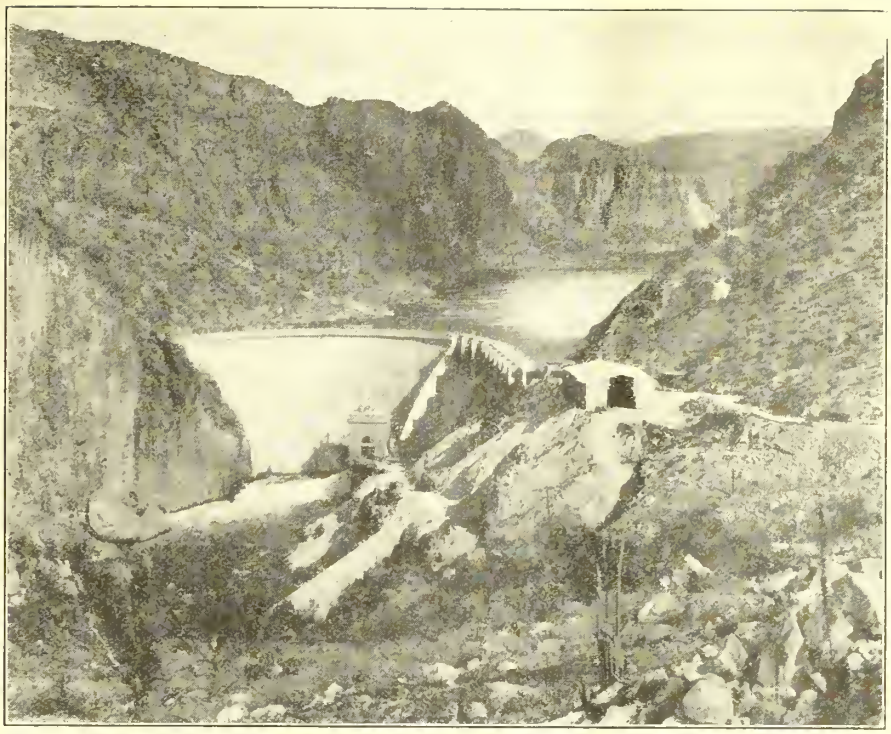
The dam is located in a box canyon 1½ miles off the main Phoenix-Roosevelt Highway (Apache Trail), approximately

46 miles by road from Phoenix and 29 miles from the nearest railroad point at Mesa. The rock at the sides and bottom of the canyon is a hard, dense, homogeneous, rhyolite breccia, part of a flow of great depth and several hundred square miles in area, covering this part of the country. It proved to be practically free from seams, checks or soft material, so that it was possible to secure an exceptionally water-tight dam without grouting.

PLANT LAYOUT

Owing to the narrowness and steep slopes of the canyon, space for the camp and construction equipment was quite restricted. The plant at the dam was arranged, as far as possible, to effect the handling of all material by mechanical means, with a minimum of rehandling. Gravel of good quality for concrete was available in the river bed, from one-third to two-thirds of a mile distant upstream from the dam. A road was built from the gravel pits along the south side of the canyon to the mixing plant at the spillway. Screening and washing was all done at the pits and the segregated material delivered by trucks. The gravel was dug by the Monighan drag line, which was available for the purpose immediately on completion of the cofferdams and excavation for the base of the dam. A crusher was not found necessary. The mixing plant consisted of a single 1-yard Smith mixer, located at the upstream approach to the spillway, opposite the center of the upstream face of the arch of the dam. A duplicate mixer was held in reserve, but its use was not required. The capacity of the plant was 200 yards per 8-hour shift.

A 240-foot Insley steel chuting tower with 16-inch concrete chutes suspended from sky lines made possible the placing of concrete in any part of the structure. A reserve supply of sand and gravel was stored in the spillway, adjacent to the bins at the mixing plant, and when needed was picked up by a small wooden stiff-leg derrick and fed to the bins. A galvanized, corrugated metal cement storehouse was built with a capacity of 25,000 sacks. Mechanical handling of cement was provided by chain blocks suspended from movable trolleys. At the base of the dam, on the downstream side, a 105-foot steel guy derrick was erected for handling material and an inclined track was run from the cement shed down the slope of the canyon to the base of the derrick. A second inclined track connected the cement shed with the mixing plant. A battery of six 18-inch Kimball deep-well pumps was used for dewatering the excavation. This equipment was borrowed from the project's extensive system of irrigation and drainage pumps in the valley.



Mormon Flat Dam, Salt River project, Arizona

On the completion of spillway excavation, the P. & H. gasoline shovel was moved to the location of the road to be constructed around the reservoir. The final excavation from the 70 feet deep, heavily timbered pit at the lowest part of the foundation was handled by a small stiff-leg derrick. All equipment except the two excavating machines was electrically operated.

DESCRIPTION OF DAM AND POWER PLANT

The river at the dam site flows west. The width of the canyon at the stream bed is only 90 feet, and 159 feet above, at the crest of the dam, is 350 feet. The north abutment of the dam is nearly vertical, while the south side is an irregular slope averaging approximately 1-vertical to 1¼-horizontal. The dam consists of an arched section spanning the canyon, the upper part of the south haunch abutting against a short ogee gravity overflow section, forming a part of the spillway. The spillway, 259 feet long over all, including the ogee section, is closed by nine steel Taintor gates, 23 feet high by 27 feet wide, and has a total clear opening between piers and abutments of 243 feet. Three of these gates are above the ogee section and six are built on the crest excavated in the south wall of the canyon.

The total height of the dam from lowest bedrock to top of coping is 229 feet. The thickness of arch ring at the base varies from a minimum of 20 feet at the approximate center to 29 feet at the north haunch. The thickness at the top is 8 feet. The outlets of the dam consist of two 8-foot penstocks which unite and discharge through the turbine, two 6-foot penstocks, and three 54-inch penstocks. The two 6-foot penstocks are equipped with sliding gates on the upstream side, operated from the top of the dam. One of these also has a 6-foot valve on the downstream end. The bottom 54-inch penstock is closed with a 54-inch needle valve. The other two are closed by steel bulkheads. These three penstocks are reserved for the possible future installation of an additional generating unit to the power plant. The three 54-inch penstocks were orginally closed by 54-inch needle valves, transferred from the north tunnel at Roosevelt. Two of these valves have been moved to Stewart Mountain Dam and the penstocks closed by steel bulkheads.

The Taintor gates are all motor operated by a movable lifting mechanism, mounted on a track running the length of the spillway crest. The spillway is designed to pass 150,000 second-feet with the reservoir full to the top of the coping. At the top of the Taintor gates the reservoir has a capacity of 63,000 acre-feet, which is the normal stored water level; at the spillway crest, 42,000 acre-feet. The total drainage area above the dam is 6,030 square miles, of which all but 270 square miles is above Roosevelt Dam, and all but 160 square miles is above Horse Mesa Dam. The combined normal storage capacity of the two upper dams is 1,882,000 acre-feet.

The arched section was designed on the cylinder theory, with maximum allowable stress of 350 pounds per square inch.

The radius of the upstream face varies from a minimum of 100 feet in the narrowest part of the canyon to a maximum of 187 feet at the top. The dam is strictly utilitarian in construction and finish, without elaborate architectural treatment. The coping consists of a plain 5-foot wall, broken into panels by plain pilasters. The character of the concrete was such as to leave a smooth surface against the forms, free from pockets, and the dam as a whole looks well finished and in keeping with the setting. The total concrete in the dam is 42,980 cubic yards.

The power plant, begun after completion of the dam, and finished March, 1926, consists of a single generating unit. It is located at the base of the south haunch of the dam, between the arch and the bottom of the spillway. The house is designed with a view to possible extension in the event of installation of a second unit at a future date.

CONSTRUCTION

The preliminary work had been completed by October 1, 1923, the by-pass flume nearly completed, excavation begun for the cofferdams and base of the dam, spillway excavation by the gasoline shovel was well under way, and the road to the gravel pit half finished. The first water was passed through the flume October 10, 1923, although the diversion and downstream cofferdams were not fully completed until December 1. The great depth and narrowness of the excavation for the base of the dam greatly restricted work room, but the excavation was finally completed March 11, 1924, and first concrete poured on the same day. By June 8, 1924, concrete had been poured to a point where it was possible to divert the water through two 10-foot openings in the north end of the dam, the intake end of the flume being closed by a bulkhead, and the rest of the structure removed to permit the placing of concrete. The arch ring was poured in four sections so as to provide three evenly spaced contraction joints. The 10-foot openings mentioned were located between adjacent sections. The pouring of concrete to close the last of these openings was timed to take place during the winter months, this part of the work being kept a minimum of 30 days behind the pouring of concrete in the balance of the arch. The impounding of water behind the dam was begun early in February, 1925, the entire structure then being closed for about half its height.

Detailed construction costs adjusted as of September 30, 1929, are as follows:

Mormon Flat Dam

Bond expense	$57,189.40
Hospital fund	4,071.45
Engineering, including preliminary investigations and diamond drilling	43,125.00
Road to dam site	18,291.17
Camp and water supply	39,463.01
River control	109,754.99
Temporary wiring and substations	39,345.80
Excavation, dam, haunches, spillway	196,199.03
Concrete and sand and gravel plant	86,756.95
Operation of sand and gravel plant	106,120.77
Concrete, cement, mixing, placing, forms, etc	368,291.27
Sluice gates—cost of, installing, etc	14,172.41
Spillway gates and hoist—cost of, installing, etc	91,660.02
Telephone line	1,246.21
Moving 40,000-volt line out of reservoir	13,814.13
Relocating Apache Trail	27,588.76
Miscellaneous	13,440.11
Total cost of dam	1,230,530.48
NOTE.—This does not include an item of $26,720.79, being one-third of the valuation of three 54-inch needle valves transferred from Roosevelt, two being later removed to Stewart Mountain. The three valves had an installed valuation at Mormon Flat of $80,162.38.	
Cost of power plant	412,576.93
Cost of changes in the power system due to the Mormon Flat power plant	59,287.12
Cost of the spillway gates, new generator, transformer house, and other work at Roosevelt, done under the Mormon Flat bond issue	562,863.30
Total expenditures, Roosevelt and Mormon Flat	2,265,257.83

The gravity extension division of the Minidoka project in Idaho will hereafter be known as the Gooding division, and the main canal as the Milner-Gooding Canal.

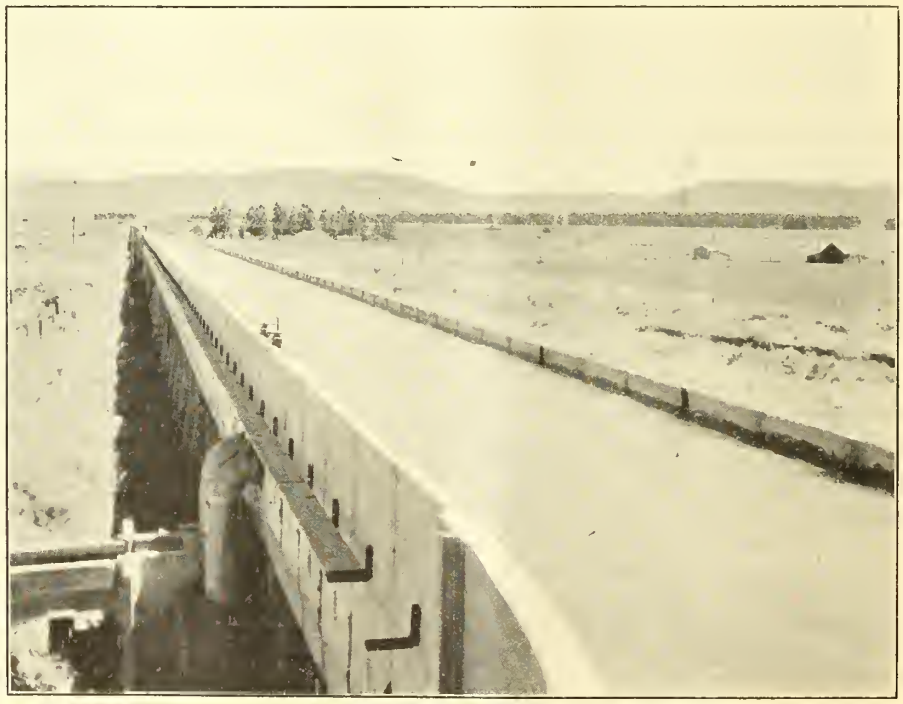
Cracks in Structures to Be Inspected

The Boulder Dam consulting board, composed of L. C. Hill, D. C. Henny, A. J. Wiley, William F. Durand, and F. L. Ransome, which was in session in Denver recently, recommended a comprehensive study of cracks in dams, the study to include a theoretical analysis combined with a field investigation. This suggested study is one item in a proposed comprehensive investigation of volumetric changes in concrete under conditions applicable to dam construction.

Prof. H. M. Westergaard, who has for the past 10 months been employed by the Bureau of Reclamation for special mathematical studies in connection with the design of Boluder Dam, has been assigned to this investigation and expects to start his field studies at an early date.

Owing to the large number of projects to be visited a limited time only is available for the field examination. Accordingly the project superintendents have been requested to have all major cracks in structures located and plotted on drawings in advance of Professor Westergaard's arrival on the project, also to prepare a written statement giving any available information regarding the time of formation of the cracks, the amount of seepage, if any, from them, and such other pertinent data as will be of assistance in determining the cause and extent of the cracks.

THE contract on the Owyhee Dam, Owyhee project, was 30.6 per cent completed at the end of the month.



Outlet on concrete flume, Canal "C," Klamath project, Oregon-California

NOTE.—This is the first of a series of three articles describing the Mormon Flat, Horse Mesa, and Stewart Mountain dams on the Salt River project.

Notes for Contractors

Minidoka project.—Plans are being made for the installation of a 180 second-foot pumping unit and electrical apparatus for new fifth unit in South Side first-lift pumping station, Minidoka project, Idaho, to replace a 100 second-foot unit which will be installed at the second lift, making five 180 second-foot units at the first lift and four 180 second-foot and one 100 second-foot units at the second lift.

Specifications have been prepared for the construction of two culverts to carry the main canal of the Gooding division of the Minidoka project under the tracks of the main line of the Oregon Short Line Railroad and under the Hailey branch of the railroad and for the construction of a combination concrete siphon and diversion structure to carry the canal under the Little Wood River and to divert water from the river. The plans also include the construction of a steel girder operation bridge over the river.

Vale project.—Bids (specifications No. 481–D) will be opened at Vale, Oreg., on June 9, for construction of the Bully Creek and Fairman Coulee siphons with a connecting section of concrete-lined canal on the Vale main canal. The construction of these siphons and the concrete-canal lining involves two alternate plans—one for constructing the major portion of the siphons of 101-inch diameter riveted plate steel pipe and the other for construction of 96-inch diameter precast concrete pipes, both with appurtenant works.

Shoshone project.—Bids (specifications No. 512) will be opened at Denver, Colo., on July 1 for furnishing hydraulic and electrical machinery for the third unit of the Shoshone power plant. There are requirements for one 6,000-horsepower vertical hydraulic turbine with governor and governor pump, one governor-operated pressure regulator, one 66-inch motor-operated butterfly valve, one 5,000 kilovolt-ampere alternating-current generator, four 1,667 kilovolt ampere 2,300 to 19,100/33,000 Y-volt transformers, and one switchboard and auxiliary apparatus. All apparatus will be installed by the Government.

Boise project.—Specifications are being prepared covering the purchase of two motor-driven deep well turbine type pumps for use on drainage work in the Wilder district.

Klamath project.—Specifications (146–K) are being issued by the project office and bids asked for construction of buildings at Tule Lake station; No. 147–K, for construction of two bridges on No. 1 drain; and No. 148–K, for the reconstruction of four bridges and a conduit on the Lost River diversion channel. There are being prepared specifications covering a 1½-cubic-yard Diesel-engine-operated dragline excavator, including 10-foot boom extension and lighting set.

Owyhee project.—The Joshua Hendy Iron Works was low bidder on high-pressure gates and outlet conduits for the Owyhee Dam under specifications No. 510, opened at Denver, Colo., April 25. The low bid for all six items was $98,423 and the estimated weight was 1,586,000 pounds.

Riverton project.—The project office is asking for bids under specifications Nos. 427–R to 429–R for construction of structures on the Pilot Canal lateral system.

Yakima.—The General Construction Co., with a bid of $195,946.10, has been awarded the contract for construction of earthwork, tunnels, and structures on the North Branch Canal, division No. 3, Kittitas division.

Boulder Dam Developments
Board Approves Larger Reservoir

The Colorado River Board, comprising Maj. Gen. William L. Sibert, Charles P. Berkey, Daniel W. Mead, Warren J. Mead, and Robert Ridgway, has reported to Secretary Wilbur that it has approved a recommendation of R. F. Walter, chief engineer, Bureau of Reclamation, that the height of Boulder Dam be increased by 25 feet, or to elevation 1,232. With low water in the river about elevation 647 and the lowest point of the base of the dam resting on solid rock about 125 feet below low water or elevation 522, the dam would have a maximum height of 710 feet and raise the water surface of the river 585 feet. This increased height will provide a reservoir capacity of 30,500,000 acre-feet, of which 9,500,000 acre-feet will be used for flood control. Maximum water-surface elevation will be 1,229 and floods will be controlled to a maximum flow in the lower river of 75,000 second-feet.

Approval was given by the board to a tentative section of the curved gravity dam known as study No. 25, and a new study is now being made of this section which will be known as No. 32. The proposal of Mr. Walter to construct and test a model dam of similar design for the purpose of checking reliability of methods of stress analyses which have been employed in designing the structure was also approved by the board, and this work will be undertaken at an early date.

POWER CONTRACTS SIGNED

Contracts for lease of power privilege between the United States and the City of Los Angeles and the Southern California Edison Co., acting jointly, have been signed, and on April 30 Secretary Wilbur sent a request for appropriation to the Bureau of the Budget. The agreement provides that the United States shall construct the dam, outlet works, pressure tunnels, penstocks, power plant building, and furnish and install generating, transforming and high voltage switching equipment for the generation of energy allotted to the lessees and to the various purchasers. Energy shall be furnished by the lessees to meet requirements of allottees as follows, allocations of firm energy being percentages of total firm energy of 4,240,000,000 kilowatt-hours per year upon completion of Boulder Dam and decreasing uniformly each year thereafter: State of Arizona, 18 per cent; State of Nevada, 18 per cent; Metropolitan Water District and City of San Diego, 36 per cent; Southern California municipalities, 6 per cent; City of Los Angeles, 13 per cent; and Southern California Edison Co., 9 per cent. The rates of payment for energy are fixed at 1.63 mills per kilowatt-hour for firm energy and one-half mill per kilowatt-hour for secondary energy.

INITIAL APPROPRIATION RECOMMENDED

President Hoover on May 2 sent to the House a recommendation for an appropriation of $10,660,000 to begin construction of the project. With this amount available, the following work is planned: (1) Construction of 3 miles of highway from a point 2 miles back of the river to the top of the cliffs, at a cost of $300,000; (2) laying out the Government town site and installing water and sewerage systems at a cost of $100,000, and erecting an administration building for offices and living quarters for Government employees, both to cost $125,000; (3) a 30-mile railroad from the Union Pacific to the dam site and a railroad down to the bottom of the canyon are estimated to cost $2,500,000; (4) power for construction purposes will cost $1,750,000 and must be brought in from an outside power line, or a temporary power plant must be built; (5) an initial appropriation of $5,000,000 for beginning construction work on the diversion tunnels is included; (6) purchase of certain private properties in the reservoir site will cost about $500,000; (6) to reimburse the reclamation fund for the amount expended to date on preliminary investigations the sum of $385,000 is required.

Boulder Canyon Project

Primer

Continued from February, March, and May issues

Q. What will be the installed capacity of the power plant at the Boulder Dam?

A. About 1,000,000 horsepower. For comparison, Niagara (United States) is 557,500; Conowingo 378,000 (ultimate 594,000) and Muscle Shoals 250,000 (ultimate 600,000).

Q. What is a horsepower in terms of falling water?

A. One second-foot of water falling 8.81 feet equals 1 horsepower, 100 per cent efficiency. A second-foot of water is 1 cubic foot passing a given point in one second of time.

Q. What will be the continuous firm power output?

A. About 650,000 horsepower, based on 83 per cent plant efficiency and 10 per cent maximum shortage.

Q. How much electrical energy will be available yearly?

A. Four billion two hundred and forty million kilowatt-hours on completion of the dam (1938) and this amount decreasing each year thereafter by 8,760,000 kilowatt-hours, as a result of upstream development.

Q. What is a kilowatt-hour?

A. The energy resulting from an activity of 1 kilowatt for one hour. A kilowatt is 1,000 watts. One horsepower equals 0.746 kilowatt. 650,000 (horsepower) $\times$ 0.746 $\times$ 24 (hours) $\times$ 365 (days) = 4,240,000,000 kilowatt-hours.

Q. How will this income from sale of power be used?

A. To pay all expenses of operation and maintenance of works incurred by the United States and the cost of construction of dam and power plant, with interest, within a 50-year period. Excess revenues above amortization requirements will be utilized as follows: 62½ per cent to flood control ($25,000,000) repayment and 18¾ per cent to Arizona and 18¾ per cent to Nevada.

Q. Where will the power plant be located?

A. Just below the dam, one-half on the Nevada side of the river and one-half on the Arizona side, forming a U-shaped structure.

Q. How will the water reach the turbines?

A. Through two of the 50-foot diameter diversion tunnels, each controlled by an intake tower equipped with shut-off gates and trash racks, delivering water to 12 penstocks, each 15 feet in diameter, connected to the turbines.

Q. What will be the principal machinery installation?

A. Tentative plans call for twelve 85,000 horsepower hydraulic turbines, twelve 11 by 10 foot balanced valves, twelve 75,000 kilovolt-ampere generators with exciters, thirty-six 25,000 kilovolt-ampere 220,000-volt transformers, four 250-ton cranes, switchboard, and control apparatus.

Q. What is the estimated cost of the power development?

A. $38,200,000, not including interest.

Q. What will be the charge for primary or firm power?

A. One and sixty-three one-hundredths mills per kilowatt-hour, delivered at transmission voltage.

Q. How much secondary or dump power will be available yearly?

A. One billion five hundred and fifty million kilowatt-hours on completion of the dam (1938) and this amount decreasing each year by 8,600,000 kilowatt-hours.

Q. What will be the charge for secondary or dump power?

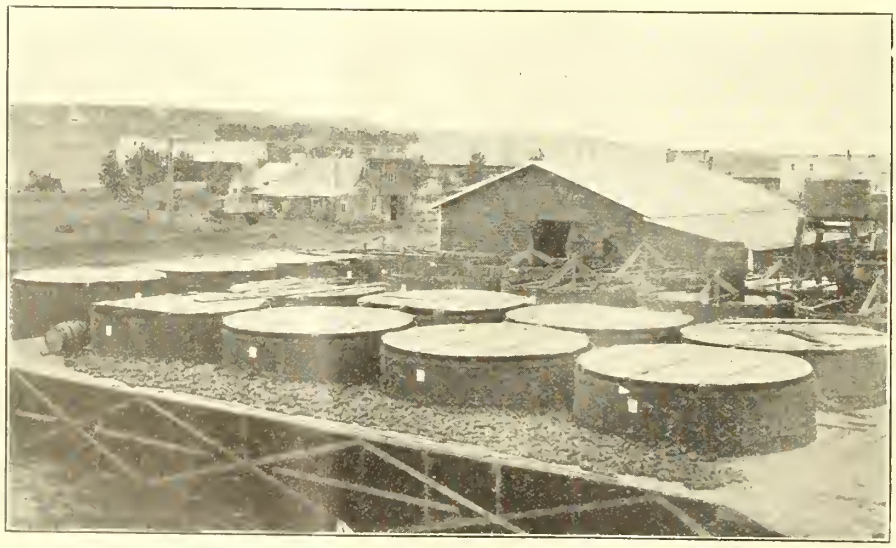
A. One-half mill per kilowatt-hour, delivered at transmission voltage.

Q. Are these rates subject to adjustment?

A. At the end of 15 years from date of execution of lease and every 10 years thereafter the rates may be readjusted.

Q. How much revenue will be derived from the sale of power?

A. For the first year of operation, the income would be $6,911,200 from the sale of 4,240,000,000 kilowatt-hours of primary energy at $0.00163 and $775,000 from the sale of 1,550,000,000 kilowatt-hours of secondary energy at $0.0005. The amount of income will decrease each year thereafter.



Pickle works at Fairview, Mont., Lower Yellowstone project

Articles Contributed to Other Publications

Mead, Elwood.
- Restricting Homestead Grants to Settlers Qualified as Farmers. United States Daily, April 23, 1930.

Nalder, W. H.
- Relining Old Tunnels, as Done by Federal Engineers. United States Daily, May 8, 1930.

Savage, J. L.
- A New Mark in Dam Building (plan for construction of Owyhee project outlined). United States Construction Magazine, March 15, 1930.

Bashore, H. W.
- Vale Irrigation Project Tunnels, Oregon. Western Construction News, February 25, 1930.

Houk, Ivan E.
- Experiments to Determine Rate of Evaporation from Saturated Soils and River Beds. Proceedings of the American Society of Civil Engineers, May, 1930.

The Derbon Construction Co. contract, under specifications No. 475 for construction of the Harper diversion dam and earthwork, tunnels, and structures on the main canal, Vale irrigation project, is now completed. This finishes the work required to make possible the delivery of water to the Harper and Little Valley areas, which will be opened under public notice in the spring.

New Refrigerating System Used in Fruit Shipments

During the latter part of February, 1930, a shipment of pears was made from Yakima, Wash., to New York, in a safety automatic iceless refrigerator and heater car, the refrigeration of which was provided by a Silica Gel system.

On February 20 this car was loaded at Yakima, Wash., with 756 boxes of pears for cold storage. These pears were placed in the car at a temperature of 31° F. The air temperature of the car was 32° F. at the time of loading, the thermostat being set to protect that degree of temperature throughout the trip.

The outside temperature en route ranged from about 60° F. during the first part of the journey to about 6° F. after the car had been on its way a few days. The shipment arrived in Jersey City on Sunday morning, March 2, but was not unloaded and placed on the auction until Wednesday morning, March 5, and an average temperature of 32° F. was maintained in both the fruit and the car from the time the shipment was loaded in Yakima on February 20 until it was unloaded March 5, including the two days it was held on track in the Jersey City yards. Both the heating and refrigeration apparatus operated automatically en route, supplying either refrigeration or heat as required to hold the temperature evenly at 32° F.

This car carried and refrigerated 756 boxes of pears as against 511 boxes, which is the average load carried in an ice-bunker refrigerator car. The fruit which arrived in this car, when placed on auction, brought 40 to 45 cents per box more than fruit received from the same district in other refrigerators of the ice-bunker type.

It has been necessary to pick some of our fruits in an underripe condition to deliver them on the distant markets in a salable condition under the best refrigeration conditions used in the past. This has not permitted putting on the market the fruit with its finest flavor that one gets with the tree-ripened fruit. This system would seem to have considerable possibilities of permitting marketing fruit that was brought to a riper state, and to command for such fruit a high market price.

Cooperation Flourishes on Klamath Project

The Malin Cheese & Produce Association is a farmers' cooperative concern that was organized in the fall of 1921 with a capitalization of $6,000. The first 13 months' business, November 1, 1921, to December 1, 1922, amounted to $34,710. The capital stock was doubled in 1922 and shares were valued at $50 each. The business paid dividends of 8 per cent annually for the years 1925, 1926, and 1927 and 10 per cent for 1928 and 1929. The volume of business during 1929 was $130,477 and payments to farmers were $106,106.75. The value of stock has a little more than doubled and is now $103 a share.

The Klamath County Dairymen's Association, of Klamath Falls, Oreg., was organized November 15, 1929, with a capital stock of $15,000. The membership is by producers only and at present comprises a little more than 100 representative farmers. The concern manufactures butter, cheese, and ice cream and distributes whole milk. It is affiliated with the Challenge Cream and Butter Association, of Los Angeles, Calif. The daily business already amounts to $400 and is increasing rapidly.

Livestock Data, 1930

The accompanying table shows the number and value of livestock and the value of farm equipment on the Federal irrigation projects at the beginning of 1930.

Horses and mules furnish the motive power for most of the farm work, although the detailed statistics show an increasing use of tractors.

Purebred sires of dairy cattle are increasing in number, but the figures indicate that there are still too many scrub bulls if the herds are to be built up for the highest milk production.

More sheep and fewer hogs characterized this latest inventory, with rabbits, fowls, and hives of bees about the same as last year. The rabbits were all reported from the Main and Tule Lake divisions of the Klamath project, Oregon-California. Riverton was the only project that did not report hives of bees.

SUMMARY OF LIVESTOCK AND EQUIPMENT ON FEDERAL IRRIGATION PROJECTS

	Number	Value	
		Each	Total
Horses	71,080	$52.02	$3,697,707
Mules	10 274	87.85	902,596
Beef cattle	67,959	52.21	3,548,450
Purebred sires	392	147.95	57,997
Scrub sires	133	74.10	9,855
Dairy cattle	129,336	79.56	10,290,656
Purebred sires	1,635	128.71	210,453
Scrub sires	1,086	54.29	58,958
Sheep	433,895	8.90	3,861,411
Hogs	93,095	9.60	894,564
Brood sows	11,930	19.65	234,399
Rabbits	2,150	1.65	3,550
Fowls	2,075,831	1.16	42,418,584
Bees (hives)	37,405	6.19	231,509
Total stock value			26,420,689
Value of equipment			[1] 16,246,570
Total stock and equipment			42,667,259
Increase or decrease in value over 1928:			
Stock			−1,377,076
Equipment			3,368,971
Total increase			1,991,895

[1] Value of equipment on Salt River project estimated.

Hauling "Hearts of Gold" cantaloupes from field, Newlands project, Nevada

Summary of Pecan Outlook for Yuma Valley, Ariz.

By Dr. George W. Barr, Agricultural Agent, Department of Development and Colonization

PRODUCTION POSSIBILITIES AT YUMA

YUMA VALLEY, with ideal climatic conditions and ample water supply at reasonable cost, is adapted to the production of pecans.

Success has been attained in various parts of the valley and under varying soil conditions.

Pecan trees mature earlier in Yuma than in most pecan sections of America.

There appears to be an entire absence of disease or pests on pecans in Yuma.

Several varieties are being produced at Yuma which are equal in quality of any pecans produced in America.

Carefully gathered records of production in Yuma Valley show higher yields per acre than in other pecan-producing sections. In no section of America has there been a more consistent production year after year, no crop failures ever having occurred at Yuma.

MARKET FOR PECANS

Production of pecans in the United States is on the increase. According to the 1925 census there were as many nonbearing as bearing trees. The average production of pecans during 1925–1928, inclusive, was 39,000,000 pounds per year, of which 22 per cent were of improved varieties.

The chief competitors of the pecan among the nuts produced in the United States are walnuts and almonds. To some extent peanuts may also be considered competitive to pecans. The following table gives the production in the United States of these nuts from 1924 to 1928 in millions of pounds:

	1924	1925	1926	1927	1928
Pecans	19.0	29.4	64.0	22.2	42.0
Almonds	16.0	15.0	32.0	24.0	26.4
Walnuts	45.0	72.0	30.0	102.0	50.0
Total	80.0	116.4	126.0	148.2	118.4

The walnut production in the United States has increased at about the rate of 6.5 per cent per year for over 30 years. Within the period 1910–1925 there was an increase in the bearing acreage of walnuts of 140 per cent, almonds 375 per cent, and pecans 175 per cent. Of the total walnut acreage in 1929 not over 70 per cent was bearing, and probaby not over 60 per cent in full bearing.

Pecans have shown a decline in price since 1925 as follows:

CLASSIFICATION OF PECANS AND PRICE PER POUND

Crop of—	Schley	Other standard varieties	Miscellaneous varieties	Seedling	All sales
	Cents	*Cents*	*Cents*	*Cents*	*Cents*
1925	54	36	31	20	35
1926	44	32	25	16	32
1927	44	31	23	17	30
1928	45	32	25	18	31

With the rapidly increasing bearing acreage and tonnage production of walnuts and almonds it would be reasonable to expect the market price to be affected adversely. Up to the present time, however, the adverse reaction on the market is not very noticeable. In fact, there has been a slight upward trend in the purchasing power of walnuts throughout most of the period from 1898 to 1928. The purchasing power of a pound of almonds decreased from 1910 to 1920. From 1920 to 1928 there was an increase in purchasing power of a pound of almonds, but the pre-war purchasing power exceeded the 1928 purchasing power.

With increased production the price of pecans will probably fall to a point approaching the price of walnuts. As the price of walnuts falls, which will likely occur as a result of the new nonbearing acreage coming into bearing, the price of pecans will follow in this decline.

Foreign trade in pecans is of little importance, averaging only about 2 per cent of the American consumption. These imports consist of seedlings from Mexico. In the case of walnuts in the years 1913–1916, 67 per cent of the American consumption was imported; in the year 1927–28, 33 per cent was imported. Before the war 89 per cent of the American consumption of almonds was imported; in 1928, 70 per cent was imported. Other foreign competitors of pecans, together with importations to the United States in the 5-year period ending July 1, 1929, were Brazil nuts 31,000,000 pounds, chestnuts 22,000,000 pounds, filberts, unshelled, 11,000,000 pounds, shelled 6,000,000 pounds. The total value of nuts imported into the United States in 1928 was over $29,000,000.

Certain studies have indicated that pecans are favored on the market in comparison with walnuts and almonds. With a lowering of the price of improved pecans to a figure near the price of walnuts, it is reasonable to expect an increased demand for pecans.

RECOMMENDATIONS

Yuma farmers will do well to increase their acreage of pecans. There is no area in America which offers more promise from a production standpoint than does Yuma Valley.

Since a long period of years is required for the setting out, growing, and producing of a life-time yield from pecan trees, the producer should select the best soils in the valley, soils which are well drained and free from alkali. The farmer who sets out pecans on mediocre or poor land will be at a disadvantage throughout the years that follow.

A further study of varieties of pecans is essential. There seems to be uncertainty as to the type of pecan which will bring the largest return to the farmer when both yield and market price are considered.

The experiment station of the University of Arizona is the logical organization to carry out experimentation of this nature.

A strong local pecan organization will be one of the largest factors in the success of pecans at Yuma. Such an organization can effect economies in grading and advertising. Through this organization a standard pack can be produced. The organization can also bring about orderly distribution.

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Harvesting paper-shell pecans, Valley Division, Yuma project

A Profitable Holstein on the Minidoka Project

With a record of 640.3 pounds of butterfat from 19,167 pounds of milk to her credit, S. W. Beck of Rupert, county seat of Minidoka County, believes his registered Holstein, Chimacum Gettie Hazelwood Posch, is one of the highest producing 2-year old Holsteins in the State. This record, which is equivalent to 820 pounds of butter a year, was made by Hazel, as she is commonly known, in the Mini-Cassia Dairy Herd Improvement Association during the year ending December, 1929.

Hazel was fed all the alfalfa hay she would eat, and a mixture of home-grown grains, consisting of oats, barley, and bran. A total of 2,260 pounds of grain was fed. Her entire feed cost for the year amounted to $87.69. The value of the butterfat was $320, leaving a net profit to Mr. Beck of $232.50 for the year.

Records kept so far this year in the association show 221.2 pounds of butterfat produced from 6,383 pounds of milk in 76 days, giving promise of an even greater production than last year.

This outstanding cow was purchased from William Bishop, jr., of Chimacum, Wash., for $270 at the Portland International Livestock Show in 1928. She was born March 6, 1926, and had her first calf, a heifer, November 15, 1928. She freshened the second time January 28, 1930, giving birth to another outstanding heifer calf.

Mr. Beck is considered one of Minidoka County's progressive dairymen. He owns a herd of 11 purebred and grade Holsteins, which made a record during the past testing year of 426.3 pounds of butterfat in the Mini-Cassia Dairy Herd Improvement Association. He is also a member of the Minidoka County Bull Association. In addition to his dairy herd he owns 100 pure-bred Hampshire ewes.—*B. E. Kuhns, county extension agent.*

Dairying a Growing Industry on the Orland Project

Dairying is one of the basic and most profitable lines of industry on the Orland project. Although the number of cows decreased slightly during the past year, their value increased $9.38 per animal, which indicates that project dairymen are building up and improving the breed and quality of their herds. This improvement in stock is still further demonstrated by the fact that notwithstanding the decrease in the number of dairy cows on the project, butter production of the two Orland creameries increased from 1,384,000 to 1,557,752 pounds, the largest in the history of their operations. This increase of 173,752 pounds occurred in spite of a considerable exportation of whole milk from the project to a factory operating at Chico. Prices for butterfat were fairly well stabilized during the year, ranging from 55½ to 42 cents per pound.

Argentina imported $35,342,051 worth of American farm machinery in 1929.

Montana State College Issues New Farm Bulletin

A particularly valuable bulletin on "Recommended Farm Practices for Northern Montana" has just been issued by the Extension Service of the Montana State College at Bozeman. While the information relates particularly to Blaine, Phillips, and Valley Counties, where the Milk River project is located, it will be equally useful on all irrigated projects in Montana east of the Rocky Mountains. Both irrigated and dry land farming methods are covered in an equally clear and thorough manner.

This bulletin might well be called the "Farmer's Primer," for it covers fully all operations on the farm connected with the production of staple crops, how the ground should be prepared, when seeded, irrigated, and harvested. There are a number of plats showing arrangements of fields on both dry-land and irrigated farms, and a brief description of the principal methods of irrigating crops. The control of noxious weeds, plant diseases, and insect pests is also covered.

The last 11 pages of the bulletin are given to the livestock industry, and here will be found brief instructions relating to the production of beef cattle, sheep, dairying, swine, and poultry. Every farmer on the northern irrigation projects should send for a copy of Bulletin No. 108, for it presents the practical side of the farming problems in a manner which should appeal to the farmer.

Appreciation by the Associate Editor

ONE of the finest developments in connection with establishing a section in the NEW RECLAMATION ERA on project women and their interests has been the splendid cooperation of water users, project organizations, bureau employees, the railroads serving our projects, and the men and women who act in an advisory capacity.

A very fine example appears in this issue in the contribution of an article on vocational agriculture on the Orland project, by R. W. Guilford, director of vocational agriculture of the Orland High School. He is not only content to stimulate those under his charge, but offers to tell about his organization on the Orland project for the readers of the NEW RECLAMATION ERA. His statement of appreciation by project people of beautifying home surroundings is also a very good contribution to this section and is passed on for the edification of our readers.

Many thanks, Mr. Guilford, we need more men like you on our projects.

IRRIGATION

Oh, Mesa, with those wise clear eyes of old
Could you have dreamed this vision to behold?
Long aeons you have gazed across the plain
And Man's control have held in high disdain;
But now where gone are deer and antelope,
The stubborn sage that clung to every slope,
The caravan that wound its weary way,
The lurching stage that would not brook delay?
Again where vanished tribes of warriors bold
Who bravely fought these native trails to hold?

Gone to oblivion, and through the land
A magic wand is Irrigation's hand.
From distant ports skilled birdmen wing their flights,
While desert dark gives way to myriad lights;
Where once the drifting dunes of sand held sway
The children gather flowers as they may,
And tapestries are spread o'er all the fields
Where yellow ripening grain abundance yields.
Oh, Mesa, with those wise clear eyes of old
Could you have dreamed this vision to behold?

—*Elizabeth De Mary, Minidoka Project*

Orland Settlers Beautify Home Grounds

By Ralph W. Guilford, Director of Vocational Education, Orland High School

The settlers on the Orland project appreciate the value of attractive surroundings. Many project homes are as attractive as the best of those in the city. Irrigation waters available from the project system remove the principal obstacle to plant growth in the semiarid climate of the Sacramento Valley. No particular care is needed in the winter, but in the summer water is necessary.

California finds many Australian trees and shrubs valuable for her use. Perhaps the fastest growing tree from Australia is the eucalyptus. For a windbreak, shade, or as a background for the house, this tree is ideal because it grows rapidly, attains a considerable size, and is an evergreen.

The Acacias, also from Australia, comprise a large family of trees and shrubs, evergreen, rapid of growth, dense, and spring-flowering. The characteristic yellow flower is borne profusely, and in different varieties is a feature of the early to late spring landscape. The Blackwood Acacia, *Acacia baileyana* and *Acacia dealbata*, grow into trees of good size, while the shrubs, *Acacia longifolia*, *Acacia cultriformis*, *Acacia floribunda*, and *Acacia verticillata*, are all adapted to places requiring a dense rapid-growing bush. Many Acacias have been planted and its yellow blossom is a feature in the spring of the year at Orland.

In spite of our hot dry weather in summer, many beautiful conifers may be found in the Orland project. The one most highly recommended is the Deodar Cedar, of which there are several beautiful specimens in the city park at Orland. The Incense Cedar, native in the mountains on either side of the Sacramento Valley, grows to a large size here. The Italian Stone Pine, the Giant Redwood, the Coast Redwood, the Monterey Cypress, Arizona Cypress, Italian Cypress, and Colorado Blue Spruce all may be found in the Land of Orland.

Flowering and berried shrubs also make their contribution to the landscape. The pyracanthas, cotoneasters, and mountain holly provide berries in various shades of red and yellow to brighten the winter landscape. The Flowering Quince, Rose of Sharon, Sweet Mock-orange, Weigela, Crape Myrtle, and others provide spring and summer blooms.

Many lawns are made a level where irrigation waters may be used to flood them. Many kinds of lawn grasses may be found. An interesting grass is the Lippia, a low spreading plant which grows laterally and makes a dense ground cover. Clover and Kentucky Blue Grass are the favorites.

The Orland High School offered a course in landscape gardening this spring and it was very well attended. There were six evening meetings followed by an all-day field trip, on which the group visited points of interest around Orland, the plant introductions gardens of the Federal Department of Agriculture at Chico, as well as other places in Chico. The course was

1

ORLAND

IRRIGATION

PROJECT

CALIFORNIA

3

1
FARM HOME

2
HOME OF T. A. POWELL

3
FARM HOME

4
HOME OF PETER KASAK

5
CONCRETE-LINED LATERALS ALONG ROW OF BUNGALOWS ON ONE ACRE-LOTS

4

5

given by the writer in connection with his high-school work as director of vocational agriculture.

The Orland project is fortunate in having a nursery close at hand to supply its needs of trees and ornamentals. The Lely nursery grows each year hundreds of fine plants, which are sold at a reasonable price. This nursery attracts buyers from near-by towns.

The city park in Orland is developing rapidly. The lawn areas will be completed this spring. Here one may find many trees and shrubs growing. The Women's Improvement Club of Orland has purchased labels for the plants so that anyone interested may find out what kinds he wishes to plant on his home grounds.

Each year the Orland project takes on a more settled appearance. Improved homes and home grounds are evidences of the permanence and solidarity of irrigation farming.

Sun River Wheat Growers Should Diversify

Prof. M. L. Wilson, agricultural economist of the Montana State College, in a recent address before the Great Falls Chamber of Commerce, pointed out that the mechanization of wheat growing is spreading into every wheat-growing country of the world, and sounded a note of warning for all wheat growers. Continuing, he said:

These highly specialized low-cost tractor wheat farmers of Montana must be alert to the shifting conditions of the world wheat market; they must keep informed, must forever perfect their specialization if they wish to continue as successful world wheat competitors. To the less specialized wheat growers and those whose financial resources have not permitted complete mechanization, there is a growing recommendation that they turn their attention to diversified farming as rapidly as possible.

Montana's greatest agricultural development problem to-day is the intelligent utilization of the vast acreage of land already under the ditch in the Great Falls trade area and north. The State college has made intensive study of this irrigated area and, with soil surveys and economic studies, is convinced that the future development must be along the lines of livestock growing, dairying, and sugar-beet growing, or other high-value-per-acre crops. If this irrigated region, in which you Great Falls business men are so vitally interested, could be settled properly, it would provide farm homes for at least 5,000 more families.

Although the Sun River project is not specifically mentioned, what Professor Wilson says would unquestionably be applicable to that locality. Farmers must get away from wheat, which is now the main crop, and put more of their acreage into diversified crops, including sugar beets. Only through complete settlement and proper agricultural development will this project have the success it deserves.

Two oldest Colorado Blue Spruce trees on Minidoka project, Idaho

Belle Fourche Project Stimulates Settlement

The local community clubs on the Belle Fourche project are cooperating with the railroad and the State department of agriculture to stimulate settlement on the project.

Among other things this plan proposes an agricultural exhibit car displaying products and scenes of western South Dakota, particularly the Belle Fourche irrigation project. The exhibits are to be prepared and displayed by the State department of agriculture and the railroad company is to transport the car free of charge from place to place. Inquiries for land that result from this campaign are to be referred to the various community clubs, which have already agreed to entertain such representatives from any midwest community. The representative is to be given every opportunity to acquaint himself with the agricultural advantages here at the local club's expense with a view to his disseminating the information in his own community back home. If sufficient interest can be awakened in any one place, special agricultural men or salesmen are to be sent there by project organizations.

Making an inspection of Tulare County lands in California in connection with the Sacramento-San Joaquin Valley investigations

Left to right: Walker R. Young, resident engineer, Bureau of Reclamation; John Turner, chairman Tulare County Water Committee, Lindsay, Calif.; Dr. Elwood Mead, Commissioner of Reclamation; F. M. Pfrimmer, member Tulare County Water Committee, Porterville, Calif.; C. H. Holley, consulting engineer, Exeter, Calif.; A. D. Edmonston, deputy State engineer in charge of water resources investigations; Earl W. Hastings, supervisor, Tulare County; C. A. Bissell, engineer, Bureau of Reclamation; M. R. Huberty, University of California; P. H. Van Etten, field engineer, State division of water resources; Frank Adams, professor of irrigation investigations and practice, University of California.

Reclamation Organization Activities and Project Visitors

On May 19 the commissioner appeared before the House Appropriations Committee in support of the item of $10,660,000, for commencement of construction of Boulder Dam. It is proposed that this item be placed in the second deficiency bill now under consideration so that when the bill becomes a law funds will be immediately available and operations may start on this mammoth flood control, irrigation, and power enterprise.

Chief Engineer R. F. Walter, H. W. Bashore, construction engineer, and Homer J. Gault, engineer, made an examination recently of the located line of the All-American Canal. They were accompanied by officials of the Imperial Irrigation District.

Former Chief Engineer F. E. Weymouth, who is now chief engineer of the metropolitan water district, Los Angeles, Calif., was in the Washington office during the month on Boulder Canyon matters.

J. Ellis Overlade, of the accounts division, has been transferred to the Department of Justice, where he has accepted the position of chief accountant, office of superintendent of prisons.

Guy W. Numbers, for many years connected with the Washington office in the capacity of appointment clerk and later as a member of the accounts division, has been transferred to the appointment division of the Secretary's office.

C. A. Lyman, field representative with headquarters at Denver, has been temporarily assigned to work in the Washington office to relieve the congested condition in the accounts division occasioned by the separation from the service of J. E. Overlade and G. W. Numbers.

J. W. Barr, of the development and colonization department, and M. A. Peck, district passenger agent, of the Southern Pacific Co.; A. M. Wells, engineer of the California State engineers' office; C. A. Bissell, engineer of the Washington office; and Walker R. Young, construction engineer of the Kittitas division of the Yakima project, were recent visitors to the Orland project.

Engineer Theodor B. Nelson-Skorniakoff, of Tashkent, Union of Socialistic Soviet Republics, an assistant to Arthur P. Davis, former director of the Bureau of Reclamation and now engaged in irrigation work in Turkestan, visited the Washington office on May 8. He left on the 13th for Tashkent via Berlin and Moscow.

W. I. Swanton, assistant chief of the engineering division in the Washington office, was recently elected president of the Washington chapter of the American Association of Engineers, which has its national headquarters in Chicago, Ill.

Miss Clara S. Davenport, of the chief clerk's division, Washington office, has recovered from a recent minor surgical operation and has returned to duty.

L. R. Smith, chief clerk of the Denver office, is spending several weeks in Washington assisting the accounts division in the preparation of estimates for appropriations.

A. T. Strahorn, of the Department of Agriculture, was in the Sacramento office on May 7–8, and then left for southern San Joaquin Valley to take up a study of land classification which is expected to embrace both the San Joaquin and Sacramento Valleys. Mr. Strahorn's detail to this work will probably occupy about three months.

C. B. Shipp, engineer for the General Electric Co., was a recent visitor on the Minidoka project in connection with the installation of the interconnection substation at the Minidoka Dam.

T. K. Cheng, commissioner of the Chekiang Provincial Government and chief of the construction department, and Y. Y. Lin, associated director of the Hangchow-Kianshan Railway, called at the Washington office on May 2 to learn of irrigation methods.

Paul Taylor, in charge of the storage division, Yakima project, has been ill since April 14 and probably will not return to duty for several weeks.

Chief Engineer R. F. Walter, Electrical Engineer L. H. McClellan, Chief Designing Engineer J. L. Savage, and Hydrographic Engineer E. B. Debler, of the Denver office, spent several days in Washington during the month in connection with Boulder Canyon matters.

Assistant Commissioner P. W. Dent was in the Denver office during the month on official business.

Alberto Decombe and Severo Vidal, irrigation engineers from Santiago, Chile, were Washington office visitors on May 14. They plan to visit the Denver office and then inspect construction work on the irrigation projects. Mr. Decombe is director of reclamation, department of public works.

District Counsel William J. Burke was on the Shoshone project during the month in conference with the project superintendent about the proposed contracts with the town of Powell for electricity and the Mountain States Power Co. Mr. Burke also conferred with the commissioner of the Deaver Irrigation District concerning the final contract now being negotiated.

Early in the month Engineer H. R. McBirney, of the Denver office, visited the construction work in progress on the Gooding division of the Minidoka project and made observations for design.

M. J. Dowd, chief engineer and general superintendent of the Imperial Irrigation District, was in the Washington office the latter part of the month in conference regarding the All-American Canal surveys.

Harold Malcolm Westergaard, professor of theoretical and applied mechanics, University of Illinois (on leave, 1929–30), senior mathematician, Bureau of Reclamation, Ph. D., Dr. Ing., Dr. techn. h. c., has been appointed as delegate to represent the bureau at the Third International Congress for Applied Mechanics, which will be held in Stockholm, August 24–29.

Engineer J. R. Iakisch has been designated to make the necessary investigations in connection with the proposed Saratoga project, with temporary headquarters at Saratoga, Wyo.

Appropriations for the Bureau of Reclamation for the Fiscal Year Ending June 30, 1931

An act making appropriations for the Department of the Interior for the fiscal year ending June 30, 1931, and for other purposes. (Act May 15, 1930, Pub. No. 217, 71st Cong., 2d Sess.)

* * * * * * *

CONTINGENT EXPENSES, DEPARTMENT OF THE INTERIOR

For contingent expenses of the office of the Secretary and the bureaus and offices of the department; * * * stationery, including tags, labels, index cards, cloth-lined wrappers, and specimen bags, printed in the course of manufacture, and such printed envelopes as are not supplied under contracts made by the Postmaster General, for the department and its several bureaus and offices, and other absolutely necessary expenses not hereinbefore provided for, $122,000; and, in addition thereto, sums amounting to $75,500 for stationery supplies shall be deducted from other appropriations made for the fiscal year 1931, as follows: * * * Bureau of Reclamation, $12,000, any unexpended portion of which shall revert and be credited to the reclamation fund; and said sums so deducted shall be credited to and constitute, together with the first-named sum of $122,000, the total appropriation for contingent expenses for the department and its several bureaus and offices for the fiscal year 1931.

For the purchase or exchange of professional and scientific books, law and medical books, and books to complete broken sets, periodicals, directories, and other books of reference relating to the business of the department by the several offices and bureaus of the Interior Department herein named, $500, and in addition there is hereby made available from any appropriations made for such bureau or office not to exceed the following respective sums: * * * Bureau of Reclamation, $2,000; * * *.

BUREAU OF INDIAN AFFAIRS

* * * * *

For payment of annual installment of reclamation charges against Paiute Indian lands within the Newlands reclamation project, Nevada, $4,421; and for payment in advance, as provided by district law, of operation and maintenance assessments, including assessments for the operation of drains to the Truckee-Carson irrigation district, which district, under contract, is operating the Newlands reclamation project, $11,020 to be immediately available; in all, $15,441.

* * * * *

For reimbursement to the reclamation fund the proportionate expense of operation and maintenance of the reservoirs for furnishing stored water to the lands in Yakima Indian Reservation, Wash., in accordance with the provisions of section 22 of the act of August 1, 1914 (38 Stat., p. 604), $11,000.

* * * * *

BUREAU OF RECLAMATION

The following sums are appropriated out of the special fund in the Treasury of the United States created by the act of June 17, 1902, and therein designated "the reclamation fund," to be available immediately:

Commissioner of Reclamation, $10,000; and other personal services in the District of Columbia, $145,000; for office expenses in the District of Columbia, $23,000; in all, $178,000.

For all expenditures authorized by the act of June 17, 1902 (32 Stat. p. 388), and acts amendatory thereof or supplementary thereto, known as the reclamation law, and all other acts under which expenditures from said fund are authorized, including not to exceed $178,000 for personal services and $27,000 for other expenses in the office of the chief engineer, $25,000 for telegraph, telephone, and other communication service, $7,000 for photographing and making photographic prints, $54,000 for personal services, and $12,000 for other expenses in the field legal offices; examination of estimates for appropriations in the field; refunds of overcollections and deposits for other purposes; not to exceed $20,000 for lithographing, engraving, printing, and binding; purchase of ice; purchase of rubber boots for official use by employees; maintenance and operation of horse-drawn and motor-propelled passenger-carrying vehicles; not to exceed $40,000 for purchase and exchange of horse-drawn and motor-propelled passenger-carrying vehicles; packing, crating, and transportation (including drayage) of personal effects of employees upon permanent change of station, under regulations to be prescribed by the Secretary of the Interior; payment of damages caused to the owners of lands or other private property of any kind by reason of the operations of the United States, its officers or employees, in the survey, construction, operation, or maintenance of irrigation works, and which may be compromised by agreement between the claimant and the Secretary of the Interior, or such officers as he may designate; payment for official telephone service in the field hereafter incurred in case of official telephones installed in private houses when authorized under regulations established by the Secretary of the Interior; not to exceed $1,000 for expenses, except membership fees, of attendance, when authorized by the Secretary, upon meetings of technical and professional societies required in connection with official work of the bureau; payment of rewards, when specifically authorized by the Secretary of the Interior, for information leading to the apprehension and conviction of persons found guilty of the theft, damage, or

destruction of public property: *Provided*, That no part of said appropriations may be used for maintenance of headquarters for the Bureau of Reclamation outside the District of Columbia except for an office for the chief engineer and staff and for certain field officers of the division of reclamation economics: *Provided further*, That the Secretary of the Interior in his administration of the Bureau of Reclamation is authorized to contract for medical attention and service for employees and to make necessary payroll deductions agreed to by the employees therefor: *Provided further*, That no part of any sum provided for in this act for operation and maintenance of any project or division of a project by the Bureau of Reclamation shall be used for the irrigation of any lands within the boundaries of an irrigation district which has contracted with the Bureau of Reclamation and which is in arrears for more than 12 months in the payment of any charges due the United States, and no part of any sum provided for in this act for such purpose shall be used for the irrigation of any lands which have contracted with the Bureau of Reclamation and which are in arrears for more than 12 months in the payment of any charges due from said lands to the United States.

Examination and inspection of projects: For examination of accounts and inspection of the works of various projects and divisions of projects operated and maintained by irrigation districts or water users' associations, and bookkeeping, accounting, clerical, legal, and other expenses incurred in accordance with contract provisions for the repayment of such expenses by the districts or associations, the unexpended balances of the appropriations for this purpose for the fiscal years 1929 and 1930 are continued available for the same purpose for the fiscal year 1931.

For operation and maintenance of the reserved works of a project or division of a project when irrigation districts, water-users' associations, or Warren Act contractors have contracted to pay in advance but have failed to pay their proportionate share of the cost of such operation and maintenance, to be expended under regulations to be prescribed by the Secretary of the Interior, the unexpended balance of the appropriation for this purpose for the fiscal year 1930 is continued available for the same purpose for the fiscal year 1931.

Yuma project, Arizona-California: For operation and maintenance, $275,000; for continuation of construction of drainage, $20,000; in all, $295,000: *Provided*, That not to exceed $25,000 from the power revenues shall be available during the fiscal year 1931 for the operation and maintenance of the commercial system.

Orland project, California: For operation and maintenance, $38,000.

Grand Valley project, Colorado: Not to exceed $15,000 of the unexpended balance of the appropriation of $75,000, for the fiscal year 1929, is hereby made available for continuation of construction during the fiscal year 1931.

Boise project, Idaho: For continuation of construction, Payette division, $620,000; Arrowrock division, $280,000; for operation and maintenance, Payette division, $20,000; in all, $920,000: *Provided*, That the unexpended balance of the appropriation of $40,000 for drainage work, Notus division, contained in the second deficiency act, fiscal year 1929, shall remain available for the same purposes during the fiscal year 1931.

Minidoka project, Idaho: For operation and maintenance, reserved works, $28,000; continuation of construction, gravity extension unit, $1,100,000, together with the unexpended balance of the appropriation for this purpose for the fiscal year 1930: *Provided*, That not to exceed $50,000 from the power revenues shall be available during the fiscal year 1931, for the operation of the commercial system; and not to exceed $100,000 from power revenues shall be available during the fiscal year 1931 for continuation of construction, south side division; in all, $1,128,000.

Milk River project, Montana: For operation and maintenance, Chinook division, $8,000; continuation of construction, $23,000; in all, $31,000.

Sun River project, Montana: For operation and maintenance, $11,000; continuation of construction, $275,000; in all, $286,000: *Provided*, That the appropriation for continuation of construction for the fiscal year 1930 shall remain available for the fiscal year 1931, for the purposes for which originally appropriated.

Lower Yellowstone project, Montana-North Dakota: The unexpended balance of the appropriation for completion of drainage system for the fiscal year 1930 shall remain available during the fiscal year 1931.

North Platte project, Nebraska-Wyoming: Not to exceed $75,000 from the power revenues shall be available during the fiscal year 1931 for the operation and maintenance of the commercial system.

Carlsbad project, New Mexico: For operation and maintenance, $50,000.

Rio Grande project, New Mexico-Texas: For operation and maintenance, $375,000; for continuation of construction, $133,000; in all, $508,000.

Owyhee project, Oregon: For continuation of construction, $2,000,000.

Baker project, Oregon: The unexpended balance of the appropriation for this project for the fiscal year 1930 is reappropriated and made available for the same purpose for the fiscal year 1931.

Vale project, Oregon: For operation and maintenance, $15,000; for continuation of construction, $530,000; in all, $545,000.

Klamath project, Oregon-California: For operation and maintenance, $42,000; continuation of construction, $222,000, together with the unexpended balance of the appropriation for continuation of construction for the fiscal year 1930; for refunds to lessees of marginal lands, Tule Lake, $5,000; in all, $269,000.

Belle Fourche project, South Dakota: For continuation of construction, $157,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1930 shall remain available for the fiscal year 1931.

Salt Lake Basin project, Utah, first division: The unexpended balance of the appropriation of $1,750,000 for construction of Echo Reservoir and Weber-Provo Canal, for the fiscal year 1929, continued available for the same purposes for the fiscal year 1930, shall remain available for the same purposes for the fiscal year 1931.

Salt Lake Basin project, Utah, second division: For commencement of construction, $300,000: *Provided*, That no part of this sum shall be available for construction work until a contract or contracts shall be made with an irrigation district or districts embracing said division, which, in addition to other conditions required by law, shall require payment of construction costs within a period not exceeding 30 years from the date water shall be available for delivery, as to lands now under production, tributary to canals and laterals already constructed, and for the irrigation of which a supplementary water supply is to be furnished.

Yakima project, Washington: For operation and maintenance, $325,000: *Provided*, That the unexpended balances of the appropriations for continuation of construction for the fiscal years 1929 and 1930 shall be available during the fiscal year 1931.

Yakima project (Kittitas division), Washington: For operation and maintenance, $25,000; for continuation of construction, $945,000: *Provided*, That the unexpended balance of the appropriation for continuation of construction for the fiscal year 1930 shall remain available during the fiscal year 1931; in all, $970,000.

Yakima project (Kennewick Highlands unit), Washington: For construction, $640,000, to be immediately available: *Provided*, That no part of the funds hereby appropriated shall be expended for construction purposes until there shall have been conveyed to the United States title to the Prosser Dam and the right of way for the Prosser-Chandler Power Canal free of all prior liens and satisfactory to the Secretary of the Interior: *Provided further*, That all net revenues received from the disposition of power not required for pumping water for the irrigation of lands in the Kenne-

wick irrigation district shall be applied, first, to the payment of the construction cost incurred by the United States in connection with the Kennewick Highlands unit, including the power plant and appurtenances, until said construction cost is fully paid, and thereafter to retire the obligations incurred by the said district in the purchase of the said dam and right of way: *And provided further,* That title to and the legal and equitable ownership of the power plant and appurtenances constructed by the United States pursuant to this appropriation shall be and remain in the United States, and all net revenues therefrom shall go to the reclamation fund after payment of aforesaid construction cost and retirement of said obligations.

Riverton project, Wyoming: For operation and maintenance, $30,000; continuation of construction, $28,000: *Provided,* That the unexpended balance of the appropriation for continuation of construction, for the fiscal year 1930, shall remain available for the fiscal year 1931: *Provided further,* That not to exceed $20,000 from the power revenues shall be available during the fiscal year 1931 for the operation and maintenance of the commercial system; in all, $58,000: *Provided further,* That no part of the funds hereby appropriated for construction purposes shall be available for expenditure on the distribution system, Pilot Butte division, during the fiscal year 1931 until the following conditions have been met.

(1) Contract satisfactory to the Secretary of the Interior shall have been executed by the Midvale Irrigation District for repayment of project investments;

(2) A sugar factory shall have been constructed on or in the vicinity of the project or definite arrangements made for such construction at an early date; and

(3) A branch railroad shall have been constructed or initiated either from Bonneville or some other suitable point on the Chicago, Burlington & Quincy Railroad, or from Shoshoni or some other suitable point on the Chicago & North Western Railway to Pavillion, Wyoming, or other suitable point in this vicinity.

Shoshone project, Wyoming: For continuation of construction, Willwood division, $22,000; for operation and maintenance, Willwood division, $16,000; for installation of a third unit in the Shoshone power plant, $100,000, together with $75,000 from power revenues; in all, $138,000: *Provided,* That the unexpended balances of the appropriations, for construction, Willwood division, for the fiscal years 1929 and 1930, shall remain available for the same purposes for the fiscal year 1931: *Provided further,* That the unexpended balances of the appropriations for drainage construction, Garland division, for the fiscal years 1927, 1928, and 1929, shall remain available for the same purpose for the fiscal year 1931: *Provided further,* That the unexpended balance of the appropriation of $20,000 for continuation of drainage system, Deaver Irrigation District, fiscal years 1929 and 1930, contained in the Second Deficiency Act, fiscal year 1929, shall remain available for the same purposes during the fiscal year 1931: *Provided further,* That not to exceed $20,000 from power revenues shall be available during the fiscal year 1931, for the operation and maintenance of the commercial system: *Provided further,* That the Secretary of the Interior is authorized to sell at not less than the appraised valuation transmission lines, substations, and so forth, no longer needed for construction, operation, and maintenance of the project.

Secondary projects: For cooperative and general investigations, $75,000.

For investigations necessary to determine the economic conditions and financial feasibility of new projects and for investigations and other activities relating to the reorganization, settlement of lands, and financial adjustments of existing projects, including examination of soils, classification of land, land-settlement activities, including advertising in newspapers and other publications, and obtaining general economic and settlement data, $50,000: *Provided,* That the expenditures from this appropriation for any reclamation project shall be considered as supplementary to the appropriation for that project and shall be accounted for and returned to the reclamation fund as other expenditures under the reclamation act.

Refunds of construction charges: The unexpended balance of the appropriation of $100,000 contained in the first deficiency act, fiscal year 1928, for refunds of construction charges theretofore paid on permanently unproductive lands excluded from the Federal reclamation projects specified in the act approved May 25, 1926 (U. S. C., Supp. III, title 43, sec. 423a), in accordance with section 42 of said act, is hereby made available for the same purposes for the fiscal year 1931.

Under the provisions of this act no greater sum shall be expended, nor shall the United States be obligated to expend during the fiscal year 1931, on any reclamation project appropriated for herein, an amount in excess of the sum herein appropriated therefor, nor shall the whole expenditures or obligations incurred for all of such projects for the fiscal year 1931 exceed the whole amount in the "reclamation fund" for the fiscal year.

Ten per centum of the foregoing amounts shall be available interchangeably for expenditures on the reclamation projects named; but not more than 10 per centum shall be added to the amount appropriated for any one of said projects, except that should existing works or the water supply for lands under cultivation be endangered by floods or other unusual conditions an amount sufficient to make necessary emergency repairs shall become available for expenditure by further transfer of appropriation from any of said projects upon approval of the Secretary of the Interior.

Whenever, during the fiscal year ending June 30, 1931, the Commissioner of the Bureau of Reclamation shall find that the expenses of travel, including the local transportation of employees to and from their homes to the places where they are engaged on construction or operation and maintenance work, can be reduced thereby, he may authorize the payment of not to exceed 3 cents per mile for a motor cycle or 7 cents per mile for an automobile used for necessary official business.

Total, from reclamation fund, $8,961,000.

To defray the cost of operating and maintaining the Colorado River front work and levee system adjacent to the Yuma Federal irrigation project in Arizona and California, subject only to section 4 of the act entitled "An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved January 21, 1927 (44 Stat., p. 1010), $100,000, to be immediately available.

* * * * *

SEC. 2. Appropriations herein made for field work under * * * the Bureau of Reclamation * * * shall be available for the hire, with or without personal services, of work animals and animal-drawn and motor-propelled vehicles and equipment.

Approved, May 14, 1930.

World Engineering Congress

The recently printed report of the proceedings of the World Engineering Congress, held in Tokio, Japan, in October and November, 1929, contains an article on "Irrigation in the United States," prepared jointly by Dr. Elwood Mead, Commissioner of Reclamation, and B. A. Etcheverry, of the University of California.

The introduction is followed by chapters on "Water Laws," "Later Measures for Promoting and Financing Irrigation Development," "Cooperative Enterprises," "Commercial Enterprises," "Modern Tendencies in the Development of Irrigation Water," "Coordination of Hydroelectric Power and Irrigation," "Improvement in the Use of Irrigation Water," and "Developments in Irrigation Construction and Design."

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department, **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant
P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
Hugh A Brown, Director of Reclamation Economics
C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armaud Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Orland	Orland, Calif	R. C. E. Weber	do	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	J. C. Page	do	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Acting supt	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstoue	Savage, Mont	H. A. Parker	Superintendent	N. E. Anderson		do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	H. W. Bashore	Constr. engr	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Yonngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	do	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	P. J. Preston	Superintendent	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash			E. R. Mills	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	E. W. Shepird	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gravity Extension division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. dist	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho.	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Bnrley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation dist	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. dist	Chinook, Mont	W. B. Sands	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Geriug, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Gosheu irrigation district	Torrington, Wyo.	A. B. Reeves	do	Mrs. Nelle Armitage	Torrington, Wyo.
Northport divisiou	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. dist	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. dist	Irrigon, Oreg	A. C. Houghtou	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. dist	Bonanza, Oreg	R. S. Hopkins	Mauager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm F. B. Chase	Do.
Strawberry Valley	Strawberry Valley W. U. A	Provo, Utah	Kenneth Borg	Project irrig. eugr	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Franuie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Yuma, Ariz	H. J. Gault	Imperial and Coachella Valley districts.
Gila River Basin	Safford, Ariz	O. C. Smith	States of Arizona and New Mexico.
Sacramento-San Joaquiu Valley	Sacramento, Calif	C. A. Bissell	State of California.
Boulder Canyon Reservoir	Las Vegas, Nev	Walker R. Young	
Salt Lake Basin	Salt Lake City, Utah	E. O. Larsen	State of Utah.
Alcova-Casper and Saratoga	Saratoga, Wyo	J. R. Iakisch	State of Wyoming.

DESERT AND CULTIVATED LAND ON AN IRRIGATION PROJECT

U. S. GOVERNMENT PRINTING OFFICE · 1930

NEW RECLAMATION ERA

VOL. 21, NO. 7 JULY, 1930

IRRIGATING AN ORANGE GROVE ON THE ORLAND PROJECT, CALIF.

FEDERAL RECLAMATION

OF ALL THE WORK that has been done in the public service in the last generation I do not know of any work of the Federal Government that has been better done, taking it by and large, than that of the Bureau of Reclamation. I was connected with that work from its inception, I know the difficulties encountered and the expenditures made, and I have yet to find a penny that was dishonestly used. Mistakes have been made. I made some of them, but in the building up of this organization, the Bureau of Reclamation stands out as a fine example of what honest, intelligent, and continuous public service has accomplished for the people of the West. Doctor Mead is one of the great administrators of that service.

JAMES R. GARFIELD,
Former Secretary of the Interior, Chairman Committee on the Conservation and Administration of the Public Domain.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 July, 1930 No. 7

Interesting High Lights on the Federal Reclamation Projects

BASED on gross contract earnings Echo Dam, on the Salt Lake Basin project, was 95.2 per cent complete at the end of the month.

BIDS were opened on June 17 for carrying mail daily to the Willwood division and what is known as the Eaglenest territory of the Shoshone project.

CONSTRUCTION of a 4-story modern office building in Yakima for the Liberty Savings & Loan Association was well under way at the close of the month, and the construction, in the business section, of a ramp garage with seven storage floors had been started. Several dwelling and apartment houses have also been completed or are in course of construction.

DAIRYING is making favorable gains on the Belle Fourche project, and plans have been completed for three new silo structures in the Arpan country, in addition to two recently constructed.

THE contract on the Owyhee Dam was 32 per cent complete at the end of the month.

A NUMBER of sales of farms in the Malin irrigation district and Langell Valley irrigation district, Klamath project, were reported during the month.

THE 1930 census showed that Klamath Falls, Klamath project, has a population of 16,053, or a 234 per cent increase over the census of 1920.

THE 1930 census gave the town of Okanogan, on the Okanogan project, a population of 1,516, a gain of 501 over the census of 1920. Omak has an estimated population of 2,500.

ONE application was received during the month for a farm unit in the Harper and Little Valley area of the Vale project. There now remain in the division three farm units available for entry having a total area of 45.8 irrigable acres. Thirty-five of the settlers on this division are now eligible for water.

THE Elephant Butte Dam, Rio Grande project, was visited by 698 tourists during the month.

PLANS are steadily going forward by the pecan growers on the Yuma project for the largest single year's planting to date during the coming winter months. The greater part of the area to be planted will be completely leveled by tractors during the summer and fall months and made ready for planting by January 1. A total of 2,112 acres has already been planted to this crop.

A SUBSTANTIAL increase was reported in the areas grown to potatoes, beets, and beans on the Minidoka project, the three crops covering an area of about 3,000 acres, or about 34 per cent.

THE present crop plantings on the Uncompahgre project indicate that there will be a considerable increase in the sugar-beet acreage this year, a slight increase in the potato acreage, with a slight decrease in the onion acreage. There will probably also be a heavy increase in the corn acreage, and in order to provide for these increases it appears that there will be less planting to oats and wheat.

THE new settlers on the Lower Yellowstone project are employing excellent farming methods in the development of their units and are quite enthusiastic over the prospects for success in their undertaking.

WORK on the new San Carlos Hotel on the Yuma project is progressing rapidly. An air-conditioning system is being installed similar to that which is being so successfully operated in the hotels of Phoenix.

THE annual report of the Mini-Cassia Dairy Herd Improvement Association on the Minidoka project was issued in May. A continued improvement in the dairy industry on the project is noted. One cow, "Beauty," owned by Haven Leigh, led all others with a record of 693.2 pounds of butterfat, which sold at a profit of $233.24 above cost of production. The average production of all cows in the association was 374.2 pounds of butterfat, the value of which was $166.70, with an average net profit of $86.80 per cow.

PROJECT livestock on the Lower Yellowstone project is in excellent condition, and the weather has been favorable for both young lambs and pigs. One farmer reported that his lamb crop was 150 per cent.

THE laying of the cornerstone on the new $50,000 Masonic temple at Yuma on the Yuma project took place on June 1 with appropriate exercises. The walls and roof of the reinforced concrete building are complete and the interior work will be rushed to completion. This structure is of the most modern type of architecture and will be a distinct addition to the city when completed.

PASTURING of livestock from northern and eastern ranges continues to be a popular industry in the Valley division of the Yuma project. Five hundred and fifty head were shipped in for feeding during May and 1,400 head of fattened cattle were shipped by rail to Pacific coast markets.

Crop Production on Federal Reclamation Projects

By Dr. Elwood Mead, Commissioner, Bureau of Reclamation

IN 1929 the cropped area on Federal reclamation projects was 1,512,250 acres, which was four-tenths of 1 per cent of the entire area farmed in the United States. The gross value of crops produced on this area was $88,459,390, or 1 per cent of the total production, or an average acre value two and a half times that outside those areas. In addition to the above area Government reservoirs supplied water under Warren Act contracts to 1,192,990 acres of land which are irrigated from private or district canal systems and which produced crops valued at $72,720,490, or a total value of $161,179,880. The combined areas furnish the foundation for the industries, towns, and trade of a large part of the arid and semi-arid regions which comprise one-third of the United States. These irrigated areas have become vital factors in the economic development of the Western States and the new wealth created each year finds its way through channels of trade to other sections and thus directly benefits the entire country.

OVERPRODUCTION NOT DUE TO RECLAMATION

Federal reclamation is being assailed from time to time and accused of being an important factor in adding to the surplus of staple crops. The production of crops on these projects is a matter of record and appears in the annual reports of the bureau. Let us consider what effect they may have on crop values. Corn is the largest crop in the country. The reclamation projects produced 1,250,000 bushels in 1929, which is 0.05 of 1 per cent of the total. This is not a sufficient quantity to be a material factor in determining the price of corn, and as it is consumed locally it does not compete with the central sections of the country nor would it pay to ship corn to the Western States for livestock feed. Corn production on Federal projects cuts no figure in the total for the Nation.

Wheat acreage decreasing.—Wheat is one of the crops that is causing the greatest concern. Government projects produced 3,910,036 bushels in 1929, just under one-half of 1 per cent of the total. What effect does this small quantity have on the price of wheat? The United States is a wheat-exporting country and it is reasonable to assume that the price of wheat is determined by the world supply and demand. A few figures covering production and prices of wheat in the United States will show this to be the case: In 1923, 797,000,000 bushels sold at 92 cents; 1927, 878,000,000 bushels, $1.20; 1928, 915,000,000 bushels, 97 cents; 1929, 806,000,000 bushels, $1.04. Wheat is a crop that fits into the early development program of an irrigated farm. There will always be some wheat grown on our western projects, as there will be a small quantity required to supply local markets, but the trend is toward less wheat. The project crop census for 1929 shows a reduction of 850,000 bushels over 1928 and nearly a million bushels less than in 1927. Furthermore, the Montana projects produce almost entirely hard spring wheat, which is always in demand and sells at a premium based on the protein content. It can not be denied that this production of wheat has some influence, but it certainly comes in the microscopic class.

Barley and oats increasing.—Barley and oats, while only a small fraction of 1 per cent of the total production, have increased 1,250,000 bushels, or 40 per cent, in two years. This is to be expected, as it is a crop that is fed to livestock on the farm and does not come into competition with the production of the humid sections. The basic industry of practically all Federal projects is the production of forage crops to be fed to livestock.

Alfalfa consumed locally.—Alfalfa is still the principal crop grown under irrigation. It comprises 31 per cent of the area of all crops on Government projects and accounts for 18 per cent of the total crop value, but amounts to only a little over 4 per cent of the total national production. But here, again, we have a crop that is too bulky to be shipped any distance and is consumed on the farm where it is raised. It is true that a very small quantity of top-grade alfalfa is ground and shipped to the Middle West to be mixed with grains and sold as special balanced rations for livestock.

Slight increase in cotton.—Cotton shows a slight increase in recent years, but still holds to 1.16 per cent of the total production. The reclamation projects in Texas, New Mexico, and Arizona should give careful consideration to the production of long-staple fiber, of which there is no surplus and of which imports from Egypt in 1929 reached 296,000 bales, which is 122,000 more bales than the total produced on Government projects.

Growing importance of fruits.—Fruits are growing in importance and value and peaches and pears have shown a big increase during the past two years. The same statement applies to citrus fruits.

Of the potato crop, 2.32 per cent is grown on Federal projects, and without doubt this has an influence on the price of potatoes, but quality here is an important factor, and the best grade of potatoes comes from the irrigated farms. The famous big baked potato of the Northern Pacific dining car is grown under the ditch and the only reason potatoes can be shipped from Idaho and sold on the Atlantic coast in competition with eastern potatoes is because of the superior quality.

An irrigated garden on the Belle Fourche project, South Dakota

COMPARATIVE STATISTICS

The accompanying figures showing production for the entire United States were taken from the December issue of Crops and Markets, published by the Department of Agriculture. Production on Federal projects was compiled from the 1929 crop census.

Comparison of agricultural production on Federal reclamation projects, with entire production for the United States, 1929

	Entire United States	Federal reclamation projects	Per cent reclamation projects
Value of crops	$8,586,619,000	$88,459,390	1.03
Acres in crops	367,083,000	1,512,250	.41
Bushels of corn	2,622,189,000	1,254,496	.05
Bushels of wheat	806,508,000	3,910,036	.48
Bushels of barley	307,105,000	2,713,374	.88
Bushels of oats	1,238,654,000	1,709,249	.14
Bushels of rye	40,629,000	66,855	.16
Bushels of alfalfa seed	717,800	136,328	19.00
Bushels of flax	16,838,000	25,987	.15
Tons of hay	101,715,000	63,631	.06
Tons of alfalfa	29,847,000	1,303,946	4.37
Bushels of sweetclover seed	961,800	70,502	7.33
Bushels of beans	19,337,000	390,067	2.02
Bushels of potatoes	357,451,000	8,302,196	2.32
Bushels of apples	139,754,000	4,971,050	3.55
Bushels of pears	20,903,000	1,028,000	4.90
Bushels of peaches	45,998,000	465,720	1.02
Tons of sugar beets	7,672,000	956,719	12.50
Bales of cotton	14,919,000	173,732	1.16
Number of beef cattle	30,799,000	67,959	.22
Number of dairy cattle	27,168,000	129,336	.48
Number of sheep	48,913,000	433,895	.89
Number of hogs	52,600,000	93,095	.18

LESS COMPETITION, GREATER PROFITS AIM OF FARMERS

Federal reclamation projects are still passing through a transition period. The best crops for each particular section that can be produced and marketed to the greatest advantage to producer and consumer have not been definitely determined, but the figures show that the farmers are working toward that goal and are reducing the area of crops that enter into competition with humid sections and increasing production along lines that will promote local development and meet local needs. This will result in less competition and insure increased profits. This problem is an important one and should be studied on each project and steps taken to concentrate on crops that can be sold to the best advantage.

WESTERN RECLAMATION RELIEVES EASTERN CONGESTION

There are now nearly 41,000 farms on Federal reclamation projects, which with project cities and towns support a population of over 600,000 people. Where would these people be if these projects had never been built? Without doubt a considerable percentage would be farming in the Middle West. The man who has been brought up on a farm and loves the life is going to stick to it—somewhere. No definite answer can be given to this complex question, but it would seem a far better solution of the problem to put him out in Washington where he can grow apples that can be sold either in the congested East or shipped to foreign countries and with the dollar he receives purchase the product of the big manufacturing centers that consume the farm products of the humid sections rather than have him working on a farm where the crops would add to the surplus. The major portion of the gross revenue of an irrigated agriculture is directly distributed to labor, transportation, trade, and the professions. Only the net profit belongs to the farmer and most of that is promptly passed on to other hands. These projects have created values in excess of a billion dollars, or over five times the Government's investment, and, what is still more important, the new wealth created each year has been distributed to all sections of the country.

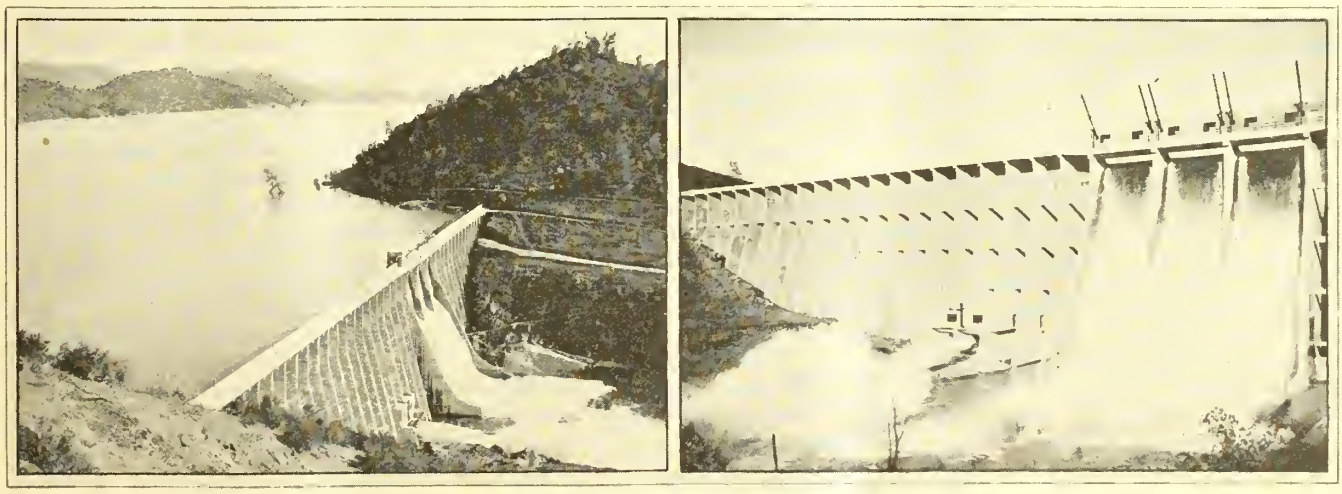
VALUE OF CROPS IN QUALITY RATHER THAN QUANTITY

Federal reclamation projects are producing better and more valuable crops each year, and in this connection the fundamental principle holds true that there is no competition in quality. The world has a right to the best, and if Arizona can produce a better grapefruit, Texas a better grade of cotton, Washington a better apple, or Idaho a better potato, then they should continue to grow them. The poorer grades must drop out of the picture, for the law of the survival of the fittest holds true in the agricultural world just as truly as in other worlds. The farmer who can grow a superior product has the same right to see a beaten path to his door as the man who makes the best mousetrap.

Kittitas Water Available

EASTON RESERVOIR, on the Kittitas division of the Yakima project, Washington, was filled this spring from the natural flow of the Yakima River. The canal head gates at Easton Dam were raised for the first time this season at 2.10 p. m., April 26, at which time a small head of water was started down the main canal. A small head was started down the South Branch Canal on May 2 and reached Menastash Creek on May 10.

Operation of the Taneum Ditch, which now becomes one of the main laterals under the South Branch Canal, was begun on April 21, using water diverted from Taneum Creek. The first delivery of Yakima River water was made on May 9 to J. W. Ellison's property, lying under the South Branch Canal.



Stony Gorge Dam, Orland project, California. Discharge, 245 second-feet over each spillway gate, and 520 second-feet from each needle valve

Résumé of Work in Progress During Fiscal Year 1930 and Proposed for Fiscal Year 1931

By R. F. Walter, Chief Engineer, Bureau of Reclamation

IN a paper read by me at the Denver conference March 13, 1929, and published in the April, 1929, issue of the New Reclamation Era, the work in progress during the fiscal year 1929 and proposed for fiscal year 1930 was discussed. In the present article I will endeavor to give a somewhat similar résumé of the work actually accomplished and in progress during the fiscal year 1930 and proposed for the fiscal year 1931.

NEW PROJECTS AUTHORIZED

No new projects not already included in the so-called 10-year program have been authorized from the reclamation fund during the year. The Boulder Canyon project has been authorized under the act approved December 21, 1928, subject to appropriations from the General Treasury as distinguished from the reclamation fund, and the work proposed thereon is discussed later in this article. Included in the 10-year program and not heretofore undertaken, however, is the Kennewick Highlands unit of the Yakima project, for which an appropriation of $640,000 has been provided in fiscal year 1931. There are some 4,000 acres of irrigable land in this unit, of which about half is now in bearing orchards of high value, lying west and south of Kennewick, Wash., which at present are served by a pumping plant, two long wooden pipe lines, and a main distributing lateral owned and operated by the Kennewick irrigation district. The pumping plant, built in 1909 and 1910, is now obsolete and inefficient, one of the pipe lines is in a precarious condition, and the canal from which the water is pumped is not of sufficient carrying capacity, so that of the 4,000 acres available less than 2,600 are being irrigated. Commercial power is purchased for pumping at a high annual cost. With the appropriation provided, the bureau plans to install three new pumping units and a 42-inch wood-stave pipe line 9,500 feet long, provide additional canal capacity, rebuild the main distributing lateral, repair the Prosser Dam (a power dam now owned by the district), build 3 miles of power canal, install a 3,500-horsepower hydroelectric plant, and construct a 35-mile transmission line from the power plant to the pumping plant to supply power for pumping, thus providing facilities for an adequate supply of water for the full 4,000 acres. The district will be furnished power needed for pumping at a low charge. The act requires that before any expenditure for construction is made the district shall convey to the United States title to the Prosser Dam and right of way for the power canal, and provides that net revenues from the sale of power not required for pumping shall be applied, first, to the payment of the construction cost incurred by the United States; next, to retire the obligations of the district in the purchase of the said dam and right of way; and thereafter shall be credited to the reclamation fund. It is expected to begin construction as soon as the conveyance of title is made and necessary plans perfected.

APPROPRIATIONS AVAILABLE

For the fiscal year 1931 Congress appropriated for construction and operation and maintenance of the various projects directly from the reclamation fund $9,236,000, by reappropriation of unexpended balances of prior years appropriations approximately $2,615,000 and authorized the expenditure of commercial power revenues totaling $365,000. In addition, an appropriation of $100,000 was provided from the General Treasury for operation and maintenance of the Colorado River levee system, while funds to be advanced by irrigation districts and others for operation and maintenance were estimated at $669,000, making a grand total of $12,985,000 available for expenditure during fiscal year 1931, as compared with a total of $14,947,000 made available for similar purposes during the preceding fiscal year.

STATUS OF RECLAMATION FUND

While the appropriations referred to in the preceding paragraph have been made by Congress, expenditure of these amounts is, of course, contingent upon the necessary funds actually being available in the Treasury to the credit of the reclamation fund. Estimates for appropriations are necessarily compiled a year or more in advance and the status of the reclamation fund to meet those appropriations can only be approximated at that time. For the past few years, however, expenditures have about equaled the receipts. A safe balance must be maintained in the fund at all times and it is therefore probable that no new work outside that included in the 10-year program can be undertaken for several years.

DAMS COMPLETED

During the fiscal year 1930 three important dams were completed—Gibson, Easton, and Harper, on the Sun River, Kittitas, and Vale projects, respectively. Estimated costs and approximate final costs (subject to minor adjustments) are as follows:

	Estimated cost	Actual cost
Gibson Dam	$2,783,000	$2,383,000
Easton Dam	293,000	235,000
Harper Dam	80,000	98,000

The Gibson Dam is located on the North Fork of Sun River about 23 miles northwest of Augusta, Mont., and forms a storage reservoir with a capacity of 89,000 acre-feet for the use of the Sun River project. It is of the massive concrete arch type, top length 1,000 feet, maximum height 200 feet, and contains 168,000 cubic yards of concrete. The Utah Construction Co. was the contractor, beginning work in October, 1926, and completing the contract in July, 1929. Grouting of the radial contraction joints was purposely left until April, 1930, when it was successfully accomplished by Government forces.

The Easton diversion dam on the Yakima River at the head of the Kittitas main canal near the town of Easton, Wash., is a concrete gravity structure 250 feet long, 65 feet in maximum height above the foundation, and contains 6,000 cubic yards of concrete. The reservoir site was cleared under contract with the General Construction Co., who began work in November, 1927, completing it in October, 1928. Contract for construction of the dam was awarded to C. F. Graff, who began work in April, 1928. In November, 1928, the contractor encountered financial difficulties and the work was then taken over by his sureties, Hans Pederson and E. L. Blaine, who completed the contract in January, 1930.

The Harper diversion dam, located at the head of the Vale project main canal on the Malheur River, 1 mile west of Namorf, Oreg., consists of a concrete spillway section regulated by seven 10 by 20 foot structural steel hinged weir gates flanked by an earth and rock fill embankment. The spillway section has a length of 156 feet and a maximum height above foundation of 29 feet, containing 1,700 cubic yards of concrete and 160,000 pounds of structural steel, while the embankment section is 470 feet long and 12 feet high with a volume of 3,000 cubic yards, The dam was constructed under contract with the Derbon Construction

Co., who began work in March, 1929, and completed the contract in November, 1929. No special difficulties were encountered, but on account of requirement for deeper foundations than anticipated the quantities of excavation, concrete, and reinforcing steel proved somewhat greater than estimated.

DAMS UNDER CONSTRUCTION

Three large dams are now under construction: Owyhee Dam, on the Owyhee project in eastern Oregon; Echo Dam, on the Salt Lake Basin project, Utah; and Deadwood Dam, on the Payette division of the Boise project in Idaho.

The Owyhee Dam is a combined storage and diversion structure with a height of 405 feet for the maximum section and a total height of 520 feet above the lowest concrete in the foundation cut-off. The total capacity of the reservoir will be 1,120,000 acre-feet, including 405,000 acre-feet of dead storage. The dam will contain 540,000 cubic yards of concrete and is estimated to cost approximately $6,000,000. Contract for construction was awarded in June, 1928, to the General Construction Co. A modern construction plant has been installed by the contractor, including a 25-ton cableway and a concrete plant with a capacity of 3,000 cubic yards per day. Satisfactory progress has been made under this contract and at the end of May, 1930, the diversion tunnel and cofferdams had been completed and the excavation for the dam foundations had also been practically completed, except for the cleaning out of the fault zone, which must be carried down to a depth of more than 100 feet below the main foundation. The special treatment required in the preparation of the fault zone for concreting has caused some delay, but it is expected that the excavation of the fault zone will be completed in August, 1930, and that the placing of concrete will proceed without interruption after that date.

The Echo Dam, which is under construction across the Weber River near Ogden, Utah, consists of a rolled embankment about 1,900 feet long and 130 feet in maximum height, forming a reservoir of 74,000 acre-feet capacity. It will contain 1,500,000 cubic yards of earth, gravel, and rock fill and is estimated to cost $2,600,000, including about $1,000,000 for rights of way, railroad and highway reconstruetion, and clearing the reservoir site. Contract for construction of this dam was awarded to the A. Guthrie Co. in November, 1927, for completion in April, 1930. The contractor is somewhat behind schedule and will not be able to complete the work until the fall of 1930. On account of threatened water shortage during the irrigation season of 1930 and the high value of stored water to the lands under the project, arrangements have been made for storage of 10,000 acre-feet for use this season by installation of temporary gates in the trash-rack structure.

The Deadwood Dam, which is under construction on the Deadwood River 50 miles north of Boise, Idaho, will provide storage of 150,000 acre-feet for the Payette division of the Boise project. This dam is of the concrete arch type, 600 feet long and 160 feet in maximum height, and will contain 50,000 cubic yards of concrete. The estimated cost of the dam, including $260,000 for rights of way and clearing of the reservoir site, is $1,300,000. Contract for construction of this dam was awarded to the Utah Construction Co. in July, 1929. The contractor made good progress on the installation of the construction plant and excavation of the foundations during the fall of 1929 before operations had to be suspended on account of heavy snows. The road from the dam site to the nearest railroad point, a distance of 65 miles, is impassable during the winter months, the only means of transportation during this period being by dog sled and airplane. Work was resumed about April 1, 1930, although the road was still impassable for automobile transportation. The work of clearing the reservoir site, which is being carried on under a separate contract, was prosecuted throughout the winter months. The progress under both contracts has been reasonably satisfactory, considering the adverse conditions, and although somewhat behind schedule on a time-elapsed basis, it is expected that the dam will be completed in time to store water for the season of 1931.

DAMS PROPOSED AND UNDER INVESTIGATION

Plans for the enlargement of the Avalon Reservoir on the Pecos River, Carlsbad project, New Mexico, have been abandoned owing to an adverse report of the Director of the Geological Survey on the water-tightness of the foundation under the bed of the reservoir and the depth to which water might be safely stored.

There remains for construction under the present reclamation-fund program the Cle Elum Dam on the Yakima project, Washington. An appropriation of $1,420,000 for commencement of construction of this dam is available in fiscal year 1931, being the carry-over of the unexpended balances from the fiscal years 1929 and 1930. During the fiscal year 1930 test pit work to explore the foundations as well as other preliminary investigations and preparation of plans have been in progress and are continuing. A further geological examination is also to be made. Actual construction has not yet been authorized pending the results of these investigations and progress is further dependent upon the negotiation of additional contracts with the various irrigation districts concerned in order to gurantee repayment of the cost.

CANAL AND LATERAL CONSTRUCTION

Having made provision by construction of these storage dams and reservoirs, as we hope, for an ample supply of water, we next turn to the equally important problem of delivering the water to the project lands. Important canal construction work has been in progress during the fiscal year 1930 and is proposed during the fiscal year 1931 on the Kittitas division of the Yakima project, the Gooding division of the Minidoka project, and on the Owyhee, Vale, Riverton, Sun River, and Klamath projects.

KITTITAS DIVISION, YAKIMA PROJECT, WASHINGTON

The canal system of the Kittitas division of the Yakima project in the State of Washington is one of the most difficult yet undertaken by the bureau. It consists of the main canal 26 miles in length, the North Branch Canal 36 miles in length, and the South Branch 15 miles in length, a total of 77 miles. The water is diverted from the Yakima River into the main canal at the Easton diversion dam. After leaving the main canal the North Branch Canal crosses under the Yakima River and two railroads in a pressure tunnel under a head of 550 feet estimated to cost $500,000. So far, canal excavation on the division has totaled around 5,000,000 cubic yards and there have been constructed some 15 siphons costing about $800,000; 8 tunnels, $600,000; 4 wasteways, $135,000; 3 miscellaneous structures, $140,000; and 16 miles of 3 to 6 inch concrete lining costing about $1,000,000, besides numerous minor structures.

Construction of this division was begun in the calendar year 1926 and the work has since continued without interruption. An appropriation of $1,112,000 was available in the fiscal year 1930 and $945,000 will be available in the fiscal year 1931. During the fiscal year 1930 the main canal was completed and the South Branch Canal will be completed by the end of the year. The first 11 miles of the North Branch Canal was also completed except for the Yakima River pressure tunnel, now about one-half complete and which should be completed during the coming winter. The next 20 miles of the North Branch Canal is under construction and should be completed in the spring of 1931. Con-

tract has recently been awarded for the last 5 miles, which, together with some wasteways yet to be contracted, should be completed in the fiscal year 1932. The total cost of the main canal was $3,650,000; of the South Branch Canal, $550,000; and the total estimated cost of the North Branch Canal is a little less than $3,000,000.

During the fiscal year 1930 laterals were completed for 5,500 acres under the main canal. Laterals to serve 8,300 acres under the South Branch Canal were under construction and 90 per cent complete at the end of April, 1930, while at the same time laterals for 30,500 acres under the North Branch Canal were also under construction and 30 per cent complete. During the fiscal year 1931 contracts will be let for additional laterals to serve about 7,000 acres under the North Branch Canal. It is expected that water will be delivered to 13,300 acres during the irrigation season of 1930 and to 40,000 acres in 1931. The total area expected to be irrigated when the project is completed is 72,000 acres.

All construction on the Kittitas division has been handled by contract, the canal work being let in large contracts and the lateral work in a considerable number of small contracts.

OWYHEE PROJECT, OREGON-IDAHO

The proposed canal system of this project is another that can be classified as among the most expensive and difficult of construction undertaken by the bureau. The main canal diverts from the Owyhee Reservoir, now under construction, through an outlet tunnel 16 feet 7 inches in diameter and approximately 3½ miles in length. Just below this tunnel the canal divides, the north branch or Mitchell Butte Canal continuing down the Owyhee and Snake Rivers in a northeasterly direction and having a total length of approximately 103 miles. This canal will siphon under both the Owyhee and Malheur Rivers and will serve lands principally in Oregon. The south branch, or Succor Creek Canal, starts with a tunnel 9 feet 3 inches in diameter and 4 miles in length and continues in a southeasterly direction with a total length of approximately 72 miles, serving lands along the Snake River principally in Idaho. Construction of the two tunnels is the first work undertaken, contracts being let in March, 1930. These tunnels are estimated to cost about $4,000,000, and three and one-half years will be required for their completion. The total cost of the entire canal system, exclusive of laterals, is estimated at $9,000,000. During the fiscal year 1931 work will continue on the two tunnels and contracts will probably be let and work begun on the construction of the first 6 miles of the Mitchell Butte Canal, which will include the Owyhee River siphon.

VALE PROJECT, OREGON

During the fiscal year 1930 the principal work in progress was the continuation of construction of the main canal. The Harper diversion dam and the first 21 miles of the main canal have been completed and water was turned into the canal at the beginning of the irrigation season of 1930 for priming purposes and for the irrigation of a few farms in Harper and Little Valleys. The next 16½ miles of the canal is under construction, work on which will be continued during fiscal year 1931 and should be completed well within the contract time limit, which is November, 1931. This will complete the main canal to Bully Creek, or mile 37.5. Bids were opened on June 9 for an additional 1½ miles, including a long siphon across Bully Creek, and this work also will continue during fiscal year 1931.

Laterals to serve 4,000 acres in the Harper and Little Valleys were completed during the fiscal year 1930 and water for these areas is now available. Construction of laterals for about 3,700 acres on the West Bully Creek bench is in progress and will be completed in the fiscal year 1931, together with laterals for 7,000 acres on the East Bully Creek bench which are yet to be contracted. Lateral construction for the remaining 13,700 acres of the project will probably await settlement of the area thus supplied with water.

Contract was let during the fiscal year 1930 for construction of a stop-plank crest on top of Warmsprings Dam by means of which 20,000 acre-feet of additional storage will be provided at a cost of approximately $20,000. Preliminary investigations and studies were also begun and will be continued in the fiscal year 1931 for the location of a storage dam on the North Fork of the Malheur River to provide additional storage. Expenditures on the Vale project during the fiscal year 1930 were approximately $790,000 and proposed expenditures for the fiscal year 1931 are $530,000.

MINIDOKA PROJECT, GOODING DIVISION, IDAHO

The work in progress on this division is the construction of the main Milner-Gooding Canal extending in a northwesterly direction from the Milner Dam on Snake River to supplement with stored water from American Falls Reservoir the present inadequate water supply for some 40,000 acres of lands in the Wood River Valley in southern Idaho. It is desired to make water available for these lands by the irrigation season of 1931 and the work is being pushed forward as rapidly as possible with that end in view. The first 3½ miles of the canal was completed during fiscal year 1930, including the headworks and diversion structure. An additional 56 miles, as far as Little Wood River, is practically all under construction, with contracts providing for completion in time for delivery of water to Little Wood River at the beginning of the irrigation season of 1931. The remaining 11 miles to connect with the North Gooding Canal of the Big Wood Canal Co. will be contracted during fiscal year 1931 and it is hoped to have it completed at least as far as the Big Wood River some time during the irrigation season of 1931. After the main canal is completed a lateral system is to be constructed for some 36,000 acres of new lands now entirely without a water supply, but this will probably not be undertaken until after the fiscal year 1932. Expenditures during the fiscal year 1931 were approximately $1,660,000 and proposed expenditures for the fiscal year 1931 are $1,100,000.

RIVERTON PROJECT, WYOMING

Construction of the Pilot Canal and laterals was continued during fiscal year 1930. The canal was completed to about mile 29 and laterals for about 15,000 acres were under construction. Except to complete these laterals where contracts have already been entered into, it is probable that no further construction work will be done on this project during fiscal year 1931, as Congress in the appropriation act for that year has provided that no part of the funds shall be available for construction purposes until a sugar factory has been constructed or contracted for, on or in the vicinity of the project, a branch railroad constructed to Pavillion, Wyo., or vicinity; and a repayment contract executed by the Midvalei rrigation district.

SUN RIVER PROJECT, MONTANA

Enlargement of the Greenfields main canal below Pishkun Reservoir for a distance of 36 miles is in progress. One section is being relocated and replaced by a new canal 14 miles in length known as the Spring Valley Canal. This canal is being constructed under contract which was awarded in October, 1929, and is due for completion by December, 1930. The remaining portion is being enlarged by Government forces, using two electric drag lines, work having begun in July, 1929. The Pishkun Reservoir, which will serve as an equalizer for the canal, is to be enlarged to a capacity of 14,000 acre-feet, thus making unnecessary the enlargement of the canal above the reservoir. Bids for this work were opened April 16, 1930, and award was made to Smith & Thornquist of Great Falls. It is hoped to complete

all enlargement work before January 1, 1931, as the Greenfields irrigation district is to take over the operation of the irrigation system on that date. Expenditures for the fiscal year 1930 were approximately $350,000 and proposed expenditures for 1931 are $380,000.

KLAMATH PROJECT, OREGON-CALIFORNIA

During the fiscal year 1930 enlargement of the diversion channel which carries excess water from Lost River into Klamath River, thus preventing the flooding of the old bed of Tule Lake, where lands have been opened to settlement, was continued. This enlargement is now about 50 per cent completed and should be finished during fiscal year 1931. The total estimated cost is about $200,000. Lateral construction for the Tule Lake division was also in progress to extend the system to an additional 3,000 acres, and during the irrigation season of 1930 it is expected that 13,500 acres will be under irrigation. Lateral construction will continue during fiscal year 1931, completing facilities for the 3,000 acres begun in 1930 and constructing laterals for an additional 3,000 acres. Settlement of the Tule Lake division, formerly the bed of Tule Lake, is progressing very satisfactorily. Of the 13,900 acres opened so far, 11,100 acres were taken and under cultivation in 1929, and over 12,000 acres will probably be under cultivation during 1930.

DRAINAGE CONSTRUCTION

Drainage programs already in progress on the Belle Fourche, Lower Yellowstone, and Shoshone projects were continued during the fiscal year 1930. Appropriations are available to continue this work in the fiscal year 1931, and during that year the work on the Shoshone and Lower Yellowstone projects should be completed. The program on the Belle Fourche project will probably require until the fall of 1932 for completion. Work on the Belle Fourche and Lower Yellowstone projects is principally by contract and on the Shoshone project by Government forces.

Some drainage and protective work has been in progress on the Tule Lake division of the Klamath project during fiscal year 1930 to take care of new lands being brought under irrigation. This work will continue as needs develop, an appropriation of $70,000 being available for the purpose in fiscal year 1931. A contract was entered into under date of November 24, 1928, with the Klamath irrigation district for the reconstruction, enlargement, and extension of the present drainage system of the main division of the Klamath project at a cost not to exceed $300,000. This work was begun in fiscal year 1930 and will be continued during fiscal year 1931, with an appropriation of $100,000. Excavation is being performed by Government drag lines while the structures are being contracted where practicable.

Drainage construction is in progress in the El Paso division of the Rio Grande project to the extent of $50,000, which the district is advancing. Other small drainage programs are also continuing as needs develop on the Yuma, Grand Valley, Boise, and Minidoka projects, appropriations being available in both the fiscal years 1930 and 1931.

OPERATION AND MAINTENANCE

On December 31, 1929, operation and maintenance of the Frannie division of the Shoshone project was transferred to the Deaver irrigation district and on December 31, 1930, operation of the Greenfields division of the Sun River project will be transferred to the Greenfields irrigation district, after which the Sun River project will be entirely under operation by the districts, the Fort Shaw division having been transferred to the Fort Shaw irrigation district on December 31, 1926. This will bring to 19 the number of projects or divisions of projects completed and turned over to irrigation districts or water users' associations.

The Vale project and the Kittitas division of the Yakima project, beginning with calendar year 1930, were added to the list of projects or divisions of projects being operated by the bureau with appropriated funds, bringing the total so operated (after December 31, 1930) to 11. These two projects, however, are only to be operated until construction is completed, when they will be turned over under existing contracts to the districts. Five of the eleven, Carlsbad, Orland, Rio Grande, Yakima, and Yuma, are completed or practically so and can be turned over at the option of the districts or associations, but the remaining four, Boise-Payette division, Klamath-Tule Lake division, Riverton, and Shoshone-Willwood division, are not yet ready for district operation.

Seven projects, or divisions of projects, after December 31, 1930, will continue under full operation by the bureau with funds advanced by the districts or water users' associations, while reserved works only will be operated by the bureau with funds advanced on three other projects. Of the seven projects, five are to be transferred to the districts or associations at later dates, the Lower Yellowstone, December 31, 1931; the Grand Valley and Uncompahgre, January 1, 1932; the Belle Fourche, December 31, 1933; and the Milk River, January 1, 1936. No provision has yet been made for transferring the remaining two, Klamath-Main division and Yuma Auxiliary, although negotiations are under way toward the transfer of the former.

SECONDARY AND ECONOMIC INVESTIGATIONS

In fiscal year 1930 Congress appropriated $75,000 for the usual cooperative and general investigations of the feasibility of proposed new projects, and an additional $150,000 in the second deficiency act of 1929, principally for preliminary investigations and studies in connection with the proposed Boulder Canyon development. For fiscal year 1931, $75,000 has again been appropriated for the usual investigations and an additional $275,000 in the first deficiency act of 1930, available both in 1930 and 1931, which is also principally for preliminary investigations and studies in connection with the proposed Boulder Canyon development. For economic surveys and investigations in connection with existing projects or proposed projects $50,000 was appropriated in fiscal year 1930 and a like amount in 1931.

BOULDER CANYON PROJECT

The Boulder Canyon project act, which authorizes the construction of the Boulder Canyon project, including the Boulder Dam, a power plant, and the All-American Canal, was signed by the President on December 21, 1928. Under date of June 25, 1929, the six months' period prescribed in the act for awaiting ratification of the Colorado River compact by the seven Colorado River Basin States having expired without the ratification of Arizona, the President issued a public proclamation declaring the Boulder Canyon project act to be effective. The Secretary of the Interior has designated the Bureau of Reclamation to construct the project.

The act authorizes the appropriation of not to exceed $165,000,000, subject to ratification of the Colorado River compact by at least six of the basin States; agreement by the State of California to limit its annual consumption of Colorado River water; and execution of contracts for power revenues adequate to pay operation and maintenance expenses and to meet repayment requirements stated in the act. Contracts for the sale of sufficient power to return revenues adequate, in the judgment of the Secretary of the Interior, to insure repayment of all costs within 50 years of the date of completion of the works, were executed in April, 1930, with the Metropolitan Water District, the city of Los Angeles, and the Southern California Edison Co. The requirements as to ratification of the Colorado River compact by six States and agreement by

California to limit its consumption of water have also been met.

In the absence of an appropriation for the construction of this project, the work undertaken by the bureau up to this time has necessarily been restricted to such preliminary investigations, designs and estimates as could be financed from the reclamation fund, through appropriations for secondary investigations, and from funds advanced by interested parties. In the designing section of the Denver office numerous technical studies were made in connection with working out the final section to be adopted for the dam; construction plans and methods were studied and previous estimates were reviewed and brought up to date. The principal modification made in the previous plans was an increase of 25 feet in the height of the dam. Detailed designs of the dimensions of the dam for this increased height were approved by the Colorado River Board of Engineers, which was appointed in accordance with Senate joint resolution of May 29, 1928.

A small testing laboratory was established at Las Vegas, Nev., in September, 1929, and work has been carried on since that date on the investigation of various deposits suitable for concrete aggregates and the testing of these materials. It is important to secure information on all available aggregates prior to passage of the proposed appropriation bill in order to avoid delay in beginning of actual construction work.

In the spring of 1929 investigations and surveys to establish the final location of the All-American canal were started and field work was continued until May, 1930. This work was performed in cooperation with the Imperial irrigation district and the Coachella Valley County water district, these organizations advancing one-half the cost. Plans and estimates for the various canal lines located in the field are now being worked up in the Denver office.

An appropriation of $10,660,000 has been approved by the Bureau of the Budget and submitted to Congress by the President to finance the work proposed on the Boulder Canyon project during the fiscal year 1931. If this appropriation is made available, construction work will be inaugurated at the earliest possible date. The principal features to be first undertaken are:

(*a*) The construction of a branch railroad from the main line of the Union Pacific near Las Vegas, Nev., to a point near the dam site, for which an appropriation of $2,500,000 has been requested.

(*b*) Erection of a construction town to house the Government employees engaged on the work, including office and living quarters for employees, roads from the town site to the canyon rim, street improvements, water and sewer systems, for which $525,000 has been requested.

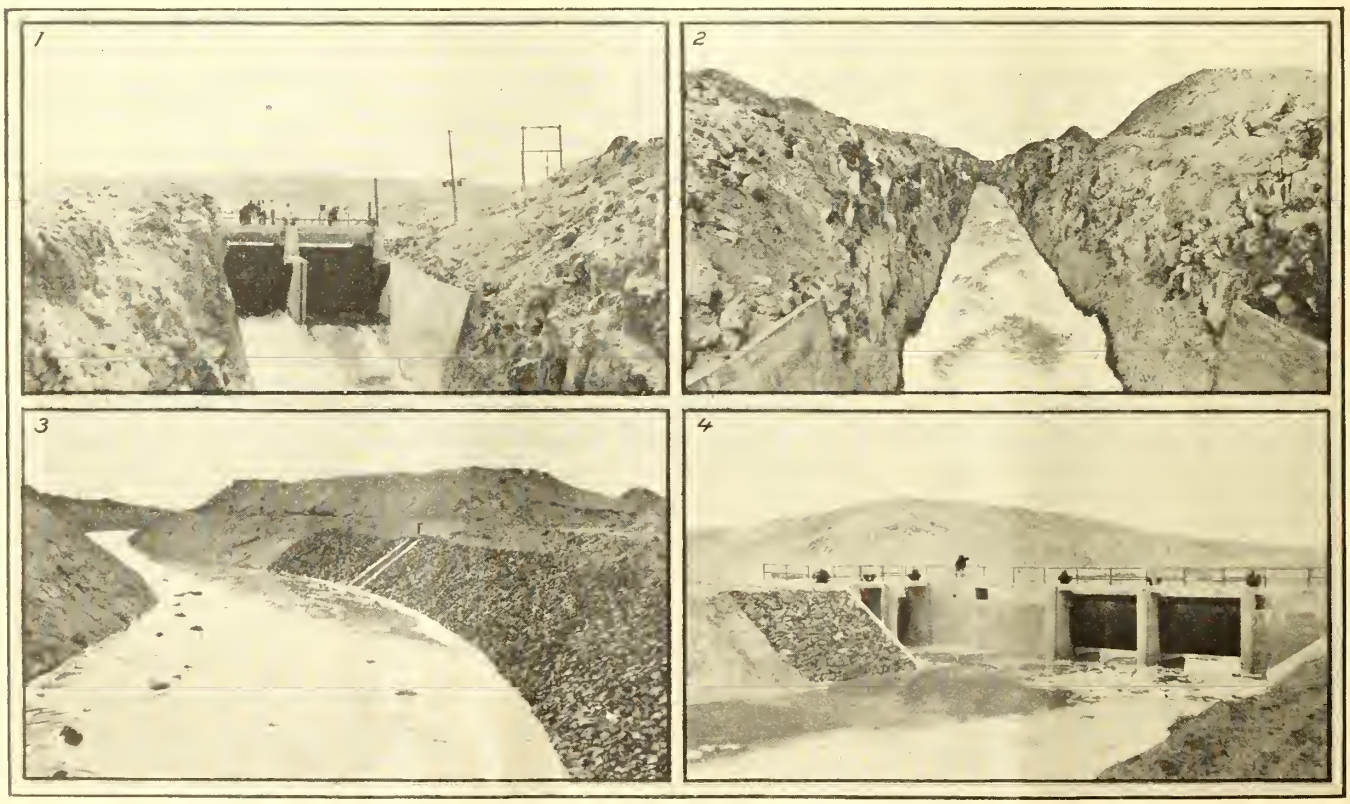
(*c*) The purchase of power or construction of a temporary power plant to provide power for construction purposes, which is estimated to cost $1,750,000.

(*d*) The purchase of private lands and property to be flooded by the reservoir and rights of way required for other purposes, estimated to cost $500,000.

(*e*) Construction of Boulder Dam. The first work to be undertaken will be the construction of the proposed diversion works which will consist of four 50-foot diameter tunnels aggregating 16,000 feet in length. An appropriation of $5,000,000 has been requested for commencement of work on these tunnels in the fiscal year 1931.

If the initial appropriation as requested by the President is approved by Congress, work will be started immediately on the above features and prosecuted with all possible dispatch. It is expected that a 10-year period will be required to complete the dam and the permanent power plant.

The object of Federal reclamation is not to supplant private projects but to undertake projects involving the construction of extensive works beyond the financial and organizing capacity of private enterprise.

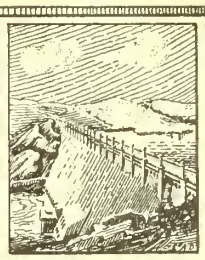


Milner-Gooding Main Canal, Gooding Division, Minidoka project, Idaho

1. Headworks. 2. First head of water. 3. View on canal. 4. Turnout for North Side Canal Company.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Elephant Butte Is Largest Artificial Irrigation Reservoir

THE Elephant Butte Reservoir on the Rio Grande project in New Mexico, which stores the waters of the Rio Grande for irrigation, is still the largest artificial irrigation reservoir in the world, although now closely pressed for this distinction by several other reservoirs. Capacity and not area is taken as the determining factor, and the Elephant Butte Reservoir when full contains 2,638,000 acre-feet of water, an acre-foot being the amount of water which will cover 1 acre 1 foot deep. For comparison the water in this reservoir would cover an area about twice as large as the State of Delaware 1 foot deep. The reservoir is 40 miles long, with an average width of 1½ miles, and the area is 40,080 acres.

FOREIGN RESERVOIRS

Closely pressing the Elephant Butte in capacity is the Assuan Reservoir on the Nile in Egypt with a present maximum capacity of 2,282,100 acre-feet, which is the amount of water over and above the normal flow of the river. The Nile carries a maximum of 353,000 and a minimum of 14,000 cubic feet per second. With the raising of the Assuan Dam to its ultimate height of 144 feet, which is now being undertaken, the reservoir capacity will be increased to 4,060,000 acre-feet. The present reservoir is about 180 miles long and the reservoir when the raising of the dam is completed will extend up the Nile a distance of 200 miles. The Hume Reservoir now under construction near Albury in New South Wales, Australia, by the River Murray Commission will store 2,000,000 acre-feet. A still larger reservoir is being built at Mettur in the Madras Presidency in India, on the Cauvery River, which will have a capacity of 2,150,000 acre-feet. Both of these foreign reservoirs will store water for irrigation.

OTHER FEDERAL IRRIGATION RESERVOIRS

In this country the Bureau of Reclamation has not only constructed the largest irrigation reservoir but also several others which are larger than any of those privately constructed. The American Falls Reservoir on the Snake River, Minidoka (Federal) irrigation project in Idaho, has a capacity of 1,700,000 acre-feet. It is 25 miles long with a maximum width of 12 miles and the average depth is 40 feet. The area of the lake is 56,200 acres, making it the largest in area of the Bureau of Reclamation reservoirs. Next in size is the Roosevelt Reservoir formed by the dam of the same name on the Salt River in Arizona, it being the storage reservoir for the Salt River (Federal) irrigation project. It is located 77 miles by road from Phoenix, Ariz., and is a popular pleasure resort. With an area of 18,300 acres, this reservoir will hold 1,637,300 acre-feet of water. The Roosevelt is one of a chain of four lakes formed by the Roosevelt, Horse Mesa, Mormon Flat, and Stewart Mountain Dams extending along the Salt River for 60 miles.

On the North Platte (Federal) irrigation project in Nebraska-Wyoming, the Pathfinder storage reservoir on the North Platte River in Wyoming, about 50 miles southwest of Casper, has a capacity of 1,070,000 acre-feet. It extends 23 miles up the North Platte and 15 miles up the Sweetwater River and has a maximum width of 4 miles. The Owyhee Reservoir now under construction by the Bureau of Reclamation on the Owyhee River in eastern Oregon will have a capacity of 715,000 acre-feet. Jackson Lake Reservoir on the Snake River in northwestern Wyoming stores water for the Minidoka (Federal) irrigation project in Idaho and has a capacity of 847,000 acre-feet. It is the largest of several beautiful bodies of water lying along the eastern slope of the Teton Mountains, south of the Yellowstone National Park. The Coolidge Dam recently completed by the United States Indian Service, on the Gila River near Florence, Ariz., forms the San Carlos Reservoir, which can store 1,200,000 acre-feet, to be used for irrigation of lands in the project of that name.

LAKES USED PARTLY FOR IRRIGATION

Lake Tahoe, in the Sierra Nevada Mountains in California-Nevada, has a water-

Roosevelt Reservoir on Salt River and Tonto Creek, Ariz.

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surface area of 120,000 acres and is one of the largest lakes in the world. In length it is about 22 miles and the maximum width is 12 miles. Within a range of 6 feet vertically the Bureau of Reclamation and a power company regulate the lake as a storage reservoir, and the Newlands (Federal) irrigation project in Nevada benefits by this storage. Upper Klamath Lake supplies water for irrigation to the Klamath (Federal) irrigation project, and the California-Oregon Power Co., regulates the lake outflow by the Link River dam in accordance with a contract with the United States. Lake regulation permits the Government to control 400,000 acre-feet of storage. This lake has an area of 60,000 acres, a maximum length of 22 miles, and width of 5 miles. On the Flathead irrigation project in Montana, which is under the supervision of the United States Indian Service, the irrigation plan provides that the water supply shall be supplemented when necessary by pumping from Flathead Lake. The lake has an area of 107,000 acres and a capacity of 1,800,000 acre-feet.

BOULDER CANYON RESERVOIR

The 55 reservoirs on Bureau of Reclamation projects (not including Boulder Canyon) either constructed, now under construction, or proposed, will have a combined area of 526,135 acres and capacity of 14,618,320 acre-feet, enough water to cover the States of New Hampshire, Massachusetts, and Connecticut 1 foot deep. The proposed Boulder Canyon Reservoir will have a maximum capacity of 30,500,000 acre-feet, about twice as large as all reclamation reservoirs combined. The area of the reservoir will be about 145,000 acres, or 227 square miles, and the length about 115 miles. At the dam this reservoir would have a maximum depth of approximately 575 feet. It would take from one and one-half to two years to fill if all the river flow was retained and from three to five years under operating conditions.

This great lake with its upper end extending into the lower section of the Grand Canyon will be interesting from a scenic standpoint, and consideration is being given to setting aside the reservoir and adjoining area as a national monument. With this in view, a blanket withdrawal of 4,212 square miles has been made in the Boulder Dam region in Arizona and Nevada, in order that the lands can be thoroughly studied by Government experts.

LARGEST ARTIFICIAL NONIRRIGATION RESERVOIR

Outside of the irrigation reservoirs, the lake formed by the Gatun Dam, on the Chagres River in the Canal Zone, Panama, is the largest artificial reservoir in the world with its 4,413,000 acre-feet capacity. The lake area is 107,200 acres. In Australia the Great Lake Reservoir, on a power project in Tasmania, has a capacity of 1,150,000 acre-feet, and is the largest in that country at the present time. The Burrinjuck irrigation-storage reservoir on the Murrumbidgee River in New South Wales is second in size, with 771,641 acre-feet capacity. Both of these will soon be surpassed by the Hume Reservoir. The Lloyd Dam on the Yelwandi River near Poona, India, forms a reservoir which stores 555,500 acre-feet of water for irrigation, and is now the largest in India, but the Cauvery-Mettur Reservoir will hold four times as much water. In Mexico the Don Martin Dam, on the Nueva Espana irrigation project, stores 1,136,000 acre-feet of the waters of the Salado River.

Near Columbia, S. C., the Lexington Power Co. is now building the Saluda Dam on the Saluda River. Behind this immense earthen embankment will be formed a lake 41 miles long and 14 miles wide. It will have a shore line of 520 miles, a capacity of 750,000,000,000 gallons (2,300,000 acre-feet), which is sufficient water to supply 160 cities each of 50,000 population for a period of one year. To fill this lake will require 10 months of average stream flow. In this country the largest privately constructed reservoir at the present time is the one formed by the Martin power dam on the Tallapoosa River in Alabama. The storage capacity is 1,376,000 acre-feet for a drawdown of 60 feet, and the reservoir area is 39,400 acres, with a shore line of 750 miles.

The following table lists reservoirs used wholly or partly for irrigation:

Name	State or country	Capacity	Area	Length	Average width
		Acre feet	*Acres*	*Miles*	*Miles*
Elephant Butte	New Mexico	2,638,000	40,080	40	1½
American Falls	Idaho	1,700,000	56,055	25	4
Roosevelt	Arizona	1,637,300	18,300	23	2
Coolidge	do	1,200,000	22,000	18	2
Pathfinder	Wyoming	1,070,000	22,700	23	2
Jackson Lake	do	847,000	25,540	10	4
Owyhee [1]	Oregon	[4] 1,120,000	13,000	40	1
Boulder Canyon [2]	Arizona-Nevada	30,500,000	145,000	115	2
Lake Tahoe	California-Nevada	[3] 120,000	124,000	22	10
Flathead	Montana	[3] 1,800,000	120,300	28	8
Upper Klamath Lake	Oregon	[3] 400,000	60,000	22	5
Assuan	Egypt	2,282,100	68,940	180	-------
Cauvery Mettur [1]	India	2,150,000	37,760	-------	-------
Hume [1]	Australia	2,000,000	-------	-------	-------
Don Martin	Mexico	1,136,000	48,412	5	6
Burrinjuck	Australia	771,641	-------	-------	-------
Lloyd	India	555,500	-------	-------	-------

[1] Under construction.
[2] Authorized for construction.
[3] Part of capacity utilized for irrigation storage.
[4] Includes 405,000 acre-feet of dead storage.

Jackson Lake Reservoir, Minidoka project, Idaho. Teton Mountains in background

Notes for Contractors

Yakima-Kittitas.—Bids were opened on June 3 at Denver for furnishing two 42-inch internal differential needle valves (specifications No. 511) for the Yakima River crossing-wasteway. The Steacy-Schmidt Manufacturing Co., of York, Pa. was the low bidder at $13,700, with a delivered cost of $14,274.66.

Klamath project.—The Harnischfegar Corporation has been awarded the contract, under specifications No. 479-D, for furnishing one drag-line excavator, capacity 1½ cubic yards. The bid price was $25,420, with delivered cost of $26,700.66.

Minidoka project.—Specifications are being prepared for the purchase of a pumping unit of 180 second-feet capacity for the South Side first lift pumping station.

Vale project.—Bids were opened on June 9 (specifications No. 481-D) for construction of the Bully Creek and Fairman Coulee siphons on the Vale Main Canal. Low bidders on the construction schedules were as follows: Schedule 1, W. H. Puckett Co., $55,401; schedule 2, Western Pipe & Steel Co., $228,000.

Sun River project.—Smith & Thornquist of Great Falls, Mont., with a bid of $110,824, have been awarded the contract for constructing the dikes for Pishkun Reservoir enlargement. They were the second low bidders.

Secondary Projects

All field work in connection with the Gila River cooperative investigations has been completed and the report should be available early in July The All-American Canal field surveys and investigations are completed and H. J. Gault is working on his report in the Denver office. A reconnaissance of the Big Lost River drainage area near Mackay, Idaho, has been made by E. B. Debler. The preliminary report on the Angeles Dam and Reservoir site, Red Bluff project, Texas, was signed on June 2 and has been distributed. The engineering report on the Alcova-Casper project, Wyoming, has been completed and field work on the Saratoga project is now in progress.

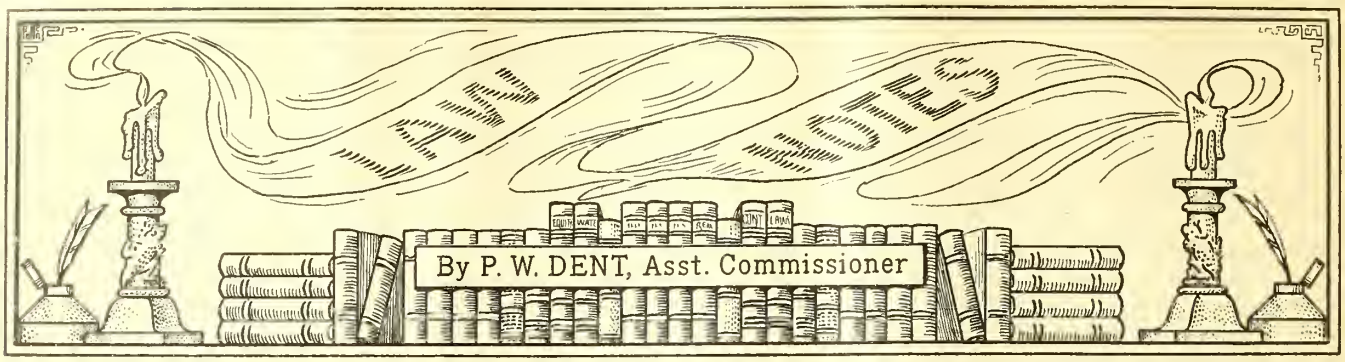
Dnieper Power Development European Russia

A fall of 820 feet in the 1,400-mile length of the Dnieper River in European Russia is to be utilized for power development by Soviet Russia. The first stage of the project now under construction comprises a dam with 120 feet head, a flight of locks, a hydroelectric plant of 350,000-horsepower capacity, and 100 miles of railway. The Dnieper is the third largest river in Europe and drains an area of 193,000 square miles. Power, navigation, land reclamation, and railway transportation are the purposes of the project. The second stage of development will comprise an increase in power, plant capacity to 650,000 horsepower-construction of two hydroelectric plants on the lower Dnieper of 80,000 horsepower each, improvement of the lower river for navigation, and reclamation of arid lands by pumping for irrigation. Hugh L. Cooper & Co., of New York City, are consulting engineers on the project.

Congress Approves Hydraulic Laboratory

The act authorizing the establishment of a national hydraulic laboratory at the Bureau of Standards, Washington, D. C., was signed by the President on May 14. An appropriation of $350,000 for this purpose, to be expended by the Secretary of Commerce, was authorized. Dr. George K. Burgess, Director of the Bureau of Standards, has asked that an advisory committee be formed whose duty it will be to aid in the design and scope of the laboratory. The committee will be composed of representatives from bureaus interested in field problems in hydraulics, and the American Engineering Council has been asked to designate non-governmental representatives. Emory W. Lane, engineer assigned to the Denver office, will be the Bureau of Reclamation representative, with Charles A. Bissell, chief of engineering division, Washington office, as alternate.

Street scene in Ellensburg, Kittitas Division, Yakima project, Wash.



Payment by United States of Costs and Attorney Fees

IN a suit brought by the United States against Ben Franks et al. to condemn certain land in connection with the Owyhee project the defendants under section 7105 of Olson's Oregon Laws, 1920, demanded costs and attorney fees of the United States. Section 7105, referred to, is as follows: "The costs and disbursements of the defendant, including a reasonable attorney's fee to be fixed by the court at the trial, shall be taxed by the clerk and recovered from the corporation, but if it appear that such corporation tendered the defendant before commencing the action an amount equal to or greater than that assessed by the jury, in such case the corporation shall recover its costs and disbursements from the defendant, but the defendant shall not be required to pay the plaintiff's attorney fee."

In a memorandum decision dated March 10, 1930, District Judge McNary refused to consider the claim. The decision in full follows:

"It has been settled by judicial authority that attorney fees can not be awarded against the United States in litigation wherein the Government of the United States is a party. Such right does not exist at common law, and it has never been authorized by act of Congress.

"Under the laws of the State of Oregon attorney fees are allowed to a defendant in a condemnation case in certain instances; but the legislature of this State can not impose a liability upon the United States.

"In Kohl et al. *v.* United States, 91 U. S. 367, 374, the court said: 'If the United States have the power (eminent domain), it must be complete in itself. It can neither be enlarged nor diminished by a State. Nor can any State prescribe the manner in which it must be exercised. The consent of a State can never be a condition precedent to its enjoyment.'

"The fact that a corporation would become the owner of a beneficial use in the premises sought to be condemned would not change the rule, as these proceedings are brought in the name of the United States and under the authority of an act of Congress.

"The allegations and matters described in the motion are immaterial and will be stricken from the answer."

A similar result as to the payment of costs by the United States was reached by Judge Dietrich, in connection with condemnation suits brought by the United States to condemn land in Idaho needed for the American Falls Reservoir, Minidoka project. The defendants in these cases were Lawrence B. Wade, Clarence B. Wade, M. A. Driscoll, and Peoples Bank & Trust Co. Judge Dietrich's memorandum decision of April 8, 1926, is as follows:

"I have sought earnestly to find some ground upon which I could make an exception to the general rule that costs can not be awarded against the Government in litigation in which it is a party. I am inclined to think that under the State statute in respect to costs in condemnation proceedings, costs should be equitably apportioned within the discretion of the court as the facts warrant, and such, I think, is a fair rule; but there really does not seem to be any more reason for awarding costs against the Government in a condemnation proceeding than in any other class of litigation. If the Government brings an unfounded suit against a citizen upon any other alleged cause of action, and is unsuccessful, it turns out, under the general rule prohibiting costs against the Government, that the citizen has been put to costs in defending a right which the Government has wrongfully assailed. A property right in real estate is no more sacred than any other property right, and the reasons for allowing costs against the Government in a condemnation proceeding are no more cogent than the reasons for awarding costs against it in any other proceeding.

"In the examination that I have been able to make of the texts and authorities, I have found no exception to the general rule prohibiting allowance of costs against the Government. My attention has been called to the case of United States *v.* Engeman, 46 Fed. 898, where in fact apparently such costs were allowed in a condemnation proceeding, but so far as appears the point here urged and relied upon by the Government was not called to the attention of the court. The opinion does not intimate that any such question was considered.

"With not a little reluctance, therefore, I feel constrained to follow the general rule, and hence to deny the several claims of the defendants for costs, and such will be the order."

A similar result was reached by the Circuit Court of Appeals, Second Circuit in the well-considered case of Carlisle *v.* Cooper, 1894, 64 Fed. 472. In that case the Government instituted a condemnation suit, but was compelled to dismiss same by reason of insufficient funds being appropriated to meet the award. The trial court awarded costs against the United States. Upon an appeal to the Circuit Court of Appeals, the judgment was reversed, the court holding that the conformity acts of Congress of June 1, 1872, and of August 1, 1888, did not warrant the trial court in following the State practice and awarding costs against the United States when a plaintiff in a condemnation suit.

The Circuit Court of Appeals, Second Circuit, in *In re* post-office site in Borough of the Bronx (1914), 210 Fed. 832, again refused to award costs against the United States.

R. V. Meikle, chief engineer of the Turlock irrigation district, California, states that for the year 1929 the gross revenue per dollar invested in power development was 12.1 cents. Comparative figures for some of the Federal irrigation projects are: North Platte, 17.1 cents; Shoshone, 11.3 cents; Yuma, 19.2 cents; and Boise (Black Canyon), 14 cents.

Amendment of Charter of Water Users' Association

The case of Wood *v.* Salt River Valley Water Users' Association (Inc.), decided by the Circuit Court of Appeals, Ninth Circuit, March 17, 1930, and not yet printed, involves the same point ruled upon by the Supreme Court of Arizona in Orme *v.* Salt River Valley Water Users' Association, 1923, 217 Pac. 935, 25 Arizona, 324, and in Citrus Growers' Development Association *v.* Salt River Valley Water Users' Association, 1928, 268 Pac. 773.

The Salt River Valley Water Users' Association was organized in 1903 for the purpose of cooperating with the United States in constructing the Salt River project under the act of June 17, 1902, 32 Stat. 388, the association agreeing to pay the cost of the project. The charter of the corporation, as required by a statute of the Territory in force when the corporation was organized, limited its maximum possible indebtedness to two-thirds of its capital stock, but article 19 of the articles permitted the association to amend its articles by a two-thirds vote to avail itself of the benefits of any subsequent State legislation.

In 1923 the State lesiglature amended the general corporation law so as to permit a corporation to incur an indebtedness exceeding two-thirds of its capital stock, upon, among other things, being authorized to do so by a three-fourths vote. Thereupon the stockholders by more than a three-fourths vote authorized the larger indebtedness.

A minority of the stockholders was opposed to the additional indebtedness and contested its legality without success in the two State cases cited above. Baffled in the State court, the minority resorted to the Federal courts, alleging a violation of article 1, section 10 of the Federal Constitution, "No State shall * * * pass any * * * law impairing the obligation of contracts."

The decision of the Circuit Court of Appeals was adverse to the claim of the minority stockholders, the court saying: "There is no contention here that the State imposed its will upon the corporation regardless of the desires of the stockholders of the corporation. The fact is that the legislation was entirely permissive and that the corporation accepted and voted upon this permission. The Dartmouth College case (Dartmouth College *v.* Woodward, 4 Wheat. 518, 4 L. Ed. 629) is strongly relied upon by the appellant, but the situation here is entirely different. The legislature is not seeking in any way to dominate the affairs of the appellee corporation, and the question of the power of the State to change the charter of the corporation by an act hostile to the wishes of the corporation, its stockholders, or members is not involved."

Pending Legislation Affecting Federal Reclamation

UMATILLA PROJECT, OREGON

S. 4234, introduced by Senator Steiwer, of Oregon, April 21, 1930, to provide for the termination of Federal operation of the Hermiston irrigation district and the West Extension irrigation district of the Umatilla irrigation project, Oregon.

The bill directs cancellation of all water-right contracts with the two districts, and with all individuals whose lands lie within the boundaries of either of such districts of the Umatilla project, together with cancellation of all obligations arising under all such contracts. The Secretary is directed to release all liens against lands in such irrigation districts on account of water-right charges in favor of the United States. A provision is made for the conveyance to the Hermiston irrigation district and the West Extension irrigation district, jointly, of all right, title, and interest of the United States in and to the irrigation works incident to the portion of the project mentioned.

May 1, 1930, the Secretary addressed a letter to the Senate Committee on Irrigation and Reclamation, expressing agreement with the commissioner's view that no action should be taken on the bill until after the proposed congressional visit to the project.

TAXATION OF UNPATENTED ENTRIES

S. 4318, introduced by Senator Walsh, of Montana, April 30, 1930, to amend the act entitled "An act to permit taxation of lands of homestead and desert-land entrymen under the Reclamation Act," approved April 21, 1928.

This bill proposes to amend the act of April 21, 1928 (45 Stat. 439), so as to make it applicable to ceded lands of entrymen under Indian irrigation projects, as well as to lands under the reclamation act. A new section would also be added providing for the termination of the State tax liens if the lands of any such entryman should revert to the United States.

May 24, 1930, the Secretary reported that he had no objection to offer to the passage of the bill if amended as recommended by Commissioner Mead.

June 4, 1930, reported with amendments by the Committee on Public Lands and Surveys.

June 5, 1930, passed by the Senate.

June 9, 1930, passed by the House.

June 13, 1930, signed by the President.

A similar bill, H. R. 12288, was introduced by Hon. Scott Leavitt, of Montana, on May 9, 1930.

May 29, 1930, reported by the House committee with amendments.

DIVISION OF WATERS OF COLORADO RIVER

S. 4390, introduced by Senator Phipps, of Colorado, May 7, 1930 granting the consent of Congress to compacts or agreements among the States of Colorado, New Mexico, Utah, and Wyoming, with respect to the division and apportionment of the waters of the Colorado River and all tributary streams above Lee Ferry.

The bill would give the consent of Congress to the negotiation of compacts among the upper States on the Colorado River watershed, and thus open the way for the development of the water supply on the upper Colorado, in the same manner as the Boulder Canyon project act provides for the development of the water rights on the lower Colorado.

May 16, 1930, the Secretary transmitted to the Senate committee memorandum of the commissioner, with which he expressed agreement, recommending approval of the bill, with slight amendments.

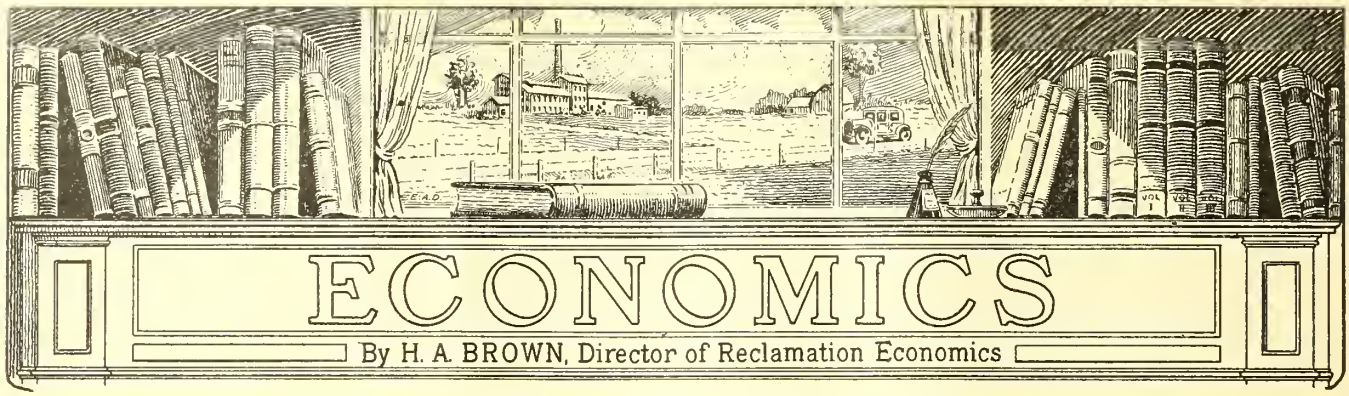
RELINQUISHMENT OF LAND TO RUPERT, IDAHO

H. R. 9987, introduced by Congressman Smith, of Idaho, February 17, 1930, to provide for the relinquishment by the United States of certain lands to the city of Rupert in the county of Minidoka in the State of Idaho.

This bill provides for the conveyance to the city of Rupert of a strip of land through the city and adjoining the property of the Oregon Short Line Railroad Co. The strip was originally reserved by the United States as a canal right of way, but the canal was built on another location.

March 10, 1930, the Secretary transmitted to Congress a memorandum from the acting commissioner suggesting certain amendments to the bill, stating that there was no objection to the proposed

(Continued on p. 143.)



Meeting of Committee on the Conservation and Administration of the Public Domain

The Committee on the Conservation and Administration of the Public Domain, appointed by President Hoover to make a study of and report on public-land problems, met in the Interior Building, Washington, D. C., during the past week. The following members were present:

Dr. Ray Lyman Wilbur, Secretary of the Interior, ex officio member.

Arthur M. Hyde, Secretary of Agriculture, ex officio member.

James R. Garfield, chairman, of Cleveland.

I. M. Brandjord, Helena, Mont.

James P. Goodrich, Winchester, Ind.

Perry W. Jenkins, Big Piney, Wyo.

Rudolph Kuchler, Phoenix, Ariz.

George W. Malone, Carson City, Nev.

George Horace Lorimer, Philadelphia, Pa.

Dr. Elwood Mead (representing California), Washington, D. C.

I. H. Nash, Boise, Idaho.

William Peterson, Logan, Utah.

Mrs. Mary Roberts Rinehart, Washington, D. C.

Huntley N. Spaulding, Rochester, N. H.

R. K. Tiffany, Olympia, Wash.

Wallace Townsend, Little Rock, Ark.

E. C. Van Petten, Ontario, Oreg.

Francis C. Wilson, Santa Fe, N. Mex.

The meetings of the committee were held for the purpose of obtaining reports from the various Government offices having to do with the administration and disposition of the public domain. Reports were received in writing from various departments and bureaus, and conferences were held with the heads of the General Land Office, Bureau of Reclamation, Geological Survey, National Park Service, Indian Office, chairman of the Interior Department Oil Committee, and the Forest Service. Reports were presented by the representatives of the public-land States, covering the conditions of the State lands, their disposition, administration, and use. Reports were received from all the States regarding the use made by those States of the public domain within their boundaries.

The committee has suspended hearings in order to give the members an opportunity thoroughly and carefully to study the mass of material presented. No conclusions have been reached nor can be reached at this time. The points developed show clearly how diverse and intricate are the many problems interwoven with the details of the administration, use, and disposition that have been made and might be made of the public domain.

The committee is studying conservation as applied to resources such as water, timber, grazing, coal, oil, gas, phosphates, potash, and other minerals in relation to the public domain. The committee has found that no problem of use of one resource can be considered alone, but that each is quite likely to be and generally is complicated by the use of the public domain for various other purposes.

The report from the General Land Office shows much administrative detail in the survey of the public domain and its disposition in accordance with many acts of Congress, covering a period of more than 75 years. Disposition of the unreserved and unappropriated public domain can only be made subject to the various interests and rights that have vested in those who have initiated those rights under the laws of the United States. The committee is also considering the effect of railway grants made to transcontinental systems, and various rights of way granted from time to time, or authorized, by Congress.

During the summer months there will be informal conferences between the individual members of the committee as opportunity occurs, in order to enable them to become familiar with the various problems and the interrelation of the uses of the Federal and State lands.

It is apparent from the material now before the committee that the problem of the conservation of the resources of the country is one of great intricacy and will require careful study before a useful conclusion can be reached. The committee appreciates that conservation does not mean the indefinite locking away of resources, but does mean their wise use in accordance with the current, as well as future, needs of our people. The problem also involves careful study of the relations between the Nation and the States, to the end that the resources within each State may be developed to produce the greatest possible benefits to the State in harmony with the needs of the Nation and the requirements of the public welfare.

Comments from Australia on Economic Report of 1929

Under date of May 5, H. H. Dare, M. E., M. Inst. C. E., Commissioner of Water Conservation and Irrigation Commission, New South Wales, Australia, wrote to Commissioner Mead setting forth his ideas, as well as those of his colleagues, on the recent report on an Economic Survey of Certain Federal and Private Irrigation Projects in the United States. The administrative officials in Australia are confronted with problems similar to those covered by this report, and Mr. Dare's statement is of interest in showing how certain economic difficulties are overcome in Australia as outlined in the following paragraphs:

"*Agricultural advice.*—The State Departments of Agriculture of Australia provide fully qualified officers to give

advice to settlers. No settler should want for any information and assistance in this connection. The salaries are paid by the State government, and are in no way a charge on the projects. We hold that anything which will allow of the extension of such facilities can only result in benefit to the settlers.

"*Control of settlement of private lands.*—The system now in vogue at Vale and Owyhee, under which every owner is required to sell at an independently appraised valuation any excess over 160 acres is noted and we will be glad to hear at a later date how this system is found to work. Something in the nature of a betterment tax has been proposed in this State, but for the present no definite decision has been arrived at as to its introduction.

"*Lands of low production.*—We have found it necessary with certain limited areas to declare them unfitted for irrigation, and in connection with adjustments of indebtedness generally we have waived the debt on such lands. It is noted that you have a similar problem in certain of your projects.

"*Conclusion.*—In conclusion my colleagues and I would like to offer our congratulations to the compilers of the report, which, if we may say so, is very clear and interesting. We feel that the information contained in the report and in the very valuable appendix should be of the greatest assistance to your bureau. Even at this distance it is of considerable value to us."

Preliminary population figures on project towns, 1930 census

State	Town	Population 1930	Population 1920	Percentage of increase
Arizona	Chandler	1,377	(1)	------
	Phoenix	47,950	29,053	65
Colorado	Grand Junction	10,459	8,665	20
	Montrose	3,502	3,581	−2.2
Idaho	Boise	21,644	21,393	1.1
	Burley	5,569	5,304	4.9
	Caldwell	4,942	(1)	------
	Nampa	8,128	7,621	6.6
Nevada	Las Vegas	5,151	2,304	123.6
New Mexico	Carlsbad	3,689	(1)	------
	Las Cruces	5,799	3,969	46.1
Oregon	Klamath Falls	16,053	4,801	234.3
Utah	Provo	14,753	10,303	43.2
	Spanish Fork	3,720	4,086	−8.9
	Springville	3,748	3,010	24.5
Washington	Cle Elum	2,512	2,656	−5.4
	Yakima	22,093	18,539	19.2
Wyoming	Casper	16,746	9,043	85.2
	Cody	1,793	1,242	45.1
	Laramie	8,599	(1)	------

[1] No census.

Exports of the United States in the first quarter of this year totaled $1,129,000,000.

American redwood is being used in railway construction in South America.

Bird Refuges on the Reclamation Projects

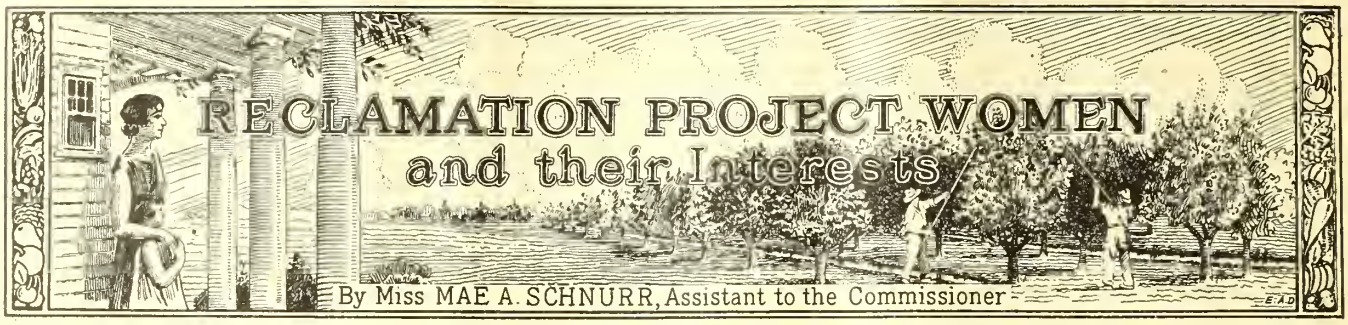
As pointed out in a recent publication, "with the increase in population and more intensive use of land, the need for the protection of wild life becomes each year of greater importance. This need has led to the establishment of reservations throughout the United States and its possessions where birds and mammals are afforded special protection."

For many years the Bureau of Reclamation has cooperated with the Bureau of Biological Survey in the establishment of bird refuges on the Federal irrigation projects, with the result that there are now 17 such bird sanctuaries located on the projects. Some of these areas have been protected by Executive order or act of Congress for more than 20 years.

The accompanying table shows the location of these bird refuges, by States and projects, their official designation, the date of the Executive order or act under which they were created, the acreage of the protected area, and the chief species of birds protected. Any complete list of the species protected at the various reservations would be too voluminous to print. The species listed in the table are the principal ones found on the various areas, or the ones for which the refuges are primarily maintained.

State and project	Designation of refuge	Date of Executive order or act	Acreage of refuge	Chief species protected
Arizona: Salt River	Salt River	1909	21,120	Cormorants, pelicans, ducks, geese.
California: Klamath	Clear Lake	1911,1912	33,840	Gulls, cormorants, pelicans, ducks, geese, herons.
	Tule Lake	1928	10,300	Ducks, geese, shore birds.
Idaho:				
Boise	Deer Flat	1909	12,300	Ducks, geese, pheasants.
Minidoka	Minidoka	1909,1912	13,240	Grebes, terns, cormorants, pelicans, ducks, coots, avocets, herons, grouse.
Montana: Sun River	Pishkun	1912	3,160	Gulls, ducks, geese, swans.
	Willow Creek	1909	3,200	Ducks, geese.
Nebraska: North Platte	North Platte	1916	5,107	Ducks, geese, swans, shore birds.
New Mexico:				
Carlsbad	Carlsbad	1909	18,680	Ducks, shore birds.
Rio Grande	Rio Grande	1909	55,680	Grebes, cormorants, ducks, geese, shore birds.
Oregon:				
Umatilla	Cold Springs	1909	2,520	Ducks, geese, swans, herons, grouse.
Klamath	Klamath Lake (see California).	1915,1921	81,619	Ducks, geese, coots, gulls, shore birds.
Umatilla	McKay Creek	1908	1,813	Ducks, geese.
Klamath	Upper Klamath Wild Life Refuge.	1927	8,140	Do.
South Dakota: Belle Fourche	Belle Fourche	1928	13,680	Ducks, geese, curlews, prairie chickens, pheasants.
Washington: Okanogan	Conconully	1909	1,120	Gulls, ducks, herons, sooty and sharp-tailed grouse, partridges.
Wyoming: North Platte	Pathfinder	1909	34,949	Ducks, geese.

Picking raspberries on the Minidoka project, Idaho



The series of articles on 4-H Club work on Federal reclamation projects was completed with the May ERA. The Orland project in the State of California offers the first article on vocational education in agriculture. Nothing more worth while can be done to keep on the land the growing boys and girls of our projects than to give to them a better knowledge of what is involved and an education as to how to do things in a better and more profitable manner. As soon as project boys and girls realize that a comfortable, profitable living can be made on an irrigated farm, just so soon will their minds be made up to own one of their own. The various educational projects carried out through 4-H Club work and vocational training are purposely made profitable, as it is only in that way that the average junior is interested and willing to make a greater effort toward a better showing.

The Federal Board of Vocational Education was set up by the Government to encourage vocational education, and the desire for it throughout the country is recognized by increased appropriations and stimulus given the movement by the ardent, zealous, untiring efforts of the field agents placed in the various States. The type of leaders selected to guide the plans of forward-looking boys and girls is very high class, as is shown by the results.

It is not only local interest which is encouraged, as may be seen by the way the various local organizations spread out to other cities and States, in an endeavor to give a broadened knowledge to the prize winners in local groups. This means contacts and the creation of a spirit of cooperation that is so necessary in any organization work.

One year's work piled on top of the other means a goal toward being a leader; and leaders in agricultural pursuits, especially in agricultural States, are so apt to become leaders in all civic affairs. That means progress for a State.

The Orland project has made the first showing to pass on to readers of the ERA. We hope other projects will follow, in order that a series of stories may be carried in consecutive issues and our projects will benefit as a result of the exchange of views, ideas, and happenings on the subject of vocational education.

Vocational Agriculture on the Orland Project, Calif.

By R. W. Guilford, Director of Vocational Agriculture, Orland High School

The Orland High School has offered vocational agriculture in its curriculum since 1922. The work was begun under the direction of Guy Smith. Mr. Smith retired from teaching to take over a farm on the project in 1923, and since then the writer has been in charge of the work.

The students in this department study agriculture in a practical way, each boy carrying on a home project in connection with which he tries out the knowledge gained at school. The instructor visits the boy at his home regularly to supervise his project work.

The different courses offered include animal husbandry, soils and crops, and horticulture, which are carried on under the direction of the State board for vocational education through its staff of supervisors. Each year the courses at Orland have been approved to receive money from the Federal appropriations carried in the Smith-Hughes bill.

The Orland boys have been active in the judging activities held in connection with fairs and shows of different kinds. At the Glenn County Fair held in Orland last fall the Orland High School stock judging team received first place in competition with nine other school teams, thereby winning the W. S. Guilford trophy. At the annual university farm picnic day held at Davis last April the Orland agronomy team was high team in a contest involving 28 schools. The Agricultural Department also sent a judging team to Los Angeles to take part in a contest held in connection with the Los Angeles Christmas livestock show. In this contest Carrol Sherrod, an Orland High School student, won third place in judging sheep in competition with 215 other boys.

They have also shown livestock at fairs. Carrol Sherrod showed a Poland China sow and litter at the State fair last fall in the junior division, and also entered them at the Glenn County fair. In all, his prizes for the season totaled about $100. Four boys—Wilmer Macy, Carrol Sherrod, Delbert Youtsey, and Leo Hayton—exhibited fat stock at the annual fat stock show in South San Francisco last November.

In all of these activities the boys have shown a keen interest, and they have had experiences which will be of value to them in later life, no doubt in connection with farms on the Orland project, on which their parents now operate irrigated land.

Titles to Illustrations on Opposite Page

1. Future farmers' float in school parade, Glenn County fair at Orland, October, 1929.
2. Delbert Youtsey and Shropshire wether lamb, shown at fat stock show, San Francisco, November, 1929.
3. Wilmer Macy and Shropshire wether lamb, shown at fat stock show, San Francisco, November, 1929.
4. Orland High School judging team. Winners of W. S. Guilford trophy in stock judging contest. Left to right: Wilmer Macy, Delbert Youtsey, and Carrol Sherrod.
5. Orland agronomy team—winners of the university farm contest at Davis, April, 1929: Joseph Kasak, left; William Linton, right; Jasper Lichsteiner, sitting.
6. Students judging dairy cattle, Glenn County fair, Orland, October, 1929.

ACTIVITIES OF VOCATIONAL EDUCATION IN AGRICULTURE

ORLAND IRRIGATION PROJECT CALIFORNIA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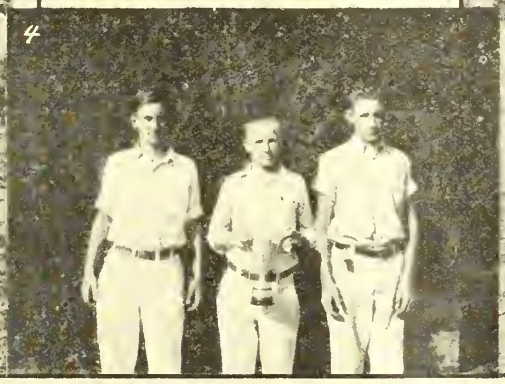
2


3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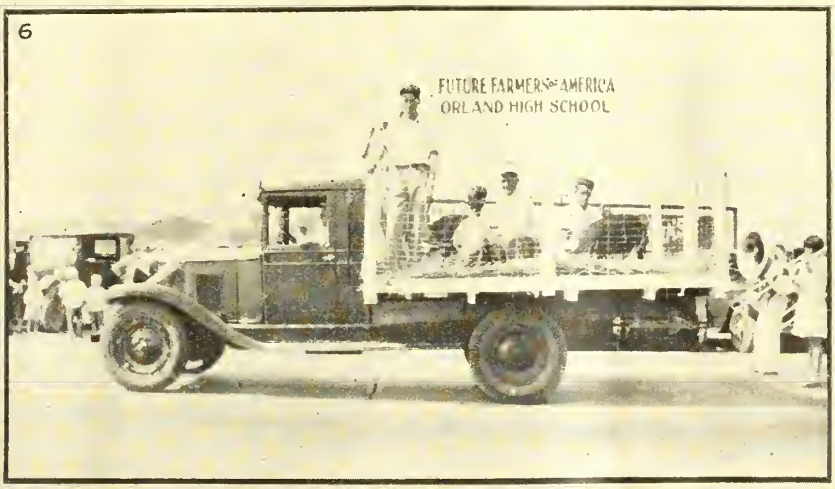

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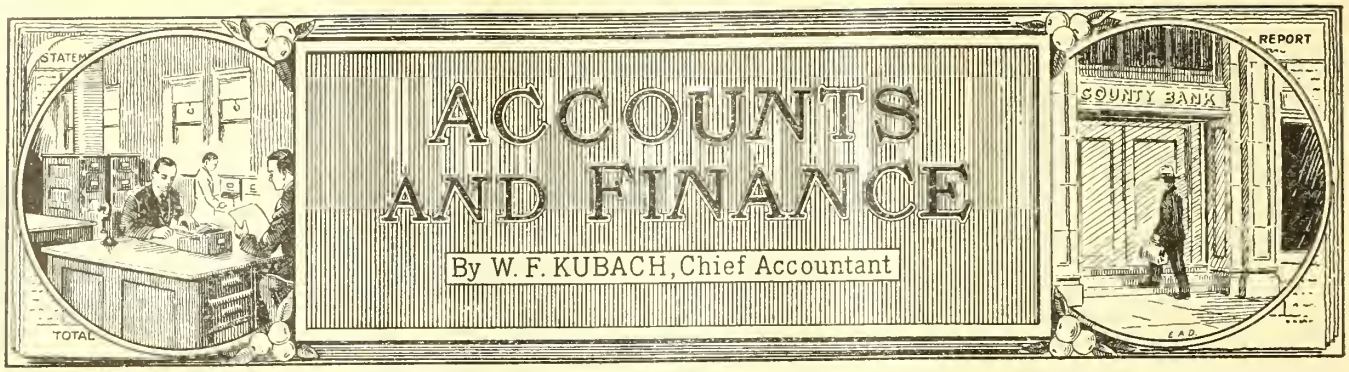


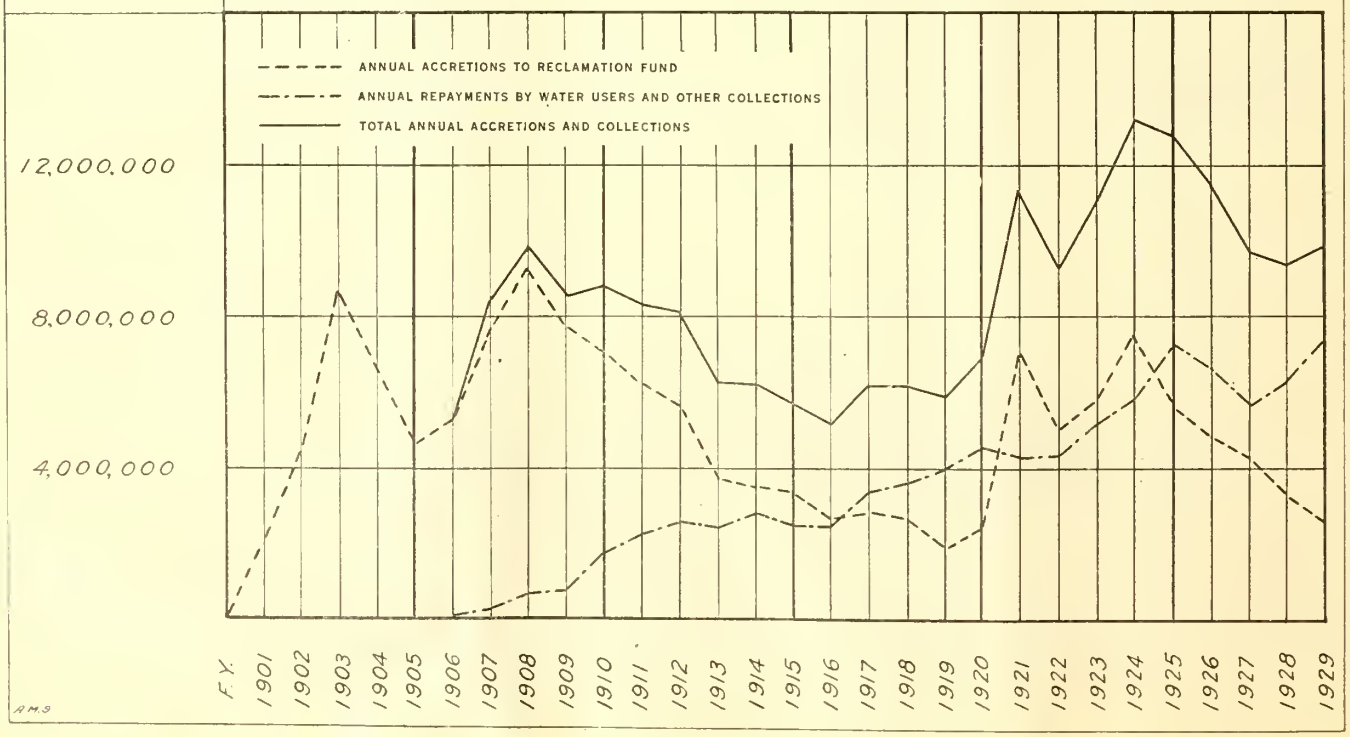
ACCOUNTS AND FINANCE

By W. F. KUBACH, Chief Accountant

The Reclamation Fund

In the February, 1930, issue of the New Reclamation Era, there appeared an article entitled "The Reclamation Fund." This article was more or less an historical discussion, giving total accretions to the fund from the various sources. Since this article appeared in the Era there has been an increased demand for data showing the accretions to the fund and collections from water users and other sources by fiscal years. The accompanying tables give this information in detail and the annual income to the fund is graphically shown on the accompanying chart.

F.Y.	Annual Accretions to Reclamation Fund	Annual Repayments by Water Users and Other Collections	Total Annual Accretions and Collections
1901	3,144,822		3,144,822
1902	4,585,520		4,585,520
1903	8,713,997		8,713,997
1904	6,826,254		6,826,254
1905	4,805,515		4,805,515
1906	5,166,336		5,166,336
1907	7,914,132	244,736	8,158,868
1908	9,430,574	543,830	9,974,404
1909	7,755,467	774,436	8,529,903
1910	7,028,186	1,842,804	8,870,990
1911	6,135,548	2,173,277	8,308,825
1912	5,657,499	2,485,272	8,142,771
1913	3,737,911	2,395,683	6,133,594
1914	3,460,452	2,772,719	6,233,171
1915	3,268,058	2,427,944	5,696,002
1916	2,648,058	2,391,397	5,039,455
1917	2,865,386	3,244,734	6,110,120
1918	2,552,650	3,581,427	6,134,077
1919	1,959,497	3,972,950	5,932,447
1920	2,422,615	4,506,180	6,928,795
1921	7,096,662	4,248,273	11,344,935
1922	4,963,910	4,313,152	9,277,062
1923	5,777,995	5,151,985	10,929,980
1924	7,405,825	5,749,575	13,155,400
1925	5,588,785	7,156,957	12,745,742
1926	4,971,490	6,601,667	11,573,157
1927	4,125,311	5,555,408	9,680,719
1928	3,176,110	6,127,220	9,303,330
1929	2,529,740	7,321,698	9,851,438



Accretions to the reclamation fund from June 17, 1902, to June 30, 1929

Fiscal year ended June 30—	Proceeds from: Sales of public lands	Oil-leasing act	Potassium royalties and rentals	Federal water-power licenses	Total
1901	$3,144,821.91				$3,144,821.91
1902	4,585,520.53				4,585,520.53
1903	8,713,996.60				8,713,996.69
1904	6,826,253.59				6,826,253.59
1905	4,805,515.39				4,805,515.39
1906	5,166,336.50				5,166,336.50
1907	7,914,131.71				7,914,131.71
1908	9,430,573.98				9,430,573.98
1909	7,755,466.81				7,755,466.81
1910	7,028,185.73				7,028,185.73
1911	6,135,547.76				6,135,547.76
1912	5,657,498.88				5,657,498.88
1913	3,737,910.55				3,737,910.55
1914	3,460,451.63				3,460,451.63
1915	3,268,057.73				3,268,057.73
1916	2,648,057.74				2,648,057.74
1917	2,865,386.34				2,865,386.34
1918	2,552,650.65				2,552,650.65
1919	1,959,496.88				1,959,496.88
1920	2,422,614.77				2,422,614.77
1921	2,466,273.08	$4,617,665.13	$12,724.47		7,096,662.68
1922	1,775,500.80	3,186,806.74	1,495.71	$106.31	4,963,909.56
1923	1,382,853.13	4,391,425.59	1,958.46	1,757.44	5,777,994.62
1924	705,076.48	6,693,908.15	3,792.91	3,048.13	7,405,825.67
1925	757,109.97	4,820,614.96	5,216.52	5,844.17	5,588,785.62
1926	509,624.61	4,448,373.42	5,791.94	7,700.07	4,971,490.04
1927	604,001.04	3,504,689.93	3,634.21	12,986.29	4,125,311.47
1928	705,822.66	2,454,168.66	5,552.90	10,565.63	3,176,109.85
1929	647,236.95	1,852,785.03	12,517.57	17,201.18	2,529,740.73
Total	109,631,974.40	35,970,437.61	52,684.69	59,209.22	145,714,305.92

Reclamation fund collections by fiscal years

Fiscal year	Construction repayments	Operation and maintenance repayments	Miscellaneous collections [1]	Sale of reclamation town lots	Total
1907 and prior			$183,201.14	$61,535.00	$244,736.14
1908	$154,203.18	$15,114.53	361,648.49	12,864.06	543,830.26
1909	145,638.04	55,711.35	563,069.04	10,017.85	774,436.28
1910	602,981.03	178,811.31	1,000,898.79	60,112.86	1,842,803.99
1911	630,353.38	267,756.66	1,205,697.75	69,468.80	2,173,276.59
1912	623,559.12	360,139.97	1,486,348.71	15,224.10	2,485,271.90
1913	871,586.87	458,334.04	1,047,977.45	17,784.74	2,395,683.10
1914	426,404.64	559,960.02	1,771,074.06	15,280.25	2,772,718.97
1915	636,242.33	171,407.23	1,601,857.46	18,436.28	2,427,943.30
1916	786,171.13	380,859.98	1,203,176.95	21,189.28	2,391,397.34
1917	681,021.73	525,548.71	2,006,912.79	31,250.15	3,244,733.38
1918	1,409,136.59	851,290.26	1,260,009.71	60,990.56	3,581,427.12
1919	1,414,039.27	1,009,483.20	1,494,064.69	55,362.49	3,972,949.65
1920	1,824,540.76	1,628,139.97	1,009,685.68	43,813.21	4,506,179.62
1921	1,427,921.28	1,417,832.85	1,346,130.00	56,388.93	4,248,273.06
1922	1,299,635.12	1,576,485.35	1,418,386.87	18,645.08	4,313,152.42
1923	2,334,805.79	1,803,337.29	1,005,785.14	8,057.04	5,151,985.26
1924	2,715,523.50	1,855,953.54	1,172,358.67	5,739.32	5,749,575.03
1925	4,245,439.01	1,607,913.25	1,299,134.92	4,470.16	7,156,957.34
1926	3,438,382.58	1,734,295.77	1,428,020.94	967.88	6,601,667.17
1927	2,131,591.29	2,264,403.34	1,167,214.91	* 7,801.96	5,555,407.58
1928	3,149,150.99	1,897,488.75	1,103,348.18	* 22,767.56	6,127,220.36
1929	4,297,118.15	1,734,732.19	1,290,001.38	* 153.83	7,321,697.89
Total	35,245,445.78	22,354,999.56	27,426,093.72	556,874.69	85,583,323.75

[1] Miscellaneous collections include water rentals, sales of power and light, rentals from grazing and farming lands, sale of surplus material and supplies, penalties on construction charges, etc.

Reclamation Organization Activities and Project Visitors

Commissioner Mead plans to leave Washington for the West on or about July 10. At this time he will make his regular summer inspection of the projects.

Doctor Mead's proposed trip to the Virgin Islands has been canceled, owing to the Boulder Dam legislation then pending in Congress and to an automobile accident to his daughter Sue, which will keep her in the hospital for several weeks. W. H. Nalder, engineer assigned to the Denver office, who was to have accompanied Doctor Mead on this trip, sailed from New York on June 19. Mr. Nalder will act in a consulting capacity on the irrigation possibilities of the islands for the raising of cane and the promotion of the sugar industry. He will probably be absent from the Denver office about two weeks.

Hugh A. Brown, Director of Reclamation Economics, has been designated executive secretary of the Committee on the Conservation and Administration of the Public Domain, appointed by President Hoover to make a study of and report on public domain problems. The office of the committee is in the Interior Department building. Mr. Brown retains his connection with the bureau as Director of Reclamation Economics.

Miss Mae A. Schnurr, assistant to the commissioner, represented the bureau at the twenty-fourth annual meeting of the American Society of Agricultural Engineers, June 16–19, at Moline, Ill. Miss Schnurr was the first woman delegate to attend a reclamation session of this society. She was unanimously appointed to membership on the reclamation committee.

Col. F. Mears, engineer in charge of the western division of the Great Northern Railway, and other assistants made several calls at the Klamath project office during the month relative to the proposed contract between the United States and the Great Northern Railway for the joint construction of the dike and railroad grade across Tule Lake.

Reclamation Economist George O. Sanford is scheduled to leave Washington for the West early in July, his itinerary to include the North Platte, Belle Fourche, Huntley, Lower Yellowstone, Milk River, and Sun River projects. He will take up with the respective projects various matters connected with their economic development.

On Saturday, June 14, Miss Marguerite Sherman, one of the very efficient stenographers of the Washington office, and Mr. Herbert L. Uppercue, of Washington, were married.

Early in the month Division Supt. A. C. Bowen and Colonization Agent Dan Noble, of the Milwaukee Railroad, visited the Sun River project.

Barry Dibble, former project manager of the Minidoka project, now in private practice in Los Angeles, was among the recent visitors to the project.

Capt. Charles R. Trowbridge, field representative of the Department of the Interior, was a visitor at the Washington office during the latter part of June.

Prof. H. M. Westergaard, who has been employed by the bureau for special mathematical studies in connection with the design of Boulder Dam, left Denver the latter part of the month to make a comprehensive study of cracks in dams.

Pending Legislation

(Continued from p. 137)

legislation, provided the amendments were adopted.

March 13, 1930, reported with amendments.

May 24, 1930, passed by the House with amendments.

May 26, 1930, referred to Senate Committee on Public Lands and Surveys.

Articles on Irrigation and Related Subjects

Mead, Elwood.
Planting Trees in Irrigation Areas. United States Daily, May 26, 1930, p. 12.

Priest, R. M.
Use of Concrete Piles in Construction of Flumes, Yuma Project. United States Daily, May 22, 1930, p. 6: Engineering and Contracting, June, 1930, pp. 252–253.

Brown, Hugh A.
Supplemental Water for Irrigation. Agricultural Engineering, May, 1930, pp. 179–180.

Westergaard, H. M.
Flaws in Dams to be Subject of Observation. United States Daily, May 22, 1930, p. 7.

Scattergood, E. F.
Community Development in the Southwest as Influenced by the Boulder Canyon Project. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 1–5.
Status of Boulder Canyon Power Allocations. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 36–40.

Thomas, Franklin.
Metropolitan Water Distribution in the Los Angeles Area. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 6–11.

Griswell, Ralph L.
Colorado River Conferences and Their Implications. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 12–19.

Weymouth, Frank E.
Major Engineering Problems: Colorado River Development. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 20–28.

Bayley, E. A.
Financial and Topographical Problems of the Colorado River Aqueduct Project. Annals of the American Academy of Political and Social Science, March, 1930, Pt. III of Vol. 148, pp. 29–35.

Lampen, Dorothy.
Economic and Social Aspects of Federal Reclamation (foreword by Dr. Elwood Mead): Johns Hopkins University studies in historical and political science, ser. XLVIII, No. 1. Published also as thesis, Johns Hopkins University, 1929, 125 pages.

United States Reclamation Board aids in water study

Clearing the way for early completion of investigations into California's coordinated water program, with a view to securing definite action on the project at the next session of the State legislature, Governor Young has announced that the United States Reclamation Bureau will undertake an immediate economic study of the water conservation plan.

The Reclamation Bureau inquiry, designed chiefly to determine the physical and financial feasibility of the proposed plan for conservation and full utilization of Sacramento-San Joaquin Valley waters, will be carried on under a cooperative agreement initiated by Governor Young with the United States Department of the Interior. It will supplement the work of Army engineers, now investigating navigation and flood-control phases of the problem, and the study of the Hoover-Young Water Commission.

Governor Young announced that the Secretary of the Interior has approved a $25,000 deficiency appropriation as the Federal Government's share in cost of the investigation, which will be matched by a similar State allotment.

"I am very gratified at this new evidence of the earnest desire of the national administration to assist California in working out a satisfactory solution of our water problem," Governor Young declared in announcing enlistment of the Reclamation Bureau's aid.

The Malayan Government may establish irrigation projects in the nonfederated Malay State of Kelantan.

Huntsville damsite and Pioneer dam, Ogden Canyon, Utah

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer. **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
G. O. Sanford, Reclamation Economist

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Orland	Orland, Calif	R. C. E. Weber	do	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	J. C. Page	do	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Acting supt	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent	N. O. Anderson		do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	H. W. Bashore	Constr. engr	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	P. J. Preston	Superintendent	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Acting constr. engr.	E. R. Mills	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	E. W. Shepard	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gravity Extension division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. dist	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho.	F. L. Kinkade.	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford.	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont
Milk River, Chinook division	Alfalfa Valley irrigation district.	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation dist	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tont	Harlem, Mont.
Do	Paradise Valley irrig. dist	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist.	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	A. B. Reeves	do	Mrs. Nelle Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. dist	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. dist	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. dist	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm F. B. Chase	Do.
Strawberry Valley	Strawberry Valley W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Yuma, Ariz	H. J. Gault	Imperial and Coachella Valley districts.
Gila River Basin	Safford, Ariz	O. C. Smith	States of Arizona and New Mexico.
Sacramento-San Joaquin Valley	Sacramento, Calif	C. A. Bissell	State of California.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga	Saratoga, Wyo	J. R. Iakisch	State of Wyoming.

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NEW
RECLAMATION ERA

VOL. 21, NO. 8 AUGUST, 1930

BLACK FIGS GROWN ON THE ORLAND PROJECT, CALIFORNIA

FEDERAL RECLAMATION

. . . a beneficent policy

AT the Western States Reclamation Conference, held in Salt Lake City June 26-27, Honorable George H. Dern, Governor of Utah, characterized the Federal reclamation act as "that beneficent, constructive piece of legislation which, without any expense to the taxpayers of the United States, but solely through creating a revolving fund out of the proceeds of the sale of public lands and out of mineral royalties from public lands situated in the States themselves, has contributed so magnificently to the development of the western part of the United States and thereby has increased the glory and grandeur of our common country."

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 August, 1930 No. 8

Interesting High Lights on the Federal Reclamation Projects

DURING the month Jack Brockie, of Rupert, Minidoka project, shipped 850 head of sheep to Denver, for which he received $9.60 per head.

CONTINUED interest in the settlement opportunities afforded on the Riverton project was manifested in June, when several prospective settlers were shown over the project.

THE amount of butterfat handled in June by the Mini-Cassia Dairymen's Association, Minidoka project, exceeded that of the corresponding month last year by 5,600 pounds.

THE Interstate Commerce Commission has granted the Great Northern Railway Co. the right to extend its line from Klamath Falls, Oreg., to Keddie, Calif., where it will connect with the Western Pacific Railroad. Construction on this line will probably start within the next 30 days.

A MOVEMENT to dispose of the unsettled lands in the Shasta View irrigation district, Klamath project, is being organized. The lands are being extensively advertised and plans were being made to sell the lands by auction early in the month.

NEGOTIATIONS with the Kennewick irrigation district, Yakima project, are being expedited in the hope that work on the Kennewick Highlands may be started this year.

PICKING of cantaloupes continued all month on the Yuma project, with the quality and yields reported as good. This year's acreage is approximately 2,000 and the prices for the crop which will be harvested by August 1 are considered very fair.

ANNOUNCEMENT has been made that Rapid City, S. Dak., a large railroad town south of the Belle Fourche project, is to become the center of a new flax straw-linen industry which will have ramifications throughout the northwestern part of the United States and Canada. The industry is to be based on a new retting machine recently invented which is said to extract the linen fiber without the old-time soaking process. The company has been incorporated in Delaware with a capital of $1,000,000. A degumming plant and storehouse will be erected in Rapid City in time to handle this year's flax straw.

FOUR new silos made their appearance on the Belle Fourche project during the month, which gives a good indication of advances in the dairy industry on the project.

COLONIZATION work was continued by the agent employed by the railroads and sugar company on the Lower Yellowstone project, and two prospective settlers were shown over the project. Several auto loads of prospective settlers are expected on the project as soon as farm work conditions in Colorado will permit.

THE new San Carlos Hotel on the Yuma project, which is rapidly nearing completion, will provide the town of Yuma with added hotel facilities of the most modern type.

Iron Hull of Boat Found

The iron hull of a Government boat has been found 16 miles south of San Luis, Mexico, near the boundary of the Yuma project and 9 miles from the present Colorado River bed. The boat, which was apparently 40 feet in length, has been identified as one constructed and operated by Captain Iver, United States Army, in 1870.

THE greatest interest in irrigation in the history of the Milk River project is being manifested this season. A considerable amount of land which has never before been irrigated will be watered and fair crops from these lands are anticipated.

OFFICIALS of the Utah-Idaho Sugar Co. and the colonization agent of the Great Northern Railway visited the Milk River project during the month to look over the lands available for settlement. It is stated that they intend to concentrate their efforts upon the settlement of the Malta division.

BASED on gross earnings Echo Dam, Salt Lake Basin project, was 98 per cent complete at the end of June.

THE canning factory at Cowley, Shosone project, started canning peas during the month, and from reports received this factory will do a much larger business this year than ever before.

THE latest report from the Lower Yellowstone project stated that gas would probably be available during the month, the construction of the natural gas pipe line from Glendive to Williston throughout the project and in the towns having been completed.

ARIZONA'S 1929 cotton crop amounted to 152,838 bales, according to the United States Census Bureau. In 1928 the State produced 145,731 bales of cotton. Maricopa County's 1929 crop amounted to 88,554 bales, against 87,700 for 1928.

THREE acres of pole beans and 3 acres of Irish potatoes brought last season a gross return of $1,100 to a Beckville, Tex., farmer.

Construction of Boulder Dam Begun on July 7, 1930

On July 7, immediately following the approval by President Hoover of the second deficiency act containing an appropriation of $10,660,000 for commencing construction at Boulder Dam, Order No. 436 was issued by Secretary Wilbur to Dr. Elwood Mead, Commissioner of Reclamation, as follows "You are directed to commence construction on Boulder Dam to-day."

Secretary Wilbur then made the following statement:

"The Boulder Dam will signalize our national conquest over the Great American Desert. With dollars, men, and engineering brains we will build a great natural resource. We will make new geography and start a new era in the southwestern part of the United States. With Imperial Valley no longer menaced by floods, new hope and new financial credit will be given to one of the largest irrigation districts in the West. By increasing the water supply of Los Angeles and the surrounding cities, homes and industries are made possible for many millions of people. A great new source of power forecasts the opening of new mines and the creation of new industries in Arizona, Nevada, and California.

"To bring about this transformation requires a dam higher than any which the engineer has hitherto conceived or attempted to build. It is to be placed in the bottom of a canyon, whose walls rise over 1,400 feet and through which flows a turbulent river, at times carrying a flow equal to the average of the Mississippi at St. Louis.

"The dam is to be built in a region of intense summer heat, amid desert surroundings, and where the public lands, in large part, are being surveyed for the first time.

MODEL TOWN TO BE BUILT

"To build the dam economically and efficiently requires that special attention be given to those factors which influence the health and energy of the workers. A thousand men will be employed over a period of five to eight years or longer. Many of these will have families, and this means that the town to be created near the dam site will have a population of 4,000 to 5,000 people. This town will not be a temporary construction camp. During the time that the dam is under construction, thousands of tourists will each year visit this section. When it has been completed, the lake 115 miles in length above it will draw other thousands because of its scenic beauties. Plans accordingly have been made to lay out a town which will represent the most modern ideas in town planning.

"The waterworks will be similar in character to those built at Yuma, Ariz., where the conditions of climate and water are similar to those at Boulder Dam.

"From the town site to the dam is about 3 miles. The town will be connected with the outside world by an automobile road and a railroad about 30 miles in length. It is not necessary that construction of the tunnels to divert the river shall await the completion of these facilities of living and transportation. There is a good road from Las Vegas to the canyon. Much of the equipment needed in tunnel construction can be hauled in over this road. A temporary construction camp can be located on the river, and the construction of the tunnels thereby expedited."

WARNING!

There will be no opportunity for the employment of laborers and mechanics at Boulder Dam until the contracts for construction are awarded. It will be at least two months before advertisements can be issued, and at least three months before awards can be made and contractors start work. The United States will employ few laborers or mechanics direct, but when the successful contractors for the railroad, Government camp, or highway are known, ample time will be given in notice to the public when labor is required. No one seeking labor should go there until such notice is given.

DIVERSION TUNNELS, HIGHWAY AND RAILROAD

"These diversion tunnels will be four in number, each 50 feet in diameter. Because of their size, their excavation will be very much like the operation of a quarry. The greatest problem will be the disposal of the excavated material. Part of it will be needed to build the cofferdams that will be placed in the river, above and below the site of the dam, to keep the water out of the excavation where the foundation of the dam is to be placed.

"The building of the road, the railroad, the tunnels, and the cofferdams will all precede the beginning of the great wedge, over 700 feet high, that is to close this river. While these earlier works are being built the final detailed plans for the dam will be completed. Only engineers who have had considerable familiarity with dams and power development can fully appreciate all that is involved in these plans. The dam is not merely a mass of concrete to hold the water back. It is a complex industrial structure traversed by pipes and corridors, in which will be placed the regulating gates and the valves for the dynamos which will generate a million horsepower of electrical energy, and the wasteways for controlling floods.

HOW THE MONEY WILL BE SPENT

"Of the initial appropriation of $10,660,000, $2,500,000 will be used to build the railroad, $525,000 will be expended in the construction of waterworks, laying out the town, building streets, sewers, and other conveniences of the town, and in the construction of a main office building for the Government engineers and clerical staff, and 25 homes for its permanent employees at the dam.

"The greater part of the 150,000 acres which will be flooded is public land, but scattered through it are small areas of privately owned land, the largest one being in the valley of the Virgin River. Title to these lands, and to whatever mining claims have merit, will have to be acquired.

"Five million dollars, of the initial estimate, is to be used in construction of the tunnels which will eventually cost $18,000,000. While the tunnels and the cofferdams are being built all the details of the dam and its power equipment will be worked out. The Reclamation Bureau will have the cooperation of the engineers of the Los Angeles Water and Power Department and the Southern California Edison Co. and its related companies. Confidence is felt that this power equipment will represent the highest efficiency yet achieved in any industrial development of this character.

DESIGN OF DAM IN COMPETENT HANDS

"The designing of this dam is in competent hands. No organization in any country has had greater experience in such work than the Bureau of Reclamation. Not a single dam of the 125 built by the Reclamation Bureau has failed. Its chief designing engineer, J. L. Savage, is recognized as a genuis in his line. He has successively designed three dams which at the time of their construction were the highest in the world. Boulder Dam adds another to this unique record. In addition to the corps of experts on the permanent staff of the bureau, it has as consulting engineers, A. J. Wiley, who has

an international reputation and is consulting engineer for the irrigation department of India; L. C. Hill, the designer and resident engineer on the Roosevelt Dam and many monumental works in this and other countries; and D. C. Henny, one of the foremost consulting engineers of the country.

"Because of the exceptional size of the dam and the difficult engineering problems involved, Congress thought it prudent to create a board of 5, 3 engineers and 2 geologists, who would review the plans and estimates prepared by the Bureau of Reclamation, and report direct to the President. The engineers on this board, Gen. William L. Seibert, builder of Gatun Locks at Panama, Daniel W. Mead, and Robert Ridgway, have approved all of the work thus far submitted to them, and will pass judgment on the detailed plans of the dam when these have been completed.

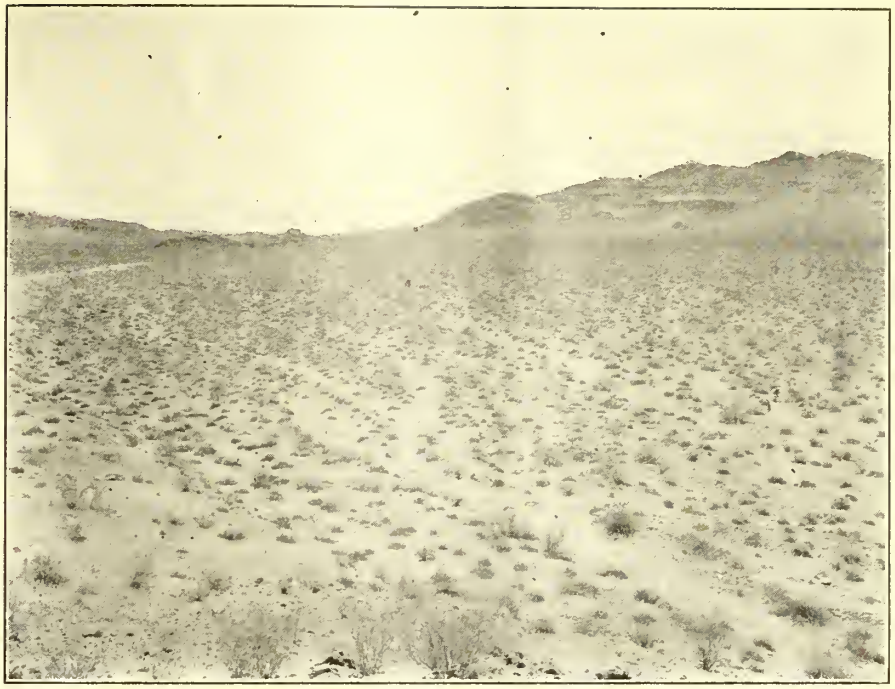
PROPOSED INVESTIGATIONS IN COLORADO RIVER BASIN

"Boulder Dam will not only be a monumental engineering work, but the laws authorizing it inaugurated the greatest scheme of rural planning yet undertaken in the West. That this scheme shall prove of the greatest possible value to the Nation, it necessitates now a study of all irrigation and power possiblities of the whole basin, and of the different States. Altogether, these investigations will deal with the possible future reclamation of 6,000,000 acres of land, an area equal to that now irrigated in the lower Nile. Consideration must be given to a possible 6,000,000 horsepower electrical development on the river as a whole.

"To bring into harmony the varying views and conflicting interests and to work out of this a properly correlated scheme of development, require ability and experience not alone of the engineer but of the economist and the statesman. The half century of extensive administrative experience of Commissioner Mead and his record as framer of successful policies are convincing evidence that this great opportunity for statesmanship is in capable hands.

"R. F. Walter, the chief engineer, who will be Commissioner Mead's right-hand man in this investigation and development, is also prepared, through long years of experience in the West and the exercise of large responsibilities, to deal effectively with the varied and difficult questions which must come up for decision.

"Of one thing the public should be warned and that is the unwisdom of going to the vicinity of the dam site in the expectation of getting work without ample provision to meet the emergency should this expectation fail. The dam site is located in the midst of a great desert with few inhabitants and slight opportunity for other employment than that which it may afford. Employment will develop only as contracts are let, and ample notice will be given when opportunities for work present themselves."



Location of proposed townsite on brink of Colorado River from point just inside of reservoir

Longest Train of "Cants" Is Re-iced in Yuma

A mile and a half of cantaloupes trekked into Yuma July 7, from the Imperial Valley en route to the eastern market, making a train of 167 cars with two locomotives pulling it. This, according to veteran trainmen of Yuma, is the longest "cant train" that has ever been pulled out of Imperial Valley. There have been lettuce trains as long and longer, but never before such a long string of just "cants."

There were 14 men in the train crew, and it was estimated that the freight bill, or the cost of placing the "cants" on the eastern market, would be approximately $100,000.

The cars, all the latest in refrigeration, are iced in Imperial Valley when loaded with "cants" and then are re-iced in Yuma, as well as at many points along the route.

The 1930 wool clip in the Salt River Valley is estimated to be about 2,500,000 pounds.

Four Upper Basin States Confer on Colorado

The first joint conference of officials of the Bureau of Reclamation with the governors, engineers, and attorneys of the four upper basin States on the Colorado River, namely, Colorado, Wyoming, New Mexico, and Utah, was held on July 21 at the State capitol building in Denver, with Dr. Elwood Mead, Commissioner of Reclamation, presiding. Doctor Mead was assisted by R. F. Walter, chief engineer.

The purpose of the conference was to secure cooperative action in the work of obtaining all possible data on water priorities, water flow, irrigation possibilities, feasible reclamation sites, and the acreage of land in each State that can be brought under economic reclamation in a comprehensive plan intended to cover a long period of years. It was agreed that each State would appoint a commission of four members to conduct preliminary surveys and prepare data for submission to a subsequent conference in Denver in August.

Representatives of the four States at the meeting were as follows:

Colorado.—M. C. Hinderlider, State engineer; R. J. Tipton, special research engineer; Gen. Robert E. Winbourn, attorney; Delph E. Carpenter, consulting engineer.

Wyoming.—Gov. Frank C. Emerson; John A. Whiting, State engineer; William O. Wilson, attorney general.

New Mexico.—Francis C. Wilson, attorney; Herbert W. Yeo, State engineer.

Utah.—William R. Wallace, Colorado River commissioner; Richard R. Lyman, member Utah Water Storage Commission.

Unwarranted Charges Against Federal Reclamation Answered in Able Address

REPRESENTATIVES of the various Western States met in Salt Lake City during the latter part of June for a conference on reclamation. One of the ablest addresses delivered at that conference was by Mr. R. E. Shepherd, president of the Twin Falls North Side Land & Water Co. and of the advisory board of the American Falls Reservoir District No. 1. Mr. Shepherd referred to four charges against Federal reclamation which he summarized as follows:

1. Twenty-five attempts have created 24 failures.
2. Thousands of misled settlers have suffered cruel losses of savings and years.
3. Enough unnecessary output has been thrown on the markets to depress prices for farmers in natural farming areas.
4. The Government has sustained heavy losses at the expense of taxpayers.

These charges were discussed by him in part as follows:

First.—As to the charge that the Bureau of Reclamation has generally failed in its reclamation projects. This is a most serious charge, and if true we would be among the first to know it, and would take the lead in calling upon Congress to repeal or modify the reclamation act.

It would be unfair to judge the work of the bureau by some of the early attempts made under more or less political pressure and before it was possible for the work to have been thoroughly organized or the way found whereby the service of the bureau could be extended in conjunction with Federal projects to assist privately irrigated areas where the farmers were unable to satisfactorily cope with certain of their problems. The assistance so rendered, practically without final cost to the Government, almost equals in results those obtained from purely Federal projects.

No one contends that mistakes were not made in those early days, but we do say that they were no greater than if as great as those incident to any new undertaking of like size and importance carried on by private enterprise.

ACHIEVEMENTS OF FEDERAL RECLAMATION

The friends of Federal reclamation have the right to have considered the general results that have followed completion of irrigation construction and occupancy of the land by informed farmers on the Federal projects. I shall only quote a few figures from authentic Government reports, and shall refer all those who are disposed to be fair with the bureau to thes various reports for detailed information.

"In 1929 the cultivated area receiving water from Government works was 2,705,240 acres, producing crops valued at $161,179,880. From the time that water was first available in 1906 for crop production, the cumulative value of crops grown on land irrigated from the works of the Bureau of Reclamation has amounted to $1,642,267,680."

I might go on, showing the product of the 17 beet-sugar factories built in consequence of Federal reclamation, and the 500,000,000 pounds of sugar supplied the American market—the product of American soil, which but for reclamation would have been purchased from abroad—also what this means in labor, transportation, and general business.

I might mention the more than 600,000 people now living on these projects, and in the towns and cities grown up thereon—all engaged in useful work; likewise, the 136 banks, with deposits of more than $150,000,000, mostly the accumulation of these people.

It is estimated that the increased value of lands and other properties on farms and in towns within enterprises watered from the works of the bureau amounts at least to $500,000,000.

These are but a few facts in the general accomplishment.

In the building of all these canals and dams, and all that goes with making an irrigation project ready for the farmer, the principal item is labor, and the money spent therefor has helped support a large number of American citizens. It is hardly necessary to allude to the fact that the building of these projects and their development into agricultural communities have in turn served to create a good domestic market for the products of practically every line of business, so that the entire country has profited thereby. This is so self-evident that statistics are unnecessary to convince any fair-minded man.

So, how can anyone say the Congress was not governed by real statesmanship in enacting the reclamation act, or that it was not predicated upon sound public policy? We admit that some mistakes were made by those charged with the administering of this law, but that is no true ground for the charges brought. The general results are what should govern in forming a correct opinion of the wisdom of this act.

RECLAMATION NOT RESPONSIBLE FOR FAILURES

Second.—It is charged that "thousands of misled settlers have suffered losses of savings and years." No doubt there have been numerous instances of persons with no previous agricultural experience who failed in their attempts to develop farms on these projects. Square pegs never would fit round holes. The complete answer to this charge is that in the hands of competent farmers the project farms have been and now are a big success, as shown by last year's crops valued at $161,179,880, as heretofore stated. It may be admitted that until recent years the absence of any provision in our laws permitting a selection from the applicants for land under these projects has led to attempts at farming by men not qualified to handle such farms. These lands were opened to entry under the homestead laws, and the same experience has been had as to the final successful farmer as occurred in the settlement of all parts of the country. Every American citizen has certain so-called "rights" to take up Government land, and until recently it has not seemed possible to permit any officer of the Government to deny anyone having this right from taking up public land under a Federal irrigation project because of doubt as to whether such person would succeed. If a given individual, qualified under the regulations, mistakes his ability as a farmer, it is unfair to charge the Bureau of Reclamation with doing him a wrong.

Third.—It is charged that "enough unnecessary output has been thrown on the markets to depress prices for farmers in natural farming areas." In other words, that these projects have crowded the markets.

BLANKET CHARGES OF FAILURE INCONSISTENT

It is rather inconsistent to first charge that there have been 24 project failures, next that thousands of settlers have been misled as to the value of project farms, and then claim these project farms have been so productive as to unduly influence crop values in other parts of the country. Here, again, those opposed to western enterprise and who charge Congress with poor vision have shown lack of knowledge regarding the major uses to which project farms are put. The large part of the $161,179,880 farm income from lands receiving water for irrigation from Government works last year came from products not grown in competition with other sections of the country. These lands have added to the food supply and raw materials necessary to the health and comfort of all the people without displacing other products to any great extent. As to many products, they in turn have made a market for certain otherwise surplus products of the so-called "natural" farm areas.

The 500,000,000 pounds of sugar produced certainly added directly to the wealth of the Nation. We still send several hundred millions of dollars abroad for much of the sugar needed by the United States. Our irrigation farmers should be encouraged to produce the entire sugar requirements of the country now coming from abroad.

A large portion of these lands is devoted to growing alfalfa hay for livestock. The forest reserves and open ranges adjoining the irrigated areas could not assist as they are now doing in supplying the meat and wool for which there is an increasing demand except for the winter feed produced on these irrigated lands. Thousands of these animals in turn go to the Middle West feed lots for finishing, thus making a market for much of the corn and other feeds produced in those States. Even with all the meat and wool produced in this country, we are still importers of large quantities, particularly of wool. Is anyone hurt by these products?

The dairy products produced on these farms are consumed in the West, and it is seldom that any go East. The rapid growth of the Intermountain and Pacific West has been of great advantage to the other dairy sections of the country in making a market for their surplus dairy animals.

The production of hogs is an important item on these farms, and much corn is shipped from the Missouri Valley for this purpose, yet we so far have not been able to supply the Pacific coast demand, and hundreds of cars are sent west from as far east as central Nebraska. The increased population of these Western States means much to hog growers of the Middle West. The coast demand very often has a healthy price influence in eastern livestock markets.

SURPLUS NOT AFFECTED

Much of the seeds that formerly were imported into the United States are now produced on these lands, and are another source of noncompetitive agricultural wealth. These lands produced large quantities of dry beans, yet last year more than 900,000 bushels were imported into the United States, and the American Army secured a considerable portion of its supply from this source. This crop certainly is not in competition with the East while such large imports exist.

A considerable portion of the fruit supply of the country comes from these western lands; yet we find it necessary to import quite a variety of fruit. As to the western apples, a large portion of the crop is exported, not in competition with eastern-grown fruit but because it has created a special foreign demand.

It may be said of numerous other products of these lands that they have made their own market, because of special quality, commanding a higher price, and not from any competitive basis.

All the wheat grown on all the irrigated land of the West would not begin to pay for the automobiles and trucks bought each year by the people living on these lands. I doubt if it would even pay for the small cars and trucks and their upkeep.

In the first place, we know that wheat is not a major crop on irrigated land. It would not pay the farmer to make it so. He knows that if he did not raise a bushel of wheat there would still be a large exportable surplus, produced by those in the "natural" farming areas, the same as there has been for past generations. Wheat is generally grown on these lands as a nurse crop, in connection with alfalfa, or in a well-planned system of crop rotation. It is usually an incident rather than the main object.

The kind of wheat grown does not as a rule go to the mills producing flour for bread, but is the grade and kind sought by millers producing what is known as biscuit flour, used in cracker factories and for pastry. It is the kind they want for hot biscuits in the South. It is a soft white wheat, and does not compete with the hard wheats generally grown in the so-called wheat areas. The wheat market in Chicago does not generally determine the price of this wheat to the same extent as it does for the regular hard wheat. To-day the soft white wheat grown on these irrigated lands where I live is selling for only 13 cents per bushel under the Chicago market, while the freight rate to Chicago is 65½ cents per hundred, or 39.3 cents per bushel. So we are not a competitor in that market.

The charge is made that these Federal irrigation projects produce about 4,800,000 bushels of wheat. Well, what of it? We eat flour out here, and it takes a large percentage of the wheat we grow for our own requirements. A considerable amount is used for chicken feed, and much is used for hog feed. The big end of the balance is milled in western and southern flour mills, and what is not needed for crackers, pastry, and hot bread uses is exported to Central and South America. I doubt if ever a bushel of wheat grown on these lands has gone to Chicago or crossed the Mississippi. So why this hue and cry about wheat?

That the extension of irrigation and development of new farming areas should have proper relation to the needs of the country for their products, we do not question; but that is no sound reason for discontinuing the Reclamation Bureau, or ceasing its study of work yet to be done and making preparation for it, or of not completing work now in hand, which will require most of the bureau's funds for the next 10 years or more.

Fourth.—Now as to the fourth and last charge—that "the Government has sustained heavy losses at the expense of taxpayers."

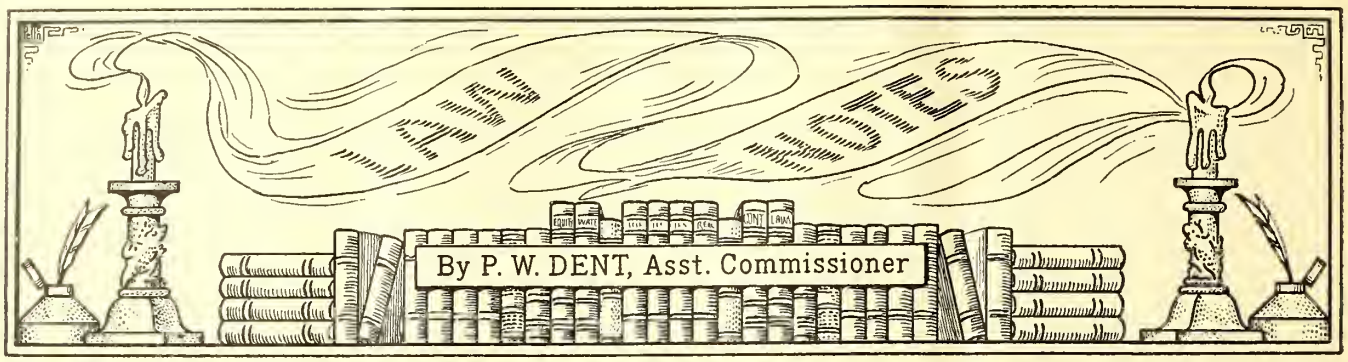
RECLAMATION ACT SOUND

It is said that the cost of some of the projects was excessive and that certain losses have been sustained. This is no doubt true. To that extent the Western States are the losers and not the Government. In an undertaking of this magnitude such things are to be expected. The losses referred to occurred in the beginning of the work, and no claim is made that they have been a continuing drain on the fund. I do not believe that there is now among the personnel of the bureau anyone who was in any way responsible for the errors in judgment which led to these losses. I contend that, while admitting these losses, this fact in no way discredits the wisdom or the statesmanship leading up to the passage of the reclamation act. It is sound in principle, and to prove it is capable of practical and safe administration one has only to point to present results. No doubt as time goes on, and with accumulated experience, this act will be improved by amendment, and we may confidently expect the work of this bureau to continue when and as the needs of the country require. There are, and no doubt always will be, various questions growing out of the administration of various projects where those in charge may not make the best determination, but this does not go to the question of the value of these projects. No doubt as soon as a given project is capable of local administration by those occupying it, such change will come about, and the bureau will more and more occupy itself with the major work for which it was so well intended, and which it is so well equipped to do.

It is the part of sound statesmanship to foster and encourage by every reasonable means the growth and development of these Western States, that there may always be found here a strong, virile race of patriotic men and women, ready, able, and willing to contribute largely and always to the good of our great country in every case of need.

The farmers on the projects must learn to cooperate in the use of water, in the growing of profitable crops, in obtaining new outlets for their products, and in providing schools, churches, and general community building.

MACHINERY has been ordered for the proposed alfalfa meal mill at Clint, on the Rio Grande project, and it is expected that the new plant will be in operation by September.



Water Appropriations Dependent Upon Exchanges

THE location of new feasible irrigation projects in the arid West is becoming increasingly difficult, and depends more and more, from a water-supply viewpoint, upon the ability of the new projects to make a larger and more economical use of the existing water supply, which can sometimes be effected by saving water which otherwise would go to waste through a lack of coordination in the use of water from the various sources of supply. By such lack of coordination further development of irrigation is often either retarded or made impossible unless plans can be devised for a thoroughly coordinated use of the available water supply.

This condition is particularly true in the State of Utah where the Bureau of Reclamation and the State are carrying on cooperative investigations to locate feasible projects and often find themselves dealing with what may be termed "mere remnants of unappropriated water." They are consequently often confronted with the problem of securing the necessary water supply from such remnants.

In the more simple cases an enlarged use can be effected by storing the unappropriated remnants to be released as needed, but in other cases securing a water supply for a proposed project involves not only the construction of a reservoir but the making of complicated exchanges as well, in order to secure a more economical and better coordinated use of the available supply.

While the law throughout the arid West is well settled that water may be turned into a stream at one point and an equal amount, less a proper allowance for losses, diverted at another point either above or below the point where turned into the stream, the procedure under which this may be done in the State of Utah avoids some possible complications at a later date by providing for an advance determination of the right to make the exchange.

The prescribed procedure calls for an application to the State engineer, who, after due notice and hearing, can grant or reject the application for an exchange. Any appropriator on the stream may protest against the allowance of the application, and after final action by the State engineer any party who feels aggrieved by his decision may appeal to the district court. Otherwise the order of the State engineer becomes final.

The statute permitting such an exchange under the authority of which frequently larger use may be made of the water supply is found at page 189, chapter 72, Laws of Utah, 1921, and is as follows:

"Upon application in writing and approval of the State engineer, any appropriated water may be turned into the channel of any natural stream or natural body of water or into a reservoir constructed across the bed of any natural stream, and commingled with its waters, and then be taken out, either above or below the point where emptied into the stream, body of water, or reservoir, but, in so doing, the original water in such stream, body of water, or reservoir must not be deteriorated in quality or diminished in quantity, and the additional water turned [in] shall bear its share of loss by evaporation and seepage and of the maintenance of said reservoir, and an equitable proportion of the cost of the reservoir site and of the construction. Any person, corporation, or association having stored his or its appropriated water in a reservoir for a beneficial purpose shall be permitted to withdraw the same at such times and in such quantities as necessities may require."

The statute substantially as it appears above was the subject of judicial construction by the Supreme Court of Utah in the case of United States *v.* Caldwell, 231 Pac. 434, wherein it was stated:

"The paramount purpose of our statute and the decisions of this court are to the effect that the waters of this State shall be applied and used so as to produce the greatest possible benefit to the inhabitants thereof, and every appropriator of water must yield to that purpose, if in so yielding all of his rights may be preserved without material injury or damage to him."

The holding of the court was that a senior appropriator may be compelled to forego diverting all of his water supply at his head gates, and to allow a junior appropriator to use upon a new upstream development a large portion of the supply theretofore in the river at the senior appropriator's head gates, the junior appropriator to turn into the senior appropriator's canal, at some remove below the latter's head gates, a supply from another source equivalent in quantity and quality to the supply in the canal at that point before the enforced exchange. The senior appropriator was permitted to continue his diversions at his head gate so far as needed for his project between the river and the point where the exchanged supply was turned into his canal.

The particularly desirable feature of the Utah statute to which attention is here being called is that it gives the promoters of a new project an opportunity to ascertain in advance whether reliance may be placed upon the right to make exchanges of water in connection with an irrigation scheme which depends for its success upon such exchanges.—*J. R. Alexander, District Counsel.*

Contract Upheld By Court of Appeals

On June 14, 1915, the Bridgeport Irrigation District entered into a Warren Act contract with the United States for the purchase of a water supply from Pathfinder Reservoir, North Platte project. The contract was not authorized by a vote of the electorate of the district. The district paid the amounts due under the contract for the years 1915 to 1919, but failed to make the construction charge payments due under the contract for the years 1920 to 1924, amounting to $54,334, with interest. Suit was brought by the

United States to enforce the payment of the debt. To the Government's complaint the district answered that the board of directors did not, under the statutes of Nebraska, have the authority to execute the contract, unless authorized to do so by a vote of the electorate of the district. The Government demurred. The Nebraska Federal District Court decided in favor of the validity of the contract, mainly on the ground of estoppel. See the ERA for October, 1929 (p. 160).

The district appealed to the Circuit Court of Appeals for the Eighth Circuit, where the decision of the lower court was upheld, the court finding that an electionless contract was authorized under sections 3465 and 3466 of the revised statutes of Nebraska, 1913, and that these two sections were not modified (as the appellant alleged) by chapter 205 of the Laws of Nebraska, 1915, which was in force at the time the contract was executed.

The contract provision for the payment by the district of interest at the rate of 10 per cent per annum from the date any installment came due until paid was also upheld by the court. The court says:

"This rate of interest is permitted by the Nebraska statutes, and it is to be noted that if the installments are paid when they become due no interest charge is made. It is in the nature of damages for failure to pay in accordance with the terms of the contract. There is nothing in the provisions of the Nebraska statute that have been called to our attention rendering this provision nugatory."

Are Federal Sales of Power Taxable by States?

In Alabama *v.* United States, decided by the Court of Claims, March 12, 1930, the court denied the claim of the plaintiff State for taxes upon excess power sold by the United States from its Wilson Dam plant, Muscle Shoals, Ala. The case is of interest to the bureau because the proposed Boulder Canyon project involves a somewhat similar Federal enterprise.

The act of June 3, 1916 (39 Stat. 166), known as the national defense act, contained in section 124 an appropriation of $20,000,000 for the construction of electrical power plants for the manufacture of nitrates and fertilizers, and authority was given for the President to sell any surplus electrical current not required for military and naval purposes. Wilson Dam in Alabama was constructed under this authority. The United States sold to the Alabama Power Co., in 1926, 429,311,000 kilowatt-hours of surplus electrical energy. A revenue law of Alabama approved by the governor July 22, 1927, imposed a license or privilege tax "upon each person, firm, corporation, agent, or officer engaged in the business of manufacturing and selling hydroelectric power in the State of Alabama" in a sum equal to two-fifths mill upon each kilowatt-hour of energy generated and sold during the preceding calendar year.

Upon the refusal of the Federal officers to pay the tax, the State brought suit in the Court of Claims. The right to collect the tax was denied. The court held that the United States has the right, in pursuance of powers delegated in the Federal Constitution to purchase, hold, and sell property without hindrance from the States, and that State taxation would be such a hindrance.

The following excerpts from the decision will set out some of the reasons given by the court for the holding:

"Any sales made of property purchased or owned * * * were made in the performance of a public function in the transaction of public business and can not by any illogical twist or the use of a false face be made to appear as private business * * *. The means and agencies which Congress may select for the performance of its constitutional functions must necessarily vary and expand to suit the expanding social, economic, and political life of the people of the country. * * *

"The mere fact that it may be an invasion of the domain of private business does not change its public character when assumed by the United States. * * *

"More than this, the Government by lease sells the output of its mineral lands, its oil lands, its timberlands, its grazing lands, and in erecting dams in the aid of navigation or irrigation or flood prevention, it sells sometimes the water power from these dams, as is proposed in the Boulder Dam act, to States, municipalities, and private persons. Are the gross proceeds of these sales or leases taxable by a State? * * *

"Once concede that the United States can engage in private business as a private personality, once throw open the question for decision as to whether the United States in particular cases is or is not engaged in private business, and the field of litigation is limitless. To concede the right of a State to tax or in any way interfere with the performance of a governmental function under the sophistical plea that it is private business would be to open up a field for a general frustration of the United States Government in the performance of its constitutional functions by any or all of the States of the Union."

Recently Enacted Legislation

SOLDIERS' PREFERENCE RIGHTS

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That a joint resolution entitled "Joint resolution giving to discharged soldiers, sailors, and marines a preferred right of homestead entry," approved February 14, 1920, as amended by a joint resolution approved January 21, 1922, and as extended by joint resolution approved December 28, 1922, be, and the same is hereby, amended to read as follows:

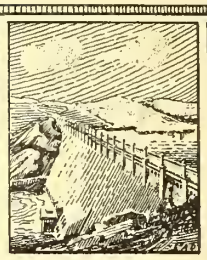
"That hereafter, for the period of ten years following February 14, 1930, on the opening of public or Indian lands to entry, or the restoration to entry of public lands therefore withdrawn from entry, such opening or restoration shall, in the order therefor, provide for a period of not less than ninety days before the general opening of such lands to disposal in which officers, soldiers, sailors, or marines who have served in the Army or Navy of the United States in any war, military occupation, or military expedition and been honorably separated or discharged therefrom or placed in the Regular Army or Naval Reserve shall have a preferred right of entry under the homestead or desert land laws, if qualified thereunder, except as against prior existing valid settlement rights and as against preference rights conferred by existing laws or equitable claims subject to allowance and confirmation: *Provided,* That for the purposes of this resolution, the war with Spain shall be considered to include the period from April 21, 1898, to July 4, 1902: *Provided further,* That the same preference rights are hereby extended to apply to those citizens of the United States who served with the allied armies during the World War and who were honorably discharged, upon their resumption of citizenship in the United States, provided the service with the allied armies shall be similar to the service with the Army of the United States for which recognition is granted in this joint resolution: *Provided further,* That the rights and benefits conferred by this joint resolution shall not extend to any person who, having been drafted for service under the provisions of the selective service act, shall have refused to render such service or to wear the uniform of such service of the United States."

SEC. 2. That the Secretary of the Interior is hereby authorized to make any and all regulations necessary to carry into full force and effect the provisions hereof.

Approved, June 12, 1930.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Gibson Dam—Sun River Project—Montana

By Ralph Lowry, Construction Engineer, Cle Elum, Wash.

GIBSON Dam is located on the North Fork of the Sun River in the main range of the Rocky Mountains about 23 miles from the town of Augusta, Mont. Its construction creates a reservoir 6 miles long, storing 90,000 acre-feet of floodwater which will be released as required to supplement the natural river flow for the irrigation of lands on the Sun River project. Stored water is released from the reservoir into the river channel from which it is diverted 3 miles downstream for the Greenfield division and 37 miles downstream for the Fort Shaw division.

PRELIMINARY INVESTIGATIONS

Preliminary surveys and foundation testing were made at the dam site and of the reservoir site as early as 1914. Additional surveys were made at irregular intervals after that date and detailed topography of the dam site was taken in 1926. Preliminary designs and estimates were prepared in the Denver office during the years 1919 and 1920. These consisted of straight gravity dams for reservoir capacities of 50,000, 105,000, and 150,000 acre-feet. A preliminary estimate for the 105,000-acre-foot reservoir was also prepared in the project office during 1919. The foundation was first explored on an extensive scale during 1918 when 35 holes, spaced to cover the proposed site in general, were diamond drilled into the foundation rock. In the spring of 1926 there were 18 additional holes drilled to more definitely develop the foundation at a location then tentatively adopted and later used for the arch dam.

Geologist C. H. Clapp, president of Montana University, under date of May 1, 1926, reported on the geology of the dam site, and under date of May 15, 1926, on the geology of the reservoir site. The report stated that the rocks in the reservoir are chiefly sedimentary, consisting of crystalline limestone, calcareous shale, and reddish-brown sandstone. Nearly all the rocks dip west at steep angles, 45° to nearly 90°, and are repeated several times by strike faults. The North Fork of the Sun River has cut a mature valley across these tilted rocks and subsequent tributary streams have opened relatively wide valleys in the shales between sharp ridges of limestone which attain a height of from 1,500 to 2,500 feet. Where the limestone ridges have been cut through first by an eastward moving glacier and later by the river, typical water gaps have been formed. The dam has been built at one of these water gaps where the rock formation is all crystalline limestone beds which are extremely regular.

TYPE OF DAM

The dam is a massive concrete arch having a maximum height of 195 feet, a crest length of 960 feet, and contains 161,000 cubic yards of concrete. A spillway consisting of a combined circular shaft and tunnel, both 29 feet 6 inches in diameter and concrete lined, is built into the solid rock of the north abutment. The spillway, with intake 200 feet upstream from the dam, is designed to discharge 50,000 second-feet before the dam is overtopped. A maximum recorded flood of 32,000 second-feet occurred in 1916.

The irrigation draft is released from the reservoir through two 6-foot diameter semisteel conduits embedded in the concrete of the dam on the north side of the river at elevation 4560. The conduits' intake is inclosed by a reinforced concrete trash-rack structure, and each tube terminates at the downstream toe of the dam in a 60-inch needle valve protected by a 5 by 5 foot hydraulic operated emergency slide gate. A reinforced concrete structure houses both gates and valves together with the necessary auxiliary operating equipment. Provision has been made for future development of power by the installation of two 6-foot diameter penstocks through the dam at elevation 4650 on the south side of the river.

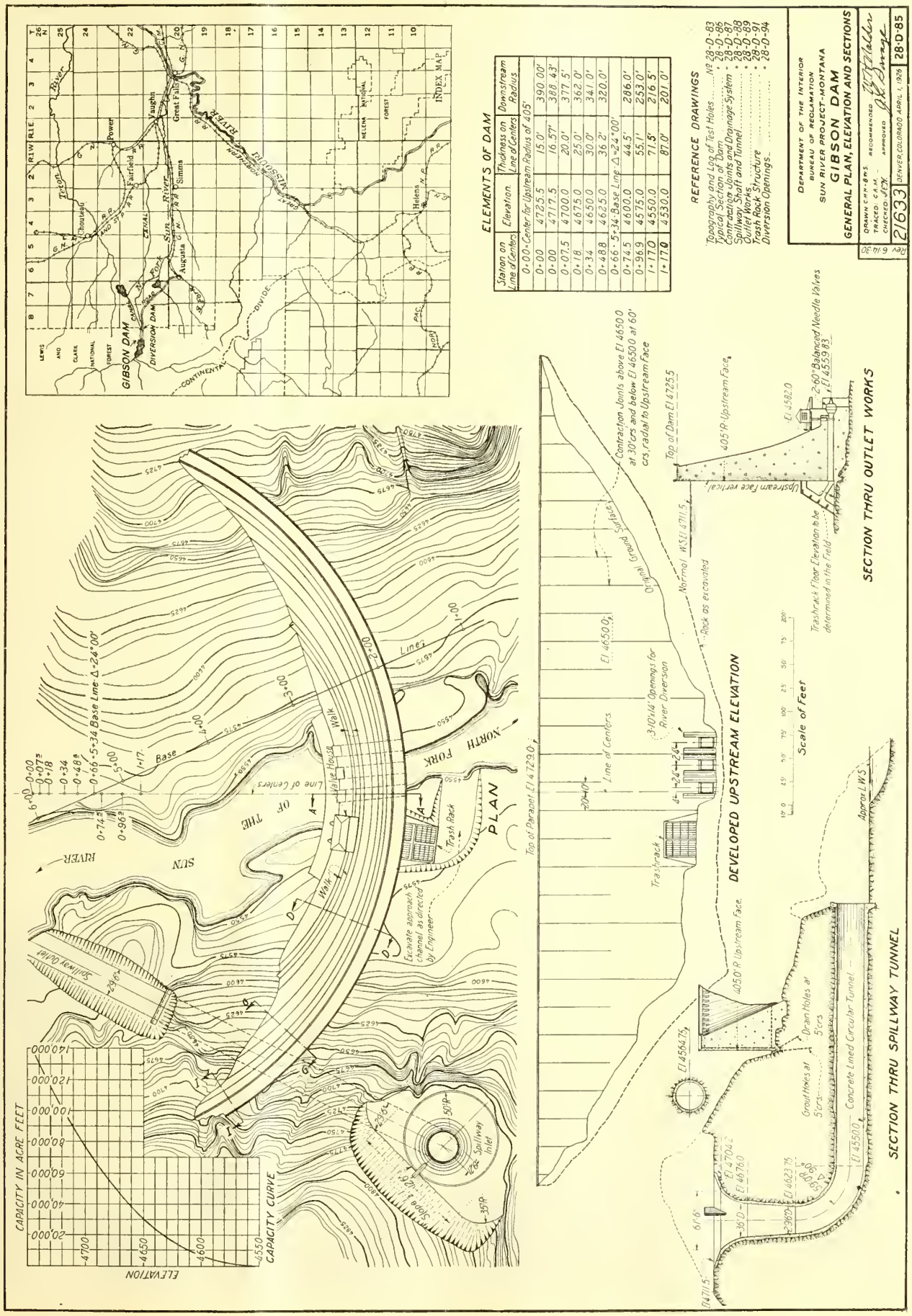
The foundation rock under the dam was grouted through holes drilled into the trench bottom of the upstream toe. Holes were spaced 5-foot centers and varied in depth from 20 feet at the top of each abutment to 40 feet across the river section. The holes were grouted through 2-inch pipe, usually after concrete had been poured to a depth of at least 5 feet over the adjacent area of the dam foundation.

Foundation drainage was provided by drain holes spaced 5-foot centers and drilled from the trench bottom at an angle downstream from the grout holes. The drain holes were drilled through a 3-inch pipe embedded in the concrete, after all adjacent grout holes had been grouted. The foundation drains were connected to a system of embedded pipes which are designed to permit the free escape of all water collected by the foundation drains to the downstream toe of the dam. Connected to the same system of pipe drains are vertical lines of 3-inch porous concrete draintile spaced 5-foot centers, and located 3 feet from the upstream face of the dam. The tile drains are designed to intercept leakage along the horizontal construction joints and provide easy passage to the downstream toe of the dam.

The dam was built with vertical contraction joints on radial lines spaced 60-foot centers below and 30-foot centers above elevation 4675. Provision was made for grouting these joints, when opened, through a system of 1-inch and ½-inch galvanized pipes embedded in the concrete and connected to electrical conduit boxes spaced about 8-foot centers over the surface of all vertical joints. The radial contraction joints are grouted to permit arch action to take place in the dam under all conditions of loading.

CONSTRUCTION OPERATIONS

Construction of the dam was authorized by an initial appropriation of $500,000 for the fiscal year 1925. Specifications No. 450, covering the work by contract, provided that the United States furnish the contractor f. o. b. Augusta all materials that were to become a permanent part of the structure excepting sand and gravel. The materials furnished included cement,



ELEMENTS OF DAM

Station on Line of Centers	Elevation	Thickness on Line of Centers	Downstream Radius
0+00 - Center for Upstream Radius of 405'			
0+00	4725.5	15.0'	390.00'
0+00	4717.5	16.57'	388.43'
0+07.5	4700.0	20.0'	377.5'
0+18	4675.0	25.0'	362.0'
0+34	4650.0	30.0'	341.0'
0+48.8	4625.0	36.2'	320.0'
0+66 - 5+34 Base Line Δ = 24°00'			
0+74.5	4600.0	44.5'	286.0'
0+96.9	4575.0	55.1'	253.0'
1+17.0	4550.0	71.5'	216.5'
1+17.0	4530.0	87.0'	201.0'

REFERENCE DRAWINGS

Topography and Log of Test Holes ..... No. 28-D-83
Typical Section of Dam ..... " 28-D-86
Contraction Joints and Drainage System " 28-D-87
Spillway Shaft and Tunnel ..... " 28-D-88
Outlet Works ..... " 28-D-89
Trash Rack Structure ..... " 28-D-91
Diversion Openings ..... " 28-D-94

reinforcing steel, pipes, valves, gates, conduits, and power outlets. The contractor furnished sand, gravel, and all labor together with the necessary plant and equipment for performing the work. Proposals tendered by seven contracting firms were opened August 31, 1926. The Utah Construction Co., of Ogden, Utah, with the low bid of $1,566,240, was awarded the contract on September 13, 1926. Work was immediately started on erection of the camp and the clearing of timber and brush from the dam site. Work was also started on improving the 23-mile road between Augusta, the nearest railroad point, and the dam. All materials and supplies including cement were truck hauled over this road, which was widened, straightened, and crowned at a cost of $21,000. Considerable rock was excavated to widen the 4-mile canyon section below the dam. A 3-phase, 23,000-volt transmission line, supplying power and light for construction work, was built from the Montana Power Co.'s line near Augusta to the dam site. This power line was energized on December 8, 1926, and, as compressors and air lines had previously been installed, work began immediately on rock excavation for the spillway tunnel and dam foundation. By the first of the year the gravel pit, located along the river 1,000 feet downstream from the dam, had been cleared and stripped; the gravel and screening plant partly erected, and a start made on the erection of the mixing plant.

Solid rock at the dam site was exposed across the river section and on the precipitous upper half of each abutment. The lower half of each abutment was covered with a talus slope. Foundation excavation began in the talus slopes where steam shovels loaded 4-yard side-dump cars which were hauled by steam and gas dinkeys to spoil banks upstream in the reservoir. The solid rock at the top of each abutment was drilled by air-operated hammer drills, shot, and moved by hand methods down the slope to the shovel. The foundation rock, across the river section and at the bottom of each abutment, after being shot, was removed by two guyed steel derricks, one on each side of the river. The upstream toe trench was excavated along with the foundation rock. Excavation for the dam foundation began in November, 1926, and was not entirely completed until June, 1928. Thirty thousand cubic yards of earth and loose rock and 37,000 cubic yards of solid rock were removed to form the completed foundation for the dam. To permit foundation excavation in the river channel the river was diverted in the fall of 1927 to the north side by rock-filled crib cofferdams and a temporary wooden flume. After the high water had passed in the spring of 1928 the river was rediverted, passing through the diversion openings provided in the dam.

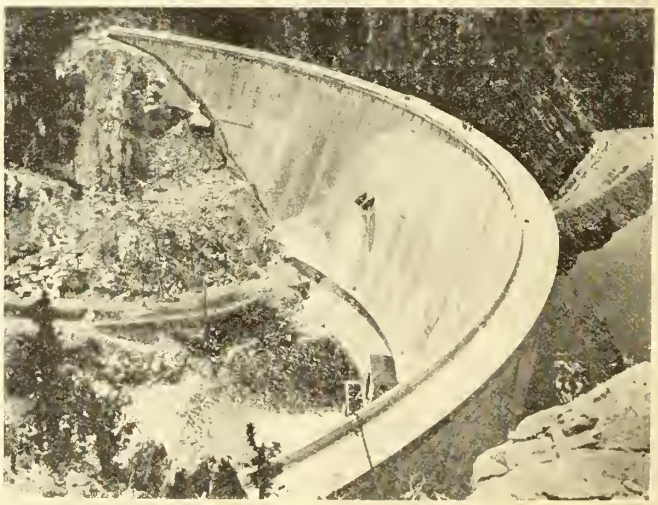
CONCRETING

Concrete was first placed in the dam during the period from September to December, 1927. Owing to the severe prevailing weather conditions the placing of concrete in the dam was discontinued during the winter months. Concrete was placed in the dam again during the summer of 1928 and completed in July, 1929.

Concrete aggregates were excavated in the gravel pit by steam shovel, loaded onto 4-yard cars, and hauled by 18-ton steam dinkeys to the gravel plant located about 500 feet south of the pit. The gravel deposit was deficient in sand and contained many oversize bowlders. Crushing equipment was provided to make use of all material excavated from the gravel pit. Crushers and rolls for producing sand were also installed. At the screening plant the material was dumped, then elevated by an endless inclined belt conveyor, and discharged into the end of a revolving screen where, with the addition of water, the material was washed and segregated to size. The four sizes of aggregate, including the natural sand, were carried up an incline by individual endless-belt conveyors and dumped into stock piles on a line between screening and mixing plants. The crushed sand was also stock piled separately. Manually operated gates in the top of the tunnel released stock-pile material onto an inclined endless conveyor belt operating through the tunnel, and which carried the segregated aggregates—first one, then another—to the top of the mixing plant where suitable bins were provided for measuring the volume of material for each batch of concrete.

The mixing plant was equipped with two 2-yard Smith mixers and the mixed concrete was hauled some 1,100 feet to the elevating towers at the dam in 2-yard bottom dump cars drawn by 7-ton gas dinkeys. The concrete was placed in the dam by means of towers and chutes. There were two steel towers, each 280 feet high, and these were erected, one on each side of the river. Concrete brought to a tower was dumped through a gate-controlled 4-yard hopper into a 1-yard skip, which was elevated by a motor-operated hoist and dumped automatically into a small hopper at the upper end of the chuting system. The chutes, including a 75-foot counterweighted section, were supported by an 80-foot steel boom guyed to the tower. The boom plant could swing through a 180° arc or be raised and lowered along the tower, as desired. Each chute terminated in a vertical down spout, made of removable 3-foot steel sections, and therefore adjustable in length. Concrete released from the tower hopper moved down the chutes to the down spout through which it dropped while the spout was

Downstream face of dam



From top of north abutment

GIBSON DAM

swung pendulum fashion while workmen with ropes pulled the chute end back and forth across the section. The chuting system was rotated about the tower by means of winch-operated cables attached to the boom end. High winds frequently interfered with the successful operation of the chuting system. Wooden panel forms, 4 by 7½ feet, faced with 22-gage sheet iron, were used to confine the concrete to 4-foot lifts in sectional areas bounded by the radial construction joints and the curved surfaces of the dam. Forms were set by spiking the bottom plate of the upper panel to the top plate of a lower panel still fastened to the concrete. The forms were held in place by twisted pairs of 8-gage wires threaded through exposed loops of embedded 6-gage anchors and wedged behind the 2 by 6 form studding, all working against inclined compression pipe struts. The struts were removed as the concrete was brought up in a section.

Extensive tests of the materials and the mixed concrete were made both before and during construction of the dam. About one thousand 8 by 16 inch concrete test cylinders were made and broken at 28 days during the progress of the work. An average concrete mix of the following proportions was used:

	Proportion by volume field, loose
Cement	1.0
Sand	2.7
Pea gravel—maximum size, ¾ inch	1.9
Coarse gravel—maximum size, 2½ inches	2.4
Cobbles—maximum size, 8 inches	3.0

The above mix produced as dense a workable concrete as could be had with the local aggregates. The density was 0.865, with a corresponding weight of 155 pounds per cubic foot. Owing to the large percentage of both crushed rock and sand which was frequently produced at the gravel plant, it was occasionally found advisable, from an economic standpoint, to use an admixture of diatomaceous earth to improve the workability of the concrete. The concrete was at all times rigidly inspected both at the mixing plant and in the forms. The average slump of all concrete placed was 3¾ inches, while the average strength was 2,940 pounds per square inch, as measured by the breaking strength of the test cylinders taken from the concrete both at the mixing plant and in the forms. The average yield of the concrete placed in the dam was 1.03 cubic yards to a barrel of cement.

The daily yardage of concrete placed was usually limited by the gravel plant output, and while two mixers were installed the aggregate supply was only sufficient for operating one mixer two shifts. With two 8-hour shifts employed the maximum yardage placed in the dam was: Day, 800 cubic yards, and month, 19,300 cubic yards.

While concrete was not placed in the dam during severe winter temperatures, there was a period during each fall and spring when frequent drops in temperature necessitated almost continuous protection. This was accomplished by inclosing freshly placed concrete with canvas and heating the inclosures by either steam or oil-burning salamanders. Hot mixing water and steamed aggregates were also used when necessary to obtain the specified temperatures for mixed concrete.

The concrete placed in the dam was cured by sprinkling with water for a period of at least two weeks after the concrete had been placed.

SPILLWAY SHAFT AND TUNNEL

Excavation of the spillway shaft and tunnel began in December, 1926. The 34-foot diameter tunnel excavation was driven 280 feet through solid limestone, without timbering, by the bench and heading method. The broken rock was loaded onto 4-yard cars by an air-operated tunnel shovel and hauled to a downstream spoil bank along the left bank of the river. When the intersection of tunnel and shaft had been reached, a raise 8 by 8 feet in plan was driven up through the shaft section to spillway intake. The raise was then enlarged to shaft dimensions by starting at the top and maintaining a cone-shaped section which guided the broken rock, after each round of shots, to the raise through which it dropped to the tunnel floor, where it was handled by methods described above for tunnel muck. Spillway excavation was completed in November, 1928. The spillway tunnel and shaft are circular in

Cost of Gibson Dam

Class of work	Quantity	Unit	Total cost	Unit cost + or −
River diversion	(1)		$20,000	
Excavation:				
Base of dam and outlet works	30,447	Cubic yards	38,059	$1.25
Base of dam and outlet works, Class III	36,837	do	128,930	3.50
Upstream cut-off of dam	963	do	9,630	10.00
Spillway inlet above elevation 4700	26,147	do	52,294	2.00
Spillway outlet, Class I	1,872	do	1,872	1.00
Spillway outlet, Class III	13,590	do	33,975	2.50
Spillway tunnel and shaft	16,070	do	120,519	7.50
Drilling—				
25-foot grout holes	1,032	1 inch, foot	1,290	1.25
Grout holes between 25 feet and 40 feet deep	5,157	do	10,314	2.00
25-foot drainage holes	607	do	1,062	1.75
Drainage holes between 25 feet and 40 feet deep	4,814	do	12,035	2.50
Placing grout hole pipe	220	Holes	5,150	2.34
Placing metal drainage pipe	106,834	Pounds	10,509	.10
Pressure grouting	113	Cubic yards	4,658	41.25
Drilling holes for anchor bars and grouting bars	461	1 inch, foot	461	1.00
Placing porous concrete draintile	22,190	do	6,341	.29
Concrete in dam	160,700	Cubic yards	1,428,330	8.90
Concrete:				
Tunnel and shaft lining	3,953	do	81,996	20.75
Spillway inlet above elevation 4704.2	404	do	7,221	17.85
Spillway tunnel outlet	128	do	1,979	15.45
Trash-rack structure floor	60	do	665	11.08
Trash-rack structure above floor	311	do	7,567	24.65
Valve house below elevation 4582	183	do	4,147	22.65
Valve house above elevation 4582	21	do	651	31.00
Footwalk on downstream face of dam	51	do	1,693	33.20
Parapets	422	do	10,072	23.75
Bending and placing reinforcing steel	252,351	Pounds	13,540	.054
Placing rail reinforcement	49,500	do	1,999	.041
Vertical drains and expansion seals	34	1 inch, foot	1,756	51.65
Placing and painting—				
Metal work in trash rack	68,100	Pounds	4,930	.073
Metal lining for outlet conduits	211,600	do	18,512	.088
Installing and painting—				
Slide gates and operating machinery	138,501	do	16,888	.122
60-inch balanced needle valves	109,818	do	16,782	.153
Jib crane and hoist	6,300	do	1,602	.254
Valve house above elevation 4582	(1)		1,967	
Placing and painting—				
Pipe handrail	403	1 inch, foot	1,156	2.87
Steel stairway	9,555	Pounds	478	.05
Sealing drain holes	162	Each	162	1.00
Placing plugs in top of vertical drains	168	do	84	.50
Selected back fill	310	Cubic yards	310	1.00
Back fill not selected	747	do	560	.75
Extra work			16,693	
Right of way			26,698	
Clearing reservoir site			36,135	
Buildings, permanent			6,193	
Roads and trails			10,348	
Experimental investigations			10,357	
Lighting system and penstock material			10,640	
Surveys and testing			29,460	
Contractor's freight refund			[2] 3,649	
Adjusted compensation			[2] 3,970	
Camp maintenance			2,927	
Engineering and inspection			85,243	
Superintendence and accounts			16,104	
General expense			9,477	
Material charged out on completion of work			6,511	
Total cost of dam			2,381,313	

[1] Lump sum. [2] Credit items.

section having a 29-foot 6-inch diamater inside concrete lining of 27-inch average and 18-inch minimum thickness. Starting in August, 1928, the tunnel invert lining was placed, beginning at the inside end of the tunnel and working toward the outlet portal. When tunnel invert lining was completed the remaining concrete lining in the tunnel was placed with the aid of a 30-foot traveling steel-lined jumbo form. The form was supported and moved by double-flanged wheels rolling on railroad steel.

In the shaft, concrete was poured behind panel forms 5 feet wide and 5 feet high anchored to the rock walls by tie wires. The concrete for shaft lining was hauled through the tunnel and hoisted up a wooden tower from which it was dumped into radial chutes terminating at the forms. All spillway concrete lining was completed in May, 1929, when the roof of the tunnel was grouted through pipes which had been embedded in the concrete for this purpose.

The Utah Construction Co. completed the work involved under their contract in July, 1929.

A storage of 90,000 acre-feet in the reservoir inundates 1,330 acres of land which was partly covered by a growth of timber and brush. The reservoir area was divided into seven schedules, irregular in size, and the clearing work advertised for contract. The bids were opened on October 24, 1927, with a low bid of $36,500, tendered by W. S. Leighty, who was awarded the contract. Clearing work started in December, 1927, and was completed in March, 1929.

The radial contraction joints were grouted by Government forces during the period from April 15 to May 1, 1930. The reservoir began filling during this period and on June 2 water went over the the spillway for the first time.

COST DATA

The accompanying table gives the quantities, total costs, and unit costs of the various items included in the construction of the dam. The contractor's profit on the dam amounted to about 5½ per cent of the total. The contractor cooperated to the fullest extent with the engineers in obtaining an accurate detail record of cost for all classes of work. Wages paid by the contractor during the construction period were $3.20 to $4.80 per day for common labor, from $4.80 to $8 per day for skilled labor, from $125 to $250 per month for miscellaneous employees on a monthly rate of pay, and from $150 to $700 per month for foremen and superintendents.

The dam was completed at a total cost to the United States of $2,381,000, while the estimated cost was $2,691,000.

Boulder Dam Construction Railroad

STUDIES of the transportation problem in connection with construction of the Boulder Dam and power plant have recently been made in the Denver office. A plan under consideration is to have that portion of the railroad from the main line to Summit, about 22 miles, built and operated by the Union Pacific, and the remainder built by contract. From Summit to the dam site the railroad will be operated by the contractor for the dam in the same manner as adopted at the Owyhee Dam now under construction in eastern Oregon. After the construction period the railroad will be operated for power plant maintenance.

The proposed railroad to the dam site will branch off from the main line of the Los Angeles & Salt Lake Railroad (Union Pacific), near Bracken, about 7 miles south of Las Vegas, Nev., and extend easterly to the dam site on the Nevada side of the Colorado River, a distance of 29.8 miles. The line will pass over two summits and will encounter a few miles of rather rough topography. The greater part of the distance from the main line to Railroad Pass, the first summit, with an elevation of 2376, can be ascended with easy grades, the maximum being 1.35 per cent. A fairly uniform country characterized by gravelly soil and wide shallow washes is crossed. From Summit station at elevation 2497, where it is proposed to locate the "interchange yard," the line will descend on comparatively steep grades, as high as 5.12 per cent, to the top of the canyon wall at the dam site, elevation 1445. At the interchange yard the usual type of locomotive will be changed for one adapted to the heavy grades beyond.

Just before reaching the dam site the railroad will cross Hemenway Wash, an area about 10 miles long and 2 miles wide, from which the concrete aggregates may be obtained. Just north of Hemenway Wash is the tentative location for the town site. This main line from Bracken Junction to the canyon rim has been designated the "L" line. Its construction will include three tunnels with lengths of 810, 155, and 610 feet. The "L" line will have 6.18 miles of secondary and yard tracks, and include a loop at the dam terminal and a connection to the incline railroad.

Because of lack of space near the dam site, it probably will be necessary to rehandle and retransport all large high-pressure gates, cast-iron conduit lining, hydraulic equipment, reinforcing and structural steel, which may, therefore, be unloaded and stored in or near the interchange yard and moved to the dam as needed, either by the Hemenway Wash branch line or by the ridge route.

BRANCH LINE TO RIVER LEVEL

The Hemenway Wash branch railroad or "LA" line will leave the Bracken Junction-Damsite line about 3.8 miles southwest of the canyon rim and extend down the Hemenway Wash a distance of about 5.74 miles to the river level at a point 1.67 miles above the dam site on the Nevada side, at elevation 700. This is the probable maximum high-water elevation and as low as it would be safe to locate the railroad grade. There will be 0.6 mile of secondary track required at the town site. An additional 2.11 miles of road will be built in an extension down the canyon to the lower tunnel portals. It is proposed to build the canyon section at grade elevation 700, with a roadbed width of 12 feet. Ten timber trestles, 35 feet to 50 feet in height, with a total length of 680 feet, are planned; also 11 tunnels with a total length of 995 feet.

One of the purposes of the "LA" line will be to haul away dam and tunnel excavation, which will amount to approximately 4,670,000 cubic yards. Track and cars can be run into the Nevada diversion tunnels at the upper portals by construction of an incline. It will be desirable to remove tunnel and dam excavation material during the first two years of the construction period. There are opportunities for dump along the river and in Hemenway Wash. Material from the Arizona side would be conveyed across the river by cableways.

INCLINE RAILROAD

An interesting feature of the proposed railroad system will be the permanent incline or funicular railroad which will extend from the top of the canyon on the Nevada side at elevation 1425 down to elevation 690 at the river level or power plant location below the dam. It will be used primarily for transporting the power-plant electrical and hydraulic equipment; also in connection with maintenance and operation of the power plant for lowering into the canyon necessary materials and supplies. The incline railroad will be connected with the construction railroad ("L" line) by a "Powerhouse spur" 1,900 feet long, and it will be possible to transfer a standard loaded freight car from the canyon rim to the river level below.

The length of the incline will be 1,288 feet. Because of the steep slope of 0.693 it would be impracticable to move a

standard railroad car over the incline, making it necessary to transfer the car to a special incline car with a horizontal platform handled by a stationary hoist and cable line. The scheme used by the city of Seattle in the construction of an incline railroad at the Diablo Dam was used as a basis for a preliminary estimate. The railroad car is run onto the special incline car platform, the longitudinal axis of which is at a right angle with the direction of travel and the incline. The incline car or transfer platform is supported by a structural steel frame mounted on four 4-wheel standard railway car trucks moving on two parallel standard-gage railroad tracks. The counterweight and car travels on a third standard-gage railroad track on the center line of the incline, halfway between the two outside tracks and also carries rollers for supporting the cable hoist line. A roadbed width of 50 feet will be required. The incline will also be utilized for the transportation of workmen, and a large number can be transported in one trip on the incline transfer car platform, which would probably be 14 by 50 feet in size.

COST ESTIMATE, SURVEYS, AND WORK SCHEDULES

There is an item of $2,500,000 for construction of the railroad system included in the appropriation of $10,660,000 for the first year's work. Early in 1929 the Union Pacific engineers made location surveys to determine the most feasible route from the main line to the dam. Based on these surveys, a final survey is now being made by Government engineers for the purpose of preparing plans, specifications, and schedules of quantities for advertisement. The construction will probably be divided into five schedules, as follows: Schedule 1, Bracken Junction to Summit, 22.71 miles, and also 5.16 miles of secondary and yard tracks; schedule 2, "L" line Summit to dam terminal, 7.69 miles including loop at dam terminal and 1.02 miles of secondary track; schedule 3, Hemenway Wash branch railroad, "LA" line, 5.75 miles, including 0.57 mile of secondary track at town site; schedule 4, Hemenway Wash branch railroad, canyon section 2.11 miles including 0.57 mile of siding and secondary track; schedule 5, incline railroad.

This railroad will handle an enormous amount of material and equipment, including about 5,500,000 barrels or 1,000,000 tons of cement; 28,000,000 pounds of reinforcement and structural steel; 34,400,000 pounds of conduit lining, steel penstocks, pumping and piping, and miscellaneous metal work; 19,600,000 pounds of gates and valves; 40,000,000 pounds of electrical equipment, and 15,600,000 pounds of hydraulic equipment. It will also be necessary to move about 7,320,000 tons of gravel, sand, and rock to the concrete-mixing plant. Freight for camp, contractor's equipment, and construction plant would approximate 253,000 tons.

Considering the large investment in the power plant (with approximately $14,000,000 invested in machinery and electrical equipment alone) and the possibility of serious losses in power revenue should a breakdown in machinery occur, operation of the railroad after the construction period will be necessary for the occasional transportation of plant equipment replacements, such as turbine runners and transformers, and also hauling lubricants and miscellaneous supplies. This can be handled much better by railroad than by road trucks.

Boulder Canyon Project Primer

[Continued from February, March, May, and June issues]

Q. Where will the new town on the Boulder Dam project be located?

A. The tentative location is about 3½ miles due west of the dam site, and near Hemenway Wash Junction on the Government railroad.

Q. Has the town been named?

A. Not yet, although several names have been proposed. One person has suggested Adaven, a transposition of letters in the word Nevada, while another proposes the name of Hidam.

Q. What about a water supply?

A. Water will be pumped from the Colorado River, with settling basins and filtration system similar to those now in successful operation at Yuma, Ariz.

Q. What other improvements will be necessary?

A. A sewerage system must be installed. Sidewalks and curbs must be provided and streets surfaced.

Q. What is the building program?

A. Government employees, principally engineers, inspectors, and clerks will require an office building and a number of houses for living quarters.

Q. Will the contractors on the dam and power plant quarter their employees in the town?

A. Yes—it is planned to set aside a portion of the town for contractors' camps. The contractors will probably arrange for the housing of their workmen, with building regulations subject to Government approval.

Q. Who owns the lands in the town site?

A. The Government owns the land, which is vacant public land and under first form withdrawal.

Q. How can one obtain a town lot for business purposes?

A. The present plan is to lease the land on 20-year leases, the Government to retain ownership and supervisory control. Continuation of the leases will be contingent upon the good behavior of the tenant. A model town is the objective.

Q. What will be the population?

A. From 4,000 to 5,000, according to present estimates.

Q. Will this town be permanent?

A. It will no doubt be permanent because the 710-foot dam and 115-mile lake will be a great attraction for tourists. There are also many scenic wonders close by, including three national parks—Grand Canyon, Zion, and Bryce Canyon.

Q. What are the immediate plans for the town?

A. Field engineering parties are at work laying out the town site and making necessary surveys. Contracts will soon be let for waterworks, sewerage system, street surfacing, sidewalks, and curbs; also for a highway from the town to the dam site.

Q. How much money will be expended on this work program?

A. In the appropriation for the first year's operations, $525,000 is provided for the town and highway.

Q. What provisions are being made for erecting buildings suited to the climatic conditions in that section?

A. A town planner has been engaged, who is well acquainted with the type of building construction required. The Bureau of Reclamation encountered somewhat similar conditions on the Yuma and Salt River projects in Arizona.

Q. What are the average temperatures in that locality?

A. They vary from 20° to 120°.

Q. How near will the new town be to Las Vegas?

A. About 25 miles.

The J. G. White Engineering Corporation is to construct a dam across the Blue Nile near Lake Tsana for the Abyssinian Government. The estimated cost of the project is said to be $20,000,000. Stored water is to be used for irrigation of lands in Egypt.

Onions are reported to be rising to the dignity of a national diet in England.

Notes for Contractors

Boulder Canyon project.—With the passage by Congress of the second deficiency bill providing an appropriation of $10,660,000 for beginning construction work on the Boulder Dam, active preparations are being made to begin construction on all phases of the work. Invitations for bids have been issued for furnishing power for construction purposes. The specifications provide for a maximum estimated requirement of 12,000 kilowatts for use until power is available from the power plant at the Boulder Dam, the length of time being estimated at six years. If satisfactory bids are not received, specifications will be prepared and invitations for bids issued for the construction of a power plant.

Specifications are being prepared covering the construction of a highway from the town site to the top of the dam and for a construction railroad from the main line of the Union Pacific Railroad to the dam site.

Active work will be started as soon as possible on the various features of the work in connection with the town site to be established, and specifications covering the work will be issued as fast as final detail plans can be completed and will include the construction of a waterworks system, sewer system, grading, curbs, sidewalk, and buildings.

Plans and specifications are being prepared for the construction of an incline hoist from the railroad at the top of the dam to the power-house floor elevation.

It is estimated that plans and specifications for the dam and power plant will be completed and invitations for bids for construction issued about April 1, 1931.

Under Specifications No. 485–D, covering aerial photographic and ground phototopographic surveys in the vicinity of Black Canyon and the Palo Verde and Cibola Valleys on the Colorado River, the following contracts have been awarded: Schedule 1, item 1, Fairchild Aerial Surveys (Inc.), $3,192; Schedule 2, items 4, 5, and 6, Aerotopograph Corporation of America, $10,900; Schedule 2, items 7 and 10, Brock and Weymouth (Inc.), $14,250.

Minidoka project.—Specifications have been prepared and invitations for bids issued for the construction of the section of the Milner-Gooding Canal between the Little and Big Wood Rivers on the Gooding division. This section of canal is approximately 3 miles in length and on account of the nature of the ground a concrete bench flume will be constructed. Sections of the canal through rock cuts will be constructed with concrete bottom and gunite side slopes.

Bids were opened at Burley, Idaho, on June 27 for the construction of culverts and the Little Wood River crossing and turnout on the Milner-Gooding Canal. (Specifications No. 484–D.) The Utah Construction Co. was low bidder at $36,089.

Owyhee project.—Plans and specifications have been prepared for the purchase of three 48-inch needle valves for the Owyhee Dam.

Salt Lake Basin project.—Plans and specifications have been prepared for the reconstruction of that portion of the waterworks system of the town of Coalville, Utah, which will be below the surface of the Echo Reservoir.

Shoshone project.—Specifications are being prepared covering the reconstruction of the Alkali Creek flume. A concrete flume will be constructed to replace the original metal flume.

Yakima project.—Invitations for bids have been issued for the construction of a one-story-and-a-half 6-room cottage at the Tieton Dam and one 5-room cottage at the Easton Dam.

Upper cofferdam and diversion tunnel outlet from above Owyhee dam

The contract for the Owyhee Dam, Owyhee project, was 34 per cent complete at the end of the month.

Japanese Project Has Largest Dam

The Kanan irrigation and drainage project now nearing completion on the island of Taiwan, Japan, will cost $25,000,000, and is being financed, one-half by the Government and one-half by the land owners whose property will be benefited. In the project there are 359,530 acres, the principal crops being rice and sugarcane; there are also 21,177 acres of fish ponds in the area. After irrigation it is estimated that crop values will average $46 an acre.

Water supply for the northern division of 110,000 acres is obtained by diversion from the Dakusui River. To supply water to 249,000 acres in the southern division, it was necessary to build a storage reservoir of 125,500 acre-feet capacity at Uzanto, formed by the Kandenkei Dam across the Mandan River. The dam is an earth and rock-fill embankment of the semihydraulic fill type, and is the largest structure in the world built for irrigation purposes. Only the Gatun Dam in the Canal Zone, Panama, and the Saluda Dam, now under construction in South Carolina, are larger.

The Kandenkei Dam contains 6,720,000 cubic yards of materials. It is 184 feet high above the foundation and 4,174 feet in length along the crest. The width at the base is 994 feet and at the top 30 feet. Both slopes are 1 in 3 for the lower section, 1 in 2½ for the middle section, and 1 in 2 for the upper section. There is a concrete core in the embankment containing 31,000 cubic yards of concrete, extending 24 feet below and 65 feet above the river bed. Earth and rubble used in the construction were brought a distance of 10 miles over a railroad built for the purpose. Construction was started in 1920 and will be completed during the present year.

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Boulder Dam Begins Its Mighty Career. Construction is started of a vast engineering project rivaled only by the building of the Panama Canal, signalizing our conquest of the Great American Desert and opening a new era of development. Illus. New York Sunday Times, July 13, 1930, page 3 of Science Section.

Doland, J. J.
Design of Monolithic Concrete Siphons Simplified by Use of Diagrams. United States Bureau of Reclamation develops diagramatic method of designing siphons for use on its irrigation canals. Illus. Eng. News-Record, June 26, 1930, vol. 104, pp. 1047–1052. (Gives views and plans on Grand Valley project and table of siphons on several projects, including the Boise, Grand Valley, King Hill, Klamath, North Platte, Rio Grande, Riverton, Shoshone, and Yakima projects.)

Dykstra, C. A., editor.
Colorado River Development and Related Problems. Series of articles by Messrs. E. F. Scattergood, Franklin Thomas, Ralph L. Griswell, Frank E. Weymouth, and E. A. Bayley. Annals of the American Academy of Political and Social Science, March, 1930, Pt. II, vol. 148, 42 pages.

Debler, E. B.
Why Boulder Dam Height Was Increased. Raising the storage level 25 feet is found to give more economical structure and better utilization of stream; flood flows, silting of the reservoir and water demand considered in recent studies. Article based on report by E. B. Debler, Eng. News-Record, June 26, 1930, vol. 104, p. 1066.

Hayden, T. A.
Salt River Project, Arizona. Pt. I. Illus. Western Construction News, June 25, 1930, vol. 5, pp. 294–302. Long account of project and construction of Roosevelt and Morman Flat Dams.

Lane, E. W.
What Share of Flood Control Costs Shall Federal Government Assume? Rational policy must include worth whileness of projects and equitable assessment of those benefited—paying fixed proportion only will preclude raid on treasury. Eng. News-Record, July 3, 1930, vol. 105, pp. 9–11.

Shepherd, R. E.
Reclamation. Address by R. E. Shepherd, president, Idaho State Chamber of Commerce. Inserted in the Congressional Record by Hon. John Thomas, July 3, 1930. Congressional Record, July 7, 1930, vol. 72, pp. 12931–12933, 71st Cong., 2d sess.

Hawley, George W.
Construction of Dams, Studied in Relation to Supervision. George W. Hawley, deputy in charge of dams, department of public works, State of California. U. S. Daily, July 5, 1930, vol. 5, p. 4.

Banks, F. A.
Heavy-load Cableway Installation for Owyhee Dam. Illus. Eng. News-Record, July 10, 1930, vol. 105, p. 62.

Water-Supply Conditions

Stream flow fell off rapidly during the month, causing heavy demands on stored waters, except on the Belle Fourche, Carlsbad, and the northwestern projects, where heavy local rains materially increased streamflow and storage conditions.

For the other projects, deficient precipitation, together with abnormally high temperatures, caused excessive irrigation demands, which necessitated crowding the canals to their full capacities and, in come cases, the adoption of rotation methods of delivery.

Bids for Aerial Surveys Boulder Canyon Project

The Denver office opened bids on June 16 for making aerial photographic and ground phototopographic surveys in connection with the Boulder Canyon project, Arizona-California-Nevada. An aerial photographic-controlled mosaic map is required of the Colorado River and adjacent territory lying between mile 565 and mile 620.5 (Palo Verde Canal heading and the lower end of Cibola Valley), an approximate area of 238 square miles. The work also includes ground phototopography of the two canyon walls in Black Canyon and aerial phototopography of the lower section of the reservoir site.

New Maps Available

A revised map of Carlsbad project, New Mexico, No. 23886, has just come from the press. It is printed in four colors, showing canals, irrigated areas, and other features. The size is 10½ by 14 inches and the price 10 cents per copy.

A new map of the Riverton project, Wyoming, is announced. It is printed in four colors, showing canals, drains, roads, and topography. This map is issued in two sizes: No. 23885, 10½ by 17 inches, sold at 10 cents per copy, and No. 23885–A, 21 by 35 inches, sold at 25 cents per copy.

The orange was originally a pear-shaped fruit about the size of a cherry. Its evolution is due to 1,200 years of cultivation.

Reclamation exhibit, International Exposition, Seville, Spain

Yuma Project Gaining Reputation for Sound-Picture Location

By C. B. Clegg, Instrumentman, Yuma Project

DURING the month of April and the fore part of May a Hollywood film corporation had a large company on location at Yuma shooting interior and exterior scenes for a talking picture, tentatively titled "The Big Trail." The theme of the picture is based on overland travel on the Oregon Trail during the fore part of the nineteenth century.

REPLICA OF TOWN ERECTED

A large force of carpenters and laborers arrived at Yuma early in April, and within a few weeks had erected a replica in all details of an outfitting post on the Missouri River. This town, composed of frame buildings, was constructed on the California bank of the Colorado River immediately above the city of Yuma. The town consisted of some 20 buildings of various types and sizes, and included a hotel, restaurant, barber shop, mercantile store, furrier shop, livery stable, saloons, houses, and a laundry. In addition, a replica of a stern-wheel Mississippi River steamboat of the early day was constructed on the edge of the river bank, which was at the head of the main street of the town. The buildings, made of new lumber, were weathered by using a spray gun filled with oil until they gave the appearance of having been in place for years. Several Indian teepees were erected at the edge of the town and these were used to house a group of some 10 Arapahoe Indians, who were brought in by the film company to lend color to the picture.

While the village or outfitting post was being built a group of corrals occupying approximately 10 acres of ground were constructed to care for approximately four to five hundred head of horses rented for the picture, together with some 50 or 60 yoke of oxen imported from all parts of the country, a portion of the oxen being shipped down from Idaho. These and the horses were used to draw nearly 100 canvas-topped prairie schooners which were constructed at the time the town was being built. Rents paid for the oxen were as high as $20 per day per yoke with feed furnished.

Altogether there were possibly 100 or more men engaged in the above work, which occupied approximately three weeks' time. Upon the completion of this work the entire company, composed of 280 people, including actors, camera men, technical staff, and some extras, arrived in Yuma for the filming of the picture. In addition, 150 local people were employed as extras at a wage of $5 per day, including room and board.

EMPLOYEES TAX ACCOMMODATIONS

The large company, together with the regular tourist traffic on the continental highway which passes through Yuma, taxed hotel, rooming house, and tourist camp accommodations to the utmost, it being necessary to house a portion of the company in private homes.

Owing to the size of the company and artisans employed in making the picture, the film company contracted for the feeding of all employees with a catering concern in Los Angeles. They erected a tent mess hall and kitchen with screen sides and board floor large enough to seat between three and four hundred people.

FILMING OPERATIONS UNDER WAY

Actual filming operations started the latter part of April and required about four weeks to complete. There were 93 speaking rôles in the picture. These were taken by the regular actors and stars of the company, while the extras filled in the minor rôles and formed the background for the various scenes.

The costumes of the entire company were in keeping with the period represented, namely the fore part of the nineteenth century, and consisted of long, full calico dresses and sunbonnets for the women, with a portion of the men wearing fringed buckskin suits, cowhide boots, and low-crowned wide-brim felt hats, while others wore plaid woolen trousers and shirts, with cowhide boots and flat-crowned hats. All of the men with few exceptions were required to grow beards. When members of the company were on the streets of Yuma in costume during lunch hour the contrast between these costumes and present-day styles of dress was quite striking and offered a never-ending source of amusement to the local people and tourists passing through the city.

In addition to the scenes taken at the outfitting post, a number of desert scenes were taken on the Yuma Mesa some 10 miles to the southeast and also on the California Mesa near the sand hills west of Yuma. These depicted the hardships endured by the early pioneers incident to travel over the deserts on their way to the Pacific coast.

IMPROVISED SCHOONERS DRAWN BY OXEN

The prairie schooners were quite realistic, with large water barrels and cowhide trunks strapped to the outside of the wagon boxes and water buckets dangling from parts of the running gear. These schooners, as previously stated, were built up locally with the use of wagon running gear imported by the film company. They consisted of a redwood trough-shaped wagon box mounted on the undercarriage. Large hoops were fastened to the sides of the box and weathered canvas was drawn over the hoops.

Probably the most interesting feature of the entire procedure to local people were the yokes of oxen drawing the schooners. Some difficulty was experienced at first in obtaining oxen drivers, or, as they are generally termed, "bull whackers." This particular occupation has very few followers with the advent of more modern means of transportation, and the general mix-ups brought about by strange, inexperienced drivers were quite amusing, as well as demoralizing to the oxen. However, competent bull

whackers were obtained and consequent trouble eliminated.

Several exteriors depicting the fording of a stream with the schooners and the bogging down of animals and wagons, together with rain scenes, were taken near Haughtelin Lakes in the reservation division, some 4 miles northeast of Yuma. For the fording scene a bank some 3 feet high was thrown up by fresnos inclosing an area approximately 250 feet square. This was filled with water pumped from one of the Government canals near by. The schooners, drawn by oxen and horses, were then lined up and driven through this water hole with a considerable amount of action due to the bogging down of wagons and animals and the work incident to extricating them by the riders and drivers. The rain and mudhole scenes were made possible through the use of an overhead sprinkling system supplied by a pressure pump. Large wind machines, which consisted of large motor-driven airplane propellers mounted on trucks, were stationed close by. With the use of these machines and the sprinkler system a violent rainstorm of any desired proportions was possible. The ground was well saturated with water prior to the start of the filming of this scene, with the result that, as shown in the accompanying view, a veritable bog existed which made passage by the schooners and draft animals exceedingly difficult. This scene, when presented as a part of the completed picture, will be very vivid and full of action and thrills.

COST OF OPERATIONS

It has been conservatively estimated that the costs incurred by the film company for equipment, labor, and housing and feeding of employees while on location at Yuma amounted to approximately $230,000, a good share of which was expended locally for labor, material, rents, and food, as well as other miscellaneous items.

The company, upon leaving Yuma, were to take further scenes in Wyoming and other Northern States for a period of one to two months. This sound picture, which is considered one of the large undertakings of the year by this company, will according to early estimates cost in excess of $2,000,000 to complete.

SECOND SERIES FEATURE SAND HILLS

Shortly following the departure of this company another corporation brought in a company to film exterior scenes in the sand hills for a French Foreign Legion picture entitled "Hell's Island." They also employed a number of local people as extras, together with a large number of saddle horses. The theme of this picture, as previously stated, has to do with experiences of the French Foreign Legion in their desert campaigns against various Arab tribes. This company was on location about 10 days, with headquarters at Yuma. They transported the players to and from the sand hills, which lie to the west of Yuma in California about 20 miles, with large passenger busses and local stages.

YUMA PECULIARLY ADAPTED TO TALKIES

During the past several years an increasing number of motion-picture companies have taken advantage of local scenery and ideal weather conditions, which include absence of rain and fogs and high percentage of sunshine. Owing to these conditions a minimum of delay is experienced resulting from inclement weather or poor visibility. With the Colorado River, mountains, deserts, and the large sand-hill area to the west of Yuma a variety of scenery is available locally. This, coupled with practically 100 per cent of possible amount of sunshine and ready access by rail or highway from the Pacific coast headquarters of the motion-picture industry, which is only 280 miles distant, should attract an increasing number of companies in search of locations for exterior scenes.

This industry in the past has materially added to the revenue of local merchants, and the local chamber of commerce and other civic organizations are working to the end that Yuma may become recognized as a desirable location for the taking of exterior scenes. Other possibilities have presented themselves since the advent of talking pictures. Owing to its more or less isolated location with desert on all sides and absence of large indus-

(Continued on p. 162)

1. Oxen hitched to schooners
2. Fording the water hole
3. Wagon train in rain storm
4. Schooners at outfit post

Sugar Beets on the Federal Irrigation Projects

The accompanying table gives statistics concerning the growing of sugar beets on the Federal irrigation projects in 1929.

Beets were grown on a commercial basis on 11 of the 24 operating projects, the crop being produced on 84,159 acres, resulting in a yield of 956,696 tons of beets, or an average of 11.3 tons per acre, valued at $6,847,911, or $81.36 per acre.

The North Platte project, Nebraska-Wyoming, accounted for considerably more than half the acreage, total yield, and total value of sugar beets grown on the projects, with an area of 45,584 acres cropped, producing 546,214 tons of beets valued at $3,878,119, or $85.07 per acre. Although above the average of all the projects, this per acre value was topped by three other projects, namely, Grand Valley, Colo., $99.24; Minidoka, Idaho, $98.48; and Strawberry Valley, Utah, $92.62.

Assuming a 15 per cent sugar content, the beets grown on the projects in 1929 yielded 287,000,000 pounds of sugar, or more than 2 pounds per capita for the population of the United States.

Sugar beets grown on projects in 1929 [1]

Project	Area	Yield		Value	
		Total	Average per acre	Total	Per acre
	Acres	*Tons*	*Tons*		
Grand Valley, Colo	824	11,682	14.1	$81,774	$99.24
Uncompahgre, Colo	2,664	27,084	10.2	189,588	71.17
Minidoka, Idaho	4,782	62,795	13.1	470,952	98.48
Huntley, Mont	4,297	46,857	10.9	351,428	81.78
Milk River, Mont	4,097	35,614	8.7	249,298	60.85
Sun River, Mont	81	495	6.1	3,713	45.84
Lower Yellowstone, Mont.-N. Dak	6,014	57,928	9.6	405,496	67.42
North Platte, Nebr.-Wyo	45,584	546,214	11.9	3,878,119	85.07
Newlands, Nev	100	506	5.0	2,595	25.95
Belle Fourche, S. Dak	8,472	88,521	10.4	641,778	75.75
Strawberry Valley, Utah	2,924	38,690	13.9	270,830	92.62
Shoshone, Wyo	4,320	40,310	9.3	302,330	69.98
Total and average	84,159	956,696	11.3	6,847,911	81.36

[1] In addition to the projects mentioned below a few beets were also grown on the Yuma, Boise, and Rio Grande projects.

Grand Valley Advertises Dairy Products

When the price of butterfat began its descent last winter, distributors and producers of dairy products in this section felt the loss with all in this industry. Independent investigations led many to believe that the consumption of oleo was greater than it should be with a decrease in the demand for local dairy products.

Through the efforts of the Mesa County agent a meeting was called of the principal producers and representatives of creameries, dairies, ice-cream factories, and all others interested in these commodities. The first meeting was held in February and was well attended.

The most manifest need was for education by advertising. All interests present contributed to a fund which was placed in the hands of a dairy products' publicity committee with authority to use newspaper and other educational advertising. Through cooperation with the advertising manager of the Grand Junction Daily Sentinel a series of six display advertisements for butter and cheese were arranged to run once each week in the local paper. In addition, 15,000 pamphlets showing the benefits from the use of these particular products were distributed through all the schools in the county. One hundred and fifty health charts were prepared and shown in schools and grocery stores.

This campaign was carried on for about two months and the resulting increase in the use of butter and cheese was so gratifying that the contributors felt well paid for their contributions.

A somewhat similar condition confronted the fresh-milk business early this season. The consumption of fresh milk, cottage cheese, and ice cream was decreasing owing to the inroads of condensed milk and similar products. Early in May a meeting was again called of the same interested parties who had participated in the previous campaign.

On this occasion several minor differences between producers and distributors were arbitrated and all decided to again contribute to a fund for advertising for educational purposes.

The same committee handles the fund and has arranged for a series of 12 advertisements, store-window cards, and similar activities. This series is now running and will continue until about August 1.

In both of these campaigns considerable interest has been aroused not only from the advertisements but also from the fact that both producers and distributors are participating for mutual benefit. A total fund of some $350 has been contributed and it is anticipated that marked improvement in this industry will result. This is more probable since the consumption of milk in this vicinity is much below the national average.

Sound Picture Location

(Continued from p. 161)

tries, Yuma is comparatively free from noise incident to large cities. For this reason it is possible to take exterior talking-picture scenes wherever desired in the surrounding country without having to guard against extraneous noises that would interfere with the theme of the story.

Federal Reclamation

Extracts from an editorial in the Yakima Daily Republic

When we saw that inquiry which Albert S. Goss, who runs the State grange, addressed to Alexander Legge, chairman of the Farm Relief Board, it started a train of thought. Mr. Goss, referring to the proposed construction of the Roza-Benton irrigation project in this valley, wanted to know if there is no way of stopping this "nonsense." Mr. Goss raised in our mind another question. It is: The irrigated districts of Washington, with their 125,000 people who own property of one kind and another worth no less than $150,000,000, who have their homes, their farms, their churches and schools, their widely varied occupations, ambitions and hopes, all built on irrigation, which began within the memory of almost all adult persons living here—is all that "nonsense"?

If it is "nonsense" to build more irrigation works in the valleys of eastern Washington in the next few years, then it was nonsense to build those we have. If the Roza-Benton project is a menace of the future, then all the Yakima projects and all the Wenatchee projects now in existence are without justification of any kind.

To say that there should be no more land reclamation in the Yakima Valley, even though the false theory of overproduction and useless competition of farmers were not false, would be just as sensible and humane and enlightened as to say that no more children should be brought into the world in this valley because when they grow up they will take away from the wage earners, farmers, and business and professional men already here their opportunities for making a living.

Development of Verde Irrigation and Power District, Arizona

On July 10 Secretary Wilbur announced that an agreement had been reached with the Verde Irrigation and Power District of Arizona, covering the points on which that organization will cooperate and making it possible, in so far as the Government is concerned, that immediate development of the project may proceed.

This enterprise, which is a private undertaking, is of interest to the Government primarily because there are Indian reservations adjacent to it. The Government's aim is to protect the rights of those Indians. In addition to this, it was called upon to act, since the canals, when laid down, must pass over Government land and could not do this until permission had been granted them.

Under the agreements as reached between the Verde Irrigation and Power District and the Government the district agrees to furnish to Indians on the Salt River and Camp McDowell Reservations sufficient water to irrigate 6,310 acres of Indian land in addition to what is already being watered there. Under the agreement the Indians are authorized to draw water as needed up to an amount sufficient to supply this specified area and are to pay for it at a fixed price per acre-foot for the amount used, which is based on the contemplated cost of water to the district. The present agreement is for a 30-year period, after which time a price adjustment is to be made.

The development of the Verde Irrigation and Power District is a private enterprise and the first consideration of the Government was to have the rights of the Indians living in the vicinity recognized. Once those rights were secured the Department of the Interior was willing to grant the necessary rights of way for the project. Hence the rights of way have been approved by the Secretary and are being promulgated in the General Land Office.

The project contemplates a series of three dams on the Verde River, which will store the flood waters of that stream and develop canals that will lead those waters onto Paradise and Deer Valleys, where there is a large acreage admirably suited for irrigation. This area is immediately to the north of Salt River Valley, which was reclaimed by the Roosevelt Reservoir and which has developed into an exceptionally productive region surrounding Phoenix. The project will develop a considerable amount of incidental electric energy as has the Roosevelt Dam and subsidiary structures on the Salt River.

Federal Reclamation Indorsed

Resolutions Adopted by Western States Reclamation Conference

TO the Honorable Governors of the Western States in conference in Salt Lake City, June 27 and 28, 1930:

Your Western States Reclamation Conference in session in Salt Lake City, June 26, 1930, realizing the necessity for the orderly, systematic development of the feasible irrigable areas of the West approved for your consideration and adoption the following resolution:

Whereas the development of the West has been largely due to the reclamation of approximately 20,000,000 acres of arid and semiarid lands, only 2,700,000 acres of which were reclaimed under the Federal reclamation act; and

Whereas it is not probable that any large additional areas may be reclaimed by private enterprise; and

Whereas the available water supply limits the additional irrigable area to approximately 20,000,000 acres under present conditions; and

Whereas this irrigable land under the most favorable conditions can not be reclaimed and brought into production at a rate greater than from 20,000 to 50,000 acres a year, which, no matter how important to the West, is so small as to have a negligible effect in producing general agricultural surpluses, particularly in view of the fact that marginal lands are being abandoned more rapidly than these will be reclaimed; and

Whereas attacks based on lack of information, misinformation, and erroneous assumptions have been made on Federal reclamation with a view to discrediting it by creating a public sentiment against it, and ultimately causing the discontinuance of Federal reclamation; and

Whereas the curtailment, lapse, or abandonment of the Federal reclamation policy would seriously retard the development of the West which would be reflected to the economic and industrial advantage of the Nation; and

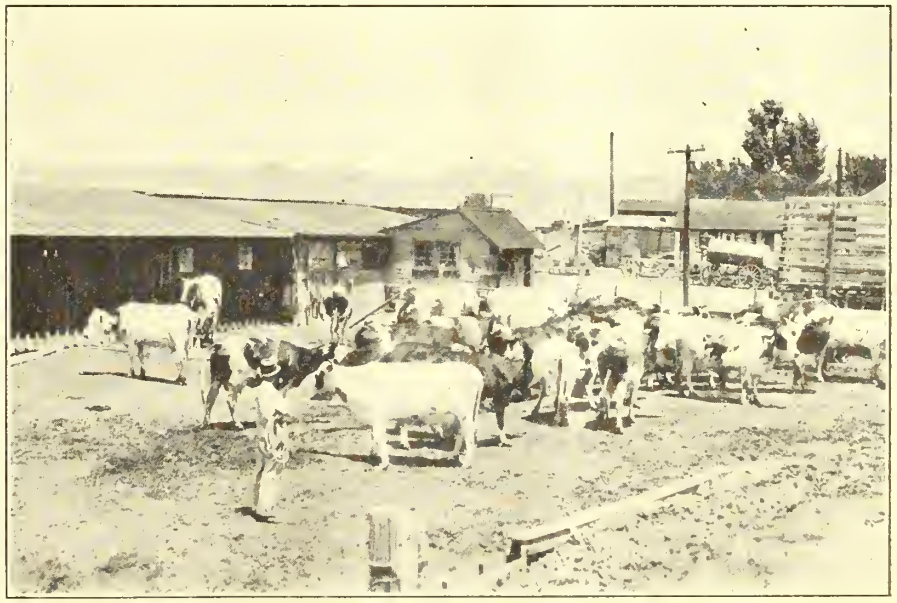
Whereas the Federal reclamation revolving fund was built up from the sale of land, from royalties on oil, coal, and other natural resources of the Western States, the available amount at the present time being about $8,000,000 a year derived mostly from repayment of construction costs:

Therefore be it resolved—

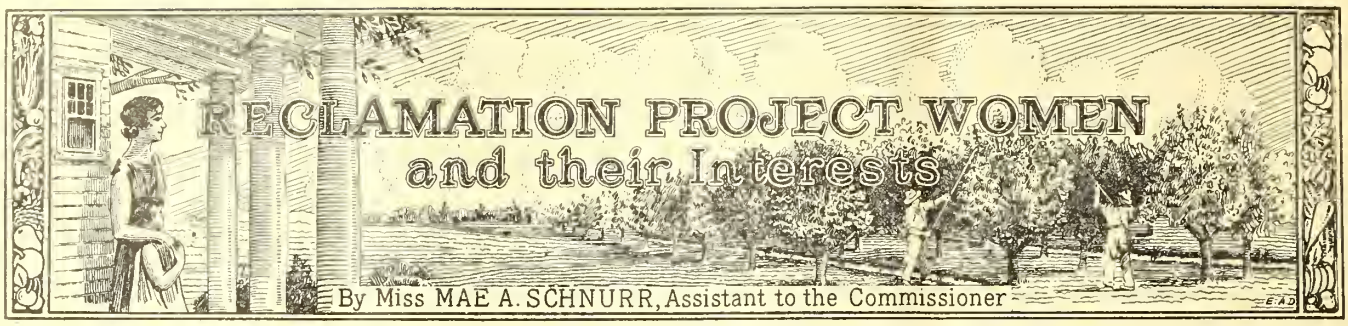
1. That Federal reclamation has been and is of great benefit to the entire Nation.

2. That its continuance is essential to the future growth and prosperity of the West and of the Nation as a whole.—

GEO. M. BACON,
Secretary of Conference.



Dairy herd, Grand Valley project, Colorado



Interesting Facts About Women's Organizations in Some Foreign Countries

HOW many times have you heard or read the remark that women's affairs are not as far advanced as men's because of the lack of organization. Perhaps they were late in getting started but there is no stopping them. There is everywhere a growing recognition of the importance of the contribution which can be made by the woman to the economic and social life of rural areas, also of the necessity of brightening her individual life and giving her that wider outlook and fuller power of adaptation which will enable her best to meet the demands of her exacting vocation.

A great deal has been written for this section as to women's organizations in the United States. A glimpse of what is being done in this respect by the country women's organizations in foreign countries is given from information gathered this year by the International Institute of Agriculture.

FRANCE.—There are in France a very large number of country or farm women's associations dealing with the vocational and household interests of the woman in the country. The origin of these is due mainly to private initiative in each case; they exist apart from State control or State aid and are not even, strictly speaking, federated under a central organization, and consequently figures of membership are not available. There does, however, exist a Union Centrale des Associations Rurales Feminines under which the associations are virtually grouped.

In principle, the agricultural syndicates or unions of farm employers and employed in France are open to women as well as men; in practice, however, only women farmers who are heads of families belong to these unions. During the last two years the regional unions of these syndicates have been endeavoring to establish a central organization of women's institutions dealing more particularly with the vocational and household interests of the woman in the country. The Union du Sud-Est, with headquarters at Lyons and with a sphere of influence extending over 10 departments, has for many years done much to promote farm household management instruction; it has established farm women's associations, 10 being established during the past year, and has just formed an Association Feminine Agricole, membership of which is open to any and all women who are in any way connected with the calling of agriculture. Similar action has been taken by the unions of Finistere and of the Cotes-du-Nord in Brittany, and it is expected that in the near future there will be a women's center of rural institutions connected with all the regional unions.

Activities.—The object of all the associations is to give a thorough training to the women in the country. The means usually adopted is the development of all stages of household management instruction; instruction by correspondence, which is admirably organized in certain regions; the Semaines Rurales, a type of meeting similar to the conferences held by the Belgian Farm Women's Clubs, but specially intended for girls; and other types of instruction.

The associations receive no subsidy or official encouragement of any kind, although the Government has established traveling schools of a very useful character.

GREAT BRITAIN.—The foundation of Women's Institutes, the name given to associations of countrywomen in England, dates from 1915, when it was realized to be essential to promote combined effort among the women in rural areas with special reference at the time to food production and preservation. Advantage was taken of the experience already gained in the Dominion of Canada, where since 1897 a movement had gone on in the different Provinces for banding together the countrywomen in the isolated districts for mutual support, social intercourse, and interchange of ideas. The project for Women's Institutes in England and Wales was laid before the Agricultural Organization Society, which gave it cordial support and undertook the necessary work in connection with the new organization. In 1917 there were 137 institutes in existence in the rural districts of England and Wales, and a National Federation was formed in that year. During the years 1915 to 1919 a grant was made by the Board of Agriculture, and for part of that time the board also undertook the propaganda work in connection with the institutes as being of national value. Later, however, it was considered advisable that the federation should be self-supporting and should itself undertake the formation of new institutes. By June, 1929, there were 4,321 Women's Institutes in existence.

In addition to the monthly meetings of each institute, which are a feature of the organization, each institute holds its own annual general meeting, when its officers are elected, the accounts and report adopted, and delegates are appointed alike to the National Federation annual general meeting and to the County Federation Council, which must meet at least twice a year.

The policy laid down at the annual general meeting of the National Federation is carried out by an executive committee of not more than 25 members, of which 17 are elected by the federation, 3 members are appointed by the Ministry of Agriculture, 1 by the Board of Education, and 1 by the Ministry of Health, and in addition 3 members are co-opted by committee itself. By this means the work of the federation is kept in touch with general and official opinion. It is represented on the National Council of Social Service, and on a number of organizations concerned with rural betterment and social or educational activities.

The National Federation is an affiliated member of the International Commission of Agriculture, and was represented at the Fourteenth International Congress of Agriculture held at Bucharest in June, 1929.

Activities.—Each institute is a non-political, nonsectarian, and democratic association of countrywomen of all classes in a given rural district. The primary activity of each institute is the holding

of a monthly meeting at a convenient time on a fixed day, such meetings to be partly instructive and partly recreative in character, the members so far as possible themselves contributing educational or recreative elements. The program for the meetings of any institute is arranged in accordance with the wishes of the members and usually for six months or a year in advance. The range of activities is very varied and includes lectures, discussions, demonstrations, or courses in various kinds, e. g., of home handicrafts, preparation and production of plays, concerts, competitions, and exhibitions. Particular stress is laid on the advantages of informal discussion, and on the cooperation of members in the various activities, according to individual tastes and capacities. On the other hand, every monthly meeting is in part a business meeting and is strictly conducted in this respect. The improvement of life in the villages is, generally speaking, one of the main objects of the whole organization, and with this object opportunity is given for obtaining information on and discussion of all practical details, such as rural housing, water supply, rural telephones, rural libraries, and educational facilities of different kinds. The formulation of any definite policy on these subjects is, however, rather the work of the county federations or of the National Federation than of the separate institutes, whose members are merely encouraged to take an intelligent view of the problems while appointing delegates to deal with them.

The federation has indubitably shown itself able to influence public opinion, and even the course of legislation, on matters that concern countrywomen, and in this way, as well as by the work done in raising the social and educational level of family life in the rural districts, it has become a valuable feature of English national life.

The history of the movement in Scotland is similar; the idea originated in a report made to the Scottish Board of Education in 1912. No action was, however, taken till 1917 when the Board of Agriculture in Scotland was approached and beginning of organization made. A constitution was adopted in 1920 rendering each institute self-governing with the right of electing delegates to biennial conferences held in each of five areas. These conferences elect members of area committees which administer funds and encourage activities in their area. A central council is elected from these committees. In 1922 the board ceased to direct the organization which has proceeded on the above lines as an entirely self-governing body since that time.

Hungary.—Although farm women's associations as such are not yet in existence in Hungary, a movement is now in progress for their formation and is being energetically fostered by the Faluszövetség (National Federation of Villages), an important modern organization for the improvement of the standard of life of the rural population.

Actually there are already from about 25 to 30 women's associations with a small membership which are concerned with the vocational and household interests of the countrywoman. The object in view is the development from the economic and social standpoint of the status of the woman in the rural districts. Practical 4-year courses are arranged in some cases for girls from country districts in home nursing, dressmaking, laundry, and household management, while the national songs, dances, and embroidery also form part of the instruction or recreation provided. The activities also include lectures, courses, and social gatherings for older women. The work so far accomplished has been built up by private initiative, but the movement is now becoming part of the activities of the Faluszövetség which was largely responsible for the organization of the Third International Congress for Rural Life Betterment in Budapest in June, 1929.

Poland.—The organization of farm women in present-day Poland has a particularly vigorous character. It falls into three well-defined groups.

(*a*) In the western Provinces of the former kingdom there were formed, as far back as 1895, the Ziemianki, associations of women landholders which are thus the earliest societies of the kind existing in Europe. These societies had an important rôle in the history of the country, but up to 1920–21 their membership did not exceed 15,000. Since that date their activities have become wider in scope, and membership is now about 30,000.

(*b*) To meet the needs of the more backward rural areas of eastern Poland and of those districts of central Poland, where the Zemianski have not been established, "Cercles de Ménagères Rurales," have been organized by the farm women's section of a large central society for rural organizations. The total membership of these is now about 24,000.

(*c*) In addition, similar bodies have been set up by the Chambers of Agriculture of Posen, Cracow, Silesia, and Volhynia, the respective membership being given as 5,300, 1,250, 1,000, and 400.

All the above, including the more historic Ziemianski, are now grouped under the "Conseil Central de l'enseignement ménager féminin," which also groups the urban associations of the same kind and the household management high schools. The primary object of the whole movement, as now existing, is the development of women's work in the family and household and of the general position of woman in society.

Activities.—Social gatherings are arranged by the associations, and are often attended in large numbers. Considerable stress is laid on the educational side of the work of all the organizations; courses are arranged in domestic subjects, including many branches of peculiarly artistic handiwork, and exhibitions and competitions are encouraged. Women advisors in poultry keeping, gardening, household management, and hygiene give lectures and visit villages and farmhouses throughout Poland. Correspondence courses in household management are also carried on.

Valuable work is also carried on for the girls and younger women in the country by various organizations of the youth of Poland. Special attention is given to competitions in maize and sugar-beet growing and in poultry rearing, and the preparation of the young people for farm life and activities is never lost sight of. Members of these more juvenile associations usually pass on to membership of women's organizations already described.

Finance.—The associations are in all cases the result of private initiative, but are encouraged by the Government subsidies, made either directly or through federating organizations.

(Editor's note: A statement of similar organization activities will appear in the next issue.)

Progress on Kittitas Division

Commissioner Mead has received a letter from Mr. F. A. Kern, secretary of the Kittitas reclamation district, Yakima project, Washington, giving a very encouraging statement concerning progress on the Kittitas division. An 80-acre tract near Cle Elum has been sold to an enterprising young man who, with his wife and two children, will live on the land and build a home this summer. Last fall 30 acres of the tract were cleared and the balance is now being plowed and will be summer fallowed this season. The soil is splendid and the farm gives promise of profitable returns.

Considerable clearing is in progress on other tracts, and the bumper crops on lands heretofore cleared which now have the advantage of water from the canal are encouraging to owners of uncleared land. Thus far delivery of water under the new ditch, both to the lands under the main canal and the South Branch Canal, is being made in a very satisfactory manner, and the green crop growing on land which last year was in sagebrush or stumps is very pleasing to the eye.

Second Deficiency Act, Fiscal Year 1930

Bureau of Reclamation

BOULDER Canyon project: For the commencement of construction of a dam and incidental works in the main stream of the Colorado River at Black Canyon, to create a storage reservoir, and of a complete plant and incidental structures suitable for the fullest economic development of electrical energy from the water discharged from such reservoir; to acquire by proceedings in eminent domain, or otherwise, all lands, rights of way, and other property necessary for such purposes; and for incidental operations; as authorized by the Boulder Canyon project act, approved December 21, 1928 (U. S. C., Supp. III, Title 33, ch. 15A); $10,660,000 to remain available until advanced to the Colorado River Dam fund, which amount shall be available for personal services in the District of Columbia and for all other objects of expenditure that are specified for projects included under the caption "Bureau of Reclamation" in the Interior Department appropriation acts for the fiscal years 1930 and 1931, without regard to the limitations of amounts therein set forth: *Provided*, That of the amount hereby appropriated, not to exceed $100,000, shall be available for investigation and reports as authorized by section 15 of the Boulder Canyon project act.

Secondary projects: The sum of $25,000 of the appropriation of $275,000 for secondary projects, contained in the first deficiency act, fiscal year 1930, is hereby made available for investigations of water supply for the San Joaquin and Sacramento Valleys.

COMMENT

Section 2 (a) of the Boulder Canyon project act, approved December 21, 1928, establishes a special fund in the United States Treasury to be known as the Colorado River Dam fund, and directs that all revenues received in carrying out the provisions of the act shall be paid into and expenditures shall be made out of the fund under the direction of the Secretary of the Interior. Section 2 (b) authorizes the Secretary of the Treasury to advance to the fund, from time to time and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of the act. On July 3, 1930, the Secretary of the Interior requested the Secretary of the Treasury to advance to the Colorado River Dam fund, $25,000 from the appropriation for the Boulder Canyon project, provided in the second deficiency act, fiscal year 1930. On July 14, 1930, the first advance of money from the Colorado River Dam fund was made to the special fiscal agent in the office of the chief engineer at Denver.

Amendment of Adjustment Act of May 25, 1926

Section 43 of the act of May 25, 1926, has been amended as follows:

"The payment of all construction charges against said areas temporarily unproductive shall remain suspended until the Secretary of the Interior shall declare them to be possessed of sufficient productive power properly to be placed in a paying class, whereupon payment of construction charges against such areas shall be resumed or shall begin, as the case may be. Any payments made on such areas shall be credited to the unpaid balance of the construction charge on the productive area of each unit. Such credit shall be applied on and after the passage and approval of this act, which shall not be construed to require revision of accounts heretofore adjusted under the provisions of this section as originally enacted. While said lands so classified as temporarily unproductive and the construction charges against them are suspended, water for irrigation purposes may be furnished upon payment of the usual operation and maintenance charges, or such other charges as may be fixed by the Secretary of the Interior the advance payment of which may be required, in the discretion of the said Secretary. Should said lands temporarily classed as unproductive, or any of them, in the future be found by the Secretary to the Interior to be permanently unproductive, the charges against them shall be charged off as a permanent loss to the reclamation fund and they shall thereupon be treated in the same manner as other permanently unproductive lands as provided in this act except that no refund shall be made of the construction charges paid on such unproductive areas and applied as a credit on productive areas as herein authorized."

Approved, April 23, 1930.

COMMENT

When adjusting the repayment accounts to conform to the various adjustment contracts made with water users' associations and irrigation districts, the accrued charges, payments, and unpaid charges applicable to lands classified as temporarily unproductive were segregated from the accrued charges, payments, and unpaid charges applicable to lands classified as productive. The amounts so segregated as applicable to temporarily unproductive lands were set up in suspense accounts to remain immutable until the lands classified as temporarily unproductive were either restored to the productive class or classified as permanently unproductive. Upon restoration to the productive area of the lands classified as temporarily unproductive, repayment of charges applicable thereto would be resumed in accordance with the status of repayment at the time the charges and payments applicable to the temporarily unproductive area were placed in suspense. This procedure was required by the provisions of section 43 of the act of May 25, 1926, and resulted in holding in suspense considerable sums of money.

The amendment of section 43 of the adjustment act provides that any payments made on areas temporarily suspended shall be credited to the unpaid balance of the construction charge on the productive area of each unit. This change in the law will give the water users the

(Continued on page 168)

FUNDS AVAILABLE, FISCAL YEAR 1931—APPROPRIATIONS, UNEXPENDED BALANCES, FUNDS TO BE ADVANCED AND POWER REVENUES

Projects and other items	Direct appropriation	Unexpended balances continued available (estimated)	Power revenues appropriated	Funds to be advanced (estimated)	Total available	Distribution by divisions and features for which appropriated									
						Examination and surveys	Storage system	Canal system	Lateral system	Drainage system	Power system	Irrigable land surveys	Telephone system	Operation and maintenance	Miscellaneous
Reclamation fund:															
Washington office	$178,000				$178,000										$178,000
Examination and inspection of projects		$43,500			43,500									$43,500	
Operation and maintenance of reserved works		70,000			70,000									70,000	
Yuma	295,000		$25,000		320,000										
Irrigation system										$20,000				275,000	
Commercial power system														25,000	
Orland	38,000				38,000									38,000	
Grand Valley		15,000		$50,000	65,000				$1,000	13,800		$200		50,000	
Uncompahgre				140,000	140,000									140,000	
Boise	920,000	10,000		30,000	960,000										
Arrowrock division							$250,000			30,000				30,000	
Payette division							620,000							20,000	
Notus division										10,000					
Minidoka	1,128,000	300,000	150,000	95,000	1,673,000										
Reserved works, except power system														123,000	
Power system														50,000	
South Side pumping division								$75,000		25,000					
Gooding division								1,400,000							
Milk River	31,000			45,000	76,000										
St. Mary storage unit							14,000								
Chinook division														8,000	
Malta and Glasgow divisions								3,000	6,000					45,000	
Sun River	286,000	300,000		3,300	589,300										
Greenfields division							80,000	470,000		25,000				14,000	
Fort Shaw division														300	
Lower Yellowstone		80,000		55,000	135,000					80,000				55,000	
North Platte			75,000	50,000	125,000										
Reserved works, except power system														50,000	
Power system														75,000	
Carlsbad	50,000				50,000									50,000	
Rio Grande	508,000				508,000			1,000	4,000	128,000				375,000	
Baker		411,800			411,800		411,800								
Owyhee	2,000,000				2,000,000		700,000	1,300,000							
Umatilla				4,000	4,000									4,000	
Vale	545,000				545,000	$1,300		490,700	33,000			5,000		15,000	
Klamath	269,000	100,000		82,500	451,500										
Main division										100,000				80,000	
Tule Lake division								100,000	50,000	70,000		1,000	$1,000	42,500	
Langell division														2,000	
Refunds to lessees															5,000
Belle Fourche	157,000	100,000		75,000	332,000			13,000		244,000				75,000	
Salt Lake Basin, Utah—															
First division		250,000			250,000		150,000	100,000							
Second division	300,000				300,000		300,000								
Yakima	325,000	1,375,000			1,700,000										
Storage division							1,375,000							75,000	
Sunnyside division														150,000	
Tieton division														100,000	
Yakima-Kittitas division	970,000	100,000		25,000	1,095,000			768,000	257,000			10,000	10,000	50,000	
Yakima-Kennewick division	640,000				640,000						$640,000				
Riverton	58,000	350,000	20,000		428,000										
Irrigation system									350,000	15,000		10,000	3,000	30,000	
Commercial power system														20,000	
Shoshone	138,000	194,000	95,000	1,200	428,200										
Garland division										150,000					
Frannie division										20,000					
Willwood division									31,500	14,000		500		16,000	
Reserved works, except power system														1,200	
Commerical power system											175,000			20,000	
Secondary	75,000	270,000		75,000	420,000	420,000									
Economic surveys and investigations	50,000				50,000	50,000									
Refunds of construction charges		54,000			54,000										54,000
Total reclamation fund	8,961,000	4,023,300	365,000	731,000	14,080,300	471,300	3,900,800	4,720,700	732,500	944,800	815,000	26,700	14,000	2,217,500	237,000
General treasury:															
Colorado River front work and levee system	100,000				100,000									100,000	
Boulder Canyon	10,660,000				10,660,000	100,000	10,175,000								385,000
Yuma auxiliary reclamation fund	25,000				25,000									25,000	
Grand total	19,746,000	4,023,300	365,000	731,000	24,865,300	571,300	14,075,800	4,720,700	732,500	944,800	815,000	26,700	14,000	2,342,500	622,000

Reclamation Organization Activities and Project Visitors

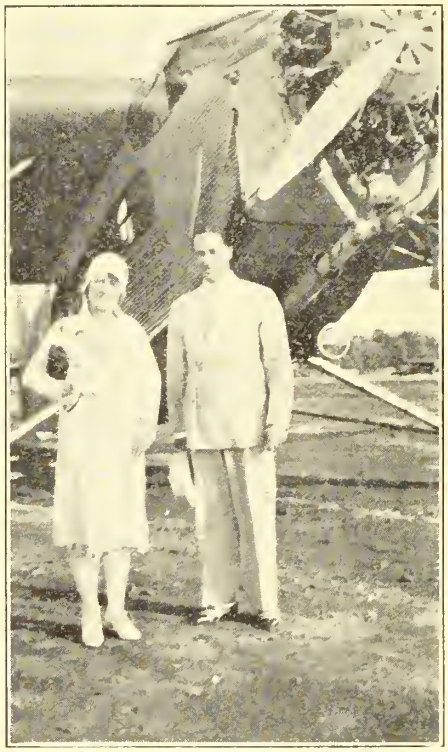
DR. ELWOOD MEAD, Commissioner of Reclamation, left Washington on July 4 for an inspection of reclamation projects. He spent considerable time in Denver in conference with the office staff on matters relating to organization and commencement of construction of the Boulder Canyon project. His itinerary includes projects in Montana, Wyoming, Washington, and Oregon. He also expects, from time to time, to consult with members of the Committee on the Conservation and Administration of the Public Domain who are making a study of public-land problems. On part of the trip he will be accompanied by E. C. Van Petten, representing Oregon on the committee, and George W. Malone, State engineer of Nevada, representing that State. Doctor Mead represents California on this committee. He plans to return to Washington about August 20. During the commissioner's absence P. W. Dent, assistant commissioner, is acting commissioner.

Chief Engineer R. F. Walter left Denver on June 8 to visit the Rio Grande and Carlsbad projects, and stopped off at Santa Fe, N. Mex., en route to inspect the Santa Cruz project at the request of representatives of the Santa Cruz irrigation district. Mr. Walter returned to Denver on the 19th.

C. N. McCulloch, chief clerk of the Washington office, has just returned from a short trip to Atlantic City and near-by points. En route Mr. and Mrs. McCulloch motored up the coast to Asbury Park and Atlantic Beach, took the steamer across the bay to New York City, and returned to Washington via Princeton and Philadelphia.

K. C. Wu, an engineer of Shanghai, China, visited the Denver office and several of the projects under construction en route to his home.

Mr. S. E. Fitz-Simon, director general of irrigation of Argentina, spent several days in the Washington office recently after a flight of 8,000 miles from his home. During his stay in Washington he invited Doctor Mead and Miss Schnurr, assistant to the commissioner, to make a flight over the city. Another engagement prevented the commissioner from accepting, but Miss Schnurr enjoyed a flight in a tri-motor all-metal plane as shown in the accompanying photograph. Mr. Fitz-Simon is now on a trip to the West, where he will visit a number of the irrigation projects. His last visit to our projects was in 1927.



Miss Schnurr and Mr. Fitz-Simon just before the take-off

Representatives of the Chicago, Burlington & Quincy Railroad were on the Riverton project early in the month, the party consisting of Frederick E. Williamson, president and chairman of executive committee; E. P. Bsacken, vice president in charge of operating department; J. C. Roth, vice president in charge of transportation; H. L. Ford, of the agriculture department; F. T. Darrow, assistant chief engineer; E. Flynn, general manager, lines west; F. Montmorency, general freight agent, lines west; F. G. Gurley, general superintendent, lines west; J. C. Grisinger, division superintendent, Wyoming; and H. O. Havemeyer, assistant to president of the Brooklyn eastern district terminal.

Secretary Wilbur has designated Oscar B. Hammer, secretary of the Tule Lake Community Club, as a fourth member of the board of examiners on the Klamath project to represent the Tule Lake Community Club in the selection of settlers in the Tule Lake area.

George A. Beyer, photographer in the Washington office, expects to leave on a brief photographic trip about the middle of August. He plans to visit the Belle Fourche, Shoshone, and Yakima projects, particularly to obtain a more complete photographic record of the harvesting of potatoes, sugar beets, and apples.

Former Chief Engineer F. E. Weymouth, chief engineer of the Metropolitan Water District, Los Angeles, was on the Yuma project during the month.

State Engineer John A Whiting, of Cheynne, Wyo., made two recent visits to the North Platte project office in connection with investigations for the Goshen Park High Line.

Dr. F. L. Ransome, geologist, made an examination recently of the Agency Valley Dam sites on the North Fork of Malheur River, Vale project. He found all three sites practicable geologically and recommended a program of additional drilling. An examination was also made of the Cle Elum reservoir and dam site on the Yakima project, Washington, and Doctor Ransome found that geologically there is nothing to prohibit construction of a safe dam of the general type proposed.

The designing force of the Denver office, at the request of the Navy Department, Bureau of Yards and Docks, will undertake computations and prepare sketches of the proposed Cat Creek Dam at the naval ammunition depot, Hawthorne, Nev.

W. F. Schilling, member of the Federal Farm Board, visited the Grand Valley and Uncompahgre projects during the month and made speeches at Grand Junction, Montrose, and Delta in which he stressed the efforts of the Farm Board in assisting cooperative marketing organizations which are properly organized and are really cooperative. He was on his way to the meeting at Salt Lake City for the organization of the turkey marketing association to cover six Northwestern States.

Comment on Adjustment Act

(Continued from page 166)

benefit of considerable sums paid as construction charges prior to the adjustment act of May 25, 1926, on lands classified by that act as temporarily unproductive.

Adjustments in the accounts to give effect to the above amendment of section 43 of the adjustment act of May 25, 1926, are now being made and the irrigation districts and water users' associations concerned will be advised of the adjustments as fast as the work is completed.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John H. Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
G. O. Sanford, Reclamation Economist

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng., S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr			do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	J. C. Page	do	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Const. engr	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent	N. O. Anderson	Denver office	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	H. W. Bashore	Constr. engr	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	P. J. Preston	Superintendent	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Acting constr. engr.	E. R. Mills	do	do	Do
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	E. W. Shepard	Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gravity Extension division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation disitrct	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo	A. B. Reeves	do	Mrs. Nelle Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	D. R. Dean	do	Mrs. M. J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Yuma, Ariz	H. J. Gault	Imperial and Coachella districts.
Palo Verde Valley	do	R. M. Priest, H. J. Gault	
Central California water resources	Sacramento, Calif	C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga	Saratoga, Wyo	J. R. Iakisch	State of Wyoming.
Cle Elum Reservoir	Cle Elum, Wash	Ralph Lowry	

HUNTSVILLE DAM SITE, OGDEN CANYON, UTAH

U. S. GOVERNMENT PRINTING OFFICE: 1930

NEW RECLAMATION ERA

VOL. 21, NO. 9 SEPTEMBER, 1930

THE ORLAND HIGH SCHOOL, ORLAND PROJECT, CALIFORNIA

FEDERAL RECLAMATION AN AID TO THE NATION'S PROSPERITY

President Hoover, in letter through Assistant Secretary Dixon to Conference of Governors of Western States held in Salt Lake City, Utah, June 30 and July 1 and 2, 1930

SINCE the passage of the national reclamation act in 1902 the Federal Government has been engaged in the construction and operation of reclamation projects in the irrigated West. The undertaking has been of great benefit to this region and has been the cause of adding much wealth to the Nation.

The work has been financed entirely from receipts from the development of the resources found upon and within the public lands, except as to a loan of $20,000,000, which is being repaid to the Federal Treasury. It is the desire of the West that, so long as the United States retains control of such large amounts of the resource assets of the public-land States, this helpful undertaking be continued. Opposition comes from those who believe the Government should discontinue an activity that, in their opinion, seems uneconomic or which appears to them as further aggravating a bad agricultural situation.

If the fundamental facts are properly appraised, it seems certain that the arguments of opponents of Federal reclamation will find satisfactory answer and they will no longer countenance the misleading information which is now being broadcast through different agencies. The importance of the matter is attested by the fact that the Conference of Governors of Western States has been held during the past two years with this subject particularly in mind.

Only two days ago resolutions were adopted in strong support of the present Federal reclamation policy as based upon equity to the interests involved and upon sound economic principles, not only applying to the western country, but to the Nation as a whole.

Time can be taken for only a brief synopsis of the facts applying to the situation as known by those acquainted with same through active and continuing experience. Only 1 per cent of farm commodities raised in the United States are produced on Government reclamation projects and 90 per cent of the quantity so produced is locally consumed. The projects themselves furnish extensive markets for manufactured goods as well as for farm products not raised under irrigation, and thus seem to afford material benefit, rather than detriment, to other sections.

It may further be said that crops raised under irrigation are generally supplemental to, rather than competitive with, the products of other farms. We may take sugar, for instance, known to be a major crop on Federal reclamation projects and susceptible of profitable culture in but few sections outside of the irrigated areas. Continental United States produces less than 20 per cent of its own sugar requirements.

Is it not wise to allow this industry to develop in the irrigated West as an aid to the Nation's prosperity? Certainly there is no competition for a market with this crop from other sections. Then we may refer to the products of irrigated areas to provide winter feed for sheep and cattle carried by the extensive open ranges of the West, and know that such livestock find way in countless numbers to feed lots of the Middle West to be finished on the corn and other products of the region.

Many other instances could be cited to show that development of irrigation in our States, gradual as it must necessarily be, will be helpful, rather than harmful, to other sections. Financed entirely from development of resources in the States in which the irrigation projects are located, no valid arguments appear to oppose this constructive Federal undertaking. Rather, support should be given in light of the contribution to the Nation's good.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 September, 1930 No. 9

Interesting High Lights on the Federal Reclamation Projects

THREE fine farm homes on the Huntley project are now under construction. They will replace old homes that have served more than 20 years.

THE interest of prospective settlers in the Riverton project continues. Several home seekers were shown over the project during the past month.

ALL crops on the Uncompahgre project were generally in excellent condition at the close of the month, and the warm weather combined with the frequent rains the latter part of the month, were favorable for plant growth. The various cooperative associations on the project will handle the bulk of the crops grown this season.

A NUMBER of prospects called at the Ellensburg office during the month seeking information regarding opportunities on the Kittitas division of the Yakima project.

SIXTY Pennington County farmers made a trip to the Belle Fourche project early in the month to view the crops and demonstrations at the United States experiment farm. The group was entertained at the farm and following dinner a talk on irrigation was given by M. H. Chapman, industrial agent for the Chicago & North Western Railway Co.

A CENTRAL organization for the distribution of funds for welfare work on the Carlsbad project was organized during the month.

ABOUT 600 acres of beans are being raised on the Boise project this year, and the present condition of the crop is excellent. It is predicted that this legume will develop into one of the important staples on the project.

THE Minidoka project reports crops in excellent condition, with heavy yields anticipated.

THE fourth Minidoka County Lamb Pool was shipped out of the project on July 10. It contained 961 lambs weighing 77,456 pounds, besides a few wethers. The lambs were sold for 8 cents per pound, making the total receipts about $6,200. A shipment of lambs was also made from Burley in July, containing 714 lambs weighing 56,800 pounds, 9 wethers weighing 855 pounds, and 2 rams.

AT the end of the month the contract on the Owyhee Dam, Owyhee project, was 36 per cent complete.

THE Lower Yellowstone project reports a larger acreage of beans than ever in its history, and prospects are excellent for the season's yields.

IN June the Mini-Cassia Dairymen's Association, Minidoka project, bought 51,147 pounds of milk butterfat, for which it paid 38 cents per pound, and 27,086 pounds of cream butterfat, at 30 cents per pound.

NATURAL-GAS service was inaugurated in the project towns of the Lower Yellowstone project during July.

RENEWED interest is being manifested in the cooperative marketing of livestock on the Klamath project. At a meeting held in Fort Klamath, 22,000 head, making a total of 31,000 head, or about 75 per cent of the cattle in Klamath County, were signed up to the Western Cattle Marketing Association.

SEVERAL suburban tracts and city residences on the Minidoka project were sold during the month.

A NUMBER of real-estate transactions occurred on the Rio Grande project during the month. One farm of 22 acres was sold for $10,000.

CONTENTMENT continues among the new settlers on the Lower Yellowstone project. The immigration agent of the Northern Pacific Railway Co. spent a day on the project interviewing new settlers. About 15 families were called on and the railway representative was impressed with the apparent satisfaction prevailing among those visited.

THE unusually dry season has stimulated interest in project lands on the Milk River project among adjacent dryland farmers who have suffered during the past two years from drought. Several project landowners have offered small farms for sale at attractive terms, and a committee of Malta Commercial Club members, working with the project superintendent, is now obtaining satisfactory agreements for the sale of tracts which will embody uniform prices and terms. It is anticipated that several desirable new settlers can be located on the project this fall.

WORK is being rushed on the new San Carlos Hotel on the Yuma project. The cooling and heating systems are being installed, and plasterers and interior finishers are at work. It is expected that the two lower floors will be ready for occupancy by September 1.

ABOUT 400 acres of land in the Shasta View irrigation district of the Klamath project were disposed of in the month of July.

THE alfalfa meal mill at Rupert, Minidoka project, recently installed a new 1,500-pound regrinder equipped with a 150-horsepower motor.

Commissioner Mead Makes Annual Inspection

DURING the last half of July and first half of August, Dr. Elwood Mead, Commissioner of Reclamation, and R. F. Walter, chief engineer, made their usual annual inspection of projects.

The first visit was to the canal survey being made in the North Platte Valley in the vicinity of Saratoga. This was followed by a conference at Casper, with parties interested in the Casper-Alcova project.

A day was spent at Riverton, and another day on the Shoshone project, where a visit was made to the newly settled farms on the Willwood division. Both the commissioner and chief engineer were impressed with the progress which has been made on Willwood since their last inspection, and they were delighted with the fine crops to be seen everywhere on the older farms of the Garland division of the project.

SUN RIVER PROJECT IN EXCELLENT CONDITION

From Willwood the party went to the Sun River project, which this year, for the first time, is assured of an ample water supply throughout the entire irrigation season. The Gibson Dam, completed last year, has above it a lake 7 miles long, and this was filled early in the season. At Sun River the party was joined by George W. Malone, State engineer of Nevada, who, as a member of the Committee on the Conservation and Administration of the Public Domain, was making a tour of the Northwest studying conditions. Mr. Walter and Mr. Malone visited the dam, while Commissioner Mead held conferences with the settlers on the Fort Shaw and Greenfields divisions of the project. On both divisions there are excellent crops, and on the Greenfields division the area irrigated this year is double that of last, with evidence of much larger yields. It is expected that the irrigated area will be further increased next season, and settlers expressed the need for an economic adviser who could help them plan their crop program, lay out their laterals, and make more rapid progress in becoming expert users of water.

MILK RIVER PROJECT CHANGING AGRICULTURALLY

After Sun River, Milk River was visited and conferences were held with irrigators at Glasgow, Malta, and Chinook. The type of agriculture on this project is changing. More sugar beets, potatoes, dairies, and the growing of garden seed for the distributors are among the important new features. It was agreed that there should be closer cooperation between the water users and the superintendent in the operation of the project, and arrangements for beginning this were discussed. Also, here again, the new crops and the new types of agriculture called for more advice in irrigation economics and irrigation practice than can be given by the superintendent.

COLUMBIA BASIN PROJECT VIEWED FROM AIR

Four days were spent in going over Columbia Basin, the last day's inspection being from above in an airplane which flew at a low elevation so as to give an opportunity to study soil and crops and the irregularities of the slopes. Here the commissioner and the chief engineer were joined by L. N. McClellan, electrical engineer of the bureau, and E. B. Debler, hydrographic engineer.

The lands in Columbia Basin which are proposed to be irrigated were settled a few years ago by dry-land farmers, who believed that wheat could be grown by rainfall alone. A succession of dry seasons brought disaster to this attempt. On the specially fine lands of the Quincy Flats there are scores of comfortable homes which have had to be abandoned, and a few towns in which no one now lives. In striking contrast to this dreary picture there is the remarkably luxuriant growth of the few oases where land is being irrigated by water pumped from wells, or from Moses Lake, which catches the drainage of Crab Creek. In the accompanying illustration is shown one of the homes on an abandoned dry farm, and the attractive home of the Gallaghers, which is irrigated from a well and supported by the proceeds of an orchard and vegetable garden having remarkable records of yields and money income.

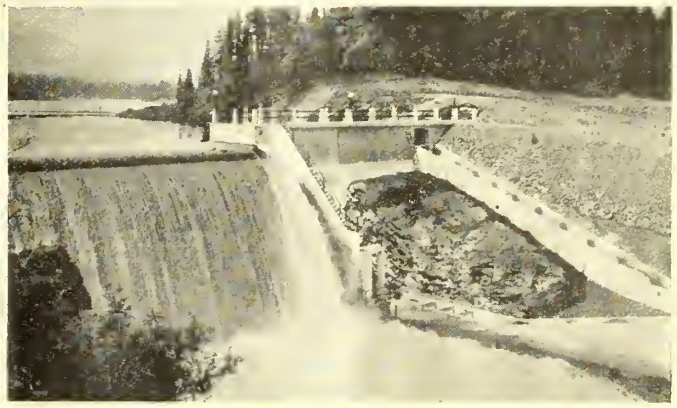
The last Congress appropriated $50,000 for continuing studies of the Columbia Basin project and this general inspection was to determine how the work of the bureau could best fit in with the extensive surveys being made by the War Department so as to avoid duplication and give to Congress and all concerned a better understanding of the possibilities of this development and what is required to carry it out in the most effective manner. The conclusion reached was to send H. W. Bashore, now superintendent of construction on the Vale project, to bring together all of the reports and investigations to date, and make such further field studies as would enable the bureau to recommend a definite program of development.

KITTITAS DIVISION HAS ENCOURAGING OUTLOOK

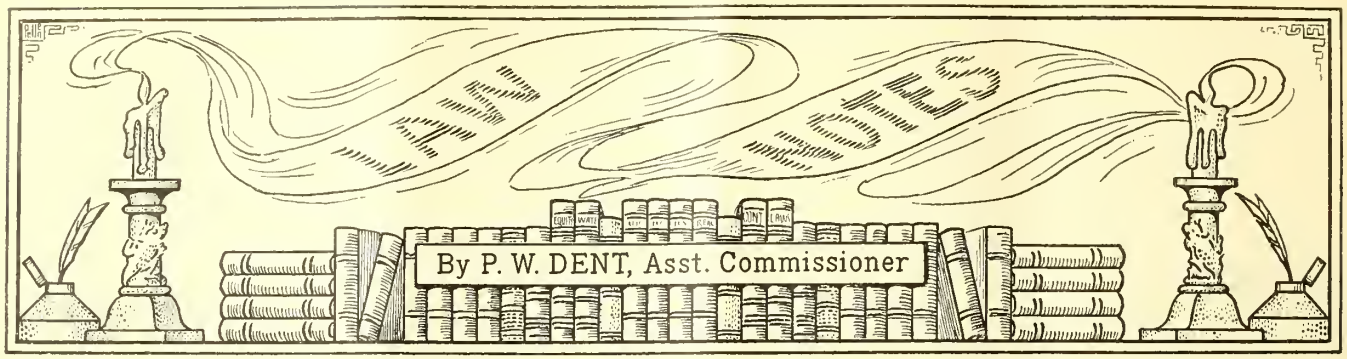
The next project visited after Columbia Basin was Yakima, where conferences were had with parties interested in development of Kennewick, Roza, and Kittitas. Conferences were also had with the Sunnyside irrigation district. All these conferences had to do with completing arrangements which would enable the bureau to go on with the construction of the Cle Elum Reservoir. After these conferences an inspection was made of the completed part of the Kittitas Canal and of the lands irrigated from it the first time this year. The illustrations from snapshots made by E. S. Benson show the durable character of the construction and the attractive dam at the head. All who took part in this examination regard Kittitas as one of the most encouraging developments since Federal reclamation began. Of the 17,000 acres under the completed part of the canal, 13,000 acres grew crops this year. Considerable progress has been made in clearing and leveling the other 4,000 acres, so that the area irrigated next year will be increased. Next year the canal will be completed far enough to supply water to 30,000 additional acres, and having seen what has been accomplished this year the people owning this land are busy getting it ready for cultivation, and the prediction is confidently made that the entire additional 30,000 acres will be irrigated next year.

VALE PROJECT HAS PROMISING FUTURE

After Kittitas, an inspection was made of Klamath, and a visit made to Vale and Owyhee. At Vale the completed part of the canal furnished water to 4,000 acres this year. More than half of this is growing excellent crops, although it was unleveled sagebrush last year. Four thousand acres will be added to the area supplied with water next year, and it is nearly all being made ready for cultivation in 1931. The rapid settlement and excellent results of the first year's irrigation at Kittitas and Vale have been greatly promoted by local interest in these new communities. The settlers have been helped by local organizations and people in near-by towns with advice, encouragement, and small loans of much needed money. As a result, there is a hopefulness and confidence in the future that is as gratifying as the excellent crops grown.



1. Deserted home on Columbia Basin project, Washington. 2. Gallagher homestead, Columbia Basin project, made possible by irrigation from well water. 3. Official party making airplane trip over Columbia Basin. Left to right, R. F. Walter, chief engineer, Bureau of Reclamation; Roy R. Gill, chairman executive committee, Columbia Basin League; Dr. Elwood Mead, Commissioner of Reclamation; A. J. Turner, consulting engineer, Columbia Basin League; C. N. McClellan, chief electrical engineer, Bureau of Reclamation; N. B. Mamer, pilot. 4. Official inspection party on top of Easton Dam, Kittitas division, Yakima project, Washington. Left to right Porter J. Preston, superintendent, Yakima project, F. A. Kern, secretary, Kittitas irrigation district; George W. Malone, State engineer of Nevada; R. F. Walter, chief engineer; Dr. Elwood Mead, commissioner; R. B. Williams; Hon. John W. Summers, Congressman Fourth District of Washington; Donald S. Walter, engineer, Kittitas division; C. C. Churchill. 5. Concrete side-hill flume on Kittitas high line. 6. Easton Dam Kittitas division, showing fish ladder.



Control of Reservoir Used by Two or More Irrigation Districts

IN Crane Creek Reservoir Administration Board *v.* Washington County Irrigation District, 1930 (284 Pac., 557), the Supreme Court of Idaho had under consideration a situation which is of interest to the water users of some of our projects, by reason of the similarity of the facts considered by the court to those existing on the Boise, Vale, and Owyhee projects, where two or more irrigation districts on a Government project have, by contract with the United States, authorized control of certain jointly used irrigation facilities by a board of control made up of representatives of the various districts. The contracts between the United States and the districts have been confirmed by the court.

In the Crane Creek case, two irrigation districts and other parties held undivided interests in a reservoir. The works were inadequate, and the districts became insolvent. In an endeavor to establish solvency a contract was entered into among the parties interested in the reservoir, including the two districts, by which, among other things, the management of the reservoir was surrendered to a person selected by all parties concerned, and it was provided in the contract that no holder of an undivided interest in the reservoir was to be permitted to withdraw water when more than 30 days in default in the payment of maintenance charges. The contract and a bond issue carrying out the adjustment were confirmed by the court. About a year later a supplementary contract, not confirmed by the court, was entered into, leaving the main provisions of the adjudicated contract intact, but providing for operation of the reservoir by the Crane Creek Reservoir Administration Board, an association composed of five members, one of whom was to be elected by each of the three private corporations and two irrigation districts then interested in the reservoir.

The present action was brought upon the contracts by the administration board and three of the coowners of the reservoir against the Washington County Irrigation District, a consolidation of the two irrigation district parties to the agreement.

The contracts were upheld, the court stating:

"The irrigation districts issuing the bonds were not the sole owners of the reservoir, and even as between themselves their rights were not theretofore defined. It was important to the purchasers of bonds to know the extent of and the limitations upon the rights of the various parties interested in the reservoir, to know that precautions had been taken to avoid conflicts and insure the just operation and capable maintenance of the reservoir, and to know whether the districts could enter into contracts of that character. We are of the opinion that the contract was so intimately connected with the refunding bond issue as to warrant its examination, when properly pleaded, in proceedings to confirm such issue. The court expressly, properly and, upon sufficient petition determined that the contract was valid. The attacks directed against the contract in this suit could and should have been made in the confirmation proceedings. The decree binds all parties, and precludes further examination of the questions there determined. Progressive Irrigation District *v.* Anderson, 19 Idaho 504, 114 Pac. 16; Knowles *v.* New Sweden Irrigation District (on rehearing), 16 Idaho, 235, 101 Pac. 87; Smith *v.* Progressive Irrigation District, 28 Idaho 812, 156 Pac. 1133."

Irrigation Pumping Plants Exempt from Taxation

The decision of the case of Williams et al. *v.* Baldridge et al. by the Supreme Court of Idaho in January of this year (284 Pac. 203) is important because it declares the constitutionality of an act of the State legislature passed at its sixteenth session (Idaho Session Laws, 1921, ch. 106).

The act under attack adds to those properties exempt from taxation:

"Property used for generating and delivering electrical power to the extent that such property is used for furnishing power for pumping water for irrigation purposes on lands in the State of Idaho, such exemption to accrue to the benefit of the consumer of such power."

The principal constitutional objection urged was that the classification made by the legislature in relieving the irrigator who is under the necessity of propelling the water upon his place by pumping, in distinction to one who enjoys a gravity flow, is arbitrary, unreasonable, and unjust. Answering this contention, the author of the opinion has written:

"Nature has made an 'intrinsic difference' in the treatment necessarily accorded irrigation in the development of this State, and we can not say that, where since statehood, and before, the people have through their legislatures recognized that the means of applying water for irrigation, where not done for profit, have been excepted from taxation it is unreasonable for the legislature to attempt to equalize the burden of applying the water to irrigation projects as between gravity and pumping conveyors.

"The exemption is made to apply to the property of all power companies used in developing or transmitting electrical energy for pumping water for irrigation purposes with certain exceptions. The pumping method is expensive. By minimizing such expense, land, otherwise unfit for cultivation, is made available for settlement. It is well recognized that where the plenary power of the legislature to exempt from taxation has not been limited by a constitutional provision it may exer-

cise this power to encourage private initiative and thereby further the public welfare.

"A classification for purposes of exemption must not be arbitrary. In view of the climatic conditions in this State and the necessities of agriculture, we do not believe that a tax-exemption statute designed to permit a wider use of electrical energy for irrigation purposes raises a classification so arbitrary and discriminatory as to be merely capricious."

The case has not entirely exhausted its lure to those whose bent is upon questions of constitutional law. It is suggestive of the query: "Does the use of the classification of electrical energy, as distinguished from steam or internal combustion, generated power, make the legislation special and thus under indictment of the State constitution providing that the legislature shall not pass local or special laws * * * exempting property from taxation?" (Art. III, sec. 19, Idaho Constitution.)

The act of the legislature as construed by the supreme court asserts the faith of the State in the feasibility of irrigation by pumping and at once provides a means of making it so.—*B. E. Stoutemyer, District Counsel.*

PROSPECTS for the best crops in the history of the Garland and Frannie divisions of the Shoshone project are the brightest in their history. Crops on lands properly prepared for irrigation on the new Willwood division are good, and even on units farmed for the first time, where the land was well prepared, fair crops are anticipated.

Second annual picnic of Willwood Division settlers, Shoshone project, Wyoming

Recently Enacted Legislation

Size of Farm Units Within Reclamation Desert-Land Entries

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the proviso to section 5 of the act of June 27, 1906, chapter 3359, Thirty-fourth Statutes, page 520, be amended so as to read as follows:

"*Provided,* That if after investigation the irrigation project has been or may be abandoned by the Government, time for compliance with the desert land law by any such entryman shall begin to run from the date of notice of such abandonment of the project and the restoration to the public domain of the lands withdrawn in connection therewith, and credit shall be allowed for all expenditures and improvements theretofore made on any such desert-land entry of which proof has been or may be filed; but if the reclamation project is carried to completion so as to make available a water supply for the land embraced in any such desert-land entry the entryman shall thereupon comply with all the provisions of the aforesaid action of June 17, 1902, and shall relinquish within a reasonable time after notice as the Secretary may prescribe and not less than two years all land embraced within his desert-land entry in excess of one farm unit, as determined by the Secretary of the Interior, and as to such retained farm unit he shall be entitled to make final proof and obtain patent upon compliance with the regulations of said Secretary applicable to the remainder of the irrigable land of the project and with the terms of payment prescribed in said act of June 17, 1902, and not otherwise. But nothing herein contained shall be held to require a desert-land entryman who owns a water right and reclaims the land embraced in his entry to accept the conditions of said reclamation act."

Approved, June 6, 1930.

PALO VERDE AND CIBOLA VALLEY INVESTIGATIONS

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is hereby authorized to make all necessary engineering and economic investigations and studies of conditions in the Palo Verde and Cibola Valleys and vicinity on the Colorado River in California and Arizona to determine how best to protect the lands in this vicinity from damage by overflow and seepage. Report shall be made and plans and estimates prepared showing cost of additional works necessary, together with a statement of the value of works already constructed which can be merged with and made a part of a completed system.

Approved, April 19, 1930.

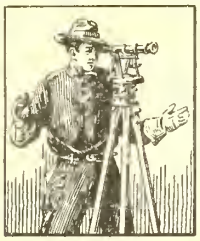
RECLAMATION-FUND CREDITS

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any amounts collected from defaulting contractors or their sureties, including collections heretofore made, in connection with contracts entered into under the reclamation law, either collected in cash or by deduction from amounts otherwise due such contractors, shall be covered into the reclamation fund and shall be credited to the project or operation for or on account of which such contract was made.

Approved, June 6, 1930.

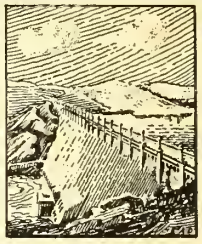
The first step in preparing land for agriculture in the arid portion of the West is to remove the native desert plants. The smaller varieties of sagebrush and greasewood can be removed by deep plowing when the soil is moist. When the growth is 20 to 60 inches high it is removed usually by "railing," grubbing, and plowing.

WORK of remodeling the fig cannery on the Orland project for this year's operations has been started.



ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Horse Mesa Dam, Salt River Project, Arizona

By C. C. Cragin, General Superintendent and Chief Engineer, Salt River Valley Water Users' Association

THE Horse Mesa Dam is the main feature of the second stage of the Salt River power and storage development by the Salt River Valley Water Users' Association. In connection with the building of the dam and power plant, the work involved the changing of 165 miles of 45,000-volt transmission line to 110,000 volts, with necessary substations, etc.

Financing was accomplished by the sale of $4,743,000 bonds of the Salt River Valley Water Users' Association. The primary purpose of the dam is to create head for the generation of 45,000-horsepower electric energy. The reservoir has a storage capacity of 245,000 acre-feet, the upper part of which is available as regulating storage to increase the output of the Roosevelt plant during the season of low irrigation demand for water. The entire construction organization, equipment, and facilities used in building the Mormon Flat Dam was available for the Horse Mesa work, which was all done by the association forces.

TIME OF CONSTRUCTION

The bond issue was sold August 29, 1924, but preliminary work had been begun prior to that date in anticipation of the sale. The construction occupied approximately three years' time, being finally completed August, 1927. A factor in decreasing the net cost of this dam was the power generated during construction by the Horse Mesa power plant, which first went into service April 2, 1927. Water reached the spillway crest July 1, 1927.

LOCATION AND GEOLOGY

The dam is 10 miles above Mormon Flat and 15 below Roosevelt. The distance to the dam site from the nearest accessible point on the Phoenix-Roosevelt-Globe highway (Apache Trail) is 6 miles. The nearest railroad point is Mesa, 44 miles from the dam site. The distance from Phoenix is 60 miles.

Rock at the dam site is similar to that found at Mormon Flat, being part of the same great rhyolite flow, which is continuous over this section of the country. A number of seams, checks, and pockets of soft material were encountered, and considerable grouting was necessary in order to secure a thoroughly water-tight structure.

DESCRIPTION OF DAM

The general course of the river at the dam site is westerly. The width of the canyon at the base is 150 feet, and 265 feet above it, at the top of the dam, the width is 540 feet. From the stream bed to lowest bedrock the depth is 33 feet, giving maximum height of the dam, from lowest foundation to top of coping, 305 feet. In material, general arrangement, finish, and architectural treatment the dam is similar to that at Mormon Flat. It consists of a central arched section spanning the canyon and terminating at the north end in an ogee gravity overflow section. It has two spillways, one at the south end, excavated in solid rock, and the other at the north end, partly excavated in rock and the remainder consisting of the overflow gravity section of the dam mentioned. The dam was designed by the trial-load method, both the arch and cantilever, or beam loads, being considered. This is the first dam in which this method, which was developed in full by engineers of the Bureau of Reclamation and the association, has been used. The resulting dam is a slender arch in which the surfaces frequently vary from circular arcs, the maximum radius of curvature of the upstream surface of the dam being 251 feet at the crest and the minimum being 82 feet. The thickness of the dam at the crest is 8 feet. At the base of the dam the thickness varies from 43 to 57 feet. In the final sections adopted the stresses under full load are made as nearly uniform as within the bounds of practicability and the center of pressure approximately coincident with the center line of the arch. The maximum allowable stress was taken at 650 pounds per square inch.

The spillways are closed by 9 steel Taintor gates, 23 feet high by 27 feet wide, similar in design to those at Mormon Flat, 6 of these being located in the north spillway and 3 in the south spillway. All are motor operated.

The power plant consists of three 15,000-horsepower generating units, supplied by 8-foot penstocks passing directly through the dam. Each penstock is provided with an 84-inch Dow disk-arm pivot valve, located between the face of the dam and the turbine. The power house is constructed at the base of the arch, directly across the river bed. It operates under a normal head of 264 feet. Total concrete in dam and power plant is 151,957 cubic yards.

PRELIMINARY WORK

Preliminary work involved the construction of 6 miles of road from the main Apache Trail into the dam, over very rugged country; the construction of temporary and permanent camps, installation of water-supply works, construction of transmission line, assembling and moving of supplies, including Mormon Flat equipment, and additional diamond drilling at the dam site. The first road camp was located approximately 1½ miles from the Apache Trail, and was occupied for a considerable period. A feature of the camp was the water supply, which was piped from the river and pumped against the static head of 1,200 feet. Road construction was unusually difficult and involved the moving of over 350,000 cubic yards of solid rock. The location, for considerable distances, was along nearly vertical cliffs. The road was completed, and passable by automobiles to the camp site below the dam, in March, 1925, but was not completely finished to both upper and lower levels at the dam site until May. The transmission line, built to supply current for construction purposes, was installed in permanent form, designed for the ultimate outgoing potential of 110,000 volts. This line was used to bring the current from the 45,000-volt Roosevelt-Phoenix line and stepped down in temporary substations, as required.

PLANT LAYOUT

The road grading was done by a 1-yard P. & H. gasoline shovel, released from service on completion of the Mormon Flat work, and a 1¼-yard Osgood steam shovel. These were converted into drag

lines after completion of the road and used for foundation excavation, with the 2-yard Monighan drag line which had been used at Mormon Flat.

The precipitous sides of the canyon greatly restricted the room available for construction plant and permanent camp, which was strung out along the canyon for nearly a mile and a half below the dam.

The concrete mixing plant was perched on a narrow bench, against the face of the nearly vertical cliff, about 50 feet above the level of the spillway, a short distance upstream from it. The two 1-yard Smith mixers, used at Mormon Flat, were reinstalled here with a Blaw-Knox inundator and the 240-foot Insley tower, to which an additional 100 feet was added. The 20-inch concrete chutes were suspended from a 2½-inch main sky line, 1,200 feet long, which spanned the canyon above the dam from anchorages high up on the sides of the cliffs. A 2-inch sky line was provided in addition. A total of 1,000 feet of 20-inch chute was used and two 75-foot counterbalances. The screening and washing plant, gravel and sand storage bins, and cement shed were located above and in the spillway. The 105-foot Insley steel guy derrick used on the Mormon Flat job was installed immediately above the spillway, and used for rehandling material.

An unusual feature was the method of obtaining sand and gravel for concrete. This was dug from gravel bars in the river by two 3-yard electrically operated clamshell derricks, mounted on 40 by 60 foot barges, constructed at the dam site for the purpose. These barges were floated during the earlier construction stages on the water ponded by the upstream cofferdam, the top of which was 14 feet above stream bed. These barges furnished the entire required gravel supply, occupying stations from three-quarters of a mile to over 3 miles upstream from the dam. During the later part of the work they were operated successfully in over 100 feet of water. The gravel was loaded by the clamshells directly into 18 by 40 by 5 foot (40-yard) gravel scows. A fleet of six of these scows were constructed and towed between the excavating barges and the dam by two 40-foot gasoline marine tugboats, which had been purchased in San Francisco, brought to Mesa by rail, and hauled to the dam by truck. At the base of the dam a third 3-yard clamshell bucket derrick, identical in design with those used in digging gravel, was stationed and used to unload the scows. This clamshell deposited the gravel through a grizzly into a 25-yard moveable bin, so constructed that its position might be changed as the water was raised behind the dam. An inclined double track reached from the base of the dam to a 10-yard bin 350 feet above stream bed, discharging to the screen. Specially constructed steel automatic dump cars were operated on these tracks to raise the gravel from the grizzly to the upper bin. The travel of these cars was synchronized so that the empty descended while the full car ascended. The capacity of the mixing plant was 500 cubic yards per day of two 8-hour shifts for each mixer. A crusher was installed but was used to an almost negligible extent.

Seepage water in the excavation was handled by four 18-inch deep-well Kimball pumps temporarily requisitioned from the drainage and irrigation system in the valley. With the exception of the shovels and drag lines, the entire plant was run by electric power.

CONSTRUCTION

Owing to the abrupt slopes of the cliffs at both ends of the dam, it was essential to complete the rock excavation for road, spillways, and the ends of the arch in advance of undertaking any work in the river below, this being necessary in order to avoid injury to workmen by falling rocks. Excavation above stream bed was complete March 1, 1926. The total quantity of solid-rock excavation in road, spillways, and abutments was 421,000 cubic yards. Loose-rock excavation at the dam site, including material rehandled, was 117,000 cubic yards.

The river was by-passed by means of a wooden flume, 300 feet long, 20 feet wide, and 10 feet deep, constructed around the base of the cliff at the south edge of the foundation excavation. The ability to interrupt the surface river flow by closing the gates at Roosevelt was a decided advantage in this part of the work. Bedrock over practically the entire base of the dam was completely exposed by April 20, 1926. The cleaning out of seams, and the removal of undesirable material was accomplished, and the first bulk concrete placed May 20. From that time on pouring of concrete was practically continuous. Five evenly spaced contraction joints divided the dam into six sections. The faces of adjacent sections were keyed and old concrete painted with asphalt before new was poured against it. The power-house construction was carried up concurrently with the dam. In October, 1926, the dam was constructed to a height of 100 feet above bedrock, and water was thereafter passed through the penstocks and draft tubes, and the wooden flume removed. All concrete was carefully proportioned to secure the greatest density and strength. Thorough tests were made on specimens of concrete used throughout the entire construction, the average of minimum tests on 28-day concrete being over 2,000 pounds per square inch. Plums were used up to 6 inches in diameter. The same procedure was adopted as that used at Mormon Flat in maintaining an opening between two sections of the arch. The filling of this gap, in all cases, was kept a minimum of 30 days behind the time of pouring the adjacent concrete. A high-pressure grouting machine was used with a compressor delivering 200 pounds. The cement shed had a capacity of 15,000 sacks, a fleet of twenty-seven 5-ton trucks being used in the hauling of cement and other material from Mesa.

By April 2, 1927, the first unit of the power plant was placed in operation under a 119-foot head, and by July 1, 1927, the lake level had been raised to the level of the spillway arch, giving a head of 243

Horse Mesa Dam, Salt River project, Arizona

feet. A temporary 110,000-volt transformer installation was made a short distance downstream from the dam pending the completion of the permanent installation. The total power generated by the Horse Mesa plant during the construction period was in excess of 22,000,000 kilowatt-hours, giving a net profit of approximately $150,000.

Approximately 7½ miles of the old Apache Trail is submerged by the water of the lake. Relocation and reconstruction of this road was undertaken by the highway department of the State of Arizona, which took over the road as a part of the State highway system, under a contract with the association dated April 29, 1922. Work on this project was delayed, however, so that the road was out of commission for approximately six months from July 23, 1927, when the lowest part of the old road was submerged by the lake.

ANALYSIS OF COST, HORSE MESA DEVELOPMENT

Dam and power plant:		
Engineering (including $9,937.91 for diamond drilling)		$125,720.91
Bond expense		273,135.43
Hospital fund		1,708.99
Field clerical, etc		22,376.28
Camp		119,411.60
Roads—		
Horse Mesa	$407,899.29	
Roosevelt	7,283.36	
		415,182.65
Telephone lines		36,492.02
Temporary power lines and substations (exclusive of $1,215.60 for excavation, concrete, and engineering)		208,921.32
River control (exclusive of $66,195.10 excavation)		39,139.18
Excavation (exclusive of $322,203.48 road excavation)		376,348.74
Concrete (including plant)—		
Miscellaneous items	$5,411.53	
Sand and gravel	442,026.84	
Mixing	95,388.64	
Placing	411,866.57	
Cement	575,918.91	
Forms	222,606.56	
		1,753,219.05
Concrete, reinforcing steel	46,550.76	
Grouting	37,528.04	
Taintor gates	78,005.44	
Penstocks and valves (exclusive of $4,570.76 for inlet excavation, forms, and steel)	60,182.59	
Horse Mesa power-plant equipment, material, labor, tools, etc	666,688.75	
Miscellaneous items, etc., at dam and power house	30,457.06	
Salvage returned from job (material, not plant)	$15,039.19	
Adjustment of inventory	39,330.75	
	54,369.94	
		[1] 4,236,698.87
Permanent transmission lines and substations:		
Engineering	12,809.25	
Bond expense	70,906.66	
Hospital fund	443.65	
Field clerical, etc	5,808.94	
Material and labor	992,744.49	
		1,082,712.99
Total cost of Horse Mesa development		5,319,411.86

[1] The foregoing includes the cost of temporary substation for outgoing voltage during the part of the construction period beginning April 2, 1927, when the power plant first went into service, and a credit of $150,000 would properly be applicable to the development on account of profit from power generated during this period.

Notes for Contractors

Boulder Canyon project.—A contract between the United States and the Los Angeles & Salt Lake Railroad Co., covering the construction, maintenance, and operation of a railroad from a point near Las Vegas, Nev., on the Los Angeles & Salt Lake Railroad, to the site of the Boulder Dam, was executed on August 1, 1930. According to the contract, 22.39 miles of the total of 29.84 miles of main line track required, of the section between the main line of the railroad company and the summit, will be constructed, operated, and maintained at the sole cost and expense of the railroad company; a section 0.32 mile in length and the delivery yard at the summit will be constructed by and at the expense of the railroad company, and the United States will pay to the railroad company one-half of the cost of maintenance, repair, and renewal of this section, plus 10 per cent, to cover elements of expense not capable of exact ascertainment; and the remaining section of 7.13 miles of main track with all side and yard tracks and other facilities will be constructed, maintained, and operated by the United States. A schedule of freight rates covering delivery of the principal items of construction materials, machinery, and equipment at the delivery yard at the summit is included in the contract.

Two additional contracts have been awarded for aerial photographic and ground phototopographic surveys in the vicinity of the Boulder Dam. A contract covering ground phototopography of the two canyon walls in the Black Canyon in the vicinity of the dam site was awarded to the Aerotopograph Corporation of America at a total price of $10,750, and a contract covering aerial phototopography of an area adjacent to the dam site and the making of an aerial photographic controlled mosaic map of the same and additional areas was awarded to Brock & Weymouth (Inc.) at a total price of $15,000. A contract with Fairchild Aerial Surveys (Inc.) for an aerial photographic survey of the section of the Colorado River between the Palo Verde Canal heading and the lower end of the Cibola Valley has been completed.

Invitations for bids have been issued for furnishing power for construction purposes. If satisfactory bids are not received, specifications will be prepared for the construction of a temporary power plant in the vicinity of the dam site.

Invitations for bids have been issued for the purchase of a 32-foot power boat for the use at the dam site.

Minindoka project, Gooding division.—A contract for the construction of two culverts under railroads and the Little Wood River Crossing and turnout on the Milner-Gooding Canal has been awarded to the Utah Construction Co., the total contract price being $36,089.

Salt Lake Basin project.—Specifications have been prepared and invitations for bids issued for the purchase and installation of about 1,566 linear feet of 8-inch cast-iron water pipe to replace the portion of the pipe line of the city of Coalville, Utah, which will be within the flow line of the Echo Reservoir.

Shoshone project.—Bids were opened on July 1 for the purchase of hydraulic and electrical equipment for the third unit at the Shoshone power plant under Specifications No. 512. Contract for furnishing the hydraulic machinery was awarded to the Newport News Shipbuilding & Dry Dock Co. at a total price of $53,750. All bids on the electrical equipment were rejected and invitations were issued for new bids.

Denver office.—Specifications were prepared and invitations for bids issued covering the purchase of a hydraulic compression testing machine to be installed in the new United States customshouse now being erected in Denver, Colo. Alternative items provide for machines of 2,000,000 and 3,000,000 pounds capacity and for different types of construction and degrees of operating precision. Bids will be opened on August 1, 1930.

Colorado River Commission Starts Work

In connection with preliminary plans for irrigation investigations of the Upper Colorado River Basin and allocation of 7,500,000 acre-feet of water, a conference was held on July 21 in the State capitol in Denver by Dr. Elwood Mead, Commissioner of Reclamation, and Chief Engineer R. F. Walter, with the following representatives of the four Upper Colorado River Basin States: William R. Wallace, Colorado River Commission, and Richard R. Lyman, member of the Utah Water Storage Commission, from Utah; Gov. Frank C. Emerson, Attorney General William O. Wilson, and State Engineer John A. Whiting, from Wyoming; Francis C. Wilson, water commissioner, and Herbert W. Yeo, State engineer, from New Mexico; and M. C. Hinderlider, State engineer, R. J. Tipton, and Robert E. Winbourn, attorney general, from Colorado. Later a commission was formed consisting of the following representatives from the Upper Basin States: W. D. Beers, engineer, George M. Bacon, State engineer, Utah; John A. Whiting, State engineer, Wyoming; Herbert W. Yeo, State engineer, New Mexico; M. C. Hinderlider, State engineer, Colorado. The commission thus formed met in Denver on August 25 and outlined the course of the bureau's investigation.

The members of this commission were not empowered to negotiate any water division agreement, but simply to act in cooperation with the Bureau of Reclamation in the collection of the necessary data, its preparation, and its submission to the later conference of official commissioners, when the formal treaty dividing the upper basin's share of the Colorado River water will be drawn.

Progress on Colorado River Development

At 7.45 p. m., July 3, word reached Las Vegas, Nev., that President Hoover had signed the second deficiency bill, making the appropriation for Boulder Dam work available. In a wire from Chief Engineer R. F. Walter, an official order to start work was received at 8.10 a. m. on July 5. Before noon work had been started by the Brock & Weymouth Corporation in connection with the phototopographic surveys around the dam site, and plans were under way for starting survey parties on town site, highway, and railway locations in the vicinity of the dam site. Reconnaissance work has been done in connection with the location of the Government section of the railway, the highway from the town site to the dam site, and the town site final location.

Mrs. A. P. Davis, First American Woman Driver In Soviet Russia

The wife of former Director A. P. Davis, now chief construction engineer at Sredazvodhoz, Tashkent, Turkestan, Union of Socialist Soviet Republics, has won the distinction of being the first American woman to drive an automobile in Soviet Russia. When Mrs. Davis drove her car through the streets of Tashkent, where many women still wear the veil and are kept to the strict seclusion of the harem, crowds of excited people gathered around her automobile and questioned her. They did not understand why she was driving the car while her husband occupied the back seat. Mrs. Davis told the natives that women in the United States drive from both the front and rear seats.

New Map Available

The first edition of a map of the Gooding division of Minidoka project, Idaho, has come from the press. Two printings are used to show reservoirs, canals, laterals, highways, telephone and power transmission lines, and the boundary of that part of American Falls Reservoir District No. 2 under the project.

The map is issued in two sizes: No. 23884, 10½ by 13 inches, scale 5 miles to an inch, price 10 cents per copy; and No. 23884-A, 21 by 25½ inches, scale 2½ miles to an inch, price 25 cents per copy.

Articles on Irrigation and Related Subjects

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Reclamation Problems Analyzed in Economic Study. Active State cooperation in construction and maintenance urged, Government credit for individual settlers needed. Report of 22 projects. Eng. News-Record, July 31, 1930, vol. 105, p.175.

Taylor, P. I.
Largest Dams in the United States and Abroad. (Tables.) Eng. News-Record, July 17, 1930, vol. 105, p. 104.

Hayden, T. A.
Salt River Project. Part II. Illus. Horse Mesa and Stewart Mountain Dams. Western Construction News, July 10, 1930, vol. 5, pp. 319–327.

Du Puy, William Atherton.
Government Is Not a Business. Illus. National Business, August, 1930, vol. 18, pp. 36–38, 126.

Houk, Ivan E.
Uplift Pressure in Gravity Dams. Assumptions for design, measurements at existing dams, uplift effects. Illus. Western Construction News, July 25, 1930, vol. 5, pp. 344–349.

Young, Walker R.
Chief Construction Engineer for Boulder Dam. Portrait. Western Construction News, July 25, 1930, vol. 5, p. 368.

Bissell, C. A.
Elephant Butte Reservoir Is Largest Artificial Irrigation Lake. Southwest Builder and Contractor, Aug. 1, 1930, vol. 76, p. 35.

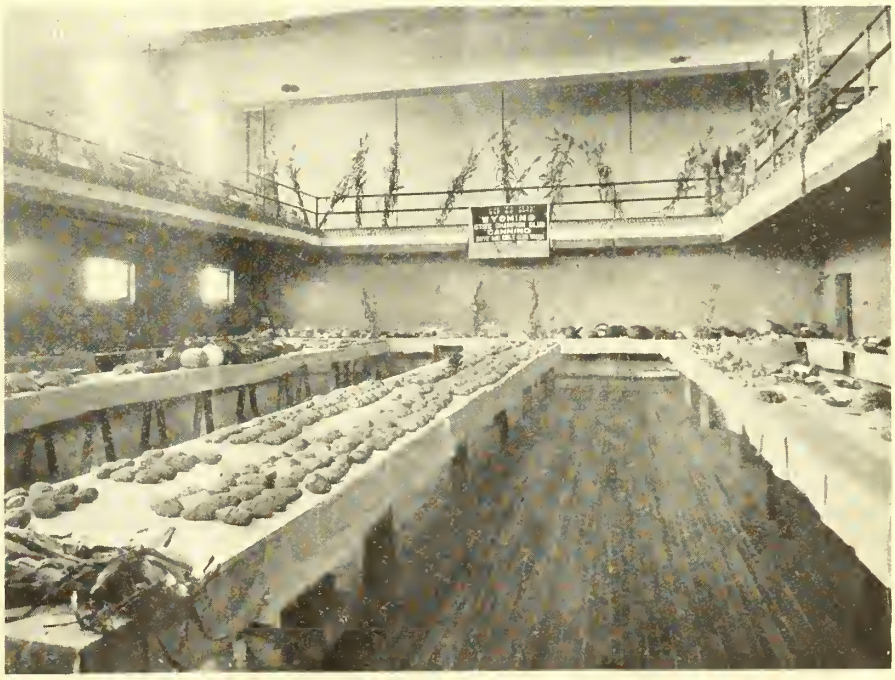

Exhibit of products raised on the Shoshone project, Wyoming

Regulations for Grazing Permits to Settlers on Riverton Project

UNDER date of July 3, 1929, certain regulations were approved governing the issuance of grazing permits to settlers on the Riverton irrigation project to run stock on the ceded portion of the Shoshone Indian Reservation.

It appeared desirable to modify these regulations in order to induce settlers to cultivate a larger acreage under the project. The regulations have accordingly been modified to permit an owner of land on the project to employ another person to live on and cultivate his lands or lease them to a tenant and to limit the grazing to which each owner of irrigated land will be entitled to 1,000 sheep or a proportionate number of other stock. The regulations which were approved by First Assistant Secretary Dixon on August 12, 1930, are as follows:

1. The applicant must be a bona fide settler on irrigated lands within the Riverton project, either as the owner of such lands or as a bona fide lessee of such lands.

2. He must live upon and cultivate such lands except as stated in paragraph 3 below.

3. Any owner of irrigated land who lives elsewhere, and employs another person to live on and cultivate the lands, will be considered a bona fide settler provided such owner clears and prepares for irrigation, plants, and cultivates at least 20 per cent of the irrigable area of such land the first year, 40 per cent the second year, and not less than 60 per cent the third and succeeding years.

4. A tenant actually living upon and cultivating leased irrigated lands may be granted grazing privileges, provided he meets the requirements as to cultivation as set forth in paragraph 3; and provided further, that a copy of his lease, contract, or agreement with the owner of such land shall be filed with the superintendent of the reservation.

5. Any actual settler who homesteaded lands on the ceded portion of the Shoshone Reservation prior to the construction of the Riverton project, and whose homesteaded lands lie within that portion of the project to which water is being delivered, may be granted grazing privileges, provided he meets the requirements as to cultivation as set forth in paragraph 3.

6. The number of stock for which an applicant may secure a grazing permit shall not exceed the number required to consume the feed raised on his own farm and such feed as he may purchase from other bona fide settlers on the project, and in any event shall not exceed 1,000 head of sheep or equivalent livestock units.

7. The superintendent of the Shoshone Reservation shall notify the regular permittee on range 19, on or before August 1 of each year, of the proposed reduction in number of stock to be run by him under his permit.

8. Permits issued under these regulations will be at the same rate, for sheep, as now paid by the Yellowstone Sheep Co., viz, 40 cents per head per year. For domestic or farm cattle, including farm horses, the rate shall be $2 per year.

9. Permits must be completed and filed with the superintendent of the Shoshone Reservation not later than September 1 of the year the permit becomes effective.

10. Payments shall be made semi-annually, in advance, and any permit in which the grazing fees amount to more than $100 per year must be accompanied by a satisfactory bond.

11. All permits issued under these regulations must be written to expire not later than September 30, 1933, to conform to the expiration date of existing permits on the ceded portion of the reservation, and be submitted for departmental approval in the usual way.

We hereby agree to the foregoing regulations subject to the approval of the proper officials of the Department of the Interior.

(Signed:) R. P. HAAS,
Superintendent,
Shoshone Indian Reservation.
H. D. COMSTOCK,
Superintendent, Riverton project.
O. N. GIBSON,
Attorney,
Midvale Irrigation District.

Modern Fruit-Packing Shed to be Erected in Yuma

The Arlington Heights Fruit Packing Co., of Riverside, Calif., is ready to start the construction of a $16,000 packing shed on a spur of the Southern Pacific Railroad near the outskirts of Yuma. This plant will be modern in every detail and will contain the latest type of packing machinery. The packing shed will be completed by September 15. It is planned by the local grove owners and syndicates on Unit "B" and lands adjoining to pack the entire 1930 crop in this shed. The fruit will then be marketed in pools through the Desert Citrus Exchange, of which the local growers are members. This exchange, which is a branch of the California Fruit Growers' Exchange, marketed a large part of the 1929 crop in a very satisfactory manner.

Grape Shipments from the Southwest

On July 10 the Yuma project shipped by express to Houston, Tex., its first carload of grapes for the season. Shipment was made by A. M. Nevins, one of the leading grape growers in the vicinity. Other growers have made shipments, recently mostly to Texas points, in less than carload lots, and indications are that from three to four carloads of Yuma Valley and Mesa grapes will be shipped out this season. That this is a fine grape country is shown by the fact that special grape trains of from 10 to 20 carloads have passed through the project from Imperial Valley since June 24, and shipments are expected to continue until August 15. On July 7 a train of 16 cars passed on their way to Toronto, Canada.

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FARM DEVELOPMENT
ON THE
VALE PROJECT,
IDAHO.

1. DESERT LAND.
2. WARM SPRINGS DAM AND RESERVOIR.
3. 4. 5. 6. 7. 8. 9 AND 10. HOMES AND CROPS OF NEW SETTLERS.

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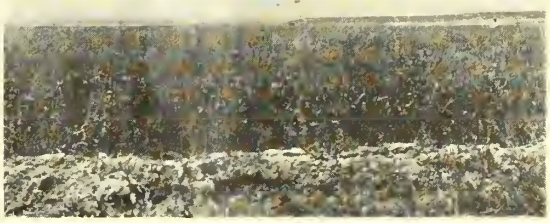

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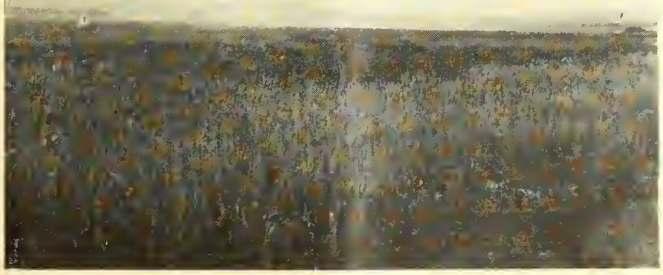

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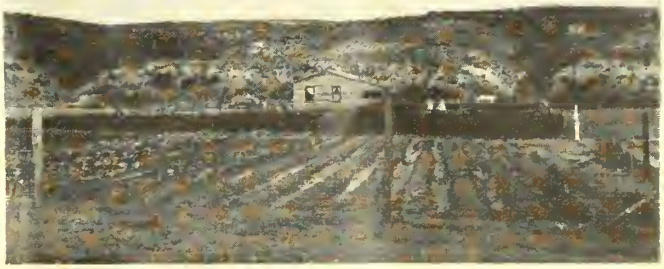


Citrus Fruit Grown on Reclamation Projects in 1929

Citrus fruit was grown on three Federal irrigation projects in 1929, namely, the Salt River project, Arizona, the Yuma project, Arizona-California, and the Orland project, California.

In that year the crop was grown on 8,323 acres, producing 51,373,860 pounds of fruit valued at $1,765,245, or $212.09 per acre. The Salt River project accounted for 88 per cent of the acreage, 89 per cent of the yield, and 91 per cent of the value, and also reported the highest value per acre of $219. Practically the entire crop on the Yuma project was produced on the mesa land.

Citrus fruit grown on reclamation projects in 1929

Project	Area	Yield		Value	
		Total	Average per acre	Total	Per acre
	Acres	*Pounds*	*Pounds*		
Salt River, Ariz.	7,345	45,960,000	6,257	$1,608,600	$219.00
Yuma, Ariz.-Calif.	647	4,588,860	7,092	120,345	185.85
Mesa (auxiliary)	636	4,575,660	7,200	119,495	188.00
Valley division	11	13,200	1,200	850	77.30
Orland, Calif.	331	825,000	2,492	36,300	109.67
	8,323	51,373,860	6,172	1,765,245	212.09

Belle Fourche Project Farmers Hold Picnic

The Sixteenth Annual Picnic, held at the United States experimental farm near Newell, S. Dak., on July 19, furnished a day's outing and entertainment for the farmers of the Belle Fourche irrigation project. A large crowd enjoyed dinner in the grove and a look over the farm provided instructive object lessons in rotations and growing of irrigated crops on some 600 experimental plots.

Visitors included S. H. Hastings of the United States Department o fAgriculture, Congressman William Williamson, and F. D. Kriebs, State secretary of agriculture. The Congressman spoke of the benefits which western South Dakota farmers would derive from the new tariff bill in its application to meats, grains, dairying, sugar, and other products. Mr. Kriebs called attention to the generally favorable crop situation in South Dakota which, although spotted in places because of excessive heat and drought, gave promise of a good average yield.

Registration of old settlers was a feature of the gathering and the records show that more than 200 guests were entitled to be so classed. Mrs. H. S. Wright, of Nisland, who is now 84 years old, came to the Black Hills in 1876, and Mr. H. C. Wilson, a Belle Fourche project farmer near Vale, settled in the valley many years before the beginning of Federal reclamation.

Baseball and other sports, together with a dance in the evening, provided entertainment for the crowd.

Over two-thirds of the acreage devoted to alfalfa in the United States is found in the 17 Western States. Its importance to these States is due not only to its large acreage but also to its high yield and value.

South Africa's maize crop this year will total 4,600,000,000 pounds, breaking all previous records.

Economic Report on the Saratoga Project, Wyo.

Field work by W. W. Johnston, associate reclamation economist, in classifying lands of the Saratoga project, Wyoming, was completed on August 5. The economic report on the project, now in course of preparation, will contain a complete discussion of soils, land classifications, status of lands, and climate. In addition, it will include data on county and project finances and dairying to supplement the economic report of August, 1926, by Messrs. Dunnewald and Kreutzer. This report covers such items as type of agriculture, size of farms, transportation, crop yields, cost of development, problems of settlement, and the economic value of water. It is believed that the conclusions in this report are as applicable to-day as at the time the report was prepared, and accordingly this earlier report will be included as an appendix to the present economic report.

Upon completion of the report, about the middle of August, Mr. Johnston planned to proceed to Provo, Utah, to make an examination of class 5 lands of the Strawberry Valley project.

Mesquite, a native of the Southwest, varies from a straggling, spiny shrub under adverse conditions to a widely branched tree under favorable conditions. It is removed ordinarily by hand grubbing.

Cotton Grown on the Projects in 1929

Cotton was grown during 1929 on five Federal irrigation projects under the Bureau of Reclamation. The area devoted to this crop on the Salt River project, Arizona, the Yuma project, Arizona-California, the Orland project, California, the Carlsbad project, New Mexico, and the Rio Grande project, New Mexico-Texas, amounted to 271,282 acres, which in 1929 produced 173,731 bales of lint of 500 pounds each and 79,331 tons of seed, having a total value of $18,705,391, or $69 per acre.

The largest acreage, yield, and value in 1929 were on the Rio Grande project, New Mexico-Texas, where the 105,425 acres in this crop produced lint and seed valued at $7,865,372, or $74.60 per acre. The highest value per acre of $86.87 was on the Salt River project, Arizona, where 73,819 acres produced lint and seed valued at $6,412,909.

Detailed statistics are given in the accompanying table.

Cotton grown on reclamation projects in 1929

Project	Area	Yield				Value	
		Lint		Seed		Total	Average per acre
		Total	Average per acre	Total	Average per acre		
	Acres	*Pounds*	*Pounds*	*Pounds*	*Pounds*		
Salt River, Ariz.	73,819	24,984,115	338	49,968,235	677	$6,412,909	$86.87
Yuma, Ariz.-Calif.	72,058	14,925,800	207	29,162,210	405	2,898,465	40.22
Orland, Calif.	160	39,500	247			7,110	44.44
Carlsbad, N. Mex.	19,820	7,536,438	380	11,784,000	594	1,521,535	76.77
Rio Grande, N. Mex.-Tex.	105,425	39,380,000	373	7,748,000	642	7,865,372	74.60
	271,282	86,865,853	320	158,662,445	585	18,705,391	69.00

International Water Commission

United States and Mexico

Following the submission through the State Department to the President and Congress of the report of the American section of the International Water Commission, United States and Mexico, the three commissioners, Dr. Elwood Mead, chairman, Gen. Lansing H. Beach, of California, and Mr. W. E. Anderson of San Benito, Tex., tendered their resignations. Congress authorized the printing of the report as House Document 359, but adjourned without action.

Subsequently the President appointed Mr. Lawrence M. Lawson, of El Paso, Tex., as sole American commissioner on the water commission. He will carry on such activities as may be necessary until Congress considers the report. Mr. Lawson is at present international boundary commissioner, United States and Mexico.

To assist Mr. Lawson the State Department has appointed as consulting engineers Mr. Louis C. Hill. of Los Angeles, Calif., and Mr. W. E. Anderson of San Benito, Tex. Mr. Hill is an experienced engineer and has been retained on a number of occasions by various branches of this Government to carry out important engineering work in the vicinity of the Mexican border, his most recent assignment being as a member of the Boulder Dam Consulting Board.

Miss M. A. Schnurr, assistant to the commissioner, who was designated by the Secretary of State as secretary of the American section on the organization of the commission in 1924, after accomplishing the transfer to El Paso of the administrative work and records of the commission, also resigned.

Mr. Karl F. Keeler, of Provo, Utah, who has been attached to the American section of the commission as an engineer since June, 1928, will continue his services as associate engineer with headquarters at El Paso, Tex.

Alfalfa prefers a deep, well-drained loam soil, abundant sunshine, and a dry atmosphere, if its roots are well supplied with water. Certain varieties do well in Imperial Valley, Calif., 100 feet below sea level; other varieties thrive on the San Luis plains of Colorado, 7,500 feet higher.

The Chinese and Egyptians practiced artificial incubation over 2,000 years ago. They used large egg ovens of brick.

In increasing their standard of living people of Germany are eating more vegetables and butter.

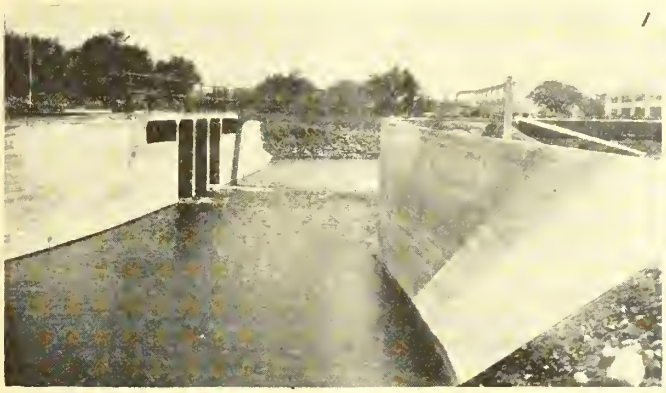
Transcontinental Air-Mail Route

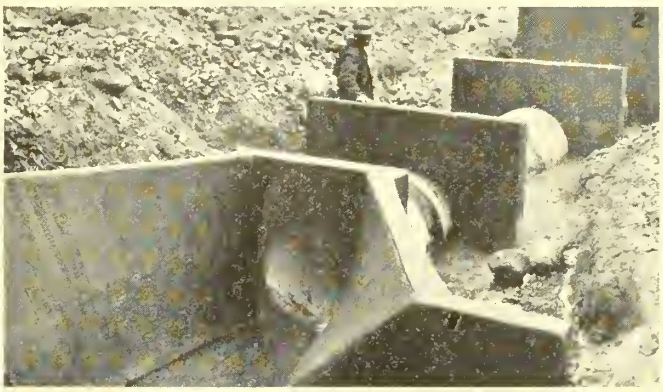
On August 25 bids for two new transcontinental air-mail routes were opened in the office of Assistant Postmaster General W. Irving Glover, one of which is to run from Atlanta, Ga., to Los Angeles and touch the Rio Grande and Yuma projects.

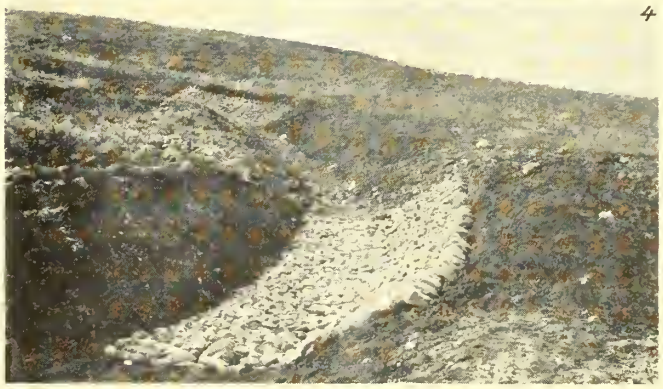
The Watres Act, under the terms of which the transcontinental routes are to be operated, gives preference to the lowest bidder who has owned and operated an air transportation service on a fixed daily schedule over a distance of not less than 250 miles and for a period of not less than six months prior to the advertisement for bids, affording encouragement by the Government to the carrying of passengers in the air.

In the central plain of California and some western valleys alfalfa seeding usually follows many years of continuous cropping to wheat and other small grains.

Experience in the growing of alfalfa shows that it thrives best in the soil and climate of the arid and semiarid regions provided water is available for irrigation.







KITTITAS DIVISION, YAKIMA PROJECT, WASHINGTON

North Branch Canal
1. Naneum Creek Wasteway
2. Thirty-six-inch precast lock joint pipe turnout

South Branch Canal
3. Drops on Lateral 14.3
4. Dry rock paving on steep grade

THE August issue of the NEW RECLAMATION ERA carries an account of some of the very interesting results of inquiries sent out this year by the International Institute of Agriculture relative to economic and social conditions of women of the agricultural classes and their organizations in various countries.

This account and those that will follow show that these associations and their federations are characterized by a certain similarity, although there are variations in the development of the movement, with a view to adjustment with the conditions and problems of the national life of the various countries.

The account is resumed, with a concise statement of the organization of farm women in several other countries.

UNION OF SOUTH AFRICA.—Three separate organizations of countrywomen's associations are now in existence in the Union of South Africa—the Women's Section of the Transvaal Agricultural Union, established in 1925; the Women's Institute of Natal, Zululand, and East Griqualand, formed in 1928; and the Cape Province Women's Agricultural Association, established in October, 1929. In the Transvaal there are now 126 branches of the Women's Section with approximately 3,000 members; in Natal, Zululand, and East Griqualand there are 27 branches with about 1,000 members, while the newly formed Cape Province association has already 50 branches with 1,610 members. At present the three organizations are not grouped into a South African federation, but it is hoped to federate within the next year or so, when the provincial organizations are firmly established. It is anticipated also that during that period the project will have matured for the organization on similar lines of the 40 or more countrywomen's associations which are included in the Agricultural Union of the Province of the Orange Free State.

The objects of each of the organizations are similar, and the following particulars of that of the Transvaal, the earliest of the three, will in many respects apply generally.

The constitution of the Women's Section of the Transvaal Agricultural Union is bilingual, the membership embracing Dutch and English countrywomen. The object of the organization is to enable women to take an effective part in rural life and development. The Women's Section, accordingly, has power (*a*) to form women's branches in the Province; (*b*) to establish cooperation among women; (*c*) to make provision for the fuller education of women in all branches of agriculture, handicrafts, domestic science, hygiene, and social welfare; (*d*) to formulate the general principles governing the branches; (*e*) to raise funds, obtain grants, subscriptions, and loans from State, municipal, local, and other bodies or from individuals, and to receive legacies and other benefits, and to apply such funds solely to the above objects; (*f*) to cooperate with other societies of women in the Transvaal Province and elsewhere.

All the three organizations were established by private initiative. The State Department of Agriculture assists by providing an organized service of lecturers and demonstrators on agriculture and home economics. The Land and Agricultural Bank of South Africa has recently given small grants in aid.

Activities.—So far as possible, monthly meetings of each branch are arranged with programs on similar lines to those indicated for the Women's Institutes of England and Wales, although naturally planned with reference to the requirements and interests of rural life in South Africa. The importance of the contribution made by the woman to farm life and activities is possibly even greater in the new countries than in Europe, and it is, at any rate, significant that in South Africa the movement has been closely linked from the first with the agricultural unions of the Provinces which take so prominent a position in the economic life of the country.

UNITED STATES OF AMERICA.—The distinguishing feature of the organization of farm women in the United States is its national character. In 1913 the United States Congress passed an act for the establishment of home demonstration work on a national scale. The work which was intended to benefit women on farms and in rural areas began in the next year and is carried on through the extension service of the State agricultural colleges under the direction of specially trained country-home demonstration agents. Classes are organized and inspections carried out even in the most remote districts, and an integral part of the scheme consists in the home demonstration clubs which women and girls are invited to join, and which provide for their social as well as their educational needs. In this way there is cooperation between the Government, the agricultural college, and the farm people themselves, the women taking their full part. The benefit to American farm life has been very great, and the high standard of culture and comfort reached is in many cases directly due to this institution.

In addition, many rural clubs are now linked with the General Federation of Women's Clubs, with headquarters in Washington, D. C.

DENMARK.—Country women's associations, of which 85 exist in this country, are grouped in a federation known as De samvirkende danske Husholdnings-foreninger, the headquarters of which is at Kamstrup near Roskilde. The total membership is 6,500. The object of these associations is to give instructions and advice to country women on rural household management. Courses, lectures, exhibitions, and meetings are arranged and instruction is given on foodstuff values and also on household accounts. Enquiries are made in regard to any new articles of food, etc. The associations were started in 1920 by private initiative, but since 1928 States ubsidies have been made in respect to household management advisory work.

The existence is also reported of a union of the housewives' societies of Sweden, Norway, Denmark, and Finland, which has held congresses at Oslo and at Copenhagen.

FINLAND.—In Finland there are a number of organizations concerned with the vocational and cultural aspects of the life of country women and girls. Of these the following are the most important:

(*a*) The Suomalainen Marttaliitto, or Union of Finnish Housewives, consists of 450 local associations grouped into 15 federations, the total membership being over 30,000. This organization was founded in 1890 and has for its object the cooperation of women of all classes; but in view of the prevailing agricultural character of Finland, a large proportion of the members are rural housewives.

(*b*) The Finlands Svenska Marthaförbund, which is a similar organization of Swedish-speaking women, consists of 200 local associations grouped into 11 federations, with a total membership of about 15,500.

(*c*) The Maamiesseurojen naisosastot, or Women's Sections of the Agricultural Unions, are independent organizations closely connected with the agricultural unions of Finland, and thus forming the farm women's associations in the strict sense. In 1928 the number of these sections was 150, with a total membership of 20,760.

All these organizations were formed as a result of private initiative but receive State grants. A fourth organization, Maatalouskerholiitto, or Federation of Rural Clubs, was instituted by the State, but is mainly concerned with the development of rural interests and farming aptitudes among young people.

Activities.—The object of all these unions is the same; to encourage women in the country to practice self-improvement and to develop the potentialities of their own calling. All the activities appropriate to the management of a rural household, therefore, claim the attention of a union, viz, housework, cookery and baking, child nurture, hygiene, gardening, handicrafts, and poultry rearing. The methods employed are as follows: Women advisors are appointed in housekeeping, gardening, and handicraft; arrangements are made for lectures, meetings, exhibitions, courses, competitions, excursions, and also for purchases in common, as, for example, of seeds.

GERMANY.—The development of country or farm women's associations has been extremely vigorous in Germany. The movement dates from the early part of this century, the first association being actually formed in east Prussia in 1898 and even before the war associations, for the most part grouped in federations, existed in nearly every province, with the definite object of encouraging the woman's share in the farm enterprise and the local marketing of home products. In 1916 the National Federation of Farm Women's Associations was instituted, grouping the existing provincial federations, and this is at present the largest and most important vocational organization of country women in Germany, comprising in all 1,766 associations grouped into 25 State and provincial federations, with a total membership of some 120,000.

More recently and in order to make provision for the special interests of the country women who are members of organizations concerned with social welfare activities among women and young people but not necessarily exclusively rural in character, the National Committee of Country Women's Federations has been formed. This committee is a section of the German Union for Preservation of the Rural Home and Rural Welfare and acts as a center of collaboration for 19 unions and federations, predominantly urban in character, confining its action to the interests of the country-women members.

A certain number of associations are in existence which deal with the training of women and girls for rural life and interests, but these are not strictly speaking associations of farm or country women.

Activities.—The Reichsausschuss Ländlicher Frauenverbände has of late mainly given attention to the provision of qualified women teachers for country schools, instruction in handicraft, girls' continuation schools, rural housing, the scientific organization of the work of the farm woman and in particular with the unsatisfactory hygienic and social conditions that have resulted on economic development, and the problem of their remedy or prevention. These questions are handled partly by select committees and partly by public meetings. In accordance with its character as a center of collaboration and of scientific investigation the Reichsausschuss confines itself to bringing the results of its enquiries to the knowledge of the component federations or unions.

The objects of the federation are vocational and economic in scope. The first clause of the statutes of the federation refers to the recognition of household work as a profession and the proper equipment of the woman for her position and occupation. The activities include: The provision of classes and courses for women and of continuation schools and classes for girls in household and agricultural subjects; the protection of home-grown agricultural products, especially fruit and vegetable growing; improvement of marketing facilities, organization of egg circles, of bee and poultry keeping and small rural industries; the promotion of social and educational gatherings, broadcasting, exhibitions, competitions, etc.

The organizations of farm women owe their existence to the foresight and energy of individuals and depend mainly on the contributions of members. State aid is received for any work of public utility undertaken by them, such as schools, courses of different kinds, etc., but these grants are not large.

Loading potatoes, Yakima project, Washington

Reclamation Organization Activities and Project Visitors

Commissioner Elwood Mead is planning to leave Washington about the middle of September on another western field trip. He expects to attend sessions of the Hoover-Young Commission, and visit Boulder Dam, Lower California in connection with the All-American Canal, and the Yuma project.

Reclamation Economist George O. Sanford returned to Washington on August 26, having inspected the Belle Fourche, Lower Yellowstone, Milk River, Sun River, and Huntley projects. On a portion of his trip he was accompanied by District Counsel W. J. Burke. Several days were spent on the Bitter Root project, in western Montana, where plans were considered for meeting the requirements imposed by Congress in connection with the Federal loan authorized by the Leavitt bill.

Porter J. Preston, superintendent of the Yakima project, has been transferred to Denver, where he is to be engaged in investigational work on the Colorado River Basin. John S. Moore, associate engineer, will assume charge of the Yakima project with the title of acting superintendent.

Ralph Lowry, construction engineer, has been transferred from Cle Elum Dam, Yakima project, to Boulder Dam as principal assistant to the resident engineer at Las Vegas, Nev.

H. W. Bashore, construction engineer on the Vale project, has been detailed to make a study of the Columbia Basin project, with headquarters at Spokane, Wash.

Senior Engineer W. H. Nalder, of the Denver office, returned to his post on July 14. At the request of Herbert D. Brown, Chief of the Bureau of Efficiency, Mr. Nalder had been on a trip to the Virgin Islands for the purpose of investigating irrigation possibilities on the island of St. Croix.

P. I. Taylor, of the engineering division, Washington office, made an automobile tour through New England during the month and spent two weeks camping on Squam Lake near Ashland, N. H.

On July 29 Jay E. Provenchar, mucker at Owyhee Dam, was struck by a falling timber at the bottom of a shaft, from the effects of which he died shortly thereafter.

We have learned with deep regret of the death of Mrs. Sarah L. Suydan, assistant clerk in our field office at Ellensburg, Wash. Mrs. Suydan was fatally injured in an automobile accident on July 24 and died at the Ellensburg General Hospital on July 27.

After a tour of a number of the projects and several days spent at the Washington office, Madam Tatiana A. Kolpakova, S. Zaprometov, Alexander A. Gimsky, and B. Mikhailov, engineers from Soviet Russia, have returned home.

F. G. Cross, assistant superintendent of the department of natural resources of the Canadian Pacific Railroad Co., was a visitor on the Huntley project the latter part of the month.

Chief Designing Engineer J. L. Savage left Denver on July 18 to visit and inspect the northwestern projects, including the Shoshone, Gibson, Pishkun, Echo, Owyhee, Tieton, and American Falls Dams, the Kittitas division of the Yakima project, and the work of the California water resources investigations at Sacramento. He was accompanied by E. S. Randolph, chief designing engineer for the Madden Dam, Panama Canal.

Electrical Engineer L. N. McClellan left Denver on July 29 to meet the commissioner and chief engineer at Spokane, Wash., in connection with the investigations of the Columbia Basin project. From there he went to the Yakima project on matters relating to the Kennewick Highlands pumping project.

Drainage Engineer J. R. Iakisch was on the Belle Fourche project the latter part of July and the first few days in August inspecting construction work and considering plans for 1931.

H. D. Comstock, superintendent of the Riverton project, inspected the construction work on the Milner-Gooding Canal, Minidoka project, on July 7 and 8.

S. E. Fitz-Simon, engineer for the reclamation service of the Argentine Republic, visited the American Falls Dam, Minidoka project, and the Owyhee Dam, Owyhee project, the latter part of the month.

Hollis Sanford, inspector, was transferred on July 7 from the Yakima to the Owyhee project, where he assumed his new duties in connection with the concrete-pipe plant.

Sr. Jose L. Favela, agente general, Republic of Mexico, Tia Juana, Mexico, was a recent visitor on the Yuma project.

On July 30 Maj. Frederick G. Cross, assistant superintendent of operation and maintenance, eastern section, Canadian Pacific Railway, Brooks, Alberta, was an unofficial visitor on the Shoshone project.

While on a recent business trip to the Klamath project, R. W. Hawley, for many years an engineer in the Bureau of Reclamation, called on the project office force and renewed old friendships.

D. G. McCulley, associate engineer, was transferred on July 14 from the Owyhee project to Boulder Dam. Foster Towle was appointed to take over the work previously handled by Mr. McCulley.

The twentieth annual session of the Oregon Reclamation Congress was held at Burns, Oreg., August 7–9. E. B. Debler, hydrographic engineer of the Denver office, attended as the bureau's representative.

H. C. Stetson, engineer, was in Bridgeport, Nebr., on July 19 for the purpose of conferring with R. H. Willis, chief of the bureau of irrigation, power and drainage, Department of Public Works of Nebraska, Superintendent of Power C. F. Gleason, and representatives of the Dawson County Irrigation Co., relative to the regulation of the flow of the North Platte River.

On July 28 H. F. McPhail, engineer, returned to Denver from a trip made for the purpose of investigating the possible power market in connection with the construction of the Flaming Gorge project.

Until July 27 Master Mechanic T. S. Martin, of the Denver office, was at Sunnyvale, Calif., inspecting the high-pressure gates for the Owyhee Dam, leaving there for Coalville, Utah, to supervise the installation of the gates and valves at Echo Dam.

U. S. GOVERNMENT PRINTING OFFICE: 1930

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
G. O. Sanford, Reclamation Economist

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr			do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Acting Supt	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	Superintendent	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Constr. engr	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent	N. O. Anderson	Denver office	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	H. W. Bashore	Constr. engr	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	John S. Moore	Acting Supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Acting constr. engr.	E. R. Mills	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith		Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

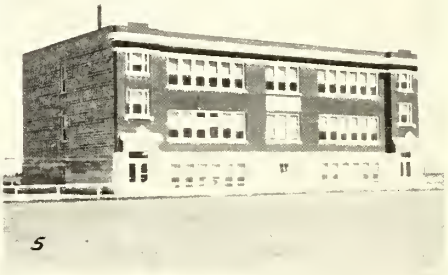
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

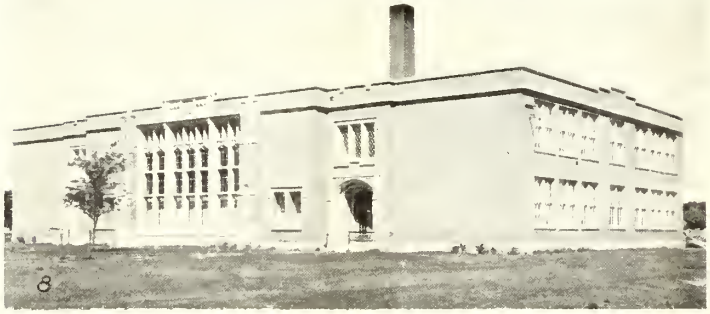
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. I. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrigation district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wyo.	A. B. Reeves	do	Mrs. Nelle Armitage	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.,
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Palo Verde Valley	Yuma, Ariz	R. M. Priest, H. J. Gault	
Central California water resources	Sacramento, Calif	C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Alcova-Casper and Saratoga	Saratoga, Wyo	J. R. Iakisch	State of Wyoming.
Cle Elum Reservoir	Cle Elum, Wash		





1. Graded School, Ellensburg, Yakima project
2. Yuma Union High School, Yuma project
3. High School, Shoshone project
4. Horse Creek School, Belle Fourche project
5. Riverton High School, Riverton project
6. Churchill County High School, Newlands project
7. Tieton School, Yakima project
8. Sunnyside Graded School, Yakima project
9. Public School, Yuma project
10. High School, North Platte project
11. 4th Avenue Grammar School, Yuma project
12. Public School, Belle Fourche project
13. Cowiche High School and Gymnasium, Yakima project
14. Lake District School, Orland project

NEW RECLAMATION ERA

VOL. 21, NO. 10 OCTOBER, 1930

DAIRY HERD ON THE YAKIMA PROJECT, WASHINGTON

IRRIGATING ALFALFA

BECAUSE of the rapidity of its growth and the number of cuttings obtained during a season, alfalfa requires more water than most crops. Nevertheless, water should be applied carefully in order to avoid waste and to prevent injury from over-irrigation. There are several methods of applying water to alfalfa, their suitability depending on the character of soil and subsoil, climate, water supply, size of farm, and other factors. The most common are the border and check methods, and flooding from field ditches. The border method consists of dividing a field into long narrow strips by low levees extending usually in the direction of the steepest slope. This method can be used best where large streams of water are available to the farmer. The check method consists in surrounding nearly level plots of ground with low levees. The most favorable conditions for this method are light, sandy soils on an even slope of 3 to 15 feet to the mile, or heavy soils on which it is necessary to hold water for some time in order that it may percolate to the desired depth. Flooding the field from laterals or small ditches is a common method in the Rocky Mountain States. It can be used to advantage on slopes that are too steep for other methods. It costs little to prepare fields for flooding and the method is adapted to the use of small streams of water.

No fixed time can be recommended for watering alfalfa. In general, it is best to irrigate as late as possible before the cutting and again after the crop has been removed if water is then needed. The appearance of the alfalfa, especially the color of the leaves, is an aid to the farmer in determining when water is needed.

—From Farmers' Bulletin No. 1630.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 October, 1930 No. 10

Interesting High Lights on the Federal Reclamation Projects

SEED peas have all been threshed on the Lower Yellowstone project and, in most cases, the yields were fairly satisfactory. Beans were being cut at the end of the month and gave promise of making a heavy yield. Corn is also in excellent condition and is being harvested in some of the earlier fields.

THE Arlington Heights Packing Co., of Riverside, Calif., has erected at Yuma a citrus-packing shed to pack the local citrus crop on both Unit "B" lands and the private groves adjoining. The packing shed and machinery represent an investment of approximately $16,000 and are modern in every detail.

A FIVE-STORY modern office building for the Liberty Savings & Loan Association has just been completed in Yakima, and contract has been let and construction begun on an 11-story office building on the site of the old First National Bank Building, which will cost more than half a million.

THERE are about 7,000 acres of sugar beets on the Lower Yellowstone project, and this crop has never looked so well at this season of the year. Preliminary estimates by the sugar company place the average yield at close to 12 tons per acre. The sugar content on the September 1 tests was 12 per cent, which is also high for this time of the year.

FIFTEEN homeseekers called at the Ellensburg office during the month to make inquiry concerning project lands on the Kittitas division of the Yakima project and considerable interest was exhibited by the visitors. A large acreage under the North Branch Canal is being cleared of sagebrush preparatory to planting crops in the spring of 1931. Some settlers are erecting houses and other buildings and drilling wells on new land.

EFFORTS have been continued, with the possibility of a successful conclusion, looking toward the merger of the three poultry organizations marketing these products for the Grand Valley and Uncompahgre projects.

A HERD of select Guernsey cattle picked from the various herds of the South Side division of the Minidoka project was shipped from Declo during the month to be exhibited at the county fairs in southern Idaho. This herd attracted much attention wherever it was shown, and won many prizes.

ONE farm application was filed at the Vale project office during the month, and one homestead application for a farm unit acquired by assignment was made to the local land office. Eight tracts of private land were sold to new settlers.

THE Park County Fair on the Shoshone project had a better attendance this season and was of more interest to the people of the entire county than ever before. The community exhibits attracted all visitors. In the absence of fruit the Willwood settlers were forced to accept third prize on their exhibit, which was unique. One-half of the booth showed conditions in 1927, the display including sagebrush, cactus, and other native plants artistically arranged, and a few mounted sage hens. On the opposite side of the booth a horn of plenty poured forth a fine display of vegetables and grain. Several blue ribbons could be seen on the exhibits of the Willwood settlers.

THE Orchard Mesa district of the Grand Valley project has proceeded to take a tax deed to a considerable area of land and will soon have available many tracts at reasonable prices.

SUGAR beets continue to make good growth on the Belle Fourche project and there is general expectation that yields will average a maximum since the sugar factory was established. Cucumbers for pickles are yielding exceptionally heavy, and already $200 per acre has been realized from a number of patches.

THE Big Horn Canning Co., of Cowley, Shoshone project, has finished the 1930 pack of peas, totaling nearly 25,000 cases. Corn and beans have been canned and the company is now engaged in canning tomatoes.

THE Utah-Idaho Sugar Co. sponsored a tour of farmers over the Belle Fourche project on August 26 in the interest of better farming and more beets per acre. The party visited the experiment farm at Newell and a number of other places where methods and machinery were fully explained to the visitors.

HARVESTING of fruit and nuts on the Orland project and surrounding vicinity kept all local labor well employed during the month at wages of $3.50 and $4 per day for laborers and $6 for teamsters with two horses.

THE new San Carlos Hotel on the Yuma project was opened on August 23 and is proving to be very popular. The entire hotel and coffee shop are served by an air conditioning or refrigeration system, which appeals to tourists and salesmen as it assures them of unbroken rest at night.

WORK on the construction of the Great Northern Railway from Klamath Falls, Klamath project, to Bieber, Calif., was started on August 27.

Construction of Main Canal Lining on Kittitas Division, Yakima Project, Washington

(Machine Placing and Control Methods Improve Quality of Concrete)

By Engineer Arthur Ruettgers and Associate Engineer A. A. Whitmore

CONSTRUCTION work performed on the Kittitas division of the Yakima reclamation project, Washington, during the seasons of 1927 and 1928 included the placing, by contract, of about 55,000 cubic yards of concrete in canal and tunnel lining, combination lining and flume sections, inverted siphons, culverts, turnouts, bridges, and miscellaneous canal structures. The greater portion of the concrete, about 52 per cent, was placed in 3-inch reinforced canal lining. A description of this work, which involved the successful development and use of some novel construction equipment and the application of the more modern methods for scientifically controlling the concreting operations, forms the main substance of this article.

GENERAL DESCRIPTION OF WORK

The Kittitas division of the Yakima project will, upon completion, provide facilities for the irrigation of about 72,000 acres of land located in the higher reaches of the bowl-shaped Kittitas Valley, surrounding a privately irrigated body of bottom land centered at Ellensburg, Wash. The irrigation plan contemplates the diversion of 1,320 second-feet of water from the Yakima River at the Easton Dam, about 40 miles northwest of Ellensburg. The Main Canal completely traverses the southern slope of the Yakima River Canyon for 26 miles to its entrance into the Kittitas Valley, where the canal divides, the north or larger branch (of 925 second-feet capacity) crossing the river and skirting the northern and eastern rims of the valley, and the south branch (of 250 second-feet capacity) following along the southern rim.

Stretches of the Main Canal, aggregating about half its entire length, were lined with 3-inch reinforced concrete to prevent excessive seepage losses in sand and gravel formations, to reduce the construction cost through heavy cuts, or to serve as a safeguard against expensive washouts on steep sidehill locations. Construction of the lined canal was performed under five separate contracts by four different contractors. A typical section of the canal is shown in Figure 3.

INDEX TO PHOTOGRAPHS ON OPPOSITE PAGE

Photo No. 1.—View looking upstream from station 1202, Main Canal, showing two drag lines excavating for lined section of canal.

Photo No. 2.—General view of trimming and lining operations. Drag line equipped with clamshell bucket used to remove excess material from trimming operations.

Photo No. 3.—Template used in connection with trimming operations. Looking upstream from station 105, Main Canal. Outlet of Tucker Creek Siphon in the background.

Photo No. 4.—Apparatus used by Derbon Construction Co. for trimming operations on division 3, Main Canal. A screed board provided with a steel cutting edge is drawn down the slope, the ends of the cutting screed rest on boards set to grade of canal side slope.

Photo No. 5.—Break in canal lining caused by development of hydrostatic head behind the lining—station 90, Main Canal.

Photo No. 6.—Lining operations—Main Canal station 1094±. Movable scaffold for tying reinforcing steel in foreground. Lining machine, concrete distributing platform, and mixer in background, the subgrade being wet down prior to the placing of the concrete lining.

Photo No. 7.—Gravel "finger" or side slope feeder drains. Note the longitudinal drain placed near upper side of canal base; also note ribbons at the top of side slopes and on bottom of canal on which the concrete lining platform runs. Looking upstream from station 1224, Main Canal.

Photo No. 8.—Discharge from lateral drains—Two 6-inch pipes discharging about ¾ second-feet—station 1⅓, Main Canal.

Photo No. 9.—Constructing longitudinal drain. Trimming "jumbo" in background. Drag line equipped with clamshell bucket used to remove excess material left from trimming operations.

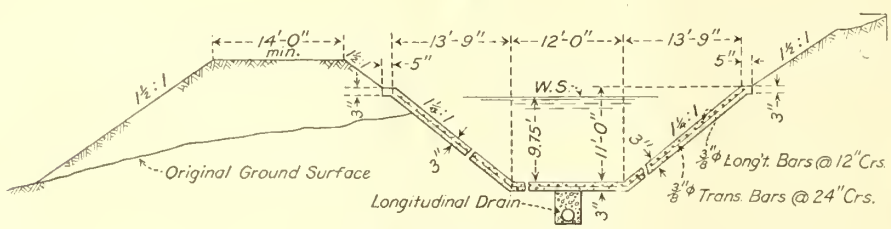


Fig. 3-TYPICAL SECTION
(Not to scale)

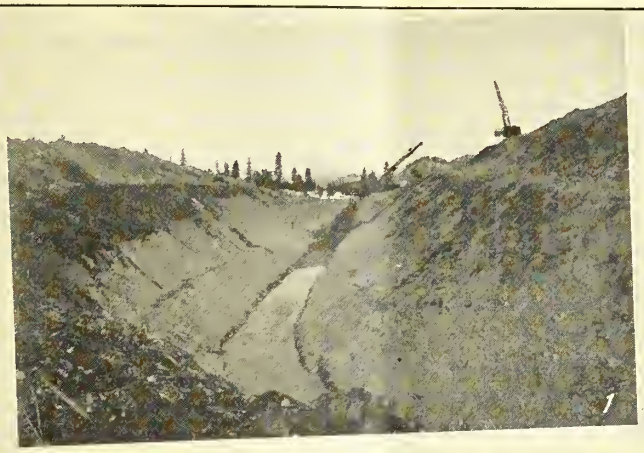
WORK PRELIMINARY TO CONCRETING

Excavation.—Rough excavation of the canal section was in all cases performed by drag lines equipped with buckets of 1 to 2½ cubic yards capacity. (Photo No. 1.) Smaller drag lines, usually equipped with clamshell buckets, were used to dispose of excess material removed in the trimming operations. (Photo No. 2.)

Trimming.—The final trimming was generally done with the aid of a traveling template (photos Nos. 3 and 4), mounted on rollers, and consisting of two wooden trapezoidal-shaped frames so constructed and placed with respect to the canal center line and grade that a straightedge moved along between the frames indicated the proper subgrade for the side slopes and canal bottom. The roller track was made of 3 by 6 inch plank firmly embedded in the canal bottom, adjacent to the toe of each side slope. (Photo No. 7.) Removal of the high spots in the canal section and back filling of the cavities were performed by hand methods. Cavities deeper than 6 inches were back filled by placing moist material in thin horizontal layers and compacting with standard iron tampers, otherwise the compacting was done with flat steel shovels. Where the material was excessively sandy a thin layer was removed and replaced with clay to prevent raveling of the surface. Further efforts to prevent raveling of finished surface consisted in keeping the subgrade moist by sprinkling until the concrete was finally deposited. (Photo No. 6.)

The traveling template was also utilized in providing narrow berms at the tops of the side slopes. A ribbon of plank, placed on these berms, served as a second track for the operation of a movable scaffold from which the reinforcing steel on the side slopes was tied (photo No. 6), and subsequently to guide and support the concrete distributing platform and lining machines.

Drainage.—Inasmuch as a 3-inch concrete lining in a canal section of the dimensions used offers little resistance to external pressure when the canal is empty, and as the region traversed is subject to a mean annual precipitation of some 20 inches, with the major portion occurring during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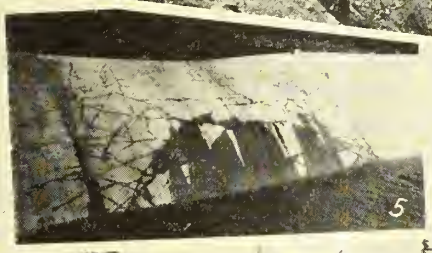
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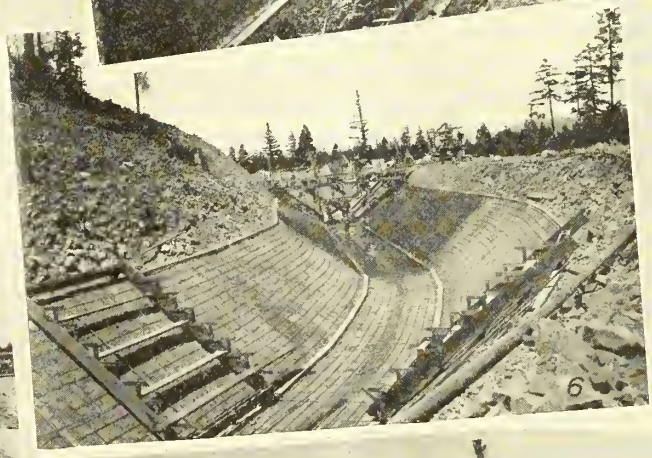
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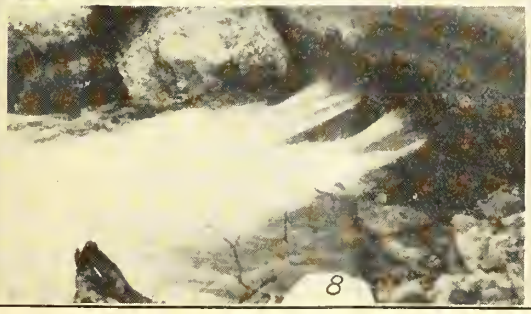
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the nonirrigation season, particular care was taken to provide adequate drainage for the lining. Longitudinal drains of 4 to 12 inch vitrified or concrete pipe, embedded in gravel (photo No. 9), were laid beneath the floor of the lining in one or two lines, depending on the topography and ground water conditions encountered in excavating. Where the conditions appeared to require it, feeder or "finger" drains of gravel or tile, at right angles to and connecting with the longitudinal drains, were placed in the upper side slope of the lining. The importance of these finger drains, particularly at draws, was emphasized during the progress of the work by the failure of several panels on the upper slope through the action of hydrostatic pressure back of the lining. (Photo No. 5.) The early practice was to place the longitudinal drains along the center line of the canal, but this was abandoned in favor of locating the drains near the toe of the upper slope, the latter location offering more direct connection with finger drains and better prospects for effective drainage in general. (Photo No. 7.) The longitudinal drains sloped in both directions to lateral or outlet drains, spaced 300 to 1,000 feet or more apart and consisting of 6 to 12 inch pipe, with cemented joints, placed through or under the lower canal bank. (Photo No. 8.)

CONCRETING OPERATIONS

Requirements.—The matter of devising the most suitable means for handling the concreting operations was not a simple one, as the character of the work and related specifications required that account be taken of a variety of conditions, some of the principal ones being as follows:

(*a*) The size of the lined section, steepness of side slopes, small thickness of concrete, and difficulty of centering the reinforcing steel in the thin concrete slabs were not favorable for the adoption of the customary method of hand placement of the concrete.

(*b*) The top of the lower bank (of 14 feet minimum width), which as a rule furnished the only means of direct access to the work, provided only a limited amount of space for the storage of materials and the accommodation of operating equipment and crews.

(*c*) The distance over which the work was spread, and the necessity for completion within the allotted time, demanded mobility of all operating equipment. Simultaneous prosecution of concreting operations in several locations involved duplication of equipment and organization.

(*d*) The specifications required that the lining be placed monolithically in short

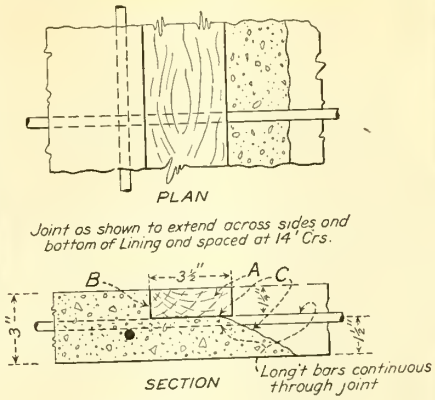


Fig. 2 - DETAIL OF JOINT

panel sections and given a steel trowel finish. A special transverse joint (fig. 2), later abandoned and replaced by a plain butt joint (see paragraph on "Panel joints"), was required at panel ends. Longitudinal joints (parallel to the axis of the canal) were not permitted.

(*e*) Neighboring creeks and the Yakima River furnished the only adequate and reliable sources of water.

(*f*) The bid prices were such that efficiency of operation and exercise of the strictest economy were essential for the realization of a profit.

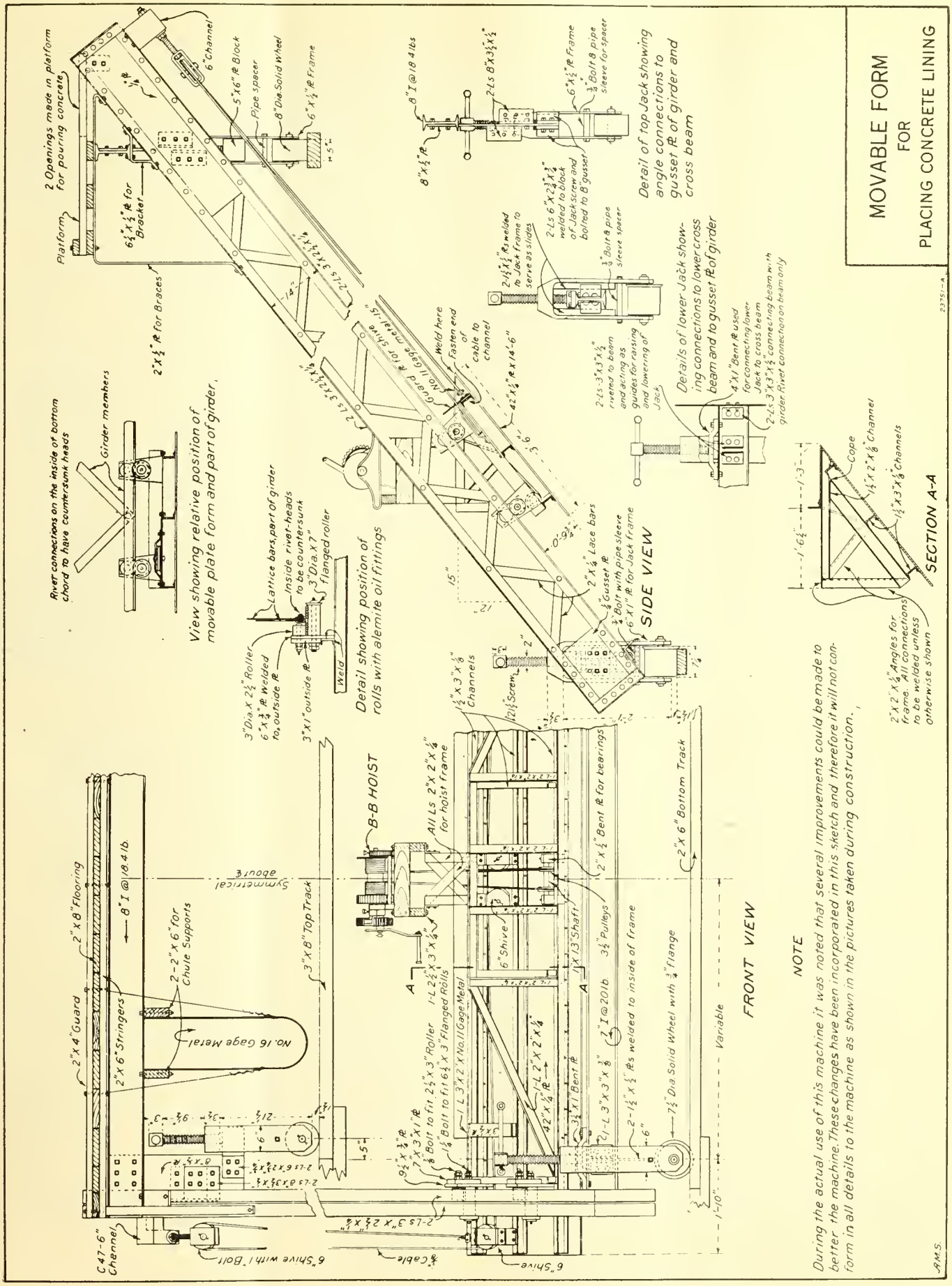
The extent to which the first contractor succeeded in adapting his concreting operations to the particular requirements of the job, in lining approximately 2½ miles of Main Canal in 1927, is evidenced by the fact that all three of the other contractors who engaged in lining operations in 1928 employed methods and equipment embodying the same general principles, in so far as the handling and placing of concrete is concerned, as those which characterized the 1927 work.

Steel plate lining machine.—Of particular interest is the novel machine designed and perfected by the forces of the General Construction Co. for lining the side slopes. (Fig. 1 on opposite page.) The apparatus consisted of a movable steel plate 14 feet 6 inches long (the customary panel length being 14 feet) and 3½ feet wide, supported by and operating beneath two parallel fabricated steel girders with roller ends. (Photos Nos. 11 and 12.) An operating platform about 18 inches wide attached to the upper edge of the steel plate received the concrete and accommodated several workmen, in addition to carrying the winch by means of which the plate was made to travel upward along the canal slope and compact the concrete as it was spaded into the space back of the upper portion of the plate. A screw jack at each roller for raising or lowering the girders permitted adjustment of the plate to the required slope angle and thickness of concrete. The simultaneous use of two of these machines, one on each side slope, not only fulfilled the requirement for monolithic construction of panel units (the floor section being placed by hand immediately following completion of the slope sections), but also introduced an element of competition between the individual working crews which had a noticeable effect in speeding up the work.

Transporting and placing concrete.—Wheel buggies were generally used to transport the concrete from the mixer, located on the lower bank, to the canal section, where each batch was directed to its desired position on the side slope or bottom with the aid of a distributing platform mounted on rollers and equipped with a series of flexible chutes or spouts. The ribbons of plank track in the canal bottom and at the top of the lined slopes also served as screeds and, in the latter case, as outside forms for the 5-inch concrete berms.

About 10 complete panel units (equivalent to 140 linear feet of lining) constituted the average pour for one working shift of 8 hours, the record for a shift being 14 panels or 196 feet of lined canal. The reinforcing steel was kept above the subgrade by inserting small precast cement mortar blocks underneath the bars at various points as conditions required. Experience proved that the most practicable procedure for pouring the lower 3½ feet of slope lining was to shovel the concrete directly on to the slope (photo No. 11) and, after striking it off roughly, to lower the steel plate to position and rap it with a bar in order to bring the fine material into contact with the plate. Upon completion of this operation, the plate was started on its upward course, its movement keeping pace with the addition of concrete from the platform by the spaders. The action of the moving steel plate, with proper spading, correct concrete consistency, and other related factors under control, resulted in a true surface and a reasonably good finish. The finish was perfected by going over the entire surface lightly with a long-handled steel trowel. Any defects appearing on the surface, due to insufficient mortar or spading, were remedied by adding the amount of concrete or mortar needed and troweling over. Mortar was also used to provide fillets at the intersections of the floor and side slopes. The floor, as previously indicated, was placed by the usual hand methods, one of the last operations being to remove the plank track or screeds and fill in the grooves with tamped concrete after thoroughly cleaning the grooves. (Photo No. 11.)

Other types of lining machines.—Photographs Nos. 17 and 13 show types of lining apparatus in which the general


MOVABLE FORM
FOR
PLACING CONCRETE LINING
SIDE VIEW
FRONT VIEW
SECTION A-A
View showing relative position of movable plate form and part of girder.
Detail showing position of rolls with alemite oil fittings
Detail of top Jack showing angle connections to gusset ℞ of girder and cross beam
Details of lower Jack showing connections to lower cross beam and to gusset ℞ of girder
B-B HOIST
Symmetrical about ℄
2 Openings made in platform for pouring concrete
Platform
6" Channel
5"x6" ℞ Block
Pipe spacer
8" Dia. Solid Wheel
6"x½" ℞ Frame
6½"x½" ℞ for Bracket
2"x½" ℞ for Braces
8" I @ 18 lbs
8"x½" ℞
2 Ls 8"x3½"x½"
6"x½" ℞ Frame
¾" Bolt & pipe sleeve for spacer
2 Ls 6"x3½"x½" welded to block of Jack screw and bolted to 8" gusset
¾" Bolt & pipe sleeve spacer
2½"x½" ℞s welded to Jack frame to serve as slides
2-Ls 3"x3"x½" riveted to beam and acting as guides for raising and lowering of Jack
4"x1" Bent ℞ used for connecting lower Jack to cross beam
2-Ls 3"x3"x½" connecting beam with girder. Rivet connection on beam only
Girder members
Rivet connections on the inside of bottom chord to have countersunk heads
Guard ℞ for Shive
No. 11 Gage Metal
Weld here
Fasten end of cable to channel
42"x½" ℞ x 14'-6"
2 Ls 3"x2½"x½"
2"x¼" Lace bars
¾" Gusset ℞
¾" Bolt with pipe sleeve
6"x1" ℞ for Jack frame
Lattice bars, part of girder
Inside rivet-heads to be countersunk
3" Dia. x 7" flanged roller
3" Dia. x 2½" Roller
6"x¾" ℞ welded to outside ℞
3"x1" outside ℞
Weld
½"x3"x⅛" Channels
12½" Screw
All Ls 2"x2"x¼" for hoist frame
2"x½" Bent ℞ for bearings
2"x6" Bottom Track
3"x8" Top Track
2"x8" Flooring
8" I @ 18.4 lb.
2-2"x6" for Chute Supports
2"x6" Stringers
2"x4" Guard
No. 16 Gage Metal
C 47-6" Channel
6" Shive with ¾" Bolt
⅝" Cable
6" Shive
1-L 2½"x3"x¼"
1-L 3"x2"x No. 11 Gage Metal
Flanged Rails
1-L 3"x2"x3" Roller
¼" Bolt to fit 6¼"x3" Flanged Rails
¼" Bolt to fit 2½"x3" Roller
6" Shive
3½" Pulleys
1"x13" Shaft
7" I @ 20 lb.
2-1½"x½" ℞s welded to inside of frame
7½" Dia. Solid Wheel with ¾" Flange
Variable
1-L 3"x3"x⅜"
1-L 2"x2"x¼" ℞
42"x¼" ℞
3½"x1" Bent ℞
2-Ls 3"x2½"x¼"
2-Ls 8"x3½"x¼"
2-Ls 8"x22½"x¼"
Cope
½"x2"x⅛" Channel
1½"x3"x⅛" Channels
2"x2"x¼" Angles for frame. All connections to be welded unless otherwise shown
NOTE
During the actual use of this machine it was noted that several improvements could be made to better the machine. These changes have been incorporated in this sketch and therefore it will not conform in all details to the machine as shown in the pictures taken during construction.
A.M.S.

principles of the movable plate lining machine and distributing platform were combined in a single unit. These forms of apparatus involved a smaller plant investment and were devised by two of the contractors whose lining operations were less extensive. As seen from the pictures, the movable steel plate in the original slope lining machine was replaced by a metal-lined plank strike-off board, with operating platform, which, instead of being rigidly held down at its ends, simply rode on two plank screeds spaced a panel length apart and located under the distributing platform, or "jumbo," as it was called.

In comparison with the steel plate lining machine, the spading board was less effective in compacting the concrete and drawing mortar for finishing to the surface; consequently more hand finishing and a greater use of mortar was required. This feature of the spading-board type of apparatus, coupled with its lack of headroom, greater dependence on a definite consistency of concrete for satisfactory operation, and other characteristic features tended to reduce the speed of concrete placement below that obtained by the use of the more expensive type of equipment, although it is believed that the quality of the lining secured was considerably better, and the cost to the contractor less than would have resulted under the ordinary methods of hand placement.

Concrete materials.—The materials entering into the lining construction, including sand and gravel shipped from Puget Sound, cement, diatomaceous earth admixture, reinforcing steel, and drainpipe, were received by the contractors at the most convenient railroad points and hauled by them in motor trucks to the work. As a rule, the aggregates were dumped into stock piles from elevated spur tracks provided by the contractors at the railroad delivery points, and loaded therefrom into trucks by means of mechanical loaders, or elevated to storage bins of central proportioning or mixing plants.

Concrete mixing.—Concrete for the first half mile of lining on the Main Canal was mixed at a stationary mixing plant (constructed primarily for the production of concrete for the Easton diversion dam) and hauled to the scene of lining operations in narrow-gage cars drawn by dinkey locomotives. With this one exception, all concrete placed in Main Canal lining was mixed in portable mixers which traveled the canal bank along with the concrete placing equipment. Modern paving mixers with caterpillar traction were employed on some of the more recent work. (Photo No. 12.)

On two of the contracts the mixer was fed from stock piles of materials on the top of the bank, supplemented, where necessary, by direct motor-truck deliveries from the main sources of material supply. On the remaining two contracts the contractors established central proportioning plants at the railroad delivery points (photo. No. 18) where the requisite amounts of aggregates, cement, and admixture for a mixer batch were measured out and loaded into trucks with bodies specially constructed to handle three batches of the dry materials and, upon arrival at the mixer, to unload the batches separately into the charging hopper.

INDEX TO PHOTOGRAPHS ON OPPOSITE PAGE

Photo No. 10.—Looking down concrete-lined section of Main Canal from outlet of Peterson Creek Siphon. Note safety ladder on right-hand side slope. Safety ladders placed every 250 feet on alternate side slopes in lined sections of the canal.

Photo No. 11.—Close view of lining machine showing movable steel plate traveling up side slope of canal. Bottom of canal, lining in preceding panel being finished and concrete being placed in lower 3½ feet of side slopes for succeeding panel. Also note notched screed board on side slope under "jumbo."

Photo No. 12.—View of original lining machine and concrete distributing platform developed by General Construction Co., contractor for divisions 1 and 2 of Main Canal. Note truck about to back up and discharge cement and aggregates into hopper of the caterpillar traction paving mixer. Each truck handled three batches of dry materials.

Photo No. 13.—Combined distributing platform and movable strike-off board employed by S. H. Newell & Co., contractor for construction of division 2 (Schedule 2), Main Canal. Contractor stock piled the cement and aggregates on the canal operating road.

Photo No. 14.—Improved type of apparatus for testing impermeability of concrete disks under water pressures of 0–500 pounds per square inch.

Photo No. 15.—Curing canal lining by water method, using Babb sprinklers. Burlap covering the green concrete is shown in the background—station 103, Main Canal.

Photo No. 16.—Completed canal lining. Cured by "Hunt process" paint method. Paint is sprayed on immediately following the finishing operations.

Photo No. 17.—Combined distributing platform and movable strike-off board type of apparatus employed by C. F. Graff, contractor for construction of Easton Dam and upper half mile of Kittitas Main Canal.

Photo No. 18.—Derbon Construction Co.'s sand and gravel bunkers at Derbon's Spur on the Chicago, Milwaukee, St. Paul & Pacific Railroad about 1½ miles west of Horlick.

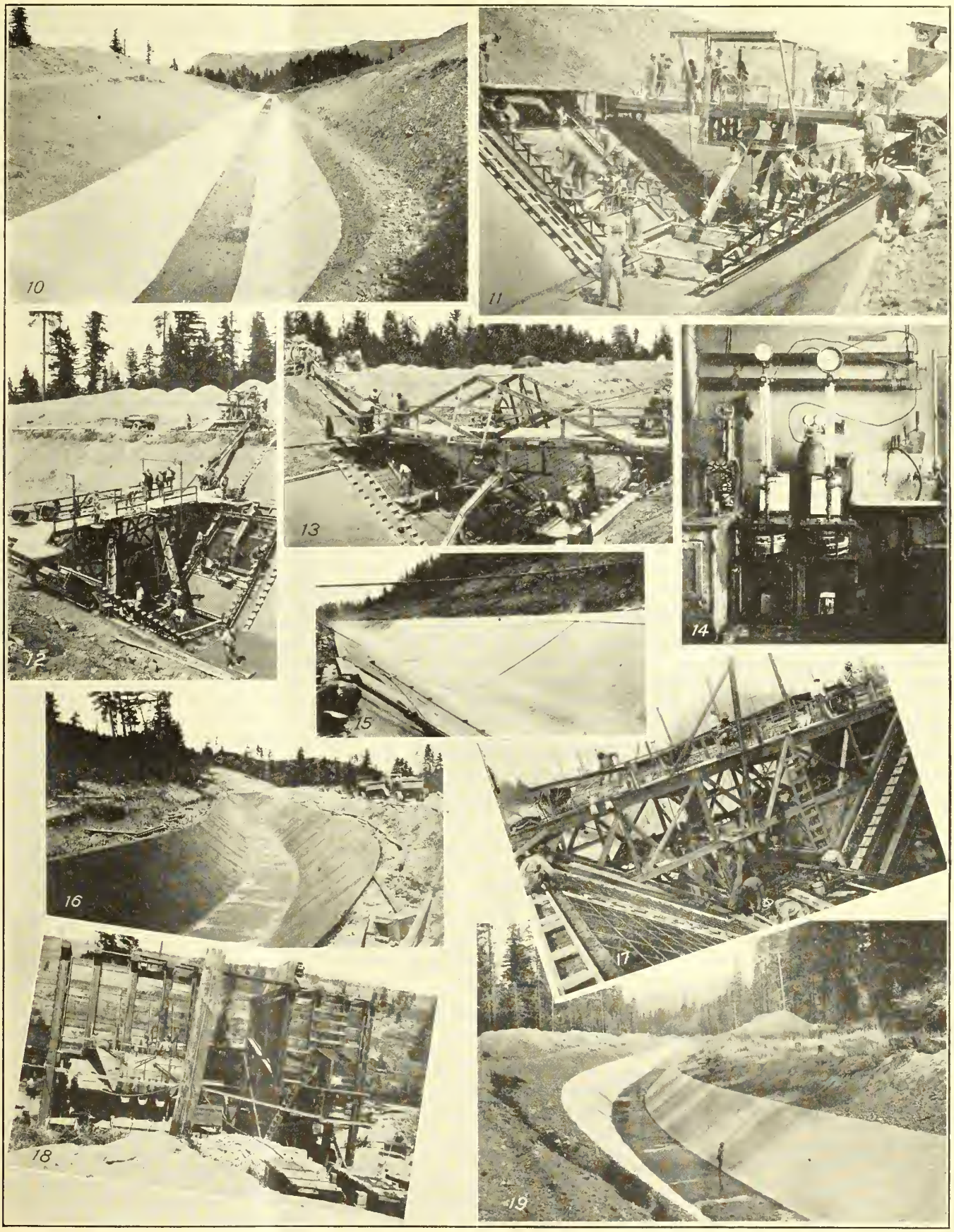
Photo No. 19.—Another section of concrete-lined canal. Looking down the Main Canal near Easton, Wash. Note true alignment obtained by use of movable concrete placing platform.

Water problems.—The necessity for almost constant sprinkling of the subgrade from the time of final trimming until the concrete was laid, the use of water for mixing concrete and supplying camp needs, and the specification requirement for keeping the freshly poured concrete continuously damp for a minimum period of 14 days created a heavy and steady demand for water. This demand was met, on four of the contracts, by piping from neighboring creeks or the Yakima River, usually with the aid of pumps, and on certain sections of the work by diverting the creek flow into completed portions of the lined canal and impounding it behind a small earth dike in the canal section. On the fifth and largest contract an adequate creek flow was not available, and water for all purposes except curing was obtained by pumping from the Yakima River, through approximately 600 linear feet of 3-inch pipe and against a head of about 350 feet, to an elevated storage tank adjacent to the canal, whence it was pumped through smaller pipe of varying lengths to the particular locations required.

Concrete curing.—Curing of the concrete by the water method was effectively accomplished by the use of Babb sprinklers (photo No. 15) located at short intervals along two lines of pipe paralleling the canal center line, one on each side slope. Operation of the sprinklers was continuous for 14 days after the date of pouring, except for short night periods in certain instances. The lining was completely covered with a layer of burlap during the first seven days of curing, which served principally to protect the green concrete from the direct rays of the sun and distribute the applied moisture more uniformly.

A substitute for the water sprinkling method was employed in curing the lining in the last 6 miles of the Main Canal. The method used (known as the Hunt process), which was based on the principle of conserving the original mixing water for cement hydration, consisted in coating the exposed surfaces of the fresh concrete with a special asphaltic compound. The material was applied with a spraying machine (photo No. 16) immediately following the finishing operations.

Panel joints.—Considerable trouble was experienced during the earlier lining operations in obtaining a satisfactory transverse construction joint between adjacent panel units. Details of the type of joint originally contemplated, and employed on other projects for lining of 4 inches or greater thickness, are shown in Figure 2. The theory of the joint is that when the plank form A is removed from the partially set concrete (shown in section) and fresh concrete is added, a good bond should develop with the irregular-shaped tongue C, but the formed vertical surface B should bond very imperfectly and act as a plane of weakness to induce a crack. This result was not realized in practice, the cracks frequently taking a zigzag course within the limits of the tongue, or a fairly regular path along a plane other than the one intended. The small thickness of the lining, the difficulty of obtaining the vertical surface and holding it after removal of the plank, and the apparent impracticability of securing a substantial tongue of concrete are some of the reasons attributed for failure to produce a satisfactory joint of the type described.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Various attempts were made to improve the joint. One was to leave the plank in place until the second pouring was completed and then fill in the groove, but this resulted in the formation of cracks along both edges. The best results were obtained by using end plank or screeds of the full lining thickness and notched to accommodate the interfering longitudinal reinforcing bars (photo No. 17), thus eliminating the troublesome tongue of concrete and producing a plain butt joint. With the introduction of the butt type of joint, the top surface of the concrete at the joint was penetrated to a depth of about three-fourths of an inch, with a special tool similar to a sidewalk jointer, while the concrete was plastic, and the operation repeated after the concrete had stiffened. Cutting the joint was early discontinued upon discovering that it was not required to insure the development of the crack at the joint. Use of the cutting tool, however, produced an excellent joint in that rounded shoulders were formed each side of the joint which do not spall under slight movement of lining resulting from temperature changes.

Transverse cracks.—The lined section and construction joint were designed with the view of controlling the inevitable development of transverse cracks by inducing their occurrence at short regular intervals and along straight sightly lines. That this control was not fully realized with the perfection of the construction joint was evidenced by the appearance of additional intermediate transverse cracks within several days to six weeks after the concrete was placed. A survey of side-slope cracks along selected stretches of completed lining showed that the number of intermediate cracks averaged 0.8 per 14-foot panel for the water-cured lining and 1.3 for that cured with the asphalt coating. In other words, taking account of the regular construction joint cracks, the transverse cracks occurred at average intervals of 8 feet and 6 feet for the water-cured and asphalt-treated lining, respectively, indicating that the amount of longitudinal reinforcing steel used might have been in excess of that required to restrict the contraction cracks to the 14-foot spacing, under the particular conditions prevailing. Three principal reasons advanced for the increased number of intermediate cracks in the asphalt-treated lining (which increase was more marked on the north or sunny slope) are (1) the apparent greater surface drying, through evaporation; (2) the more rapid setting up of the concrete, permitting less adjustment between the concrete and reinforcing steel during the setting period; and (3) the probable greater daily range of temperature variations in the concrete, due to the black color of the surface coating.

Another significant feature revealed by the survey was that the first panel poured each day exhibited a tendency to develop from one and one-half to three times as many intermediate cracks as the panels poured subsequently. Evidence obtained from an investigation of the possible causes of this phenomenon indicated quite conclusively that the restrained condition of the longitudinal steel in the first panel, by virtue of its embedment in the set concrete of the previous day's pour, was chiefly responsible for the excessive cracking tendency, the theory being that the rigid steel immediately adjacent to the set concrete offered greater opposition to the contraction forces in the new concrete, and consequently forced cracks at closer intervals.

CONCRETE MIXES, TESTS AND CONTROL METHODS

Need for control.—The liberal appropriations available and in prospect at the time construction of the canal and distribution systems of the Kittitas division was inaugurated offered favorable prospects for the prosecution of work on a rather large scale. It was early recognized that the production of uniform concrete of the best quality for the money was dependent upon a wise choice of aggregates and the development of a carefully prepared plan of procedure for concrete design, inspection, and control. The vital importance of securing quality concrete, as well as the justification for a reasonable amount of investigational and directional work leading to this end, became manifest when it was realized that estimated expenditures for the production of concrete for canal lining and structures represented approximately 50 per cent of the total proposed construction investment of $9,000,000.

Investigation of aggregates and concrete mix.—Attention was first directed to the selection of suitable aggregates. This involved the preliminary testing, by the Bureau of Standards, of numerous samples of materials taken from local deposits, followed by an exhaustive test of further samples from the one local deposit which promised to be satisfactory. The latter test was conducted at a laboratory which had been established at the project office at Ellensburg, and equipped to make the customary physical analyses, mortar briquet tests, and the 6 by 12 inch standard cylinder compression tests. Additional apparatus was subsequently installed for making impermeability tests of concrete disks 12 inches in diameter and 4 inches thick under water pressure. Before completion of the tests the aggregates exhibited some questionable characteristics, and decision was finally reached to use a high-quality sand and gravel from the Puget Sound region.

The specific aggregates for use having been selected, an extensive series of laboratory tests was carried on to determine the gradings and maximum sizes of aggregates best suited to meet the various concrete requirements, to develop water-cement ratio strength control curves for the range of mixes contemplated, to establish the water-pressure-resisting properties of the different mixes, and to acquire other information of value such as the relation between strength, density of concrete, and density of dry mixed aggregates for various gravel to sand ratios, the effects of varying periods and kinds of curing, the resistance of concrete to weathering, and, last but not least, the economic relationships. Standard specifications were followed in all laboratory procedure, except where such specifications were not available, as in the case of the impermeability tests. In practically all cases the laboratory test specimens were made with 2 and 6 inch slump concrete, this being the range of consistencies permitted by the construction specifications. The gravel to sand ratios used in the mixes first designed were based on the recommendations of Duff A. Abrams. These were modified somewhat after thorough trial in the field, for it was found that an increase in the proportion of sand, especially in the richer mixes, resulted in marked improvement in workability and concrete placement, without any appreciable sacrifice of strength or other desirable properties.

Control methods.—One of the factors instrumental in unifying field concreting practice was a pocket-size loose-leaf booklet of Instructions for Concrete Inspection and Control, which was prepared and blue printed locally to serve as an auxiliary guide in the application and interpretation of the contract specifications and was placed in the hands of each concrete inspector and other employees directly connected with the work. Chapters in the booklet were devoted to responsibilities and general duties of the inspector, inspection of materials, distribution of splices in longitudinal reinforcing bars, forms and their removal, methods and periods of curing, mixing and placing of concrete, making the slump test, measuring concrete materials, determination of moisture in sand or gravel, field calculations for converting designed mix to field mix, making and storing 6 by 12 inch test cylinders, sampling aggregates and making sieve analyses, and effects of proper and improper curing of concrete. Tables were also included giving bulking allowances for moist sand (for use in volumetric proportioning) designed mixes and their

uses, batch weights (including moisture) per sack of cement for each approved mix, surface moisture in sand and gravel per sack of cement, relation between dry rodded and dry loose mixes, and other miscellaneous data for reducing field computations to the minimum. The latest revision of Concrete Mixes and Their Uses is given in Table No. 1.

While the booklet of instructions served as a vehicle for arousing the inspector's interest, enlarging his knowledge of concrete, and supplying him with a set of working rules and tables, it could not be expected to maintain that spirit of alertness and constant attention to details so essential to the control of the numerous operations involved in the making of good concrete, especially when the work was progressing at top speed. In other words, a follow-up system was necessary and was provided by the following means:

(*a*) The various concreting jobs in progress were constantly visited by a so-called chief inspector, a construction man of wide experience and mature judgment, who passed on the various features of the work and particularly those of a practical nature, such as the sufficiency of the forms, the proper placement and splicing of reinforcing bars, and the most suitable consistency of concrete for the particular conditions to be met. By consulting with the contractor, the inspector, and the division engineer, the chief inspector was able to check improper practices at their sources and iron out many differences or controversies.

(*b*) The construction engineer made a regular practice of going over all or part of the work at least once a week during the period of activity.

(*c*) Inspectors were required to make 6 by 12 inch test cylinders in accordance with a definite procedure and schedule, and to see that they were properly cared for until collected by a truck sent out from the project laboratory. After being collected the cylinders were stored in moist-sand curing vats up to the date of breaking.

(*d*) Each concrete inspector was also required to prepare a daily "Inspector's report" and "Cylinder report," on mimeographed forms, principally to keep the project office informed and provide a permanent record for future reference. The "Inspector's report" embraced all the essential features of the work, including location, work performed, delays, weather conditions, details of the mix and consistency, etc., and provided opportunity for the inspector to state his personal views or air his particular troubles. The reports were promptly checked by the division office engineer, then referred to the division engineer and mailed to the project office, where they were carefully reviewed. If any irregularities of consequence or requests for advice or assistance were noted, the matters were generally handled by correspondence, using short stereotyped form of letters, or by a trip to the field on the part of the man directing the laboratory operations. The same agencies were utilized in the event any breaks of the field test cylinders proved to be abnormal and their abnormality was unaccounted for.

TABLE 1.—*Concrete mixes and their uses*

Mix (dry rodded)	Size of gravel	Admixture	Approximate slump	Approximate w/c ratio	Sacks [1] of cement per cubic yard	Work in which used
	Inches	*Per cent*	*Inches*			
1:1.6:2.4	½	0	5–6	0.70	7.11	Lock-joint pipe.
1:1.7:2.8	1¼	0	6	.67	6.55	Siphon barrels (over 100 feet head).
1:2.0:3.25	1¼	1½	6	.81	5.75	Siphon barrels (under 100 feet head) and siphon transitions.
1:2.4:3.6	1¼	3	2	.87	5.03	Canal lining (unformed).
1:2.4:3.6	1¼	3	4–6	.93	5.02	Tunnel lining, canal lining (formed), part of dam where 3-inch aggregate is not suitable, and ordinary thin-walled structures.
1:2.75:6.25	3	3	2–3	1.10	3.42	Interior of main body of dam.
1½:2.75:6.25	3	3	3–5	.80	4.96	3 feet exterior of main body of dam.

[1] Increase by 5 per cent for field application.

NOTE.—Sacks of cement per cubic yard of concrete, slump, and w/c ratio values are the results of Ellensburg laboratory tests.

(*e*) Additional field trips were made by the laboratory representative, at rather frequent intervals and without warning, to check up on the more technical details incident to securing the specified concrete mixes (such as proper measurement of aggregates, water, etc.) or to investigate the conditions on particular jobs where there was reason to believe, based on information emanating from the construction engineer, chief inspector, or other source, that the control system was not functioning as well as it might.

Concrete mix used and basis for selection.—The concrete mix used on the greater portion of the canal lining work was a 1:2.4:3.6 by volume, dry rodded, with 3 per cent diatomaceous silica admixture, and 2-inch average slump. A 1:2:4 mix was first attempted but proved deficient in sand for securing the best workability and counteracting the harshening effect of field segregation of the coarse aggregate. Another change made during the early stage of construction was the reduction of the maximum size of the gravel from 1½ to 1¼ inches.

Impermeability, rather than strength, was the governing factor in the selection of the canal lining mix. While strength reflects many of the desirable properties of concrete and serves as a convenient general measure of value, it is not necessarily a criterion of water-tightness. In the case of the canal lining, the latter quality was regarded as of greater import in lengthening the life of the concrete by rendering it more resistant to the disintegrating forces to which the lining will be subjected, including contact with flowing water during the irrigation season and exposure to severe frost and variable moisture conditions during the balance of the year. What little test data on impermeability, for the particular aggregates chosen, were available at the time it became necessary to determine the canal lining mix indicated that a mix leaner than a 1 to 6 by volume could not be relied upon to furnish the desired degree of water-tightness, notwithstanding the relatively high compressive strength (about 4,500 pounds per square inch) corresponding to the 1:6 mix. This conclusion was substantiated by laboratory tests later conducted to investigate the water-pressure-resisting properties of 4 by 12 inch concrete disks of various mixes, as previously mentioned. Water pressures up to 500 pounds per square inch were employed in the tests, principally in connection with the determination of suitable mixes for siphons designed to operate under unusually high heads. Photograph No. 14 shows the latest form of impermeability apparatus developed. It is without the scope of this article to describe the details of the apparatus or give the results obtained from the tests, except to refer to one feature bearing directly on the canal lining mix, namely, that the addition of diatomaceous silica to the extent of 3 per cent by weight of the cement brought about a marked improvement in the water-tightness of the concrete, although the original purpose in employing the admixture in the leaner mixes was mainly to improve the workability and lessen the tendency for segregation.

Measurement of concrete ingredients.—A careful measurement of the ingredients in each batch of concrete for canal lining was insisted upon. In all cases the sand was weighed and thus the problem of sand bulking was eliminated. The gravel was measured by weight or by volume based on and occasionally checked by weight. Moisture in the aggregates, for determining the correct batch weights and accounting for the total water entering the concrete, was measured by means of

apparatus embodying the water-displacement principle, or by ordinary heating or alcohol-burning methods. The introduction of water at the mixer was gaged by the mixer man to bring the concrete to the specified consistency or slump, the general practice being to regulate the mixer tank adjustment for the minimum water requirement and then add what little additional water was needed. This procedure was found to be the most practicable, and, while on first thought it might seem to involve a material departure from rigid water control, a little reflection will reveal the fact that, with reasonably accurate measurement of the materials other than water, any variation in the water-cement ratio in bringing the concrete to the same consistency would be largely confined to the effect of variation in grading of the aggregates and would generally be insignificant. Considerable trouble was experienced by inspectors in determining the average amount of water added at the mixer, per batch of concrete, due principally to inefficient water regulating and measuring equipment on the mixers in use. In most cases the difficulties were wholly or partially overcome by calibrating the mixer tanks and supplementing the results with occasional check measurements of the mixer discharge by diverting it into a portable measuring tank.

Importance of controlling concrete consistency.—Fortunately the contractors were as vitally interested as the Government in securing controlled concrete for the canal lining, inasmuch as consistency was a critical factor in the placement of the concrete on the side slopes. Even a variation of but 1 inch in slump made a marked difference in the results. If the slump was less than 2 inches, a honeycombed concrete emanated from the moving form, whereas a 3-inch slump produced a bulging and waving of the concrete. Best results were obtained with a slump of 2 to 2½ inches, a range which was quite consistently maintained by the mixer men after a little experience.

Field test data.—The results of the 28-day breaks of field test cylinders on canal lining, for the 1928 construction season, are summarized in Table No. 2. Included in the table are average compressive strengths for the separate lining jobs and the work as a whole, a comparison between actual and predicted strengths, and data revealing the strength variations, including an improvised "Control factor." Table No. 3 gives the compressive strengths of two series of 3 by 3 by 6 inch concrete test blocks which were cast and cured simultaneously as an integral part of the canal lining. One series is representative of water-cured lining, and the second of lining cured by the asphalt-paint application (Hunt process). A striking feature of the test results in Table No. 3 is the gradual increase in strength of the water-cured specimens, as compared with the rapid hardening of the surface-treated blocks. As stated in the explanatory note, the block tests were carried on during a period of extreme summer temperatures. The slower setting of the water-cured blocks is accounted for mainly by the cooling effect of the continuous sprinkling.

Value of concrete control.—Judging from the opinions expressed, there is little doubt in the minds of those connected with the concrete work, or of even the casual observers who witnessed the concreting operations or viewed the completed work, but that the effect of the more systematic and precise concreting methods practiced was noticeably reflected in the finished product. (Photos Nos. 10 and 19.) The only question which remains, apparently, is whether the improvement realized will manifest itself in the form of decreased maintenance and increased life of the concrete to a sufficient extent to compensate for the additional effort expended; and while there is a general feeling of assurance that it will, the proof of the pudding is in the eating and time alone will tell. From the experience gained on the Kittitas division, this much at least may be said for control: (1) That it shows unmistakable evidence of improved concrete and may yield big financial returns; (2) that it brings forcibly to the attention of inspectors, and others engaged in directing the operations, the many influences affecting concrete in the making and the necessity for coordinating and controlling the various detail processes if concrete of uniformly high quality is to be produced; (3) that when control embodies properly made tests of laboratory and field specimens it provides a definite and intelligent means for establishing the field mixtures and gaging the quality of the final product, even though such specimens may not be truly representative of the concrete in the work; and (4) that it stimulates an interest in concrete and inspires further investigation, which in turn should eventually rid the manufacture of concrete of its major perplexities.

TABLE 2.—*Results of 6 by 12 inch test cylinders, canal lining, 1928*

Description	Contractor					Average of all field specimens (moist-sand cure)	Predicted strength based on laboratory control curve
	C. F. Graff	General Construction Co.	S. H. Newell & Co.	Derbon Construction Co.			
				Moist-sand cured	Surface-treatment cure		
Number of field test specimens	59	91	72	155	90	377	----------
Average reported W/C ratio	0.77	0.82	0.83	0.84	0.84	0.82	[1] 0.82
Average 28-day compressive strength	4,359	4,914	4,572	4,466	3,755	4,562	4,400
Mean variation in strength was as follows:							
A. Per cent within 10 per cent of average strength	65	62	53	51	47	56	----------
B. Per cent within 15 per cent of average strength	87	82	68	74	74	77	----------
C. Per cent within 20 per cent of average strength	90	98	92	85	87	90	----------
Control factor $=\frac{A+B+C}{3}$	81	81	71	70	69	74	----------

[1] Water-cement ratio given represents average of field values reported and corresponds to laboratory water-cement ratio of about 0.87, the difference of 0.05 being due to aggregate absorption estimated at 0.5 per cent by weight.

TABLE 3.—*Compressive strength of 3 by 3 by 6 inch concrete blocks from canal lining*

Age at test	From General Construction Co. lining (continuous sprinkling for 14 days)				From Derbon Construction Co. lining (cured by asphalt-paint application—Hunt process)			
	S. slope	Floor	N. slope	Average	S. slope	Floor	N. slope	Average
7 days	3,220	3,610	3,610	3,480	4,920	5,305	4,055	4,760
14 days	3,780	4,610	4,000	4,130	4,330	5,055	4,330	4,572
28 days	4,740	5,000	4,535	4,758	5,480	4,000	4,040	4,507

NOTE.—Lining containing blocks poured on July 20, 1928, followed by 8 days of extremely hot weather, during which the temperature mounted to 110° F., and exceeded 100° on 6 successive days.

PERSONNEL

The construction of the Kittitas division of the Yakima project was under the direction of Walker R. Young, construction engineer. The development of technical control procedure for the concrete work and the prosecution of the laboratory work were under the general direction of

Arthur Ruettgers, office engineer. A. A. Whitmore, division engineer, was in direct charge of the reach of Main Canal, which included the lining work contracted to C. F. Graff, S. H. Newell & Co., and the General Construction Co. The reach of canal comprising the lining constructed by the Derbon Construction Co. was in charge of V. W. Russell, division engineer. The principal designing work for the Bureau of Reclamation is done in the Denver office under the general supervision of J. L. Savage, chief designing engineer. All engineering and construction work is under the general supervision of R. F. Walter, chief engineer, with headquarters at Denver, and all activities of the bureau are under the general charge of Dr. Elwood Mead, commissioner, with headquarters at Washington, D. C.

Secondary Projects

The report of the Gila River cooperative investigations by O. C. Smith will probably be completed in October. Work is in progress in the Denver office on the report of the All-American Canal investigations. The Palo Verde Valley investigations have been completed. In California A. T. Strahorn has finished his classification of lands in the Sacramento and San Joaquin Valleys, over 11,000,000 acres, in connection with the central California water resources investigations. Prof. Frank Adams is continuing his economic investigation. The Table Mountain Dam site on the Sacramento River is being tested, and water-supply studies are being carried on. E. B. Debler has completed his report on the Mackay project in Idaho. Current work in the Salt Lake Basin, Utah, includes investigations on the Provo River, Ogden River, and Cache Valley divisions. Work has been suspended at the Cle Elum dam site, Washington, pending execution of the necessary repayment contracts. Field work on the Saratoga project, Wyoming, has been completed and the report is being prepared in the Denver office. A study of water supply and future irrigation development in the Uintah Basin, Utah, has been started by J. R. Iakisch.

ON the Rio Grande project the livestock industry, particularly dairying, is being given more attention than ever before. Three registered Guernsey bulls and nine registered cows have been imported during the present season. The entire stock was purchased for the dairy industry, which shows a desire to increase the quality of milk and quantity production of dairy stock.

Boulder Canyon Project Construction Work Starts

On the desert about 7 miles south of Las Vegas, Nev., near Bracken, Secretary Wilbur on September 17 formally inaugurated construction work on the Boulder Canyon project. He drove a spike of Nevada silver into a railroad tie on the 22-mile branch railroad, which is to be built under a contract with the Los Angeles and Salt Lake Railroad Co. from its main line to Summit, which is about 7 miles west of the dam site.

Officials from six Colorado River Basin States, Nevada, California, Colorado, Utah, Wyoming, and New Mexico, attended the ceremony. The Bureau of Reclamation was officially represented by Dr. Elwood Mead, commissioner; Raymond F. Walter, chief engineer; and Walker R. Young, construction engineer. The day was declared a State holiday in Nevada, and special trains were run from Las Vegas and other points to "Boulder Junction."

Governor Fred B. Balzar, of Nevada, presented the silver spike to Carl R. Gray, president of the Union Pacific Railroad, who in turn presented it to Secretary Wilbur. The Secretary in driving the spike became the first workman on the project.

In a brief dedicatory address, Secretary Wilbur said, in part:

"I have the honor to name this dam after a great engineer, who really started this greatest project of all time—the Hoover Dam.

"This is one of man's greatest victories over nature. It is as if our country suddenly had a new State added to it, for a new and wider use of this controlled water will care for millions of people and create billions of wealth.

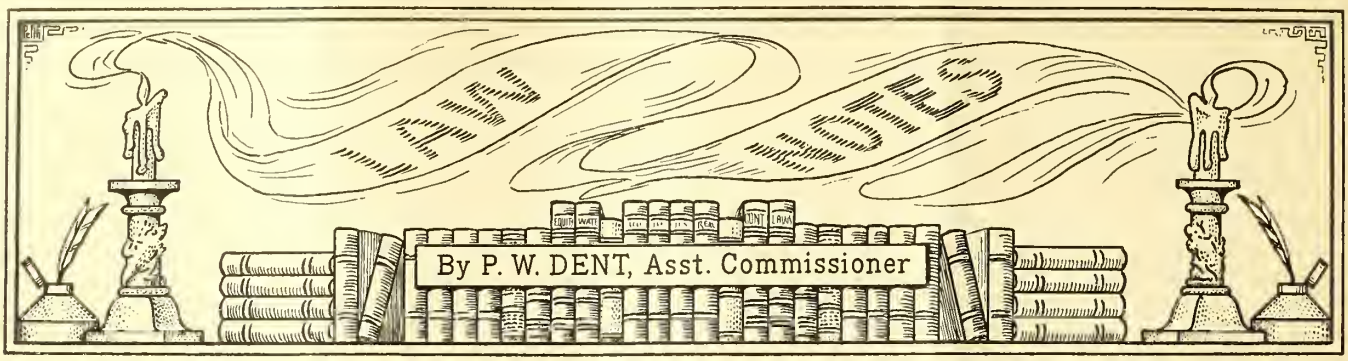
"Such great projects of engineering, financial and social skill as the Panama Canal and this dam are the just pride of our people—greater than victories in war or the harvesting of existing natural products hidden in or grown from the soil.

"Floods, like fire, are the enemies of man, but they can be tamed to be his servants. Here we will hold back those floods which could wipe out Imperial Valley and make them give aid instead of concern to its farmers. From here we are to deflect hundreds of millions of gallons of water to the southern California plain, where the water resources of the semiarid region are strained almost to the danger point."

The Secretary said that commencement of construction marks "the beginning of a new era in the handling by States, working together, of those common problems upon the solution of which the continued vitality of our Nation depends."

The celebration was continued in the evening in Las Vegas, with the Las Vegas Chamber of Commerce and the Metropolitan Water District of southern California in charge of the festivities.

21,000 tons of sugar beets in bins at Utah-Idaho Sugar Co.'s factory, Chinook, Milk River project, Montana



Irrigation District Taxation

THE Lincoln Land Co. owned about 400 acres of irrigable land within the Shoshone reclamation project which is being constructed under the Federal reclamation laws. These laws forbid the furnishing of water to more than 160 acres in one ownership. The Shoshone Irrigation District was formed, embracing, with other land, the holdings of the Lincoln Land Co., and entered into a contract to pay to the United States the cost that the Government had incurred in constructing the portion of the Shoshone project within the boundaries of the district. The district levied assessments upon the 400 acres belonging to the company, and, same not being paid, secured a tax deed for the premises, and brought an action against the company to quiet the district's title to the land. The company removed the case to the Federal court for the district of Wyoming, and contested the legality of assessments upon 400 acres, when under the law the company could receive water for only 160 acres.

In a memorandum decision dated August 8, 1930, District Judge Kennedy (Shoshone Irrigation District *v.* Lincoln Land Co., No. 1915, civil) upheld the assessments. The following is quoted from his memorandum decision:

"The attack of the defendant upon the title of the plaintiff in and to the lands involves two phases; the first and principal point in controversy is as to the assessability of the lands of the defendant under the conditions existing, and the second relates more particularly to the procedure under which the assessments were levied and the sale of land was held.

"As to the first point of the controversy, the legal battle revolves around this situation: The defendant owned in excess of 900 acres of land within the established irrigation district, something in excess of 400 of which was susceptible to irrigation. The irrigation project was built and established under the Federal reclamation act, a provision of which limits the right to the use of water to any one owner to an area of 160 acres. The matter of the assessment for benefits in the way of maintenance and construction charges was carried on by the irrigation district under a contract with the Federal Reclamation Bureau. The land was assessed upon the basis of these benefits as to the irrigable portion for maintenance and construction charges. It is stipulated that lands in the vicinity of those in controversy had been rendered more valuable than the arid lands similarly situated on account of the irrigation from the project for the operation of which the irrigation district was formed. The plaintiff claims that under the circumstances there was a benefit to the lands forming a basis for the inclusion of the lands in the assessment. While the defendant claims that inasmuch as these lands are in a sole ownership for which under the Federal law no water could be obtained for use upon them they were erroneously included for assessment and that as a consequence such assessment is null and void.

"Counsel have filed extensive briefs but no case has been cited where the direct point appears to have been passed upon by the courts. Cases are cited which hold that the assessment for benefits is not to be made upon the particular use to which the individual owner may put the land so assessed, but that the basis of an assessment is as to whether the lands by virtue of the benefit afforded is actually increased as to its market value. If this principle should be applied to the lands here, I am of the opinion that as the evidence tends to show an addition in value by virtue of irrigation to the lands in the neighborhood the value of the defendant's lands was likewise enhanced. The only case cited by either party which seems to discuss the Federal limitation to the use of water for area not exceeding 160 acres is Nampa and Meridian Irrigation District *v.* Petrie, 153 Pac. (Idaho) 425.

"It may be noted, however, that the court did not pass upon the exact point, for the reason that the attack was upon the contract between the irrigation district and the Reclamation Bureau, and the court found it unnecessary to pass upon the point inasmuch as no actual assessment had yet been made against land where the situation had arisen as in the case at bar. The opinion squints, however, to a conclusion that the Federal limitation would not necessarily be an impassable barrier to an assessment upon the basis of benefits to land so situated.

"The lack of time has forbidden an exhaustive study of the question and it is certainly not one free from doubt. I have come to the conclusion that I shall adopt as a theory for this decision that lands susceptible of irrigation within the district which are shown by the general trend of the evidence to be benefited by the irrigation project so that their value becomes enhanced thereby are properly included within the district and assessable accordingly, as the basis of special improvement taxation is property benefit independent of ownership conditions.

"The remainder of the points raised by the defendant relate to matters of procedure in making assessment, giving notice, conducting sale, and the like. While these points are likewise problematical in the matter of their proper determination, I shall adopt the view that, inasmuch as the evidence shows that the irrigation district was properly organized, the procedure in the general matter of assessment was regularly undertaken and conducted in a court of competent jurisdiction of which proceeding the defendant had due notice, that the matters complained of are mere irregularities rather than of a jurisdictional character, in the assertion of which the defendant is now estopped, and the determination of that court as to the matters passed upon is res adjudicata.

"It is undoubtedly desirable that the questions here raised should be settled by the higher courts, but, for the reasons here briefly stated, the general findings of the court will be in favor of the plaintiff and a decree may be submitted accordingly in accordance with the prayer of the bill, with costs to plaintiff, and reserving to defendant its exceptions. Such decree may also provide that defendant have 90 days within which to prepare and file a transcript of record of appeal, the bond for which shall be fixed at $500."

Recently Enacted Legislation

STATE TAXATION OF LANDS

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act entitled "An act to permit taxation of lands of homestead and desert-land entrymen under the reclamation act," approved April 21, 1928, is amended to read as follows: "That the lands of any homestead entryman under the act of June 17, 1902, known as the reclamation act, or any act amendatory thereof or supplementary thereto, and the lands of any entryman on ceded Indian lands within any Indian irrigation project, may, after satisfactory proof of residence, improvement, and cultivation, and acceptance of such proof by the General Land Office, be taxed by the State or political subdivision thereof in which such lands are located in the same manner and to the same extent as lands of a like character held under private ownership may be taxed.

"SEC. 2. The lands of any desert-land entryman located within an irrigation project constructed under the reclamation act and obtaining a water supply from such project, and for whose land water has been actually available for a period of four years, may likewise be taxed by the State or political subdivision thereof in which such lands are located.

"SEC. 3. All such taxes legally assessed shall be a lien upon the lands and may be enforced upon said lands by the sale thereof in the same manner and under the same proceeding whereby said taxes are enforced against lands held under private ownership; but the title or interest which the State or political subdivision thereof may convey by tax sale, tax deed, or as a result of any tax proceeding shall be subject to a prior lien reserved to the United States for all due and unpaid installments on the appraised purchase price of such lands and for all the unpaid charges authorized by law whether accrued or otherwise. The holder of such tax deed or tax title resulting from such tax shall be entitled to all the rights and privileges in the land of an assignee of such entryman on ceded Indian lands or of an assignee under the provisions of the act of June 23, 1910, as amended, or of any such entries in a Federal reclamation project constructed under said act of June 17, 1902, as supplemented or amended.

"SEC. 4. If the lands of any such entryman shall at any time revert to the United States for any reason whatever, all such liens or tax titles resulting from assessments levied after the date of this amendatory act upon such lands in favor of the State or political subdivision thereof wherein the lands are located, shall be and shall be held to have been, thereupon extinguished; and the levying of any such assessment by such State or political subdivision shall be deemed to be an agreement on its part, in the event of such reversion, to execute and record a formal release of such lien or tax title." (Public No. 349, 71st Cong.)

Approved, June 13, 1930.

Claim for Seepage Damages

In Spurrier *v.* Mitchell Irrigation District et al., 229 N. W. 273, decided by the Supreme Court of Nebraska, February 21, 1930, the court considered a claim for damages by seepage. The plaintiff's land lay within the Mitchell Irrigation District and had been irrigated under said district since its organization in 1896. The Gering and Fort Laramie Irrigation District, another defendant, was organized in 1918, for the irrigation of land on higher levels than plaintiff's. It was not until after the Gering and Fort Laramie ditch was placed in operation that the seepage appeared. The plaintiff contended that the percolating waters from the defendant districts combined to cause the damage complained of.

Section 21 of article 1 of the Nebraska Constitution provides as follows: "The property of no person shall be taken or damaged for public use without just compensation." Also section 2887 in article 1, chapter 26 of the Compiled Statutes of Nebraska, 1922, reads in part as follows: "Any irrigation district organized under the provisions of this article shall have power to and it shall be its duty to provide for the proper drainage of any and all lands embraced within its limits which are or have been subirrigated by reason of the lawful use of water from its canal by the owner or lessee of the lands subirrigated or from any cause not the fault or by the consent of such owner or lessee, and for such purpose such district shall have all the authority herein granted for levying special assessments or otherwise providing funds necessary to properly drain such lands."

It was held that section 2887 is inapplicable as against the districts, since the statutory duty is limited to seepage upon lands within a district from the district water supply. State *v.* Farmers Irrigation District, 217 N. W. 607. It was also held that section 21 of article 1 of the constitution is inapplicable, since the method of taking, if the constitutional provision is to be applicable, must violate the rights of the plaintiff, and it was held that no such violation existed here.

Having cleared away the statutory and constitutional provisions relied upon by the plaintiff, the court proceeded to hold that the owner of an irrigation ditch is not liable for unintended seepage damage, in the absence of negligence. The court says: "The owner of an irrigation ditch is not an insurer against damage by seepage as a result of the construction and maintenance of said ditch, but is only required to use reasonable skill and care in the building of his works, and the operation thereof. He is only liable for injuries resulting from negligent construction and operation. Howell *v.* Big Horn Basin Colonization Co., 14 Wyo. 14, 81 Pac. 785, 1 L. R. A. N. S. 596. The foregoing view is supported by the great weight of authority." Judges Rose and Good dissented on the view that article 1, section 21 of the constitution, required payment to the plaintiff, and they cited a decision of the Circuit Court of Appeals, Eighth Circuit, to this effect. Hooker *v.* Farmers Irrigation District, 272 Fed. 600.

Portion of Ancient Tree Unearthed in Yakima Bed

A piece of a 7-foot tree estimated to be 12,000,000 years old, which was found 150 feet below the bed of the Yakima River in Washington, has been identified by Arthur Koehler, wood identification expert of the United States Forest Products Laboratory, as a species of Sequoia.

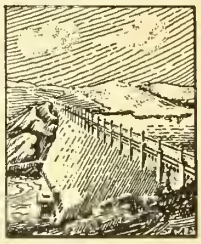
This ancient wood was taken from a log encountered when a United States Reclamation Service tunnel was being driven under the river, and was in solid basalt believed to have been poured out of one of the Columbia Plateau volcanoes 12,000,000 years ago.

"The wood is too friable to be sliced thin for microscopic examination," Mr. Koehler says, "but examination of the whole piece with a hand lens leaves no doubt of its close kinship with 'Sequoia sempervirens,' the redwood of to-day.

"The redwoods have not always been confined to a narrow strip in California, but throve at one time throughout what is now the United States, Canada, Alaska, Greenland, Europe, and northern Asia. Fossil Sequoia cones were found in rocks and swamp deposits in Europe in the nineteenth century before the only living representatives of the species were known to the white man."

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Silt Conditions at Elephant Butte Reservoir

SUPERINTENDENT Fiock of the Rio Grande irrigation project, New Mexico-Texas, has recently made some interesting observations regarding silt conditions in the Elephant Butte Reservoir and the Rio Grande flood of September, 1929. Data regarding silt in the Rio Grande can be found in certain publications, one of which, Silt in the Rio Grande, by W. W. Follett, is a special report on the subject and covers extensive investigations and experiments from 1896 to 1912. Some of these data are contained in United States Geological Survey Water Supply Paper No. 358, Water Resources of the Rio Grande Basin, 1888–1913. The Bureau of Reclamation engineers have also made several reports, one in particular making a thorough review of the Follett report and bringing the data to a much later date.

SOURCES OF SILT

A small per cent of the total run-off of the Rio Grande drainage area above Elephant Butte carries in, or is responsible for, a very large percentage, if not practically all, of the silt carried into the reservoir. The reason for this is that practically all of the silt comes from the tributaries of the river in the untimbered central part of New Mexico, but the run-off from this area is confined to summer floods of short duration, and while they often reach maximum flood peaks they do not usually last long enough to make a considerable volume of water. To be sure, the summer floods of 1929 did produce a considerable volume of water which formed a much-needed accretion to the stored water supply, but this is not generally the case. Normally the spring floods produced by melting snow in the mountains of northern New Mexico and Colorado are relied upon for the irrigation supply and storage increments.

The spring run-off from melting snows in the mountains of northern New Mexico and Colorado carries an average of only about one-half of 1 per cent of silt into the reservoir, while the flashy summer floods from the untimbered areas in the central part of New Mexico carry as high as 10 per cent and sometimes more of silt, depending upon where they originate; floods from the Puerco River usually running the highest in percentage of silt. As a matter of fact, the spring run-off enters the upper regions of the river as clear water and would flow into the reservoir as practically clear water if it were not for the fact that it picks up its relatively small load of silt before reaching the reservoir from deposits placed in the river bed through the central part of the State during previous summer seasons.

WATER CARRIES 1.65 PER CENT OF SILT

The mean average per cent of silt carried by the water is about 1.65 per cent. This has been arrived at by different methods and entirely independent investigations which check remarkably close. For instance, the mean of Mr. Follett's determination by analyzing samples of water collected at San Marcial over the period from 1896 to 1912 found the mean percentage of silt to be 1.66 per cent of the total volume of water. A silt survey made of Elephant Butte Reservoir in 1920 to determine the amount of silt which had been deposited since the beginning of reservoir operations in 1915 found the silt in the reservoir to be 1.66 per cent of the total volume of water which had entered the reservoir from the Rio Grande. Another silt survey made in 1925 concluded that the amount of silt entering the reservoir between 1915 and 1925 was 1.64 per cent. The results of the investigations and surveys showed that the mean average amount of silt entering the reservoir per year is approximately 20,000 acre-feet.

THE 1929 FLOOD

The flood of September 23–26, 1929, was probably one of the largest, if not the largest, floods of the Rio Grande since white men have known about it. However, there is one other flood which occurred since a record has been kept of the river discharge, beginning in 1895, which has been recorded with a higher mean daily flow than what was concluded to be the maximum mean daily flow of the 1929 flood. On October 11, 1904, records give a mean daily flow of 33,000 cubic feet per second, while the estimated maximum mean daily flow of the September, 1929, flood was 29,300 cubic feet per second. The probable maximum peak discharge of the 1929 flood was 47,000 cubic feet per second, while the 33,000 cubic feet per second mean daily flow of the 1904 flood could have been the result of a higher or lower maximum peak discharge than the peak of the 1929 flood, depending upon the period of duration of the maximum flow.

SILT INFLOW DOUBLED BY FLOOD

The amount of silt carried by the 1929 flood undoubtedly amounted to more than any other year since the Elephant Butte Reservoir was put in operation, and had the effect of increasing both the average percentage of silt to total flow, and the average yearly amount of silt carried into the reservoir as determined from the silt surveys made in the reservoir in 1920 and 1925. This effect can be observed on the accompanying table, which shows that the amount of silt carried into the reservoir during 1929 was probably more than twice the previous mean average per year of approximately 20,000 acre-feet, as determined by the two silt surveys. The table shows the monthly discharge and the amount of silt transported by the Rio Grande in acre-feet during the past four years, or since the last silt survey of the reservoir was made, and as determined by samples taken at San Marcial.

A detailed analysis or study of all available silt data would doubtless produce some interesting conclusions. It might be found that 10 per cent of all of the water entering the Rio Grande above Elephant Butte carries 90 per cent or more of the silt; also that the other 90 per cent of the water would enter the reservoir as practically clear water or carry a very low per cent of silt if it were not for the silt brought into the river or valley through the central part of the State by the flashy summer floods, part

of which is deposited along the river and retransported during the process of scouring out the river bed by the spring run-off from melting snow in the mountain area of northern New Mexico and Colorado.

VALUE OF SILT RETENTION WORKS

Any silt retention works or system which could be instituted on the Rio Grande watershed in the central part of New Mexico would be a great asset to the irrigation project. The water supply coming from this area is not usually of any great consequence and it produces practically all of the silt, so that even though this minor portion of the entire water supply for the reservoir was materially decreased, the elimination of the silt and the consequent extension of the usefulness of the reservoir would be more valuable to the project than the relatively small amount of water which might be lost thereby.

Flow of the Rio Grande at San Marciol, N. Mex.—Total flow and amount of silt transported in acre-feet

[53 pounds=weight 1 cubic foot dry silt (Follett)]

	1926		1927		1928		1929	
	Total flow	Silt by volume	Total flow	Silt by volume	Total flow	Silt by volume	Total flow	Silt by volume
January	45,179	284	38,729	282	49,537	116	26,503	147
February	37,100	162	32,902	218	46,984	138	29,609	158
March	59,031	259	35,339	200	49,710	116	43,067	260
April	117,511	1,016	134,390	838	40,251	114	78,801	447
May	440,597	2,768	317,569	1,420	250,770	2,198	276,476	2,755
June	273,961	1,128	167,841	908	105,774	736	131,607	635
July	27,173	1,773	154,588	8,406	595	4	38,059	2,868
August	1,616	133	65,631	2,208	9,465	296	274,161	14,660
September	3,899	469	189,435	8,852	5,042	136	305,662	21,756
October	3,124	196	105,172	7,653	0	0	122,801	(1)
November	8,930	561	61,033	158	4,376	26	75,931	(1)
December	31,751	131	47,883	79	27,808	106	58,377	(1)
Total	1,049,913	8,880	1,350,513	31,222	590,312	3,986	1,203,945	[1] 43,686
Average per cent silt for years by volume		0.85		2.31		0.67	1,461,054	3.63

[1] Last 3 months 1929 not included, silt determination not yet made. Total, 1926, 1927, 1928, 1929; total inflow 4,194,683 acre-feet (does not include last 3 months 1929.) Total silt, 87,774 acre-feet. Average silt, last 4 years 21,943 acre-feet per year; average per cent silt, 4 years, 2.09

Proposed Reclamation of Sahara Desert

The French are convinced that the parched sands of the Sahara Desert cover a vast sheet of water which if brought to the surface, as it is planned to do, would make violets grow along the Equator.

A group of scientists will be sent into Africa to study how the moisture can be made available. The adherents of the scheme assert the sands may become the richest granary in the world, producing two wheat crops a year.

The topography of the Sahara contains thousands of dried river beds, which is said to be proof that the region was not always useless sand. Scientists are convinced that the Sahara was once a populated garden spot, and that only the drying up of the rivers through the choking of sources caused the death of all vegetation.

Before any wells are dug the Government insists that a map be drawn showing the exact location of underground water, so that new drilling will not drain the wells of existing oases and cause the destruction of palm groves and communities there.

If the map of hidden waters is made and wells sunk with iron pipe, an area 2,700,000 square miles in size might be made to raise all the wheat and breed all the cattle which Europe needs to feed a growing population.

A RECENT contract was let for the first school bus on the Riverton project. The route covers approximately 22 miles and will serve new settlers near Pavilion.

Summary of Construction Results

THE summary of construction results on Federal irrigation projects to June 30, 1930, which has just been completed, shows some interesting figures and gives some idea of the enormous amount of work accomplished by the Bureau of Reclamation since its inception in 1902. Twenty-three projects are now under construction or are operated in whole or in part by the bureau. Sixteen projects are completed or certain divisions constructed by the bureau are operated by water users' organizations.

The 55 reservoirs on the projects have a total capacity of approximately 13,000,000 acre-feet. This is less than one-half of the storage capacity of the reservoir to be formed by Hoover Dam, but would make five reservoirs the size of Elephant Butte, which is the largest artificial irrigation reservoir in the world. There have been built 13,278 miles of canals, 1,097 miles of waste-water ditches, and 2,615 miles of open and closed drains. The canals, if placed end to end, would reach four times across the United States.

In the 55 storage dams and 50 diversion dams completed or now under construction there have been placed 22,200,000 cubic yards of materials, divided as follows: Masonry, 3,000,000; earth, 17,000,000; and rock, 2,200,000. The 3,000,000 cubic yards of masonry are about 83 per cent of the concrete masonry to be placed in Hoover Dam, the volume of which is estimated at about 3,600,000 cubic yards. The total volume of reclamation dams is almost exactly the same as that of the Gatun Dam in the Panama Canal Zone, which is the largest dam in the world.

The bureau has constructed 1,312,801 feet, or 249 miles, of dikes and levees containing 7,205,359 cubic yards of material. There have been built 161,469 canal structures, 11,864 bridges, 5,260 flumes, and 14,675 culverts. The linear feet of pipe laid is 4,279,249, or 810 miles. In the construction of projects it has been necessary to erect 1,786 buildings, dig 747 wells, build 1,347 miles of roads and 116 miles of railroads, and construct 4,011 miles of telephone lines and 3,205 miles of power-transmission lines.

At the 23 power plants on the projects there are developed 189,348 horsepower. The total excavation to June 30 amounted to 292,106,000 cubic yards. This would make a pile of dirt 1 mile long by 1 mile wide and 300 feet in height. For a comparison, when the Panama Canal was opened in July, 1914, the amount of material excavated, both by France and the United States, was 160,000,000 cubic yards, or about 55 per cent of the bureau total.

In connection with the building of the various irrigation structures, the bureau has placed 2,565,000 cubic yards of riprap, laid 1,969,000 square yards of paving, and placed 909,000 square yards of gunite. The dams and other structures contain 4,392,000 cubic yards of concrete. It is interesting to note that this amount of concrete would build eight dams the size of Arrowrock. The bureau has used in its construction work 4,926,000 barrels of cement. It would require 24,000 freight cars, a train 200 miles long, to transport this amount of cement.

Boulder Canyon Project Notes

The new town site is now commonly referred to as "Boulder City." Other names have been suggested, but none has been officially adopted. Two locations for the town site have been under consideration, one about 3 miles from the dam site near the Hemenway gravel pit, and the other near Summit, the terminus of the Union Pacific branch railroad, about 6 miles from the dam site. The location near Summit has now been chosen principally because of its elevation of 2,500 feet, being 800 feet above the other site. Its location at the branch railroad terminus and soil conditions were also factors in making the selection. Here at the top of the ridge living conditions will be much better than down on the slope towards the dam.

The third floor of the Beckley Building in Las Vegas has been leased and will be the project headquarters for Construction Engineer Walker R. Young and his office force.

Engineers representing the Utah Construction Co. and also Hitchcock & Tinkler visited the Denver office recently to confer on construction plans, with the intention of submitting bids at the proper time.

A board of consultant specialists on concrete problems in connection with Hoover Dam has been organized with the following members: F. R. McMillan, director of research, Portland Cement Association, Chicago, Ill.; Prof. William K. Hatt, head of school of civil engineering, Purdue University, La Fayette, Ind.; Prof. Raymond E. Davis, department of civil engineering, University of California, Berkeley, Calif.; Prof. H. J. Gilkey, University of Colorado, Boulder, Colo.

The plan of providing a water supply for the new town by pumping from the Colorado River may be changed if artesian water can be made available at a reasonable cost. The city of Las Vegas is supplied with abundant water from artesian wells. Estimates are being prepared for alternative plans; one to desilt and carry the water from the Colorado through 6 miles of pipe line with a 2,050-foot lift; the other to use the underground water supply of the Las Vegas Valley, carrying it through about 20 miles of pipe line with a 650-foot lift.

The Hoover Dam consulting board of engineers comprises A. J. Wiley of Boise, Idaho; D. C. Henny, of Portland, Oreg.; L. C. Hill of Los Angeles, Calif.; and Prof. W. F. Durand, of Leland Stanford University, California.

A proposal has been made to transfer Federal-aid road mileage on the Goldfield-Lida road to the proposed Las Vegas-Hoover Dam highway. The Government plans to build a 24-foot highway from the new town to the dam site as a part of the project. There are no recent developments on the Arizona side. From Kingman, Ariz., to the dam site the distance is about 88 miles. There is an existing road from Kingman to Chloride, thence to the junction of the Searchlight Ferry road, and thence about 10 miles north along the White Hills road, a total distance of about 42 miles. A rough estimate by the deputy State highway engineer places the cost of a temporary Kingman-Boulder Dam highway at $115,000 and a standard highway at $1,500,000.

On November 4 the city of Los Angeles will vote on a $19,000,000 bond issue to defray the expenses of a 3-year construction program for power development. For the construction proposed $31,000,000 will be required, but of that amount $12,000,000 is to be derived from power revenues. Among items on the program are $14,665,000 for additions to city distribution system, largely preparatory to distribution of Hoover Dam power; and $2,525,000 for Boulder Canyon transmission-line rights of way and attendant engineering.

John C. Page, formerly superintendent of the Grand Valley project, Grand Junction, Colo., has been transferred to Las Vegas as office engineer.

Burton Lowther has been appointed consulting engineer to make an investigation and report covering the sanitary features of the town to be built by the Government near the Hoover dam site. The report will include recommendations as to source of water supply, water sedimentation and purification if required, type of equipment and general arrangement of water-works system, location and design of sewer system and sewerage disposal plan.

A land promoter was recently convicted in the Federal court of Los Angeles of using the mails to misrepresent certain lands he alleged would be benefited by construction of Hoover Dam. The Government contends that the promoter bought mountain tops for 50 cents an acre and sold the land as high as $7 an acre.

Colorado River Bodies Hold Meetings in Denver

A meeting of the Colorado River Compact Commission of the Upper Basin States was held at Denver on August 22 and 23, attended by the following State representatives: M. C. Hinderlider, State engineer, and R. J. Tipton, assistant to the State engineer, of Colorado; John A. Whiting, State engineer, and R. I. Meeker, consulting engineer, of Wyoming; Herbert W. Yeo, State engineer of New Mexico; W. D. Beers, river commissioner, and W. W. Ray, consulting engineer, of Utah. Principles of water allocation and division were discussed, and an attempt was made to divide the waters of Green River between Utah and Wyoming. Difficulties were encountered in the division, owing to conflict between irrigation interests in Wyoming and power interests in Utah. Plans were also discussed for dividing the waters of San Juan River between Colorado, New Mexico, and Utah.

The Colorado River Planning Commission met in Denver on August 25 and 26, attended by the following representatives: Porter J. Preston, chairman, R. F. Walter, and E. B. Debler, of the Bureau of Reclamation; M. C. Hinderlider, State engineer of Colorado; John A. Whiting, State engineer of Wyoming; Herbert W. Yeo, State engineer of New Mexico; George M. Bacon, State engineer, and W. D. Beers, river commissioner, of Utah. Plans for utilization of moneys appropriated by Congress for investigations on the Colorado River were discussed, and data presented on use of water and future plans of development as collected by each State. Some progress was made in smoothing out the difficulties encountered between Utah and Wyoming in the division of the waters of the Green River, considered at the meeting of the Colorado River Commission, and the bureau was requested to undertake some additional investigations there. This will be done immediately.

BASED on gross earnings at the close of the month the Echo Dam, Salt Lake Basin project, was 96 per cent complete.

Notes for Contractors

Boulder Canyon project.—On September 5 the chief engineer of the Union Pacific System, Pacific Electric Building, Los Angeles, Calif., opened bids for grading, trestles, and culverts for the 22-mile branch to be built from the main line near Las Vegas to Summit. The low bidder was the Merritt, Chapman & Scott Corporation of San Pedro, Calif. The work will involve 218,000 cubic yards of common excavation; 23,400 cubic yards of loose-rock excavation; 64,600 cubic yards of solid-rock excavation; 36 pile trestles, 6 frame trestles, and 62 corrugated iron pipe culverts. Material for the trestles and culverts will be furnished by the railroad company. The time required for completion is three months, and the work was started in September.

Minidoka project, Gooding division.—Specifications are being issued for construction of that section of the Milner-Gooding Canal between Little Wood and Big Wood Rivers. Outside of about one-half mile of earth section, this reach of canal will consist of reinforced concrete bench flume construction and rock excavated sections with concrete floor lining and gunited rock side walls.

Shoshone project.—The Shoshone Irrigation District will soon advertise for bids for construction of a reinforced concrete flume crossing at Alkalai Creek and Garland Canal.

Vale project.—Work is in progress on specifications, maps, and profiles for 7½ miles of the Main Canal, between stations 2060 and 2450; also for the Bully Creek East Bench lateral system.

Minidoka project, South Side division.—Bids will be opened at Denver, Colorado, on October 31 (Specifications No. 514) for furnishing one pump having a capacity of 180 second-feet when operating under a total effective head of 31 feet, and one 800-horsepower, 2,200-volt, 3-phase, 60-cycle, synchronous motor, and auxiliary and control apparatus, for pumping station No. 1. All apparatus will be installed by the Government.

Salt Lake Basin project.—Invitations for bids and specifications have been issued covering the purchase and installation of 1566 linear feet of 8-inch cast iron water pipe to replace the portion of the pipe line of the City of Coalville, Utah, which will be within the flow line of the Echo Reservoir.

Denver office.—Bids were opened on August 14, 1930, for the purchase of a hydraulic compression testing machine. Alternative bids were received for furnishing testing machines of 2,000,000 and 3,000,000 pounds capacity and of various types of construction and degrees of operating precision. The bids ranged between $14,000 to $29,700, f. o. b. factory shipping point.

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Silt Transportation by Sacramento and Colorado Rivers and by the Imperial Canal. Illus. Proceedings, American Society of Civil Engineers, April, 1930, vol. 56, pp. 801–807.

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The proposed Colorado River Aqueduct and Metropolitan Water District. Discussion by L. C. Hill. Illus. Proceedings, American Society of Civil Engineers. August, 1930, vol. 56, pp. 1283–1289.

Bayley, E. A.
Preliminary Topographic Surveys for Proposed Colorado River Aqueduct. Illus. Proceedings, American Society of Civil Engineers. August, 1930, vol. 56, pp. 1335–1345.

Hyatt, Edward, State engineer.
California Plan for Conservation of Water Resources. With discussion by J. B. Lippincott and F. C. Scobey. Proceedings, American Society of Civil Engineers, August, 1930, vol. 56, pp. 1217–1227.

De Boer, S. R.
Planning of Capitol Cities: Denver, Colo. Proceedings, American Society of Civil Engineers, August, 1930, 56, pp. 1381–1384.

Vogt, Fredrik.
Laminated Arch Dams with Forked Abutments (illus.) and Plastic Flow in Concrete Arches. Discussion. Proceedings, American Society of Civil Engineers. August, 1930, vol. 56, pp. 1440 and 1447.

An unusually large number of inquiries concerning settlement opportunities on the Riverton project have been received recently, and a number of high-class prospective settlers have been shown over the project. One man has been accepted by the board and has taken a farm unit.

Practical Hints to Housewives

THE following is the account of Mrs. Russell Arndt, of Vale, S. Dak. (Belle Fourche project), who entered the State contest for the most important improvements made in proportion to the money expended.

The contest, termed "Making the Kitchen Work Easier," was under the direction of Miss Mary A. Dolve, extension specialist, of Brookings, S. Dak., and Miss D. Hinkley, local demonstration agent.

I feel that I have received a great good from the kitchen contest held in our county. While I had realized for a long time that our old-fashioned pantry which contained our preparation center was too far from the stove and storeroom and very unhandy, causing many extra steps in the course of a day's work, I had really given it no serious thought, until our home agent, Miss Hinkley, explained the "Kitchen Project and Contest" to our club, and Miss Dolve scored my kitchen for the first time. She immediately recommended built-in cupboards in the place of the pantry. We considered the expense and decided we could not afford to make the change this year.

I gave up the idea of changing the pantry until I tried out the pedometer for a week, and found I was walking an average of 10 miles a day in doing my kitchen work, while some days I walked as high as 15 miles. This seemed to me a great distance to walk in doing my work, and I began to think of ways to lessen the distance traveled, to make my work easier, and my kitchen more attractive. I had attended several of the kitchen demonstrations and decided many of the suggestions could be carried out in my kitchen.

One day a happy thought struck me. Why not clear out the pantry and move in the large cupboard used in the storeroom? This with the cabinet already in the pantry would afford plenty of room for pots, pans, dishes, etc. A few days later during a rainy spell, when the men were unable to work in the fields, they tore out the pantry and repaired the walls. They also cut an outside door into the storeroom, so that they need not come through the kitchen with all the milk each morning and evening. There was no expense to this as we used the door which had been taken from the pantry. I immediately noticed it made lots less dirt in the kitchen to do away with this traffic to and from the storeroom. This was especially true on muddy days.

We moved in the large cupboard, which I painted a light gray to match the woodwork and cabinet. I placed it in the corner for a storage center and brought my preparation center many feet nearer the stove and water supply. I had a shelf put above the preparation center on which I placed my tin food containers. Under the shelf I hung the small equipment—spoons, ladles, etc. I bought a small wall cabinet, which I placed near the stove to hold articles needed in cooking. Under the cabinet were hooks on which I hung the lids and pot holders.

I put a 48-inch border of blue and white sanitas on the walls and calcimined the rest of the walls and ceiling white. In purchasing the sanitas I selected a design which could be put on lengthwise. This has an advantage over the kind which must be put on in strips as it does away with the joinings. This lengthens the life of the sanitas as it always pulls loose and ravels more quickly at the joinings.

The floor linoleum was badly worn and hard to clean; we discarded this and purchased new linoleum, a beautiful tiled piece in blue, gray, and white with a touch of orange. I used this color scheme throughout my kitchen. I painted the food containers blue and decorated them with pictures cut from magazines. I covered the pictures with white shellac so they can be washed.

The table, chairs, tea cart, and washstand were already painted blue with a design in orange and gray, and the woodwork and cupboards were a light gray,

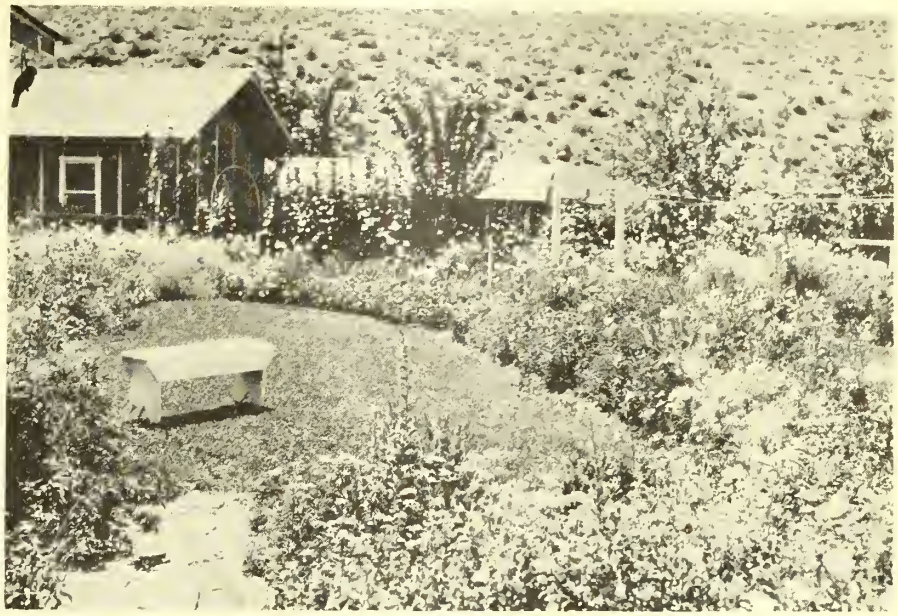
Exhibit at Nyssa Flower Show, Owyhee project, Oregon-Idaho

which helped to carry out my color scheme. For the touch of orange I painted the molding above the sanitas, the window sticks, and curtain rods this color. I used the same shade for lettering the food containers. My new curtains are white marquisette with an orange dot.

Since rearranging my kitchen I have used the pedometer and found that I have cut my mileage in half, as I now walk on an average of 5 miles a day. Besides being much handier the kitchen is much more cheerful and attractive, the window which was in the pantry now adds more light near the preparation center. While the working centers are brought closer together there is a feeling of spaciousness which was not there before. I find the cupboards are easier to keep in order and are more sanitary than the pantry. Aside from the linoleum, sanitas, curtains, and wall cabinet, there was no expense to the rearrangement of the kitchen as we used materials already at hand.

To visitors who have traveled the rough trail across the sagebrush plateau to the Owyhee Dam site, the Government camp, with its shade and fruit trees, luxuriant gardens, neatly trimmed lawns and modest homes surrounded by the rugged and colorful but barren walls of the Owyhee Canyon, never ceases to be a source of admiration. Here the wide variety in flowers, fruits, and vegetables testifies to the adaptability of the soil and climate to plant growth and the natural desire on the part of the residents for homes in the midst of pleasant surroundings.

Shown in the illustration is a portion of the garden of Mr. and Mrs. C. A. Betts. Full justice, however, can not be done to the artistic arrangement of the flower beds, grass plots, flagstone walks, sundial, pool and fountain, nor to the color combinations of the flowers.



An Owyhee garden

The ladies of the camp have just pride in the fact that they were awarded first prize for community display in 1929 at the annual Nyssa Flower Show and first prize for best basket of mixed flowers in 1930.

Aided Settlement in Japan

In order to relieve congested conditions on the main island of Japan, the Japanese Government, according to a statement by Mr. S. Terai, Tokyo representative of the Hokkaido government, is using every effort to settle the northern island of Hokkaido.

Hokkaido has a land area of 23,925,000 acres, of which 3,950,000 are considered suitable for cultivation, the remainder being mountainous territory. At present the population is but 2,498,679, representing about 438,700 families. Three years ago a program was outlined by which it was hoped the population would be increased to 6,000,000 during the next 20 years. It was estimated that nearly $500,000 would be required for this purpose, and this program is now being carried out.

"On the main island," says Mr. Terai, "the average farm cultivated by one farmer is about 2½ acres. Suppose a farmer has two or three sons. The eldest inherits the property, but what becomes of his two brothers? The parents can not afford to divide such a small plot of land among three or even between two children. It would be better for them to give $150 to $200 to each of the younger sons and so enable them to go to Hokkaido as homesteaders.

"Under the government's arrangements a tract of land of from 12½ to 25 acres is loaned to a homesteader rent free. If he succeeds in putting 60 per cent or more of this under cultivation within five years he receives a title to the land without any payment. A farmer with $150 or $200 of his own money, obtaining the government subsidy, is well started toward success. The great trouble lies in finding applicants who are capable."

The homesteader must have a certain amount of capital to start with. It costs about $10 to $12.50 an acre to prepare the land, and 2½ acres are required to maintain the average family. All above that is profit. The cost of building a rough house for a family is about $50. The homesteader may purchase farm implements at reduced prices through the Hokkaido government, while his railway fare is halved.

Exhibit of farm products on the Newlands project, Nevada

Crop Trends on Federal Irrigation Projects, 1915–1929

EACH year the Bureau of Reclamation carries in its annual report a consolidated table showing, by large classes and by individual crops, the actual and relative acreage and value of the crops covered by the annual project census of agricultural products.

The changes in the percentages which the acreage and value of each crop represent of the total acreage and value are, as a rule, slight when the figures for two consecutive years are compared.

CROP TRENDS ON FEDERAL IRRIGATION PROJECTS, 1915–1929

Crop	Acreage cropped								Crop value							
	Total				Per cent				Total				Per cent			
	1915	1919	1924	1929	1915	1919	1924	1929	1915	1919	1924	1929	1915	1919	1924	1929
Cereals:																
Barley	37,474	28,882	35,871	78,920	4.6	2.5	3.0	5.2	$576,420	$1,187,094	$825,070	$1,590,882	3.2	1.3	1.2	1.8
Corn	39,785	47,925	66,410	66,012	5.3	4.3	5.5	3.0	786,963	2,071,345	1,209,450	1,029,613	4.3	2.3	1.8	1.2
Oats	49,514	42,987	35,571	45,417	6.5	4.0	2.9	3.0	664,572	1,142,912	564,757	699,962	3.7	1.3	.9	.8
Rye	780	2,237	661	4,781	.1	.2	------	.3	8,332	36,316	7,345	79,721	.1	------	------	------
Wheat	84,052	167,211	86,861	144,160	11.4	15.0	7.1	9.5	1,529,873	7,027,924	2,393,871	3,836,566	8.4	8.0	3.6	4.4
Total	211,605	289,242	225,374	319,290	27.9	26.0	18.5	21.1	3,566,160	11,465,591	5,000,493	7,236,744	19.7	12.9	7.5	8.2
Other grain and seed:																
Alfalfa seed	14,517	9,631	16,859	20,601	1.9	.9	1.4	1.4	464,428	822,195	730,387	774,103	2.5	.9	1.1	.9
Clover seed	5,537	8,663	7,406	19,702	.7	.8	.6	1.3	204,881	721,817	207,007	502,194	1.1	.8	.3	.6
Sorghum (grain)	7,216	28,145	1,579	----------	1.0	2.5	.1	------	161,541	1,267,673	74,858	----------	.9	1.4	.1	------
Flaxseed	330	1,029	298	3,389	------	.1	------	.2	6,681	19,308	4,567	69,247	.1	------	------	------
Millet seed	244	328	129	----------	------	------	------	------	2,761	4,225	1,550	----------	------	------	------	------
Total	27,844	47,796	26,271	43,692	3.6	4.3	2.1	2.9	840,292	2,835,218	1,018,369	1,345,544	4.6	3.1	1.5	1.5
Hay and forage:																
Alfalfa hay	335,161	455,440	457,957	467,176	44.3	40.8	37.6	31.0	6,460,239	25,800,146	15,207,721	15,398,048	35.6	29.0	22.9	17.7
Clover hay	6,726	5,792	9,247	25,089	.9	.5	.7	1.6	76,333	153,552	110,963	1,887,267	.4	.2	.2	2.1
Other hay	12,484	29,741	33,764	34,860	1.6	2.7	2.8	2.3	144,838	630,783	458,828	434,951	.8	.7	.6	.4
Corn fodder	33,529	4,959	7,292	4,852	4.4	.5	.6	.3	682,698	186,603	120,352	110,143	3.8	.2	.2	.1
Peas	927	230	----------	----------	.1	------	------	------	29,183	5,877	----------	----------	.2	------	------	------
Other forage	870	4,836	39,874	28,280	.1	.4	3.3	1.9	22,387	242,378	759,071	643,877	.1	.3	1.1	.7
Pasture	98,128	113,776	142,458	324,259	12.9	10.3	11.7	21.4	902,132	1,759,493	1,444,148	3,298,345	4.9	1.9	2.2	3.7
Total	487,825	614,774	690,592	884,516	64.3	55.2	56.7	58.5	8,317,810	28,778,832	18,101,083	21,772,631	45.8	32.3	27.2	24.7
Vegetables and truck:																
Beans	2,610	1,930	7,537	21,050	.4	.1	.6	1.4	80,257	100,967	214,221	1,221,415	.5	.1	.3	1.4
Onions	324	260	2,762	2,865	------	------	.2	.2	39,670	118,176	373,056	286,337	.2	.1	.6	.3
Potatoes, white	17,269	30,752	37,698	46,964	2.3	2.8	3.1	3.1	1,282,842	5,068,336	3,428,847	7,733,673	7.1	5.7	5.1	8.7
Potatoes, sweet	279	744	316	1,027	------	------	------	------	11,302	100,514	58,619	230,161	------	.1	.1	.3
Truck	11,481	17,003	22,474	54,692	1.5	1.6	1.9	3.7	769,270	2,573,334	4,063,206	10,454,390	4.2	3.0	6.1	11.8
Total	31,963	50,689	70,787	126,598	4.2	4.5	5.8	8.4	2,183,341	7,961,327	8,137,949	19,925,976	12.0	9.0	12.2	22.5
Fruit and nuts:																
Apples	16,502	27,926	24,801	24,269	2.2	2.5	2.0	1.6	864,591	8,970,724	4,151,640	6,285,626	4.8	10.1	6.2	7.1
Peaches	2,326	2,629	2,398	3,512	.3	.2	.2	.2	124,531	635,181	280,558	576,602	.7	.7	.4	.6
Pears	1,755	3,989	4,234	6,095	.2	.4	.4	.4	155,577	1,013,933	614,122	1,723,441	.9	1.2	.9	2.0
Prunes	302	1,086	1,683	2,686	------	.1	.1	.1	71,176	224,648	120,814	192,450	.4	.3	.1	.2
Citrus fruit	1,167	1,990	2,541	8,323	.2	.2	.2	.6	79,858	724,850	861,170	1,765,245	.4	.8	1.3	2.0
Small fruit	1,577	1,422	3,475	3,055	.2	.1	.3	.2	177,618	484,748	688,580	821,861	1.0	.5	1.3	1.0
Miscellaneous	2,298	2,422	3,323	5,701	.3	.2	.3	.4	174,158	722,426	436,321	743,460	.9	.8	.6	.8
Total	25,927	41,464	42,455	53,641	3.4	3.7	3.5	3.5	1,647,509	12,776,510	7,153,205	12,108,685	9.1	14.4	10.8	13.7
Miscellaneous:																
Sugar beets	20,848	37,964	67,123	84,183	2.7	3.4	5.5	5.5	1,236,049	3,805,379	4,140,818	6,850,733	6.8	4.3	6.2	7.7
Cotton (lint and seed)	3,325	107,390	216,450	271,282	.4	9.7	17.8	18.0	204,761	20,892,328	22,516,199	18,705,391	1.1	23.5	33.9	21.1
Hops	545	----------	----------	----------	.1	------	------	------	102,200	----------	----------	----------	.6	------	------	------
Cane	1,411	5,165	259	1,069	.2	.5	------	------	34,419	142,880	6,113	32,631	.2	.2	------	------
Other crops	1,335	14,881	18,001	52,962	.2	1.3	1.5	3.5	32,001	316,072	414,331	481,055	.1	.3	.7	.6
Total	27,464	165,400	301,833	409,496	3.6	14.9	24.8	27.0	1,609,340	25,156,659	27,077,461	26,069,810	8.8	28.3	40.8	29.4
Duplication	55,015	95,896	140,702	324,983	7.0	8.6	11.4	21.4	----------	----------	----------	----------	------	------	------	------
All crops	757,613	1,113,469	1,216,610	1,512,250	100.0	100.0	100.0	100.0	18,164,452	88,974,137	66,488,560	88,459,390	100.0	100.0	100.0	100.0

In the accompanying table the crop census figures for 1915 (data for 1914 not being available), 1919, 1924, and 1929 were brought together in an effort to see whether there had been any marked change in the relative acreage and value of the crops grown on the projects at 5-year intervals.

Taking the groups in order, it is noted that the percentage of the cultivated acreage in the cereals declined steadily to 1924, with a slight increase in 1929. The percentage of the area in these crops may probably be considered stationary, under ordinary agricultural conditions, at about 20 per cent. Similarly, other grain and seed would ordinarily represent about 3 per cent or less of the cropped acreage, and hay and forage somewhat over 55 per cent. It should be noted, however, that the acreage in alfalfa hay, although showing a steady actual increase, has shown an equally progressive relative decrease from 44.3 per cent in 1915 to 31 per cent of the cultivated acreage in 1929.

Vegetables and truck, as a whole, indicate a relative increase at each of the 5-year periods, practically all of the crops also being grown on a larger acreage during each of the specified years, with truck crops showing a steady relative increase as well. White potatoes appear to have reached a stationary proportion of about 3 per cent, although fluctuating market conditions might be expected to cause ups and downs in the percentage from year to year. The actual acreage of this crop has increased at each of the years mentioned in the table.

Fruit and nuts in general also seem to have become more or less stationary, so far as their relative acreage is concerned, at about 3½ per cent of the cropped area, with apples showing a slight decline, and citrus fruit a marked increase in 1929 over the preceding years.

The crops in the miscellaneous class show as decided an increase as vegetables and truck, both actually and relatively, most of the increase being due to two crops, sugar beets and cotton. It is probable that the percentage of the cropped acreage in sugar beets will show a marked increase in the next few years as suitable areas, particularly on the Sun River, Milk River, and other northern projects, are planted to this crop.

The trend of the percentages of the total crop value represented by the individual crops and classes of crops follows fairly closely that of relative acreage for each of the specified years, with some marked fluctuations as in the case of cotton, due largely to market conditions.

An interesting point brought out in the table is the steady increase in the duplicated acreage, that is, the acreage devoted during the crop year to two or more crops, which has increased from 55,015 acres, or 7 per cent of the cropped area in 1915, to 324,983 acres, or 21.4 per cent in 1929. This is significant of the more intensive cultivation of the land on the Federal irrigation projects and helps to account for a per acre crop value from these projects two to two and a half times larger than that for the United States as a whole.

Irrigated Areas Attract Dry-Land Farmers

Considerable interest on the Milk River project was displayed in agriculture during the past month, especially by neighboring dry-land farmers who have had a practical crop failure during the past two years. Many of them who have sufficient stock and equipment to handle an irrigated farm now desire to locate upon the project. In order to encourage this movement several of the larger landowners have subdivided their holdings and offered them for sale at very attractive prices and payment terms, and new settlers were recently located upon four of such units. The local interests are cooperating actively in this work, and it is expected that several more idle tracts will be disposed of this fall in time to allow some preparation for next season's crop.

A mass meeting of the Phillips County Farm Bureau was held during the month to consider the condition of the dry-land farmers who had suffered crop failure for the past two years, and the relief measures necessary. This meeting was attended by about 200 people, and it was strongly advocated that dry farmers who have 300 acres or less lease their lands to the large operators and move on irrigated farms under the project. This meeting stimulated to a great extent the settlement program which has been in progress for several months past, and will no doubt be beneficial to its development.

PRODUCTS OF THE RIVERTON PROJECT, WYOMING

Upper left: Oats grown 1 mile west of Pavillion. Upper right: Homeseekers examining 1930 crop. Lower left: Two satisfied settlers harvesting oats. Lower right: Harvesting with power.

Federal Reclamation Projects and the Drought

Recently, a short news item from Olympia, Wash., was published in the United States Daily. Briefly, it stated that many of the crops in the State were being affected by the water shortage as a result of the drought, but that the "Yakima and Wenatchee districts are not affected, since they are served by stored water."

This brief and relatively insignificant item carries a world of significance to the water users on the Federal irrigation projects under the Bureau of Reclamation, Department of the Interior. The value of irrigation will be conclusively proved this year in the opinion of Dr. Elwood Mead, Commissioner of Reclamation, who returned recently from an inspection trip over a number of the Federal irrigation projects. Wherever Doctor Mead went he found that irrigated crops were exceptionally good.

ADVANTAGES OF IRRIGATION

On the Greenfields division of the Sun River project, Montana, the area being irrigated is double that of last year, and the crops are the best ever grown. Fifty new farmers have come to the Lower Yellowstone project, Montana - North Dakota, largely through the efforts of the Lower Yellowstone Development Association. On the Milk River project, Montana, all the crops were good, especially sugar beets and beans, fertilized with superphosphates from the smelters. An active campaign is in progress to encourage burned-out dry farmers to settle on this project this fall. Many owners of large tracts of irrigable land are making very attractive offers to prospective settlers. Mr. Josef Sklower, president of the Malta Irrigation District, is giving almost all his time to the work of listing lands for sale and arranging contracts. This project shows more active cooperation from all sources than ever before, with every indication that a comprehensive and worth-while program of settlement and development will be carried out successfully.

The newly irrigated lands on the Kittitas division of the Yakima project, Washington, and on the Vale project, Oregon, are producing crops that give mute testimony to the fertility of the soil when properly irrigated and cultivated.

These few examples are typical of the results being obtained on the Federal irrigation projects.

For many years the average value per acre of the crops grown on these projects has been from two to two and a half times greater than the average per acre crop value for the country as a whole, largely due to the fact that on the irrigated areas crops capable of a higher per acre return are grown and also to the ability of the water user to distribute the moisture so necessary to proper growth at the times and in the quantities best suited to the particular crops grown.

TULE LAKE LAND OPENING

On October 18 the Bureau of Reclamation will open to entry 24 public land farm units on the Tule Lake division of the Klamath project, Oregon-California. Ex-service men will have a preference right of 90 days in filing on these units, and it is expected that, as at previous openings of this division, all of the units will be applied for by these preferred applicants on the date of opening. As usual, applicants must have a capital of at least $2,000 and must have had at least two years' farming experience.

This is believed to be an exceptional opportunity for men of small means to obtain an irrigated farm, as the lands are considered among the best of those opened in recent years by the Bureau of Reclamation.

Further information and application blanks may be obtained by addressing the Commissioner, Bureau of Reclamation, Washington, D. C.

Here is the essential difference in conditions between the farmer dependent on rain, which may come when most needed, or may be withheld until his crops are endangered, and favored individual on a Federal irrigation project, whose water supply is adequate for his needs and for the production of those crops which will bring him the highest net return.

The Federal irrigation projects show conclusively the advantages of ability to control moisture. Whether it rains or not is a matter of small moment on these favored areas. Blessed with an adequate water supply, stored behind massive dams, and released as needed to meet the demands of the irrigators, these products of Uncle Sam's beneficent policy of helping men own farms proceed along the even tenor of their way, with sympathy for their less fortunate neighbors, and with thankfulness for their own impregnable position.

Sun River Project Needs Qualified Farmers

After nearly two decades of development work the Sun River irrigation project is starting to function along the lines its founders desired, and 200 qualified farmers are needed immediately on the Greenfields division alone to take advantage of available land under ditch. Those now engaged in proving the fertility of this large irrigated section, which many believe is soon destined to furnish most of the produce for Great Falls and neighboring cities, are raising most everything worth growing, including fruits, vegetables, chickens, livestock, hay, feed, trees, and meadows, and lawns that outclass many city yards.

The present summer finds outstanding progress on the project because of the completion of Gibson Dam in Sun River Canyon, which assures ample water for the first time since the project was started. New ditches and reservoir extensions nearing completion will give assurance of regular delivery of sufficient water throughout the irrigation season.

This in brief constituted the findings of upwards of a score of Great Falls business and professional men who recently took advantage of a tour of 120 miles of the Sun River project arranged by the chamber of commerce in cooperation with project officials.

After an inspection of 15 farms the visitors reached the following conclusions:

Any experienced farmer who is willing to study irrigation and apply the methods of proven value can make a good living and a profit on a small farm on the Sun River project.

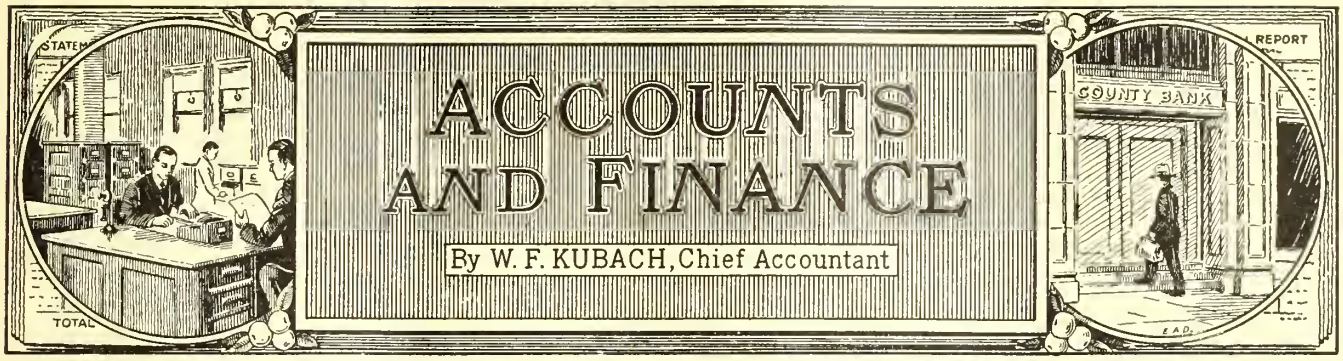
Small farms are imperative to hold down labor costs and make for efficient handling of the various crops needed to support a family with a minimum cash outlay for imported goods.

The most desirable sized farms are 80-acre tracts with ample water, with 160 acres for fully experienced farmers who are amply financed.

A stake of upward of $2,000 in cash in addition to equipment is needed by the average settler, but the exact amount of cash and equipment is governed by conditions of the land, experience of the settler, his ability to adjust himself to intensive farming, and other basic factors in project tillage.

That the Sun River Valley soon is destined to supply a large portion of the produce used in Great Falls, and that this produce will be of a higher quality than now is being imported from neighboring States.

That phosphate used as fertilizer apparently has solved the problem of enriching the soil so that sugar beets and other crops may be grown at greatly increased profits.



Repayment of Construction Charges

THE accompanying table shows the status of the construction account repayments at the end of the fiscal year 1930. While the amount uncollected on June 30, 1930, was $1,629,740.14 as compared with $1,211,787.77 on June 30, 1929, or an increase of $417,952.37, this increase is mainly due to the failure of one project to pay the annual installment for the calendar year 1930. Contract has been executed by the water users' association to refinance this debt to the United States and this delinquent installment will be paid in the near future.

It is gratifying to note that of the 23 projects repaying construction charges, 4 have paid 100 per cent of the charges due and payable, and 17 have paid 95 per cent or more. The account as a whole shows only 4 per cent delinquency. Only a few projects show increased delinquencies during the past fiscal year. This is unquestionable evidence of the willingness and ability of the water users to meet their payments and keep the reclamation fund revolving. Approximately 75 per cent of the money now available for reclamation operations, exclusive of the Boulder Canyon project, comes from repayments by water users and from other incidental operations.

Although the condition of the account is not quite as good as on June 30, 1929, there has been a marked improvement during the past three years. This indicates that the financial readjustments between the United States and the water users pursuant to the acts of December 5, 1924, and May 25, 1926, are achieving in the majority of cases the purposes of the acts. The activities of the irrigation districts, water users' associations, and other organizations in the collection and payment of obligations due the Government have contributed greatly to the present condition of the account.

Salt River Project, Arizona, Refinances Debt

On September 16, 1930, shareholders of the Salt River Valley Water Users' Association, operating the Salt River project,

(Continued on page 208)

STATUS OF CONSTRUCTION ACCOUNT REPAYMENTS, JUNE 30, 1930

State and project	Construction account, June 30, 1930, repayable	Value of repayment contracts	Amounts of repayment contract due on June 30, 1930	Balance of repayment contract deferred (not due)	Amounts paid on amounts due	Amounts uncollected of amounts due	Per cent repaid of amounts due
Arizona: Salt River	$10, 166, 021. 97	$10, 166, 021. 97	$5, 896, 292. 77	$4, 269, 729. 20	$5, 286, 331. 45	$609, 961. 32	89. 7
Arizona-California: Yuma	9, 512, 609. 94	5, 048, 073. 94	3, 583, 042. 45	1, 465, 031. 49	3, 511, 170. 04	71, 872. 41	98. 0
California: Orland	2, 356, 448. 44	2, 482, 342. 95	703, 314. 19	1, 779, 028. 76	684, 975. 64	18, 338. 55	97. 4
Colorado:							
Grand Valley	4, 052, 535. 32	4, 074, 584. 11	59, 986. 08	4, 014, 598. 03	44, 053. 45	15, 932. 63	73 4
Uncompahgre	5, 466, 773. 15	5, 510, 871. 31	707, 771. 71	4, 803, 099. 60	489, 277. 64	218, 494. 07	69. 1
Idaho:							
Boise	16, 124, 392. 08	14, 698, 000. 12	3, 411, 581. 39	11, 286, 418. 73	3, 407, 185. 08	4, 396. 31	99. 9
King Hill	1, 489, 968. 94	1, 489, 968. 94	25, 800. 00	1, 464, 168. 94		25, 800. 00	0. 0
Minidoka	13, 732, 723. 34	11, 619, 819. 82	7, 784, 653. 25	3, 835, 166. 57	7, 730, 684. 34	53, 968. 91	99. 3
Minidoka-Gooding	1, 889, 818. 49	5, 257, 900. 00	258, 900. 00	4, 999, 000. 00	258, 900. 00		100. 0
Montana:							
Huntley	1, 859, 806. 88	1, 803, 806. 19	532, 638. 91	1, 271, 167. 28	532, 638. 91		100. 0
Milk River	5, 319, 200. 70	5, 012, 010. 00	3, 002. 76	5, 009, 007. 24	3, 002. 76		100. 0
Sun River	7, 030, 361. 68	10, 012, 837. 24	194, 440. 78	9, 818, 396. 46	193, 394. 54	1, 046. 24	99. 5
Montana-North Dakota: Lower Yellowstone	4, 061, 076. 17	4, 134, 864. 70	218, 700. 47	3, 916, 164. 23	214, 077. 18	4, 623. 29	97. 9
Nebraska-Wyoming: North Platte	21, 066, 939. 69	22, 202, 360. 38	2, 825, 682. 40	19, 376, 677. 98	2, 650, 985. 50	174, 696. 90	93. 8
Nevada: Newlands	3, 484, 999. 67	3, 260, 278. 05	967, 781. 11	2, 292, 496. 94	965, 618. 56	2, 162. 55	99. 8
New Mexico: Carlsbad	1, 421, 545. 31	1, 425, 182. 75	860, 170. 59	565, 012. 16	824, 860. 59	35, 310. 00	95. 9
New Mexico-Texas: Rio Grande	12, 914, 178. 72	13, 669, 575. 00	2, 770, 134. 36	10, 899, 440. 64	2, 699, 244. 80	70, 889. 56	97. 4
Oregon:							
Umatilla	4, 403, 415. 95	3, 818, 252. 93	453, 913. 64	3, 364, 339. 29	389, 274. 93	64, 638. 71	85. 8
Vale	2, 632, 089. 41	4, 500, 000. 00		4, 500, 000. 00			
Oregon-California: Klamath	5, 462, 827. 77	4, 066, 473. 62	1, 057, 907. 27	3, 008, 566. 35	1, 004, 261. 55	53, 645. 72	95. 0
Oregon-Idaho: Owyhee	2, 523, 468. 57	18, 000, 000. 00		18, 000, 000. 00			
South Dakota: Belle Fourche	4, 461, 956. 64	5, 416, 493. 23	586, 010. 86	4, 830, 482. 37	586, 010. 86		100. 0
Utah:							
Salt Lake Basin	2, 317, 689. 04	3, 000, 000. 00		3, 000, 000. 00			
Strawberry Valley	3, 331, 243. 04	3, 212, 135. 57	1, 102, 641. 85	2, 109, 493. 72	1, 092, 267. 85	10, 374. 00	99. 1
Washington:							
Okanogan	424, 198. 97	424, 198. 97	130, 791. 45	293, 407. 52	130, 791. 45		100. 0
Yakima	14, 148, 888. 45	11, 652, 641. 76	6, 151, 593. 49	5, 501, 048. 27	5, 958, 511. 06	193, 082. 43	96. 9
Yakima-Kittitas	6, 562, 908. 31	9, 000, 000. 00		9, 000, 000. 00			
Wyoming:							
Riverton	3, 814, 292. 47						
Shoshone	8, 236, 556. 68	5, 585, 614. 27	781, 232. 29	4, 804, 381. 98	780, 725. 75	506. 54	99. 9
Total	180, 298, 935. 79	190, 544, 307. 82	41, 037, 984. 07	149, 476, 323. 75	39, 438, 243. 93	1, 629, 740. 14	96. 0

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, left Washington on September 9 to attend the celebration on September 17 at Las Vegas, Nev., marking the commencement of construction of Hoover Dam. After attending a meeting in San Francisco of the Hoover-Young Commission, the commissioner planned to return to the Washington office.

P. W. Dent, Assistant Commissioner, was designated acting commissioner during the recent absence of the commisioner.

Chief Engineer R. F. Walter made an inspection of the Klamath project during the month. Mr. Walter was accompanied by State Engineer George W. Malone, of Nevada, who is a member of the Committee on the Conservation and Administration of the Public Domain.

Chief Engineer R. F. Walter made a general inspection of the Grand Valley project on August 22.

Salt River Debt Refinanced

(Continued from page 207)

in Arizona, voted a bond issue of $3,000,000, mainly for the purposes of refinancing their debt to the Government.

Originally the association owed the United States $10,166,000, of which $5,287,000 has been repaid, leaving a balance to be repaid of $4,879,000 in annual installments of $610,000.

The refinancing scheme provides for the payment of $1,863,385 on or before October 1, 1930, to cover three installments due December 1, 1929, December 1, 1930, and December 31, 1931, plus interest. Following this payment the association will pay to the United States $152,490 annually for the period from December 1, 1932, to December 1, 1936. Under the original contract the association would have liquidated its entire debt on December 1, 1936. The balance of the original debt not liquidated by the association on December 1, 1936, under the refinancing scheme will be amortized by the association in equal annual installments of $217,797.

Material benefits will accrue both to the association and to the United States from the refinancing of the association's debt to the United States.

George O. Sanford, assistant director of Reclamation Economics, is attending, as the personal representative of the commissioner, the Inter-American Conference on Agriculture, Forestry and Animal Industry. The conference, which began on September 8 and will continue until September 20, is being held at the Pan American Union Building in Washington.

Victor Konn, manager of the Palestine Jewish Colonization Association, with headquarters at Haifa, Palestine, and I. Rosenfeld, consulting engineer, were recent visitors in the Washington office. They planned to visit the Denver office and a number of our projects to study irrigation, drainage, and settlement problems.

On August 27, while on a sojourn in the East, Capt. A. McD. Brooks, purchasing agent in the Denver office, stopped off at Washington and visited his friends at Reclamation headquarters.

Master Mechanic T. S. Martin was at the Echo Dam on the Salt Lake Basin project, Utah, until August 11 supervising the installation of the gates and valves at the Echo Dam. He returned to Sunnyvale, Calif., on the 11th to continue the inspection of the high pressure gates for the Owyhee Dam.

Herbert R. Pasewalk, chief clerk of the Yuma project, has accepted assignment in the Washington office as assistant to the chief accountant with the title of senior accountant. The new assignment is effective on October 1.

Earl L. Harmon, assistant engineer, and Richard W. Adams, instrumentman, on the Riverton project, have been transferred to the Owyhee Dam.

Assistant Engineers Irving J. Matthews and Grant Bloodgood, of the Riverton project, were transferred to the Boulder Canyon project during the month.

Judge Gilman, vice president, and J. T. Maher, right of way land and tax commissioner of the Great Northern Railway Co., were among the recent visitors to the Klamath project.

Gregory G. Gegechkory, chief engineer of the technical department, water economy service, Socialistic Soviet Republic, Georgia, made an inspection of the various canals and structures on the Uncompahgre project the latter part of the month.

Frederick G. Cross, assistant superintendent of operation and maintenance, eastern section, irrigation block, Department of Natural Resources of the Canadian Pacific Railway, made a tour of several of the projects during the month, including the Kittitas division of the Yakima project, Boise, Minidoka, and Uncompahgre.

Dr. B. O. Aylesworth, director of the Bureau of Markets for the State of Colorado, called at the Montrose office of the Uncompahgre project during the month and discussed marketing conditions.

Early in the month Chief Designing Engineer J. L. Savage returned to the Denver office from an inspection trip covering a large number of the dams and projects in the Northwest.

L. N. McClellan, electrical engineer in the Denver office has returned to his post of duty after a recent trip made in connection with the investigations of the Columbia Basin project and the Kennewick Highlands pumping project.

On August 11 Master Mechanic N. E. Fordham, of the Denver office, left Birmingham, Ala., where he has been engaged in inspection work, for Brackenridge and York, Pa., for the purpose of inspecting the steel castings for the 8-ton pillar crane and the 42-inch needle valves for the Yakima River crossing wasteway on the Kittitas division of the Yakima project. He later returned to Birmingham to resume his inspections at that point.

New Map Available

There has just been issued a small-size map (10½ x 16 inches) of the Kittitas division, Yakima project, Washington. It is printed in three colors and shows reservoirs, canals, structures, power lines, district boundaries, etc. This map is numbered 23666, and the price is 10 cents per copy.

U. S. GOVERNMENT PRINTING OFFICE: 1930

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John Edwards**, Assistant Secretary; **E. C. Finney**, Solicitor of the Interior Department
E. K. Burlew, Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely**, Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colorado, Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk, Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills		do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Acting supt	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo
Uncompahgre	Montrose, Colo	L. J. Foster	Superintendent	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Constr. engr	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent	N. O. Anderson	Denver office	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum.	Acting Constr. engr.	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [5]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [6]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [7]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Acting constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith		Wm. J. Burke	Billings, Mont.
Shoshone [8]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	Denver office	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and power system.
[5] Storage, main, and Tule Lake divisions.
[6] Echo Reservoir.
[7] Storage, Tieton, and Sunnyside divisions.
[8] Reservoir, power plant and Willwood division.

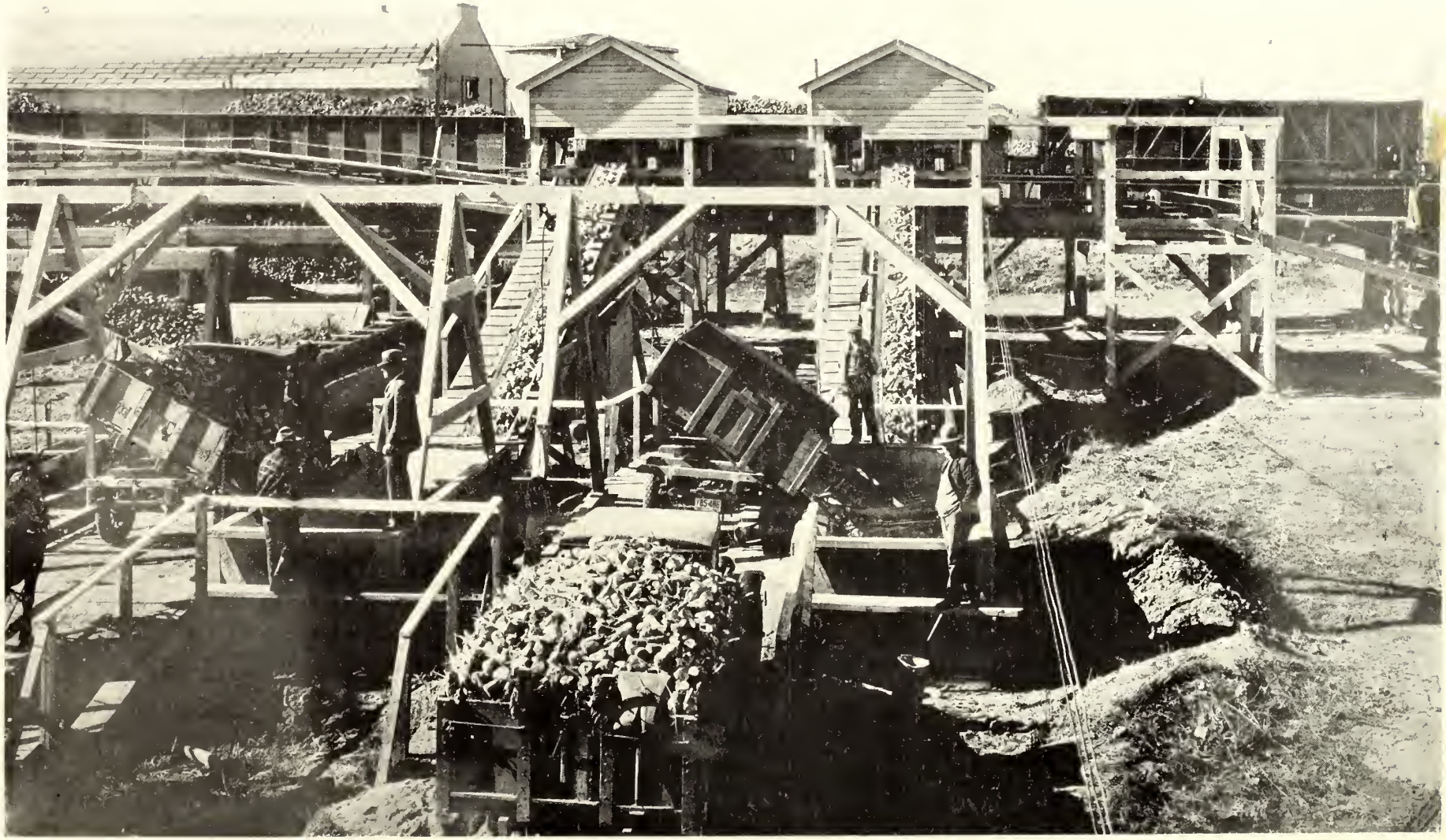
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen supt. and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Moutgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Ft. Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wis	A. B. Reeves	do	Mrs. Nelle Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddiugs	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American Canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Green River Basin		J. R. Iakisch	State of Wyoming.
Columbia Basin	Spokane, Wash	H. W. Bashore	



BEET DUMPS, SUGAR FACTORY, CHINOOK, MILK RIVER PROJECT, MONTANA

NEW RECLAMATION ERA

VOL. 21, NO. 11 NOVEMBER, 1930

A THANKSGIVING HARVEST, PRODUCTS OF IRRIGATION

Thanksgiving Message

WE are living in a land peculiarly blessed in every way. By reason of an adequate water supply the Federal irrigation projects in the West are particularly favored. The crops produced on the projects this year apparently will surpass all records since the peak year of 1919, and their increase in value is marked. Repayments to the Government from a majority of the projects were better than in any previous year. The advantages of the irrigated country are attracting worth-while settlers; the homes of old design are being improved and in many cases replaced by up-to-date structures; schools are being remodeled and new plants are being erected to conform to the latest architectural design, with equipment and scholastic advantages equal to any offered in the older sections of the country; modern churches and social centers are convenient to the settlers; and industries are increasing to meet the needs of the rapidly growing communities. For the most part the project settlers are a happy and contented people, with every reason for optimism, and surely this season should mean a time of real thanksgiving to the Giver of Every Good Gift.

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NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 November, 1930 No. 11

Interesting High Lights on the Federal Reclamation Projects

AN excellent showing was made by Riverton project exhibits at the recent Fremont County Fair. At the Wyoming State Fair potatoes from the project were largely instrumental in securing the award of potato sweepstakes for Fremont County.

ONE farm application was filed at the Vale project office during the month, and six tracts, involving 842 acres of private land, were sold to new settlers by the representative of the Vale-Owyhee Government Projects Land Settlement Association.

INTEREST in settlement opportunities on the Kittitas division of the Yakima project was shown during the month by a number of homeseekers who called at the Ellensburg office and obtained information regarding the lands under the project.

A NUMBER of reports on the Minidoka project indicate returns from beans of $130 to $150 per acre, and from potatoes of $300 to $350 per acre. One potato grower received $3,425 from 9 acres, or an average of $380 per acre.

A 200-ACRE farm near Vale, on the Belle Fourche project, South Dakota, was sold during the month to an adjacent tenant who came to the project a few years ago to engage in general farming. About half the tract is irrigable, and the sale price is reported to average $50 an acre.

THE Tri-State Milling Co. of Belle Fourche has established and is now operating on the project a plant for the manufacture of commercial feeds. This includes cubing machines imported from England and is the most complete feed mill in the State of South Dakota. The development will absorb all barley and feed grains grown in the surrounding country and will furnish a market for molasses, the by-product of the Black Hills sugar plant.

MANY inquiries concerning settlement opportunities on the Riverton project were received during the past month, and a number of personal inspections of the project were made by prospects of an unusually high class who seemed to have more than an ordinary interest in securing permanent homes.

ON the Uncompahgre project the agricultural products entered by the various community agencies of Delta and Montrose Counties at the State fair, which was held during the early part of the month at Pueblo, were excellent and brought much favorable publicity to the two counties. Many prizes were brought back home by the contestants.

CASSIA County's herd of Holsteins from the Minidoka project won first place at the Boise and Filer fairs. The report of the Mini-Cassia Dairy Herd Improvement Association for a recent month showed an average production of 735 pounds of milk and 27 pounds of butterfat per cow for 203 cows. The yield of butterfat from 51 cows was 40 pounds each.

THE Natural Gas Co. of Oregon has started work on the construction of a plant and distributing system to serve the city of Klamath Falls, Klamath project, Oregon. The cost of the plant and system is estimated at $1,000,000.

THE erection of a plant at Orland for grading and preliminary processing of olives was started during the month by the Orland Olive Growers' Association.

ON the Belle Fourche project alfalfa at $12 a ton in the stack at this season is at the highest price since the war. Corn is well matured and bringing more than the average price. Sugar beets at $7 a ton will return good profits to growers under the favorable yields being harvested.

THE cucumber crop for pickles on the Belle Fourche project was one of the best that has been harvested since the industry started six years ago Picking began on July 27 and continued until the first frost on September 20. A total of 48,500 bushels were marketed, showing an average yield of 153 bushels per acre. The highest net return of $700 was realized by a Newell rancher on a 2¼-acre tract.

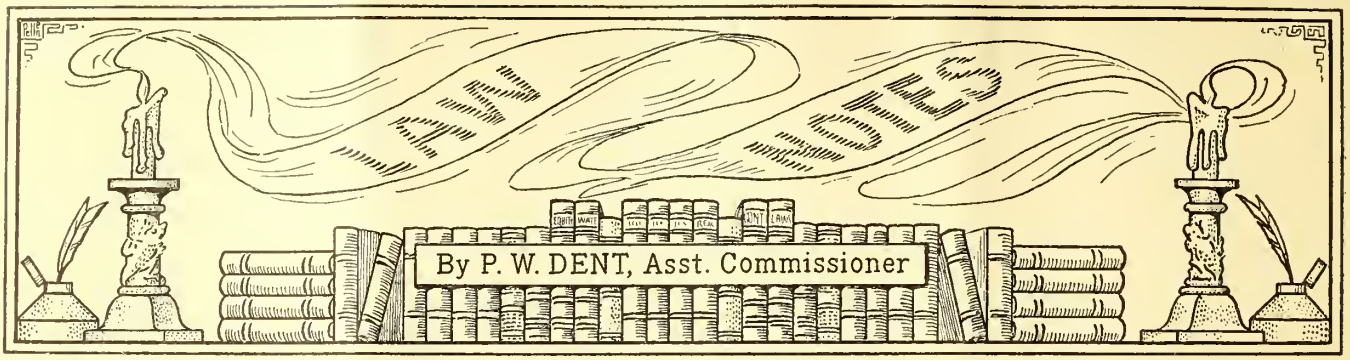
ALL crops on the Rio Grande project were in excellent condition at the close of the month. Cotton was maturing faster than at the corresponding date last year and there were indications of a higher average yield. Fruit harvesting and packing were completed, 8 cars of apples having been shipped from the Mesilla Valley. The last cutting of alfalfa was maturing with good yields in prospect.

AN 80-acre farm on the Sunflower Flats, Interstate Division, North Platte project, was sold during the month for $16,000.

NINE cars of livestock were shipped into the Yuma project during the month for feeding, and one car of fattened stock was shipped to Pacific Coast markets. With the advent of cooler weather an increasing number of feeders will be shipped into the project for fattening on alfalfa and sudan grass.

TO date this year 26,611 acres of land on the Lower Yellowstone project have been irrigated and 43,486 acre-feet of water delivered. This exceeds by over 2,000 acres the maximum heretofore irrigated in any one season.

AT the Owyhee Dam, Owyhee project, the contract of the General Construction Co. was 42 per cent completed at the end of the month. On September 23 the "big pour" of concrete in the main section of the dam was started.



Advertising—Contracts—Bids Received After Time Fixed For Opening

ON November 5, 1926, advertisement was issued by the Bureau of Reclamation for earthwork, canal lining, and structures in connection with construction of the Kittitas Main Canal, division No. 2, and Tucker Creek siphon, Yakima project, Washington, bids to be received at the office of the construction engineer, Ellensburg, Wash., until 10 o'clock a. m., December 28, 1926, and at that hour to be opened. Fifteen bids were received prior to the time specified for opening and one bid was received at 2.35 o'clock p. m. on the date of opening, or 4 hours and 35 minutes after the hour set. It was provided in the specifications that—

"No proposal received after said time or at any place other than the place of opening as stated in the advertisement will be considered."

And in view of the regulations applicable, which provided:

"Any proposal received after the time fixed for opening should be returned to the bidder unopened. If, however, such proposal is the only one received, it may be considered as an informal proposal."

And as the provisions of paragraph 13 of Standard Government Instructions to Bidders (construction and supplies), Standard Form No. 22, hereinafter referred to, were not at that time applicable (the effective date of the use of the standard contract forms approved by the President on November 19, 1926, being set as January 1, 1927), the Secretary of the Interior requested an advance decision from the Comptroller General whether such late bid should be considered in awarding contract, and the Comptroller General, in his decision dated February 9, 1927 (A–17146), shown at 6 Comptroller General, 514, replied:

"With reference to the proposal submitted by J. L. Smith, it is shown by affidavit and otherwise that he appeared at the post office at Seattle, Wash., on Monday, December 27, 1926, before the hour of 7 p. m., and delivered to the registry clerk at the said post office a parcel or package containing his proposal addressed to the United States Bureau of Reclamation, Yakima Project, Kittitas division, Ellensburg, Wash.; that said parcel was registered and also marked 'Special delivery'; that the said parcel in due course of mail should have reached the place designated for the opening of bids before 10 o'clock a. m., December 28, 1926; that because the train leaving Seattle, Wash., at 11.50 p. m., on December 27, 1926, did not carry registered mail the said parcel was placed on a train leaving Seattle, Wash., for Ellensburg, the morning of December 28, 1926; that between the hours of 7 p. m., Monday, December 27, and 9.30 a. m., Tuesday, December 28, 1926, the said parcel was in possession of the Post Office Department, Seattle, Wash.; that said parcel was received by the postmaster at Ellensburg, Wash., December 28, 1926, at 1.56 p. m., and delivered by the special post-office messenger at Bureau of Reclamation Office, Ellensburg, Wash., at 2.35 p. m., December 28, 1926, or 4 hours and 35 minutes after the hour set for opening of bids.

"Paragraph 2 of the general conditions under the 'Specifications' provides:

" '* * * A bidder may withdraw his proposal before the expiration of the time during which proposal may be submitted, without prejudice to himself, by submitting a written request for its withdrawal to the officer who holds it. No proposal received after said time or at any place other than place of opening as stated in the advertisement will be considered. * * *.'

"You report that the department's administrative regulations applicable to such cases provide:

" 'Any proposal received after the time fixed for opening should be returned to the bidder unopened. If, however, such proposal is the only one received it may be considered as an informal proposal.'

"The facts set forth show your department in possession of information that the bids, excepting the one in question, are not the lowest prices for which certain of the work might be performed. It presents a condition under which there appears no administrative authority to disregard such information, but requires action, in the light thereof, to protect the interests of the United States. The matter resolves itself into simply that the circumstances are such no award may properly be made on the bids as received, so far as the work in question is concerned, the matters set forth disclosing that such work is possible of performance at lower prices."

The Secretary interpreted this decision to mean that the late bid should not be considered in making award, but that the work would have to be readvertised because such late bid disclosed the probability that the work made the subject of the advertisement could be performed at a saving over any of the bids received prior to the time specified for opening, or any combination thereof, and as this ruling apparently opened up new and unexpected avenues of required administrative procedure, among which, so far as the instant case was concerned, there were involved (*a*) delay in entering into contracts for the work until much favorable working weather was lost; (*b*) hardship and expense to bidders, involving loss of goodwill of those who submitted bids in good faith; and (*c*) the necessity of making a combination of bids in order to arrive at the lowest aggregate cost to the Government on all of the schedules of the advertisement, the Secretary requested a reconsideration of the former decision, and the Comptroller General, in decision dated March 15, 1927 (A–17146), unpublished, concluded that the late bid might be considered in making award, in view of the circumstances, and there follows that decision:

"There has been received your request of February 19, 1927, for reconsideration of decision of this office dated February 9, 1927, relative to the question whether you are authorized to consider in connection with entering into contracts for certain construction work in the Yakima Federal irrigation project a bid of J. L. Smith which had been registered and mailed under special delivery in sufficient

time to have been received prior to the hour fixed in the advertising for opening bids but which, due to some misunderstanding on his part about a particular train carrying registered mail, was not received until 4 hours and 35 minutes after the time fixed for opening bids. Upon the facts disclosed in the former submission it was held that a part of the work should be readvertised.

"It now appears that the bidders were placed at considerable expense and time in personally examining the site of the work last autumn before the snows and that to readvertise the work would create some dissatisfaction among the bidders and would operate to delay entering into contracts for the work until much favorable working weather was lost. The proposed work on the Kittitas Main Canal, division No. 2, and on the Tucker Creek siphon in the Yakima project was divided into nine schedules, and you suggest entering into a contract on the basis of existing bids with one bidder for schedule 3 and into a contract with another bidder for the other schedule, the Smith bid to be eliminated because it was not the lowest on all of the schedules, and, in fact, was lowest by $987.10 on one schedule only.

"The construction work appears to have been advertised under nine separate schedules, and it is understood that prospective bidders were requested in the advertisement to state whether their bids on the particular schedules were conditioned on being awarded a contract for all or any number of schedules. It is reported that only one of the bids was conditioned on being awarded all of the work, but that a few of the others were conditioned on being awarded certain particular schedules, making it necessary to compare different combinations of bids in order to determine the lowest aggregate cost at which the entire work can be accomplished. By using the Smith bid on schedules 3 to 9, inclusive, it is stated that a combination may be reached to give an aggregate price of $724,529.90 and by eliminating the Smith bid the next lowest combination of bids would give an aggregate price of $728,539, or a difference of $4,009.10.

"In view of the necessity of making a combination of bids to arrive at the lowest aggregate cost to the Government on all of the schedules, and of the impracticability at this time of readvertising the work, as well as hardship and expense to bidders, I have concluded that the Smith bid may be considered in making up the combination of bids and entering into contracts for the work. See in this connection Twenty-first Opinion Attorney General, 546, where in considering a similar question it was said:

"'To be sure, a proposal received after that hour [named in the specifications], under circumstances which warranted the belief that it had been prepared and submitted in the light of the proposals submitted by other bidders, which had been already opened and made known, should not be received or entertained; but a proposal received under conditions which precluded the possibility of such unfairness should not be rejected because it happens to be received by the board of award a few minutes after 2 o'clock p. m.'"

As stated, the standard contract forms were not in effect until January 1, 1927, and were not involved in the above case. The instructions on this subject are now contained in paragraph 13 of Standard Government Instructions to Bidders (construction and supplies), Standard Form No. 22, which provides:

"13. *Time for receiving bids.*—Bids received prior to the time of opening will be securely kept, unopened. The officer whose duty it is to open them will decide when the specified time has arrived, and no bid received thereafter will be considered, except that when a bid arrives by mail after the time fixed for opening, but before award is made, and it is shown to the satisfaction of the officer authorized to make the award that the nonarrival on time was due solely to delay in the mails for which the bidder was not responsible, such bid will be received and considered. No responsibility will attach to an officer for the premature opening of a bid not properly addressed and identified. Unless specifically authorized, telegraphic bids will not be considered, but modifications by telegraph of bids already submitted will be considered if received prior to the hour set for opening."

There have been two quite recent cases where the Comptroller General has passed upon the propriety of considering a bid received after the time fixed for opening, where the nonarrival on time was due to delay in the mails, for which the bidder was not responsible, and those cases will now be referred to

The John W. Danforth Co. protested against the awarding by the Navy Department of a contract to the R. H. Baker Co. (Inc.), of Cambridge, Mass., for installation of heating-plant equipment and piping in the naval training station hospital, Great Lakes, Ill., under advertisement and specifications for bids to be opened at 11 o'clock a. m., August 24, 1927, by the Bureau of Yards and Docks, Washington, D. C. The contract was awarded to the R. H. Baker Co. (Inc.), on October 13, 1927, and it was contended by the protestant that this was not lawful, in that at the designated time for opening bids 10 bids had been received, the bid of the protestant being the lowest, and that on the afternoon of the day of opening a lower bid was received from the R. H. Baker Co. (Inc.), which was considered. The Comptroller General, in his decision dated November 23, 1927 (A–20228), unpublished, stated:

"The protest based upon the contention that the bid of the R. H. Baker Co. (Inc.), was not received in time does not appear to be well founded as a matter of law, as provision was made in the Standard Government Instructions to Bidders, under which bids were advertised for and received in this case, for the reception and opening of bids delayed in the mails. Paragraph 13 thereof provides in part as follows:

"'*Time for receiving bids.*—Bids received prior to the time of opening will be securely kept, unopened. The officer whose duty it is to open them will decide when the specified time has arrived, and no bid received thereafter will be considered, except that when a bid arrives by mail after the time fixed for opening, but before award is made, and it is shown to the satisfaction of the officer authorized to make the award that the nonarrival on time was due solely to delay in the mails for which the bidder was not responsible, such bid will be received and considered. * * *'

"The Bureau of Yards and Docks, in a report on the receipt and consideration of the bid of the R. H. Baker Co. (Inc.), states that said bid appeared to have been posted in time, in the ordinary course of the mails, to have been received by the opening hour. Therefore, as the delay in receipt of this bid was due apparently and solely to delay in the mails, there would appear, in view of the instructions quoted above, to be no legal reason why same should not have been received and given consideration along with other bids or why said bid should have been rejected on the ground that it was not received at the hour of opening bids. Consequently there would appear to be no basis for contending that the consideration of the delayed bid of the R. H. Baker Co. (Inc), was illegal."

In this case the lowest bid, although received after the hour fixed for opening, was permitted to be considered and accepted for the reason that the nonarrival on time was due to delay in the mails, for which the bidder was held not responsible.

The other case involved the Bureau of Reclamation, and had to do with an invitation for bids for cement for use in construction work on the Kittitas division, Yakima project, Washington. In this case two bids were received approximately 30 minutes after the time fixed for opening, but on a showing that they were posted in time to have been received by the opening hour in the ordinary course

of the mails the Comptroller General permitted them to be considered, and his decision dated August 10, 1929 (A-28220), unpublished, is set out in full below:

"I have your letter of August 2, 1929, as follows:

"'On June 5, 1929, bids were opened at the Denver office of the Bureau of Reclamation for cement for the Kittitas division of the Yakima project. All bids received, and an abstract of same, showing delivered cost to the United States, are inclosed.

"'The bids of the International Portland Cement Co. and of the Lehigh Portland Cement Co. were received on the date of the opening, but approximately 30 minutes after the time of opening, which was stated in the advertisement as 3 p. m. There is usually a mail delivery in the Denver office shortly before 3 p. m. However, on this particular day, a delay in starting deliveries from the post office occurred, due to a temporary arrangement made at the post office so that the postman's deliveries would all be made within his 8-hour working period. All bidders present at the opening were called on the telephone and given the quotations of the two late bidders. Representatives of bidders present at the opening were notified that bids which were expected would be opened, if received on the next mail delivery, then overdue.

"'Paragraph 13 of Standard Form No. 22, "Standard Government Instructions to Bidders", provides in part as follows:

"'Bids received prior to the time of opening will be securely kept, unopened. The officer whose duty it is to open them will decide when the specified time has arrived, and no bid received thereafter will be considered, except that when a bid arrives by mail after the time fixed for opening, but before award is made, and it is shown to the satisfaction of the officer authorized to make the award that the nonarrival on time was due solely to delay in the mails, for which the bidder was not responsible, such bid will be received and considered."

"'Form 22 was not mailed with the advertisement in this case, which stated:

"'"Sealed bids * * * will be received at this office until 3 o'clock p. m. and then publicly opened for furnishing the following supplies," etc.

"'If the two tardy bids can not be considered, items B, C, D, E, F, G, H, I, J, K, L, and M would all be awarded to the Pacific Coast Cement Co., of Seattle, Wash., at the following delivered costs to the United States: Item B, $567.93; item C, $617.33; item D, $5,730.85; item E, $9,736.63; item F, $2,002.53; item G, $6,843.57; item H, $9,997.86; item I, $8,855.25; item J, $4,344.94; item K, $931.06; item L, $1,256.61; and item M, $31,541.82. If the two tardy bids can be considered, items B, D, F, and M would be awarded to the International Portland Cement Co. at the following delivered costs: B, $565.90; D, $5,659; F, $1,980.65; and M, $31,124.50. Also, if the two tardy bids can be considered, items C, E, G, H, I, J, K, and L would be awarded to the Lehigh Portland Cement Co., with the following delivered costs: C, $615.30; E, $9,620.30; G, $6,776.50; H, $9,836.75; I, $8,712.55; J, $4,280.50; K, $917.25; and L, $1,230.60. There would thus be a gross saving of $1,106.58 if the tardy bids are considered. It is desired to avoid, if possible, the rejection of all bids and readvertising, on account of the delay to the work which would probably result from this course.

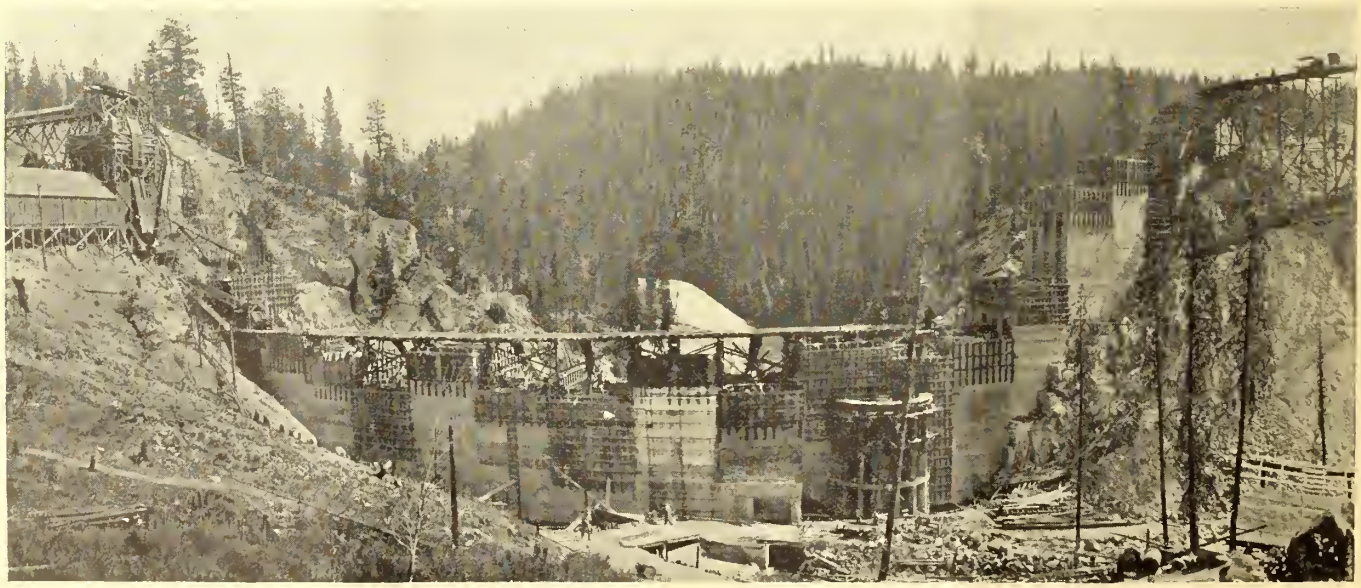
"'It is requested that you advise whether the two tardy bids should be considered under the circumstances above set out.'

"From the facts set forth in your letter it appears that the late bids of the International Portland Cement Co. and the Lehigh Portland Cement Co. were posted in time, in the ordinary course of the mails, to have been received by the opening hour, which would preclude any inference or suspicion that the said proposals were prepared and submitted in the light of proposals submitted by other bidders. While the Standard Form No. 22, 'Standard Government Instructions to Bidders', appears not to have been mailed with the advertisement in this instance, it is probable that the provisions thereof relative to the consideration of bids delayed in the mails were known to the bidders and that the bids were submitted in the light thereof. Furthermore, it appears that at the time set for opening of bids bidders present were advised that expected bids would be considered if received on the next mail delivery, it does not appear that consideration of the late bids would be prejudicial to the interest of other competitive bidders, but, on the contrary, that the consideration thereof would result in a substantial saving to the United States.

"Answering your question specifically, you are advised that the two late bids should be considered along with the other bids received."

ARMAND OFFUTT,
District Counsel.

The latest reports show on the Federal irrigation projects 39,970 irrigated farms, with a population of 157,088; 214 cities and towns, with a population of 473,073; 686 schools, 713 churches, and 130 banks, with deposits of $145,386,400 and 245,181 project and nonproject depositors.



Deadwood Dam, Boise project, Idaho (now nearing completion)

Recently Enacted Legislation

REHABILITATION OF BITTER ROOT PROJECT, MONTANA

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be appropriated from the reclamation fund established by the act of June 17, 1902 (Thirty-second Statutes, page 388), the sum of $750,000, or as much thereof as may be necessary to be used for the rehabilitation of the Bitter Root irrigation project in Montana.

Sec. 2. The Secretary of the Interior, hereinafter styled the Secretary, is authorized to use money thus appropriated for the following purposes:

(1) For liquidating bonded and other outstanding indebtedness of such irrigation project on such basis of valuation as the Secretary may regard as equitable, not exceeding 75 per centum of the principal and accrued interest, no portion of such outstanding indebtedness to be liquidated except a total outstanding indebtedness of such project is so liquidated;

(2) For doing or causing to be done under his supervision any construction, betterment, or repair work necessary to place the irrigation system of such project in good operating condition, and as provided for in the contract hereinafter required;

(3) For loaning to such irrigation district, hereinafter provided for, such funds as in the opinion of the Secretary are necessary for any construction, betterment, or repair work to place the irrigation system of such project in good operating condition.

Sec. 3. All funds so used or advanced shall be repaid to the United States within a period, to be fixed by the Secretary, of not more than forty years, with interest at the rate of 4 per centum per annum on the funds so used or advanced from the date of such use or advancement until repaid. Before any funds are so used or advanced a contract or contracts satisfactory to the Secretary shall be executed by an irrigation district, formed under State law, obligating such district to repay the funds so used or advanced as required by this act. Any contract so executed with such district shall require a lien on the land and on the irrigation systems of such project. The operation and maintenance of such project shall be continued by the authorities in charge under the supervision of the Secretary, so far as necessary to effectuate the purposes of this act.

Sec. 4. In case of default in the payment when due of any interest or other charges under any contract executed as herein provided there shall be added to the amount unpaid a penalty of one-half of 1 per centum of the amount unpaid on the 1st day of each month thereafter so long as such default shall continue, such penalties being in addition to the interest provided in section 3. The provisions of any contract executed hereunder may be enforced by suit or by the foreclosure of any lien in the manner authorized by the State laws applicable in similar cases. In addition to other remedies the Secretary, in any contract executed hereunder, may provide that in case of default for more than twelve months in the payment of any installment, the control, operation, and maintenance of the project may, in the discretion of the Secretary, be assumed by the United States and the delivery of water withheld until payments are duly made in accordance with the contract requirements.

Sec. 5. No funds shall be appropriated for the purposes herein authorized until investigation and examination shall have been made of all pertinent conditions surrounding such project and until the Secretary has made a report of his finding in writing to Congress that in his opinion by the action proposed the project can and will be placed upon a sound basis from a financial and economic standpoint so that the funds so used and advanced will be returned to the United States.

Sec. 6. The Secretary is authorized to perform any and all acts and to make and enforce all needful rules and regulations for effectuating the purposes of this act.

Approved, July 3, 1930.

Kittitas Main Canal Operates Successfully

The turning out of the water from the canal system this fall on the Kittitas division of the Yakima project terminates the first irrigation season under the partially completed $9,000,000 reclamation project in the Kittitas Valley. That the first year's operation has been most successful was attested by Dr. Elwood Mead, Commissioner of Reclamation, on his recent visit to the project. Local men who have been prominent in securing the Federal project development have nothing but praise to offer in the way the canal has served the settlers during the past irrigation season, when 142 farms having an area of 12,801 acres were supplied with irrigation works. In comparison with other reclamation projects it is outstanding in the one fact that it held water the first year, and without mishap or accident water was carried through the canal, down the spillways, through tunnels to the lateral system which terminates at the individual ranches.

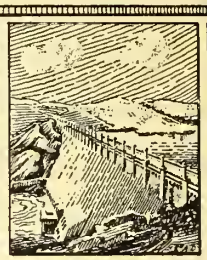
Officers of the Kittitas reclamation district realize what the foresightedness of the Government engineers has meant when they peered far into the future in visualizing the system. R. B. Williams, acting construction engineer, recently told a gathering of land settlers that the capacity of the main canal had been increased from its original conception to care for all possible emergencies and expansion programs not plainly evident now.

In 1929 the area on the Federal irrigation projects irrigated with water from Government works was 2,718,130 acres, an increase of 41,030 acres over that of 1928.

Digging potatoes on Garland division, Shoshone project, Wyoming. Yield 150 sacks No. 1 grade

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Stewart Mountain Dam, Salt River Project, Arizona

By C. C. Cragin, General Superintendent and Chief Engineer, Salt River Valley Water Users' Association

THE Stewart Mountain Dam and power plant constitute the third stage of the Salt River power and storage development, its construction closely following that of the Mormon Flat and Horse Mesa work. A secondary feature was the construction of approximately 600 miles of power lines in the Salt River Valley, with necessary substations, etc., for the service of electricity to individual farms. The development was financed by means of a $4,100,000 bond issue of the Salt River Valley Water Users' Association, of which, $2,300,000 was for the dam and plant, $1,200,000 for the valley electrification, and $600,000 for other purposes. The dam provides 70,000 acre-feet of regulating storage to increase the winter output of the three upper plants and creates 116 feet of head for the operation of a 17,500-horsepower hydroelectric plant. The total head now utilized for power, including Roosevelt, is 729 feet, out of a possible 832 feet. The aggregate storage of all reservoirs is 2,000,000 acre-feet and the combined generating capacity of all hydroelectric power plants of the project system, including 9,000 horsepower generated at four small plants on the canal system in the valley, is 103,000 horsepower.

TIME OF CONSTRUCTION

Construction was begun October 1, 1928, at which time the bond money became available, and was practically complete with the pouring of the last concrete in the body of the dam on March 8, 1930, although a few minor details remained to be done. All construction work was done by association forces, the equipment used at Horse Mesa being incorporated in the plant layout. Storage of water was begun February 21, 1930. The power plant first went on the line in a test run at 1.20 p. m. March 7.

LOCATION AND GEOLOGY

The dam is located 10 miles below Mormon Flat and 12 miles above Granite Reef Diversion Dam. Mesa, the nearest railroad point, is 23 miles distant. The adjacent mountains are much less rugged than at Horse Mesa or Mormon Flat. The dam was readily accessible by the construction of 15 miles of road over fairly open terrain, mostly flat or with easy grades.

The rock at the dam site is granite, which, when the weathered surface portion was removed, made an ideal foundation.

DESCRIPTION OF DAM

The width of the canyon (the river for a short distance at this point flowing south) is 1,100 feet from east to west at the top of the dam, and at the stream bed is 275 feet. The height from stream bed to water level is 119 feet, and a multiple arch was first considered for this site. Final exploration with diamond drills, however, developed a maximum depth of 90 feet to lowest bedrock from the stream bed. Plans were accordingly changed and the dam designed as a central arch section thrusting against massive reinforced concrete abutments; the gap between the abutments and the sides of the canyon being closed by gravity sections.

A gross length of 267 feet of the east gravity section forms an ogee spillway, being closed with 9 motor-operated steel Taintor gates, 23 feet high and 27 feet wide, the clear opening between piers and abutments being 243 feet.

The arch section was designed by the trial-load method, first used in the design of the Horse Mesa Dam. The maximum allowable stress was taken at 650 pounds per square inch. The span of the intrados of the arch at the top of the abutments is 475 feet. The thickness of the arch at the top is 8 feet. The minimum thickness of the arch at the lowest point in the base, 212 feet below the top of the coping, is 33 feet. The top of the abutments is elevation 1,530; the top of gravity sections and arch coping is elevation 1,535; spillway crest is elevation 1,506; top of Taintor gates elevation 1,529. The maximum height of abutments is 100 feet, and maximum height of gravity section 107½ feet. At the center of the arch, the face of the dam has an inclination downstream from the vertical, giving it a maximum overhang of 10 feet, which lessens toward the sides, becoming 0 at the top of the arch, 70 feet from each end.

The power plant consists of a single 17,500-horsepower generating unit, supplied by a 13½-foot penstock passing through the dam. It is located at the base of the arch adjacent to the west abutment. The normal head is 116 feet.

The dam has two 7-foot penstocks, one discharging through two 54-inch needle valves, originally installed at Roosevelt and later at Mormon Flat; the second 7-foot penstock being equipped with a butterfly valve on the downstream end. An 8-foot reserve penstock is also provided, fitted with a temporary bulkhead on the downstream end.

PRELIMINARY WORK

The work on the Stewart Mountain road was performed in record time. The construction included a temporary bridge across the Salt River at Blue Point, so that travel was possible to the dam site by automobile by November 1, 1928. The road was 30 feet wide, well graded, and was finally complete about December 1, so that the 40-mile drive from Phoenix to Stewart Mountain was possible in a little over an hour.

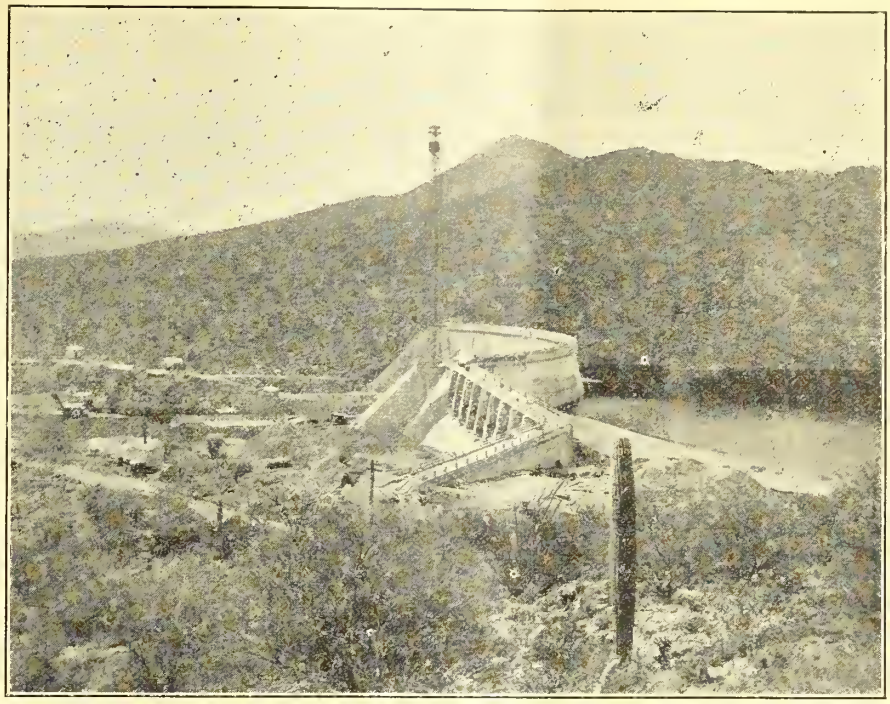
The site of the work afforded ample room for camp and construction layout, and it was possible to arrange and build a camp nearly ideal for the purpose. The main camp consisted of forty 6-man frame houses, occupying a well-drained, slightly sloping area in compact, orderly rows, in the vicinity of the mess house, commissary, time office, and other camp buildings. A camp police gang of three men kept the premises neat. Sanitary provisions at this camp were given more than usual attention and a first-aid station was maintained with a qualified interne on duty at all times. Water supply was pumped from a well located some distance from the river, chlorinated and piped to pressure tanks on the hillside above the camp. The camp was complete by December 1. Men with families provided their own quarters, which were located in a separate group, removed from the main camp. Third and fourth groups

were occupied by Mexican and Indian laborers.

Power for construction purposes was brought in by a wood-pole transmission line, constructed from Granite Reef. This line was permanently constructed for the outgoing voltage of 45,000 volts.

PLANT LAYOUT

The road grading was done by two 60-horsepower Best caterpillar tractors and graders, the finishing and maintenance being done with an Adams power grader. Excavating machines used on the job were one 2-yard Lidgerwood electric drag line; two 3-yard Bucyrus gasoline drag lines, one with 82-foot boom, carrying a 2-yard bucket, and the other with a 60-foot boom, carrying a 3-yard bucket; one 1-yard P. & H. gasoline machine, used either as shovel or drag line, and one ¾-yard P. & H. drag line. The two Bucyrus machines were purchased from the Bureau of Reclamation, reconditioned and partly rebuilt for this work. The main concrete plant consisted of two 1-yard Smith mixers, two 340-foot Insley steel towers, used as a double tower, operated from the same hoist, with gravel and sand storage bins, screening and washing plant, cement shed, with belt and bucket conveyors, all designed for complete mechanical handling of cement and aggregates. The plant was located immediately adjacent to the east abutment, close to the stream bed. The 20-inch Insley concrete chutes were suspended from three sky lines, anchored at their east ends to deadmen, passing over the top of the 340-foot double tower and at their west ends leading directly to anchorages at points on the side of the mountain. The main sky line consisted of 1,500 feet of 2½-inch plow steel cable. The other lines were of 2-inch cable, one 1,600 feet and the other 1,300 feet in length. Two 40-foot counterweights were used with the chute line. Three 24-inch belt conveyors were used for conveying aggregates from the screen to stock pile and mixers. The cement shed was located on the hillside above the screen. Trucks unloaded cement in sacks from the roadway at a level near the top of the shed, so that by means of chutes the sacks could be placed by gravity wherever desired. A 16-inch belt conveyor transported the cement from the shed directly to the mixers. The capacity of the plant was approximately 500 cubic yards per day of two shifts for each mixer. A ½-yard Smith mixer was kept available for odd jobs. On the west side of the river, close to the abutment, a 105-foot Insley steel guy derrick was mounted on an 80-foot tower and used in supporting concrete chutes and handling material. Six Kimball 18-inch screw pumps with 150-horsepower motors were used in dewatering the excavation and handling seepage water. The excavation for the base of the arch was carried on inside two rows of Lackawanna steel piling, driven to bedrock, which at one point was 90 feet below stream bed. The removal of surface material to a depth of 40 feet was accomplished by the drag lines, the sides of the pit standing at approximately 1½ to 1 slopes. From that level downward, the steel piling was used, supported as the excavation proceeded by heavy timber work carefully designed to give maximum working room. A 120-foot Insley steel guy derrick was used with a No. 7 McKiernan-Terry double-action steam hammer for driving the piling. The two rows of piling were spaced so as to give working room between the piling and the surface of the dam. The piling was pulled by the steam hammer as soon as the need for it had ceased, a part being used as reinforcing around the penstocks. The river was by-passed through a temporary flume 30 feet wide, 11 feet deep, and 450 feet long, located along the west side of the river.



Stewart Mountain Dam, Salt River project, Arizona

CONSTRUCTION

At the Stewart Mountain Dam it was possible to carry on operations over practically the entire length of the structure at the same time. The surface excavation and removal of checked, weathered, or disintegrated rock was completed at both ends of the dam, and concrete poured while excavation in the deep pit in the stream bed was still in progress. A short section of the base of the arch was poured with the ½-yard Smith mixer and used as a base for the by-pass flume, this pour being begun March 13, 1929. The first concrete placed with the main plant was in the east abutment, April 17, 1929; the last concrete in this abutment was poured October 7, 1929, and pouring on the east gravity section and spillway was completed December 26, 1929. The pouring on the west abutment began June 5, 1929. The west abutment and gravity section were completed September 12, 1929, and two sections of the arch ring, 155 feet in length over all, up to the by-pass flume, were completed September 18, 1929. Excavation in the lowest part of the stream bed was finished October 22, 1929, and concrete poured above stream bed to elevation 1420 December 9, 1929. The pouring of the part of the arch in which there was perceptible overhang was kept at approximately the same elevation in order to avoid tensile stresses in green concrete. The placing of concrete continued practically without interruption until completion. Total concrete in dam and power plant is 122,000 cubic yards.

COSTS

Final costs on this work are not available at this time.

New Map Available

A new map of the North Platte irrigation project, Wyoming, has just come from the press. It shows by means of four printings canals, drains, structures, highways, railroads, telephone and power transmission lines, irrigated areas, and a description of the project.

The map is numbered 23600, the scale is 3 miles to an inch, the size is 22 by 43 inches, and the price is 25 cents per copy.

Boulder Canyon Project Primer

(Continued from February, March, May, June, and August issues)

Q. Is the All-American Canal a part of the Boulder Canyon project?

A. Yes. There are three features included in the project—the Hoover Dam, a power plant, and the All-American Canal.

Q. What is the purpose of the canal?

A. To carry water from the Colorado River to the Imperial and Coachella Valleys in the southeastern part of California.

Q. Why the name, "All-American?"

A. Because the canal will be built entirely in the United States. The present Imperial Main Canal is largely in Mexico.

Q. What part of the $165,000,000 cost of the Boulder Canyon project is allotted to the canal?

A. Thirty-eight million five hundred thousand dollars, not including interest during construction. The Boulder Canyon project act of December 21, 1928, authorized the building of a main canal from the Colorado River to the Imperial and Coachella Valleys, but did not include in the authorized appropriation of $165,000,000 any money for the Coachella branch. The Colorado River Board estimated that $11,000,000 additional will be required to build the branch canal to Coachella Valey.

Q. Is this expenditure reimbursable?

A. Yes. Under a repayment contract with the irrigation districts the cost of the canals and appurtenant structures will be returned to the Government as provided in the reclamation law.

Q. Will the districts have to pay for the water?

A. There will be no charge to the two valleys for the use, storage, or delivery of water for irrigation or water for domestic purposes.

Q. Where is the proposed location of the intake?

A. Two locations are under consideration: (1) The Laguna Dam, about 10 miles northeast of Yuma, Ariz., the diversion point for the main canal of the Yuma (Federal) irrigation project; (2) a new diversion dam to be built about 5 miles north of Laguna to gain additional head with a resulting increase in area irrigable by gravity and a saving in excavation through the sand-hill country west of Yuma.

Q. How much water will the canal carry?

A. An initial diversion of 15,000 cubic feet per second is planned, which includes water supply for the Yuma project.

Q. What will be the dimensions of the canal?

A. A maximum section will be about 200 feet wide at the water surface, 134 feet bottom width, and 22 feet deep.

Q. What will be the length?

A. The All-American Canal will be 75 miles long. The Coachella branch will be 115 miles long.

Q. Are the sand hills to be crossed by the canal?

A. Yes. The canal for 10 miles will pass through a ridge of shifting sands. Here the deepest cutting is from 100 to 120 feet.

Q. What means are being considered to prevent blow sand from drifting into the canal?

A. Growing vegetation in a zone on each side of the canal; covering the dune sand with the coarser excavated material; spraying the sand with crude oil; maintaining a 30-foot berm on each side of the canal at mesa floor level.

Q. Will any portion of the canal be lined with concrete?

A. Four miles of the All-American and 33 miles of the Coachella branch will require lining.

Q. What principal structures are proposed?

A. Siphons or culverts will be required to carry the canal under the numerous washes, 10 on the All-American and 79 on the Coachella branch. The All-American Canal will have to be carried under the Alamo and New Rivers by siphons.

Q. What is the estimated total excavation?

A. Sixty to sixty-five million cubic yards, of which 4 per cent is rock.

Q. Are there opportunities for power development?

A. Yes. At Pilot Knob, about 7 miles west of Yuma and also at four drops on the canal.

Q. How much power can be developed?

A. About 60,000 kilowatts.

Q. Is additional water supply for the city of San Diego tied in to All-American Canal plans?

A. San Diego is considering the feasibility of having water carried through the projected All-American Canal and the Imperial irrigation district system, to be taken from some point on the west side of the Imperial Valley to San Diego.

Q. How much water is San Diego asking for?

A. One hundred and fifty-five cubic feet of water per second, together with the necessary energy to lift this water and deliver it to the coastal plain in San Diego County. The pumping lift is over 4,000 feet.

Q. What is the irrigable area of the Imperial irrigation district?

A. Five hundred and fifteen thousand acres.

Q. How much land is now irrigated?

A. From 400,000 to 450,000 acres.

Q. What are the principal crops?

A. Alfalfa, cotton, cantaloupes, lettuce, barley, corn, milo maize, and small fruits. About 30,000 carloads of cantaloupes and lettuce are shipped out each season.

Q. What is the growing season?

A. Three hundred and sixty-five days.

Q. What is the elevation of the valley?

A. From 250 feet below sea level at the Salton Sea to 0 or sea level. The adjoining mesas or highlands vary in elevation from 50 to 150.

Q. What is the rainfall in this section?

A. About 3 inches a year.

Q. How large is the Coachella Valley?

A. The gross acreage is 187,000 acres. Under the proposed canal system about 72,000 acres can probably be irrigated. There are now about 12,000 acres under cultivation.

Q. What is the status of lands in the valleys as to ownership?

A. Approximately 20 per cent public, 70 per cent private, and 10 per cent State, railroad, and Indian.

Q. What will be the total irrigable area in the Imperial and Coachella Valleys and adjacent mesas under the proposed canals?

A. The estimated area is 900,000 acres.

Madden Dam Studies

The engineers of the Denver office are preparing tentative designs and estimates for different types of dams for the proposed Madden Dam on the Chagres River, Canal Zone, Panama. Earthfill, concrete gravity, and Ambursen types are under consideration. Designs of 28 by 100 foot drum gates, a 25-foot diameter plate-steel penstock and manifold for the power plant, 84-inch internal differential needle valves, and 5 by 10 foot high-pressure emergency gates are in course of preparation. The bureau is doing this work at the request of the Panama Canal Commission.

Boulder Canyon Project Primer

The Boulder Canyon Project Primer (questions and answers), which has appeared in the February, March, May, June, August, and the current issue of the Era has been reproduced in circular form, and copies may be obtained from the Washington office.

Threshing wheat on South Side division, Minidoka project, Idaho

Notes for Contractors

Boulder Canyon project.—Proposals for furnishing power for construction purposes in connection with the construction of the Hoover Dam and incidental works were opened on September 29, 1930. The proposal submitted by the Southern Sierras Power Co., of Riverside, Calif., which was the lowest bid received, contemplated the construction of either one or two independent transmission lines from its main switching station at San Bernardino, Calif., to the dam site, the cost on the basis of the construction of only one transmission line being 1.73 cents per kilowatt-hour. Contract has been awarded to the Southern Sierras Co. under item No. 2, which calls for a single transmission line.

Work is in progress on the final designs for the portion of the railroad to the dam site to be constructed by the Government, the highway, office building, living quarters for Government employees, and other features of the town-site construction work and on the designs for the inclined hoist from the power plant to the rim of the canyon. Specifications will be prepared and invitations for bids issued as soon as the plans are completed.

Minidoka project.—Bids were opened on October 31, 1930, under specifications No. 514, for furnishing one 180-second-foot pumping unit and electrical apparatus for the new fifth unit in South Side pumping station No. 1.

Minidoka project, Gooding division.—Specifications (No. 491–D) have been issued covering the earthwork and structures between stations 3130+97 and 3317+21 of the Milner-Gooding Canal and the channel change and operation bridge at the Little Wood River. Bids were opened on October 24, 1930. The work involves the construction of about 3½ miles of the canal across the lava beds between the Little and Big Wood Rivers, requiring a large amount of rock excavation and the construction of concrete bench flumes and gunited rock sections. The construction of a concrete flume across the Big Wood River and a waste-way into the river and a channel change in the Little Wood River with a steel-girder bridge across the same are also included in the specifications.

Owhyee project.—Specifications have been issued covering the purchase of three 667-kv.-a. transformers and metering equipment for the Ontario-Nyssa substation.

Work is in progress on the final designs for structures on about 10 miles of the main canal on the Mitchell Butte division extending from Tunnel Canyon at the outlet end of tunnel No. 1 to Mitchell Butte. The structures will include a concrete siphon at Willow Creek; two high-head steel siphons, one at Snively Gulch and the other across the Owyhee River; three short concrete-lined tunnels and sections of concrete bench flume. Specifications will be issued as soon as the designs are completed.

Vale project.—Specifications have been prepared covering the earthwork and structures between stations 2060+58 and 2450 of the Vale Main Canal and the Bully Creek east bench lateral system. The principal items and estimated quantities involved are 572,000 cubic yards of canal and lateral excavation, 10,350 cubic yards of excavation for structure, 1,920 cubic yards of concrete, placing 110,000 pounds of reinforcement steel, 21,000 pounds of gates and structural steel, laying 5,620 linear feet of concrete pipe and erecting 23,000 feet board measure of timber in bridges.

Shoshone project, Wyoming.—The Westinghouse Electric & Manufacturing Co., of Pittsburgh, Pa., with a bid of $47,500 f. o. b. cars at factory, has been awarded the contract for furnishing electrical apparatus for the third unit of the Shoshone power plant, under specifications No. 513. The apparatus to be furnished comprises one 5,000-kv.-a. generator, four 1,667-kv.-a. transformers, two disconnecting switches, and switchboard and auxiliary equipment.

Diablo Dam in Washington Highest in World

Towering 389 feet above bedrock in Diablo Canyon on the upper Skagit River in the State of Washington, the Diablo Dam, just completed by the city of Seattle for power development, now has the distinction of being the highest dam in the world. It exceeds the Pacoima Dam in California by 9 feet, and our own Arrowrock, which for 15 years held the honor, by 40 feet.

The construction presented many obstacles to be overcome, which demanded engineering ability of the highest order. It was necessary to divert the river from its course through a narrow canyon, where at one point the walls were but 19 feet apart. In 1928, the first year of construction, the river rose 22 feet in 10 hours and poured over the cofferdam. This dam was 250 feet long and 40 feet in height. Twenty electric pumps were available to keep the water pumped out of the excavation; the lift for the pumps was 90 feet. The diversion tunnel, 650 feet long and 20 feet in diameter, was driven through solid rock. The upstream crib dam, faced with sheet steel, was built up of great fir logs, some of them 3 to 4 feet in diameter and 40 feet long, weighted to the gravel bed of the river with large rocks.

Two outstanding features of the work were the funicular or incline railway and the high-line cableway. The railway climbs a 68 per cent grade for 600 feet to connect the railroad in the valley with high-level trackage. A capacity of 158,000 pounds permits the handling of fully loaded freight cars. A 400-horsepower motor lifts the carriage through its nearly vertical raise in 6 minutes. The 1,985-foot high-line cableway of 2¼-inch wire rope was one of the longest ever used having such large capacity. The ends were anchored with a cylinder of concrete weighing 24 tons in the rock of each of the mountain walls. No towers were used, yet the lowest point of the sag in the line was 500 feet above the river. The capacity of the cableway was 15 tons, and a 300-horsepower motor was used for lifting and lowering the loads.

The dam is of the constant-angle arch

(Continued on p. 218)

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In preparing new land for irrigation it is seldom wise to complete the operation during the first season. The land is first roughly prepared and a cereal crop sown, irrigated in a crude way, and harvested. Meanwhile the roots of shrubs have decayed enough to be removed, filled-in soil has settled, and a permanent job of surface grading is possible, preparatory to seeding a perennial crop such as alfalfa.

Diablo Dam, Highest in World

(Continued from p. 217)

type. Construction was commenced in January, 1928, and completed in September, 1930. Some facts and figures regarding the project are as follows: Maximum height of dam, 389 feet; length of dam along crest, 1,180 feet; length of arch portion, 588 feet; bottom thickness, 140 feet; top thickness, 16 feet; solid rock excavation for dam, 230,000 cubic yards; concrete in dam, 350,000 cubic yards; quantity of cement used, 175,462,000 pounds or 1,750 carloads; reinforcing steel, 1,250,000 pounds; number of 20-foot spillway gate openings 19; length of 19½-foot diameter power tunnel 2,000 feet; reservoir storage capacity 90,000 acre-feet; length of lake created by dam 6 miles; maximum flood water flow of river 100,000 cubic-foot-seconds; ultimate power to be developed 225,000 horsepower; capacity of units now being installed 167,000 horsepower.

The Diablo Dam will be surpassed in height by the Owyhee Dam, now under construction by this bureau in eastern Oregon, which will be 405 feet in height; also by the proposed Hoover Dam, the principal feature of the Boulder Canyon project, which structure will rise over 700 feet above the foundation rock. The Owyhee Dam will probably be completed in 1932 and the Hoover Dam in 1938.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, returned to the office on October 13, after a trip to the coast. On October 1 and 2 he had conferences with representatives of the Imperial and Palo Verde districts in Los Angeles, on the subject of the all-American canal, and on October 7 he attended an executive session of the Hoover-Young Commission at Oakland.

Among the guests at Las Vegas, Nev., attending the exercises incident to the beginning of construction of Hoover Dam on September 17 were the following: Hon. Ray Lyman Wilbur, Secretary of the Interior, and Mrs. Wilbur; Dr. Elwood Mead, Commissoner of Reclamation; Carl R. Gray, president Union Pacific Railroad Co., and Northcutt Ely, executive assistant to Secretary Wilbur. The project was honored during the month by many other distinguished visitors.

E. K. Burlew, administrative assistant to the Secretary, arrived in Yakima, Wash., on September 21 and was shown over the reclamation and Indian projects. Mr. Burlew was accompanied by his son John.

A. D. Edmonston, T. D. Waddell, and Garfield Stubblefield, engineers from the California State engineer's office, were at Orland on September 27 in connection with exploration work at the alternate Iron Canyon dam site.

Miss Una H. Keck, secretary to the superintendent of the Yakima project, has been transferred to the Civil Service Commission as secretary to Hon. Thomas E. Campbell, president of the commission. Miss Keck's new appointment was effective October 1.

Victor Konn, manager, and I Rosenfeld, consulting engineer for the Rothschild Foundation in Palestine, visited the Owyhee and Yakima projects early in the month.

H. Ward Emery, former clerk on the Orland and Newlands projects and now employed by the water users of the latter project, was a project office caller at Orland in September.

Wilfred L. Rowe, assistant engineer, who has been employed on the Yakima project since 1910, was transferred to the Denver office the latter part of the month.

L. M. Lawson, commissioner, American section, International Boundary Commission at El Paso, Tex., was a caller on the Yuma project during the month.

L. C. Charlesworth, trustee and chairman of the irrigation council, and P. M. Sauders, project manager of the Lethbridge Northern Irrigation District, Lethbridge, Alberta, Canada, recently spent a few days on the Lower Yellowstone project.

R. F. Walter, chief engineer, left Denver on September 13, in company with Commissioner Elwood Mead, for an extensive field trip, visiting the Salt Lake Basin, Boulder Canyon, and Yuma projects. He also stopped at Los Angeles to confer with San Diego representatives and spent some time at Sacramento and vicinity.

C. M. Day, mechanical engineer, of the Denver office, visited the Belle Fourche and Shoshone projects the latter part of the month in connection with inspection of the outlet works at the Orman and Shoshone Dams and proposed repair work. He also inspected the installation and painting of the steel pipe siphons at Indian and Horse Creeks.

N. E. Fordham, master mechanic of the Denver office, spent the month in York, Pa., and Bedford, Ind., inspecting apparatus for the Yakima River crossing wasteway.

The appointment of Gordon B. Kaufmann, consulting architect at Boulder City, Boulder Canyon project, was approved during the month.

Among the September visitors on the Minidoka project were Sam Vance, jr., secretary of the Hillsdale Irrigation District; W. G. Hoyt, engineer of the Geological Survey; and Gregory G. Gegechkory, chief engineer, technical department, water economy service, Soviet Russia, of Georgia.

THE canning factory at Cowley, Shoshone project, has completed a very successful season in the canning of corn. The Rogers Seed Co., the Associated Seed Growers (Inc.), and the Big Horn Cooperative Association have their plants running to capacity, and occasionally two crews have to be employed to keep up with the large deliveries of beans.

T. S. Martin, master mechanic of the Denver office, was at San Francisco until the end of the month inspecting the high-pressure gates for the Owyhee Dam and the roller train castings for the Bully Creek and Fairman Coulee siphons. Mr. Martin left at the end of the month for the Salt Lake Basin project to inspect the installation of the outlet pipes and needle valves in the Echo Dam.

S. O. Harper, general superintendent of construction in the Denver office, left early in the month for Coalville, Utah, to inspect the Echo Dam. Mr. Harper stopped at the Grand Valley project on his return to Denver.

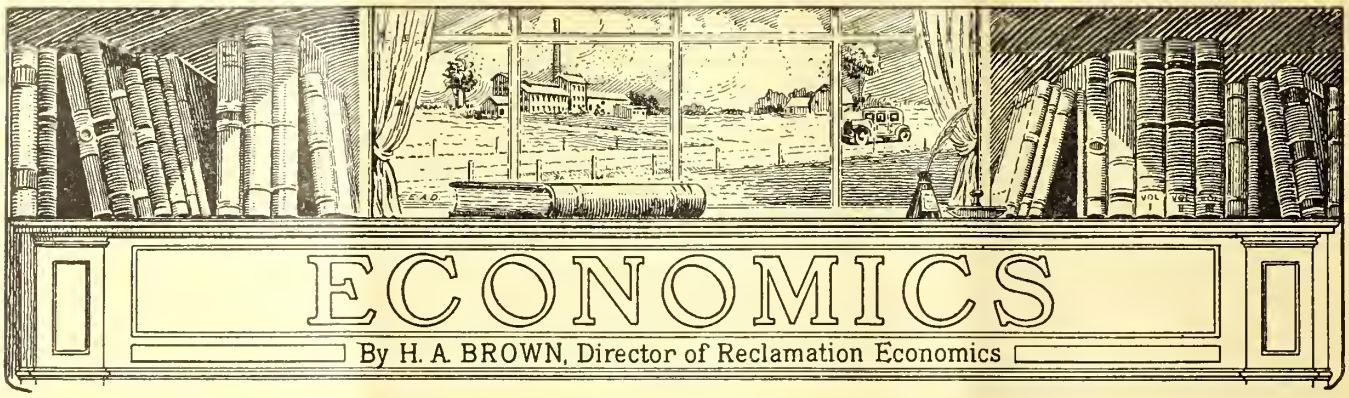
Hon. L. W. Douglas, Member of Congress, was a recent visitor on the Yuma project.

About the middle of the month G. F. Gleason, superintendent of power on the North Platte project, made a trip to the upper Platte watershed in company with Messrs. Cochrane, Whiting, and Willis. Mr. Gleason later attended a hearing regarding flood control of the North Platte Valley, held at North Platte, Nebr. by the Corps of Army Engineers.

George A. Beyer, photographer in the Washington office, spent the greater part of September and October on the Belle Fourche, Shoshone, and Yakima projects, where he took a number of still and motion pictures of farm and community activities.

S. O. Harper, general superintendent of construction in the Denver office, made a brief inspection of the Grand Valley project early in the month.

E. J. Jones, an experienced machinist, who served the Bureau of Reclamation in connection with the construction of Arrowrock Dam on the Boise project and Jackson Lake Dam on the Minidoka project, and during the past summer was in charge of the temporary gate operation at Echo Dam on the Salt Lake Basin project, has been appointed superintendent of the Weber River Water Users Association until payment to the United States for the works and water supply as provided in the contract between the United States and the association shall have been completed.



Federal Irrigation Projects a Mecca for Foreign Engineers and Economists

THE work of the Bureau of Reclamation, Department of the Interior, in the construction of storage and diversion dams, canals, and appurtenant structures for the irrigation of arid and semiarid land in the Western States and the settlement and economic development of the reclaimed land has for many years attracted the attention of engineers and economists of other nations engaged in similar work.

Each year scores of foreign specialists in these fields visit the Washington and Denver offices of the bureau and make extensive trips over the projects to study the engineering and economic problems of this country as reflected in the work of the bureau in helping men of small means to home ownership on irrigated land.

The magnitude of the work and the economic problems involved afford a fertile field for intensive study, and full advantage of the opportunities offered is taken by these foreign visitors. All of them know Dr. Elwood Mead, Commissioner of Reclamation, either personally or by reputation. For many their first visit to the Washington office is a renewal of an acquaintance with Doctor Mead, begun years ago in their own country. Doctor Mead's first-hand knowledge of irrigated agriculture and its problems is world-wide, and wherever he has been he has made lasting friendships.

FOREIGN VISITORS WELCOMED

Needless to say, all these foreign visitors receive a cordial welcome, and every facility of the Washington, Denver, and project offices is placed at their disposal to enable them to obtain a comprehensive view of the work. On leaving the Washington office each carries a letter of introduction from the commissioner to the Denver and other field offices of the bureau, thus insuring the hearty cooperation of the entire field force in making his study as profitable as possible. Every assistance is given in arranging the most convenient itineraries with a view to conserving the time and energy of these foreign friends. On the projects the superintendent or a qualified assistant takes them personally to every point of interest.

The following is a list of foreign engineers and economists who have visited the Washington and Denver offices and many of the Federal irrigation projects since the first of the year and the phases of the work in which they are particularly interested:

Miguel E. Montalva and Luis Eyquem, civil engineers, Santiago de Chile; irrigation methods.

S. A. Block, civil engineer, Netherland East Indies, hydraulic-fill dams and grouting of foundations of dams.

Prof. John G. Alexandrov, director of the state institute for hydraulic construction, chief engineer of hydraulic development on the lower Dnieper River, member of the board of state planning commission, Union of Socialist Soviet Republics; drawings and technical studies and the organization of the bureau.

George M. Hawthorne, Kerang, Victoria, Australia; management of water and growing of crops.

J. O. Broek, Holland; settlement and economic conditions.

Yoshio Machiyama, civil engineer, public works department, Japan; engineering structures.

Col. Noel M. Brazier, West Australia; irrigated agriculture and irrigation structures.

Toshikazu Hagiwara, engineer, bureau of public works, department of home affairs, Japan; engineering works under construction.

Theodor B. Nelson-Skorniakoff, Tashkent, Union of Socialist Soviet Republics, member of technical advisory staff for Turkestan Government, assistant to A. P. Davis; engineering structures.

T. K. Cheng, Commissioner, Chekiang Provincial Government, China, and chief of the construction department; irrigation methods.

Y. Y. Liu, associate director, Hangchow-Kianshan Railway, China; irrigation methods.

Alberto Decombe, director of reclamation, department of public works, and Severo Vidal, chief engineer, irrigation engineers; Santiago de Chile; construction works.

S. E. Fitz-Simon, director general of irrigation, Argentina; construction work and economic problems.

Victor A. Staricoff, Boris N. Abrahimoff Michiloff, Semyon Boskin, Serge G. Zapiometov, Hakop M. Hakopian, Alexander A. Gimsky, and Mrs. Tatiana A. Kolpakova, engineers, Union of Socialist Soviet Republics; construction and operation and maintenance methods.

K. C. Wu, engineer, Shanghai, China; construction and irrigation practice.

S. Hashimoto, department of reclamation, Seoul, Japan; irrigation.

J. O. Boving, consulting engineer, England; irrigation, drainage, and hydraulic pneumatic engineering.

Rev. John Flynn, Sydney, Australia; irrigation and settlement.

Takeo Misu, Secretary of Ministry of Agriculture and Forestry, Japan; irrigated agriculture.

Jack Mulholland, Queensland, Australia; irrigation.

P. P. Rotert, chief engineer, Dnieper district industrial development, Ukraine, Union of Socialist Soviet Republics; irrigation structure.

Roland P. Morris and Keith H. Price, engineers, Melbourne, Australia; construction.

Victor Konn, manager, and I. Rosenfeld, consulting engineer, of the Palestine Jewish Colonization Association, Haifa, Palestine; irrigation, drainage, and settlement.

Gregory G. Gegechkory, chief engineer of the technical department, water economy service, Socialistic Soviet Republic, Georgia; inspection of canals and structures.

Frederick G. Cross, assistant superintendent of operation and maintenance, department of natural resources, Canadian Pacific Railway; construction and irrigation.

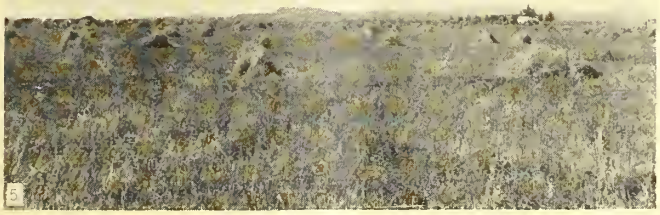
The numerous letters in the files of the bureau from these foreign visitors give ample testimony to the successful efforts of all bureau employees with whom they have come in contact to make their visit of real and lasting value,

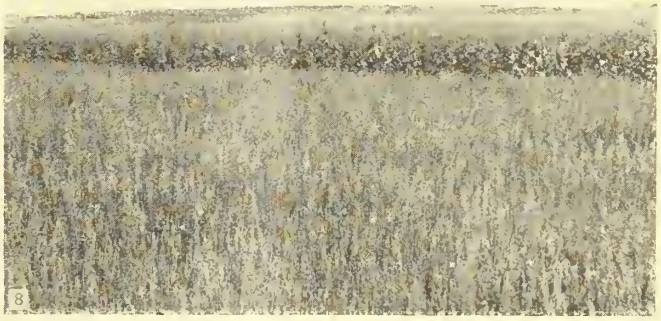
Water Supply of the Projects

September weather was ideal for crop maturity and harvest. Temperatures were about normal and precipitation generally deficient on all except the Klamath, Milk River, and Sun River projects, where heavy rains were experienced.

Irrigation demands were comparatively heavy for this season of the year, but fell off rapidly toward the end of the month, when cooler temperatures occurred. Minor irrigation shortages occurred on the Boise project.

Owing to the protracted drought of the past summer, irrigation reservoirs were drawn low and holdover storage is comparatively light. For reservoirs with concurrent data, the storage on September 30, 1930, was 2,958,000 acre-feet, compared with 3,651,000 acre-feet for the same date in 1929.



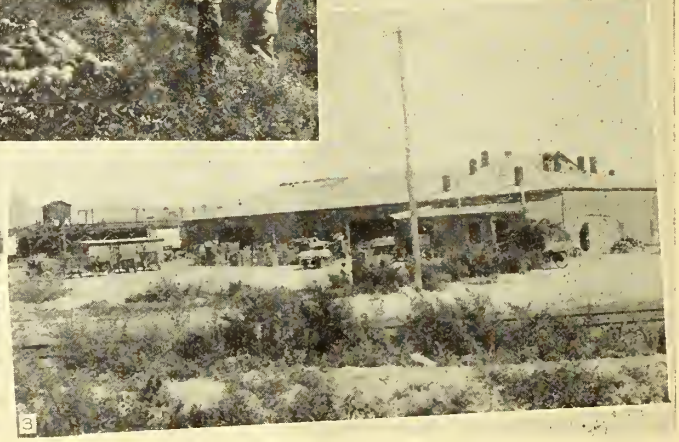


DEVELOPMENT ON RIVERTON PROJECT, WYOMING

1. Pilot Butte power house
2. Wind River diversion dam
3. Homestead buildings on ranch—first year from desert
4. Great Northern beans on new land
5. Oat field
6. Alfalfa haystacks
7. Potatoes produced on new land without fertilizer
8. Oats and corn produced without fertilizer

MELON GROWING A PROFITABLE INDUSTRY ON THE RIO GRANDE IRRIGATION PROJECT, NEW MEXICO-TEXAS

1 GATHERING HONEY-DEW MELONS
2. PACKING FOR SHIPMENT
3. PACKING AND STORAGE PLANT AT LAS CRUCES, NEW MEXICO



Rio Grande Project Yields Excellent Cantaloupe Crop

The Rio Grande project has just closed one of the most successful cantaloupe seasons in its history. The total shipments amounted to 667 cars, for which very satisfactory prices were received. Each year the distributors contract cantaloupe acreages in advance, based upon past demands, and thus both the production and price of the fruit are fairly well stabilized. The varieties of cantaloupes grown, the Pink Meats, Hearts of Gold, Perfectos, Hale's Bests, and Honey Dews, are superior in every point and ship perfectly to distant markets. The rich, sweet, firm pulp, the small space occupied by seeds, and the deep netting and creasing give them great vogue in the most exclusive metropolitan hotels. By reason of their excellent quality and also because the season falls between those of Arizona and Colorado, the eastern market takes a large share of Mesilla Valley's output. The cantaloupe acreage in the valley, not including the acreage of the smaller individual grower, has increased during the past year from approximately 1,400 to 1,800 acres. A good farmer should raise a minimum of 400 crates to the acre, for which the contractor agrees to pay 23 cents a crate. Deducting from this the cost of picking, packing, hauling, taxes, water rates, and the cost of production, the farmer has left a guaranteed price at the time of delivery of $18 to $23 an acre.

THE new canning factory at Hatch, in the Rincon Division of the Rio Grande project, is in operation and 400,000 cans of tomatoes were packed during the season.

Settlement Gains Impetus On Milk River Project

The month of September registered the greatest interest in settlement matters that the Milk River project has experienced for several years past. A settlement campaign was being conducted, and is still in progress, by the Malta Commercial Club and the Malta Irrigation District. Several large landowners have subdivided their farms and listed them for sale at attractive prices and terms of payment, resulting in the location of six new settlers. In addition many applications for farms have been received and negotiations are now in progress with at least five applicants. The Great Northern Railway has placed as settlement agent on the project a very capable farmer who is familiar with local conditions and whose function it is to bring the landowners and purchasers together. Excellent cooperation is being given this activity by the press, the local organizations, and landowners, and good results are anticipated.

Fall plowing has been started by at least one of the new settlers, and it is expected that others will prepare the land this fall for the 1931 beet crop. This movement is being stimulated considerably by the excellent crop which has already been harvested and the general evidence of good results from the season's operations as compared with the almost complete failure of adjacent dry-land crops.

As an evidence of the general improvement upon the project, the Strater community, located from 5 to 7 miles east of Malta, contracted with the Montana Power Co. for the construction of a power line from Malta to this locality for pumping and domestic use. This supplies cheap and dependable electrical energy to at least 12 farms and will be of material assistance in the development of this particular section, which is already the best improved of the project.

New Project Booklet Now Available

The latest edition of the booklet Federal Irrigation Projects is just off the press and copies are now available for distribution.

The booklet contains much valuable information to prospective settlers and should also be helpful in the dissemination of information relating to irrigated agriculture and development of the arid and semiarid West. In the forepart of the booklet is a table on the agricultural and climatic conditions of the projects, including a list of the principal products adapted to the respective localities. This is followed in sequence by an introductory statement on the achievements of the reclamation act, the cost of its administration and other financial statistics, suggestions to settlers, pictorial descriptions of the several methods of applying irrigation water, a list of the project offices, and brief articles relating to the individual projects. In the center of the booklet is an up-to-date map of the projects. The booklet is well illustrated throughout.

GRAND JUNCTION, headquarters of the Grand Valley project, seems now assured of natural gas. The Fulton Petroleum Co., which holds a franchise for the city, has recently brought in its first gas well on the Garmesa Dome near the project and intends to pipe the gas to Grand Junction. The capacity of the well is estimated at 30,000,000 cubic feet per day initial flow. The gas is said to be of good quality for municipal use.

MACHINERY and equipment have been installed in the new packing house built at Yuma by the Arlington Heights Packing Co., of Riverside, Calif., to handle the citrus fruit from Unit B and adjoining groves on the Yuma auxiliary project. This plant will probably start operations early in November.

THE 20-story Hilton Hotel in El Paso, Rio Grande project, is nearly complete and will be placed in service in the near future. This hotel occupies the site of the old 4-story Sheldon Hotel.

A LARGE motion-picture corporation of Hollywood has been filming exterior talking scenes in the sand hills some 15 miles west of Yuma. The plot deals with the French Foreign Legion. This company established a camp near the highway, well in the center of the sand hills. The stars and technical staff were housed in the local hotels. It is thought that another film company will soon start operations in this territory.

Excellent Corn Produced On Uncompahgre Project

During the fall of 1927 the Government dragline excavated a drainage ditch on the Uncompahgre project on the property of W. W. Price, one of the project water users and a director of the Uncompahgre Valley Water User's Association. This ditch reclaimed approximately 6 acres where water used to stand on top of the ground during the irrigation season, and in addition had the effect of protecting approximately 12 acres. The length of the ditch was 350 feet, the average depth of excavation amounted to about 8 feet through gravelly soil, and the cost of the work involved amounted to $142.50. The place was partially farmed last year and was planted to corn on or about May 15, 1930. The accompanying illustrations, which show the excellence of the crop, were taken on July 20.

Impressions of Irrigation in Peru

By J. Rupert Mason, San Francisco, Calif.

Peru has always been and is to-day an agricultural nation. Its earliest irrigation works were constructed and functioning before history can remember. Vast dams and canal systems were built by the ancient Incas, and the population of Peru then is estimated at 20,000,000. It was a civilization far advanced in many ways, as the people inhabiting the arid regions have nearly always been in all lands.

Experts estimate that Peru boasted a population of over 16,000,000 in the sixteenth century. There were then some 2,000,000 acres under irrigation. To-day there are less than 1,000,000 acres irrigated and the population is 5,000,000.

Peru's present irrigation policy adopted in 1919, after more than four centuries of no policy, recognizes the fundamental necessity of governmental leadership in coordinating technical and social processes to guarantee the success of irrigation undertakings, whose instruments are hydraulic works, but whose motives are the establishment of self-sustaining and permanent rural homes which are recognized as essential to lasting progress of any people.

Ex-President Leguia, of Peru, on the occasion of his ninth anniversary as chief magistrate of the Republic, said:

"With regard to irrigation, at first the scientific plans were objected to when the opening up and repairing of some old Inca channels were spoken of. Afterwards it was maintained that an outlay of 5,000,000 pounds would ruin the nation. Your calculations in the matter, Mr. Minister, show that the irrigation of the coast is a benefit to the community at large, and that it bears, moreover, the marks of becoming the most lucrative enterprise for the State. The objections are not ended, and at the last moment rises the violent opposition of the private against the general interest. It is said that irrigation, on account of competition, will lessen the value of large estates, and that the system of distribution of the lands amongst the workers that the Government has established brings about the emancipation of the present agricultural workers. The big landowner, almost feudal, condemns the irrigation works because they lessen the privilege of his riches and may emancipate the laborers. It is the eternal history of ignorance opposed to knowledge, of privilege opposed to liberty."

The mountain sides in Peru even offer mute evidence of the struggle for food centuries ago, when the Incas governed. Countless thousands of small terraces, often reaching to the mountain tops, all of which were irrigated with water from the great Andes Mountains nearby, and which rise some 22,000 feet above sea level. Many of these small terraces are still in use, and are the sole sources of food of many towns and settlements in the interior.

The amount of level irrigable land in Peru is very limited, and the works under construction by the Government make the cost of our Federal reclamation and irrigation district works appear low by comparison.

Peru, in common with all other nations, is suffering from the present unprofitable price levels of its products of the soil. Thousands of acres of long-staple cotton were unpicked this year. Yet the demand for small irrigated tracts, fairly close to cities, where families can grow their own vegetables, have their own chickens, cows, etc., far exceeds the supply.

SOME excellent yields of grain and alfalfa seed were produced this season on lands near Gooding, on the Gooding division of the Minidoka project, to which deliveries of water from the Snake River were made through the system of the North Side Canal Co.

Views of a productive cornfield on the Uncompahgre project, Colorado

Business of Farming Made Easy Through Vocational Education

Learning the "business of farming" is made the aim of thousands of boys and girls of school age. The Federal Government encourages vocational education. It has been accepted as a national policy.

FEDERAL INTEREST

The national vocational education act, popularly known as the Smith-Hughes Act, was passed by Congress in 1917. Under this act funds are made available to each State in the Union, on application, after meeting certain provisions of the act. The Federal Government's apportionment represents 50 per cent of the total expended, as each Federal dollar spent within a State must be matched by the State or some other agency in the State.

STATE RESPONSE

The States were very responsive in reaching out for the benefits of this legislation to their particular communities, as is evidenced by increased appropriations made annually and administered by the Federal Board of Vocational Education, an independent establishment, with headquarters in Washington, D. C., and having a very able staff of vocational education specialists.

THE STATES PAY

The Government's arrangement of requiring financial support by the State is a particularly happy one, as this has the effect of testing the sincerity and good faith of the States in asking this Federal aid for their territory.

VOCATIONAL AGRICULTURE

The effect of vocational education in agriculture comes more vividly to our attention because of the untold benefits that are derived in this field of endeavor, when specialized knowledge of improved and tested practices means sometimes the difference between success and failure on an irrigated farm.

FUTURE FARMERS OF AMERICA

Vocational agriculture supplies men to fill the ranks of farmers that are thinned out each year for one reason or another. Vocational agriculture also is very likely to develop leaders. Their examples of what can be accomplished with improved methods will encourage the specialized training of others. In this work theory and practice go hand in hand. Not only school work but work in the field is undertaken as part of the course of instruction.

With the knowledge of bigger and better ways of doing things comes confidence of the farm boy in himself and his work. It creates rural leadership. Very often he goes in for teaching in addition, and the program that started in a small way has gained an impetus that means new leaders and new followers.

IRRIGATION AGRICULTURE REQUIRES SPECIAL TRAINING

Agriculture accomplished under irrigation methods is vastly different from dry farming. There are overhead charges that must be met by returns from the soil, which do not exist under dry farming, and which mean a higher return per acre must be secured.

SETTLERS SELECTED FOR FITNESS

A settler desiring an irrigated farm must satisfy a board of examiners that he has the necessary experience and a minimum capital of $2,000, or its equivalent in farm equipment, before he can settle on one of our Federal irrigation farms. This does not necessarily mean that he has had special education in agriculture, but it does mean that he has the equivalent in experience.

WHO SEEKS VOCATIONAL AGRICULTURAL EDUCATION?

For the most part those applying for this training are the sons of farmers who have had experience on their fathers' farms and can see the benefit of organized instruction that would fit them to operate farms in keeping with the change in agricultural conditions.

NETWORK OF EDUCATIONAL AGENCIES

The system of agricultural education would seem to be quite complete; we have the Department of Agriculture and its vast army of 4–H Clubs, the agricultural colleges and the experiment stations, doing scientific investigational work. These colleges of agriculture train young men and young women in the science of agriculture. The agricultural vocational schools are providing systematic organized training for young men and women over 14 years of age who are not able to attend college. The Smith-Lever Act provides a system of practical instruction to men, women, boys, and girls through demonstrations, which is aimed to bring about immediate improvement in agriculture and in rural life. With these various agencies working in close cooperation and harmony, we are bound to build up a rural citizenship that will fill the ranks of farmers as they are depleted and place the agriculture of our country on a sound economic basis, insuring greater national growth and prosperity.

THE Shoshone project received considerable recognition in the Park County display at the recent Wyoming State Fair which was held at Douglas. The county received 25 first-prize ribbons, 14 second-prize, and 1 third-prize. The livestock judging team and the clothing demonstration team from this county also won first place in spite of the fact that competition was keener than ever before among the boys' and girls' 4-H Clubs.

The area cropped on the Federal irrigation projects in 1929 was 2,705,240 acres, an increase over 1928 of 23,970 acres.

What Hourly Value Has a Home Maker's Time?

The modern home maker knows that by doing her own housework she can save money for the family. Not all tasks, however, bring her an equal return for her labor. With some of them she has no choice; they must be done in the home, and she herself must do them. Others she does because she prefers her own product, or because she is obliged to be in the house during certain hours. But if she is debating whether or not to spend time on one job rather than another, she could make a wiser choice if she knew how much money she saved by doing each and how much time it took to make this saving.

Shall she make cotton school dresses for the children or buy them ready made? Do the washing or send it to the laundry? Bake or buy bread? Hire help for general housework or manage alone?

Convenient information on all these points is lacking. Each woman must be her own investigator. It is suggested that the home maker might start first with the tasks in which she is most interested and keep track of the time and money she spends in doing the work herself, including time and car fare spent in purchasing supplies and the cost of owning and running any equipment which she uses. She must then estimate what she would have spent had she bought a commercial substitute of a similar type and quality or hired a domestic worker whose results are about as good as her own. From the amount of money saved and the amount of time used she can calculate what she is worth per hour in this particular task.

The speed at which she works makes a difference in the value of her time per hour. In general she can expect to find a lower money value for her time when the use of machinery has cut factory labor costs to a minimum, as in ready-made cotton house dresses, which she can buy in good-enough quality for but little more than she would pay at retail for materials. Time would be better expended on work that saved a larger amount. For example piecework commercial laundering requires much ironing by hand; the housewife receives a good return on her labor by doing this work herself. Again, ready-made silk dresses are partly hand-finished, and if a woman sews nicely it may pay her to make such dresses at home and save this labor cost. Perhaps the greatest benefit of a study of the dollars and cents value of the home maker's time is a fuller appreciation of her contribution to the family finances.

FAVORABLE advertising and excellent crops on the Sun River project are responsible for the renewed interest in project settlement opportunities.

HARVESTING of potatoes on the Milk River project, which was practically completed at the end of the month, showed excellent yields. Present indications point to the best harvest in the history of the project on the Malta division.

Works now under construction under the 10-year program involve an ultimate expenditure of about $80,000,000. This provides for the completion of old projects and the construction of new projects under the reclamation act authorized by Congress. The Boulder Canyon project is being constructed with funds and under authority separate from the reclamation act.

A total of 1,965 acres of lettuce have been planted in the Yuma Valley this fall. This is an increase of 500 acres over last year's crop.

In the Billings district, Montana, this year the season, on the whole, was against the beet grower, particularly in the important spring months. Yet the 1930 crop promised a new record in high yield for economical production.

Shipments from Apple Orchards in Washington

During the course of Doctor Mead's recent inspection of the Columbia Basin project he visited an apple orchard at Quincy, Wash.

At the request of other members of the party, Doctor Mead was furnished recently by W. J. Molden, agent of the Great Northern Railway Co., with statistics of shipments of apples from two orchards in that locality. The statistics cover the period July 21, 1929, to July 21, 1930.

From the Apple Lane Orchard Co. outbound freight comprised 76 carloads of boxed and bulk culls, totaling 3,106,026 pounds, on which the freight charges were $32,300.44. Inbound freight weighed 748,995 pounds, on which the charges were $1,877.59.

From the Greer Bros. outbound freight comprised 106 carloads of apples, both boxed and bulk, totaling 3,966,732 pounds, on which the freight charges were $48,172.02. Inbound freight weighed 1,003,421 pounds, on which the charges were $1,963.80.

These figures cover only that part of inbound and outbound freight handled by the railroad. In addition, there were several cars of potatoes, alfalfa hay, wheat, soft fruit, watermelons, and cantaloupes, which were either handled by truck or disposed of locally.

Picking and boxing irrigated apples for transportation to packing house

Financial Operation of Boulder Canyon Project

THE Hoover Dam in the main stream of the Colorado River at Black Canyon and the power plant structures for the generation of electrical energy as a means of making the project a self-supporting and financially solvent undertaking are being constructed by the United States under a unique financial arrangement never before advanced for the construction of public works by the United States Government for the development and utilization of the resources of the Nation.

At one time during the investigation of the feasibility of this project there was advanced for financing the construction of the project the plan of a special bond issue by the United States Treasury. The financial plan for the construction of the Hoover Dam and power plants set up by the Boulder Canyon project act of December 21, 1928 (U. S. C. Supp. III, title 33, ch. 15A), is similar to financing an undertaking of this nature by a bond issue, when one considers the United States Treasury as the parent corporation purchasing the bonds of a subsidiary corporation, the Department of the Interior, to which has been delegated by Congress the rôle of a corporate entity promoting, constructing, and operating the project in such a manner as to make the project a self-supporting enterprise.

The Boulder Canyon project act authorizes the appropriation from time to time, out of any money in the Treasury of the United States not otherwise appropriated, of such money as may be necessary to carry out the purposes of the act, not exceeding in the aggregate $165,000,000. This may be viewed in the light of an authorization by the directors of the parent corporation—the United States Treasury—to purchase from time to time the promises to pay (bonds) of the subsidiary corporation—the Department of the Interior—in such amounts and within annual allotments set aside therefor as the subsidiary corporation deems necessary for the construction of the enterprise, the promises to pay being redeemable in the manner provided for by the act. The act also may be viewed in the light of empowering the Department of the Interior to issue bonds or promises to pay, secured by a mortgage on the properties to insure fulfillment.

The statute prescribes the interest rate which the promises to pay must bear; i. e., 4 per cent per annum. In order to give the enterprise an opportunity to get on a self-supporting basis before demands for interest shall fall due, the act authorizes sufficient aggregate appropriations to pay the interest during construction. This feature is similar to that provided by law in the majority of States where irrigation districts are formed for the construction of irrigation projects, the irrigation districts being permitted to include in the bond issue interest for the first one to four years.

Section 2 (a) of the act establishes a special fund to be known as the Colorado River Dam fund; section 2 (b) authorizes the Secretary of the Treasury to advance to the fund, from time to time and within the appropriations therefor, such amounts as the Secretary of the Interior may deem necessary for carrying out the provisions of this act; and provides that interest at the rate of 4 per cent accruing during the year upon the amounts advanced and remaining unpaid shall be paid annually out of the fund. The amounts advanced to the fund may be viewed in the light of proceeds from the sales of an authorized bond issue to be used to finance the construction of the dam and power plants and to pay annually to the United States Treasury interest on the funds advanced during the period of construction, the interest so paid to be capitalized.

Section 2 (d) provides that the Secretary of the Treasury shall charge the fund as of June 30 in each year with such amount as may be necessary for the payment of interest on advances made under subdivision (b) at the rate of 4 per cent per annum accrued during the year upon the accounts so advanced and remaining unpaid, except that if the fund is insufficient to meet the payment of interest the Secretary of the Treasury may, in his discretion, defer any part of such payment, and the amount deferred shall bear interest at the rate of 4 per cent until paid. Such an indebtedness is similar to an interest-bearing advance to a subsidiary by the parent corporation.

Whether the annual interest is paid out of funds advanced to the Colorado River Dam fund, as provided by section 2 (b) or deferred as provided by section 2 (d) the interest charge practically amounts to interest compounded annually.

The financial arrangement provided for by the act has advantages over that of a bond issue. The item of interest during construction should be considerably less than under a bond issue, where working funds would have had to be obtained by floating blocks of bonds aggregating $1,000,000 or more.

Although the construction of this project will be a drain on the Federal Treasury for a period of seven or eight years, this enterprise should be a source of revenue to the Treasury soon after the generation and delivery of power commences. Repayment, including interest thereon during the period of construction, is to be made, within 50 years from the date of completion of the works, of all moneys advanced to the fund, together with interest thereon at 4 per cent per annum. Several studies of the financial operation of the project have been made. During the 50-year period of amortization, which commences upon completion of the works, it is estimated that provisions now made for the sale of power and water will return approximately $373,500,000 of gross revenue, of which $230,000,000 will be returned to the Treasury of the United States to repay the advances for the construction of the dam and reservoir, outlet works, pressure tunnels, penstocks, and power-plant buildings, together with

(Continued on p. 228)

FINANCIAL OPERATION OF BOULDER CANYON PROJECT

[Firm power defined as 4,330,000,000 kilowatt-hours per year at completion of dam and decreasing at rate of 8,760,000 kilowatt-hours per year thereafter. Dump power average taken as 1,550,000,000 kilowatt-hours per year at completion of dam and decreasing at rate of 8,600,000 kilowatt-hours per year thereafter. Sale of water taken as 640 second-feet first year and increasing uniformly over a 16-year period to 1,500 second-feet]

Year after completion of dam	Units installed beginning of year	Millions of kilowatt-hours generated		Cost, including interest during construction at beginning of year less $25,000,000 flood control	Investment, including interest during construction at beginning of year less $25,000,000 flood control	Gross revenue from sale of firm power at 1.63 mills per kilowatt-hour	Gross revenue from sale of dump power at 0.5 mills per kilowatt-hour	Gross revenue from sale of water at 25 cents per acre-foot	Total gross revenue	Operation and maintenance	Depreciation reserve funded at 4 per cent	Interest on investment	Payment for retirement of investment	Total annual expenses	Surplus deficit	United States 62½ per cent share of surplus	Nevada and Arizona 37½ per cent share of surplus	Investment remaining in flood control at beginning of year	Interest on flood control	Net payment for retirement of flood control	Accumulated surplus in Colorado River Dam fund
		Firm power	Dump power																		
0	3	881	0			$1,436,030			$1,436,030	$135,872	$162,223		$1,137,935	$1,436,030							
1	6	1,978	1,307	$80,175,950	$79,038,015	3,224,140	$653,500	$116,800	3,994,440	138,275	166,567	$3,161,521	517,715	3,984,078	$10,362	$6,476	$3,886	$25,000,000	$1,000,000		
2	7	2,448	1,384	80,919,342	79,263,692	3,990,240	692,000	126,610	4,808,850	140,010	169,707	3,170,548	543,519	4,023,784	785,066	490,666	294,400	25,993,524	1,039,741		
3	12	3,555	1,533	82,674,910	80,475,741	5,794,650	766,500	136,420	6,697,570	142,675	174,522	3,219,030	577,872	4,114,099	2,583,471	1,614,669	968,802	26,542,599	1,061,704		
4	12	3,955	1,524	82,674,910	79,897,869	6,446,650	762,000	146,230	7,354,880	142,675	174,522	3,195,915	600,987	4,114,099	3,240,781	2,025,488	1,215,293	25,989,634	1,039,585		
5	12	4,121	1,516	82,674,910	79,296,882	6,717,230	758,000	156,040	7,631,270	142,675	174,522	3,171,875	625,027	4,114,099	3,517,171	2,198,232	1,318,939	25,003,731	1,000,149	$1,194,352	
6	12	4,286	1,507	82,674,910	78,671,855	6,986,180	753,500	165,850	7,905,530	142,675	174,522	3,146,874	650,028	4,114,099	3,791,431	2,369,644	1,421,787	23,805,648	952,226	1,417,418	
7	12	4,277	1,498	82,674,910	78,021,827	6,971,510	749,000	175,660	7,896,170	142,675	174,522	3,120,873	676,029	4,114,099	3,782,071	2,363,794	1,418,277	22,388,230	895,529	1,468,265	
8	12	4,269	1,490	82,674,910	77,345,798	6,958,470	745,000	185,470	7,888,940	142,675	174,522	3,093,832	703,070	4,114,099	3,774,841	2,359,276	1,415,565	20,919,965	836,799	1,522,477	
9	12	4,260	1,481	82,674,910	76,642,728	6,943,800	740,500	195,280	7,879,580	142,675	174,522	3,065,709	731,193	4,114,099	3,765,481	2,353,426	1,412,055	19,397,488	775,900	1,577,526	
10	12	4,251	1,473	82,674,910	75,911,535	6,929,130	736,500	205,090	7,870,720	142,675	174,522	3,036,461	760,441	4,114,099	3,756,621	2,347,888	1,408,733	17,819,962	712,798	1,635,090	
11	12	4,242	1,464	82,674,910	75,151,094	6,914,460	732,000	214,900	7,861,360	142,675	174,522	3,006,044	790,855	4,114,099	3,747,261	2,342,038	1,405,223	16,184,872	647,395	1,694,643	
12	12	4,234	1,455	82,674,910	74,360,236	6,901,420	727,500	224,710	7,853,630	142,675	174,522	2,974,409	822,493	4,114,099	3,739,531	2,337,207	1,402,324	14,490,229	579,609	1,757,598	
13	12	4,225	1,447	82,674,910	73,537,743	6,886,750	723,500	234,520	7,844,770	142,675	174,522	2,941,510	855,392	4,114,099	3,730,671	2,331,669	1,399,002	12,732,631	509,305	1,822,364	
14	12	4,216	1,438	82,674,910	72,682,351	6,872,080	719,000	244,330	7,835,410	142,675	174,522	2,907,294	889,608	4,114,099	3,721,311	2,325,819	1,395,492	10,910,267	436,411	1,889,408	
15	12	4,207	1,430	82,674,910	71,792,743	6,857,410	715,000	254,140	7,826,550	142,675	174,522	2,871,710	925,192	4,114,099	3,712,451	2,320,282	1,392,169	9,020,859	360,834	1,959,448	
16	12	4,199	1,421	82,674,910	70,867,551	6,844,370	710,500	263,950	7,818,820	142,675	174,522	2,834,702	962,200	4,114,099	3,704,721	2,315,451	1,389,270	7,061,411	282,456	2,032,993	
17	12	4,190	1,412	82,674,910	69,905,351	6,829,700	706,000	273,750	7,809,450	142,675	174,522	2,796,214	1,000,688	4,114,099	3,695,351	2,309,594	1,385,757	5,028,416	201,137	2,108,457	
18	12	4,181	1,404	82,674,910	68,904,663	6,815,030	702,000	273,750	7,790,780	142,675	174,522	2,756,187	1,040,715	4,114,099	3,676,681	2,297,926	1,378,755	2,919,959	116,798	2,181,128	
19	12	4,172	1,395	82,674,910	67,863,918	6,800,360	697,500	273,750	7,771,610	142,675	174,522	2,714,558	1,082,344	4,114,099	3,657,511	2,285,944	1,371,567	738,831	29,553	738,831	$1,517,560
20	12	4,164	1,387	82,674,910	66,781,604	6,787,320	693,500	273,750	7,754,570	142,675	174,522	2,671,264	1,125,638	4,114,099	3,640,471	2,275,294	1,365,177				3,792,854
21	12	4,155	1,378	82,674,910	65,655,966	6,772,650	689,000	273,750	7,735,400	142,675	174,522	2,626,239	1,170,663	4,114,099	3,621,301	2,263,313	1,357,988				6,056,167
22	12	4,146	1,369	82,674,910	64,485,303	6,757,980	684,500	273,750	7,716,230	142,675	174,522	2,579,412	1,217,490	4,114,099	3,602,131	2,251,332	1,350,799				8,307,499
23	12	4,137	1,361	82,674,910	63,267,813	6,743,310	680,500	273,750	7,697,560	142,675	174,522	2,530,713	1,266,189	4,114,099	3,583,461	2,239,663	1,343,798				10,547,162
24	12	4,129	1,352	82,674,910	62,001,624	6,730,270	676,000	273,750	7,680,020	142,675	174,522	2,480,065	1,316,837	4,114,099	3,565,921	2,228,701	1,337,220				12,775,863
25	12	4,120	1,344	82,674,910	60,684,787	6,715,600	672,000	273,750	7,661,350	142,675	174,522	2,427,391	1,369,511	4,114,099	3,547,251	2,217,032	1,330,219				14,992,895
26	12	4,111	1,335	82,674,910	59,315,276	6,700,930	667,500	273,750	7,642,180	142,675	174,522	2,372,611	1,424,291	4,114,099	3,528,081	2,205,051	1,323,030				17,197,946
27	12	4,102	1,326	82,674,910	57,890,985	6,686,260	663,000	273,750	7,623,010	142,675	174,522	2,315,639	1,481,263	4,114,099	3,508,911	2,193,069	1,315,842				19,391,015
28	12	4,093	1,318	82,674,910	56,409,722	6,671,590	659,000	273,750	7,604,340	142,675	174,522	2,256,389	1,540,513	4,114,099	3,490,241	2,181,401	1,308,840				21,572,416
29	12	4,085	1,309	82,674,910	54,899,299	6,658,550	654,500	273,750	7,586,800	142,675	174,522	2,194,768	1,602,134	4,114,099	3,472,701	2,170,438	1,302,263				23,742,854
30	12	4,076	1,301	82,674,910	53,267,075	6,643,890	650,500	273,750	7,568,050	142,675	174,522	2,130,683	1,666,219	4,114,099	3,453,951	2,158,719	1,295,232				25,901,573
31	12	4,067	1,292	82,674,910	51,600,856	6,629,210	646,000	273,750	7,548,960	142,675	174,522	2,064,034	1,732,868	4,114,099	3,434,861	2,146,788	1,288,073				28,018,361
32	12	4,058	1,283	82,674,910	49,837,988	6,614,540	641,500	273,750	7,529,790	142,675	174,522	1,994,720	1,802,182	4,114,099	3,415,691	2,134,807	1,280,884				30,183,168
33	12	4,050	1,275	82,674,910	48,065,806	6,601,500	637,500	273,750	7,512,750	142,675	174,522	1,992,632	1,874,270	4,114,099	3,398,651	2,124,157	1,274,494				32,307,325
34	12	4,041	1,266	82,674,910	46,191,536	6,585,839	633,000	273,750	7,493,580	142,675	174,522	1,847,661	1,949,241	4,114,099	3,379,481	2,112,176	1,267,305				34,419,501
35	12	4,032	1,258	82,674,910	44,212,295	6,572,160	629,000	273,750	7,474,910	142,675	174,522	1,769,692	2,027,210	4,114,099	3,360,811	2,100,507	1,260,304				36,520,008
36	12	4,023	1,249	82,674,910	42,215,085	6,557,490	624,500	273,750	7,455,740	142,675	174,522	1,688,603	2,108,299	4,114,099	3,341,641	2,088,526	1,253,115				38,608,534
37	12	4,015	1,240	82,674,910	40,106,736	6,544,450	620,000	273,750	7,438,200	142,675	174,522	1,604,271	2,192,631	4,114,099	3,324,101	2,077,563	1,246,538				40,686,097
38	12	4,096	1,232	82,674,910	37,914,155	6,529,780	616,000	273,750	7,419,530	142,675	174,522	1,516,566	2,280,336	4,114,099	3,305,431	2,065,894	1,239,537				42,751,991
39	12	3,997	1,223	82,674,910	35,613,811	6,515,110	611,500	273,750	7,400,360	142,675	174,522	1,425,353	2,371,549	4,114,099	3,286,261	2,053,913	1,232,348				44,805,904
40	12	3,988	1,215	82,674,910	33,232,267	6,500,440	607,500	273,750	7,381,690	142,675	174,522	1,330,491	2,466,411	4,114,099	3,267,591	2,042,244	1,225,347				46,848,148
41	12	3,980	1,206	82,674,910	30,795,856	6,487,400	603,000	273,750	7,364,150	142,675	174,522	1,231,834	2,565,068	4,114,099	3,250,051	2,031,282	1,218,769				48,879,430
42	12	3,971	1,197	82,674,910	28,230,788	6,472,730	595,500	273,750	7,344,980	142,675	174,522	1,129,232	2,667,670	4,114,099	3,230,881	2,019,301	1,211,580				50,898,731
43	12	3,962	1,189	82,674,910	25,563,118	6,458,030	594,500	273,750	7,326,310	142,675	174,522	1,022,525	2,774,377	4,114,099	3,212,211	2,007,632	1,204,579				52,906,363
44	12	3,953	1,180	82,674,910	22,788,741	6,443,390	590,000	273,750	7,307,140	142,675	174,522	911,550	2,885,352	4,114,099	3,193,041	1,995,651	1,197,390				54,902,014
45	12	3,945	1,172	82,674,910	19,903,389	6,430,350	586,000	273,750	7,290,100	142,675	174,522	796,136	3,000,766	4,114,099	3,176,001	1,985,001	1,191,000				56,887,015
46	12	3,936	1,163	82,674,910	16,902,623	6,415,680	581,500	273,750	7,270,950	142,675	174,522	676,105	3,120,797	4,114,099	3,156,851	1,973,032	1,183,819				58,850,047
47	12	3,927	1,154	82,674,910	13,781,826	6,401,010	577,000	273,750	7,251,760	142,675	174,522	551,273	3,245,629	4,114,099	3,137,661	1,961,038	1,176,623				60,821,085
48	12	3,918	1,146	82,674,910	10,536,197	6,386,340	573,000	273,750	7,233,090	142,675	174,522	421,448	3,375,454	4,114,099	3,118,991	1,949,369	1,169,622				62,770,454
49	12	3,910	1,137	82,674,910	7,160,743	6,373,300	568,500	273,750	7,215,550	142,675	174,522	286,430	3,510,472	4,114,099	3,101,451	1,938,407	1,163,044				64,708,861
50	12	3,901	1,129	82,674,910	3,650,271	6,358,630	564,500	273,750	7,196,880	142,675	174,522	146,011	3,650,271	4,113,479	3,083,401	1,927,126	1,156,275				66,635,987

"0" year represents year before completion of dam.
Allocation to contractors taken as follows: City of Los Angeles, 37 per cent; Metropolitan Water District, 36 per cent; Southern California Edison Co., 27 per cent.
Absorption period for each contractor taken as 55 per cent of allotment first year of use, 70 per cent second year, 85 per cent third year, and 100 per cent thereafter.
First year of use for city of Los Angeles is year before completion of dam, for Metropolitan Water District the first year following the city, and for the Southern California Edison Co. the third year following the city.
It is assumed that no dump power is sold until the first year after completion of dam.

Where Are the Reclamation Engineers of Yesterday?

A. H. Ayers is superintendent for Charles & George K. Thompson, contractors, of Los Angeles, Calif. Jeremiah Ahern lives at Dixon, Calif. Lester V. Branch is with the New England Power Construction Co. at St. Johnsbury, Vt. Joseph L. Burkholder is now chief engineer of the Middle Rio Grande conservancy district at Albuquerque, N. Mex. Ernest H. Baldwin has retired and lives at Springfield, Mo. J. B. Bond is chief field engineer with the Metropolitan Water District, Los Angeles, Calif. A. N. Burch is engineer on irrigation investigations with the division of water resources, Department of Public Works, Sacramento, Calif. Morris Bien lives at Takoma Park, Md. Cyrus C. Babb is hydraulic enginner, United States Engineer office, Charleston, S. C. E. C. Bebb is engineer with the Federal Power Commission, Washington, D. C. John S. Conway, formerly Deputy Commissioner of Lighthouses at Washington, D. C., has retired. Francis T. Crowe is construction engineer for the Utah Construction Co., now building the Deadwood Dam on the Boise project. William S. Cone is engaged in consulting work at Los Angeles, Calif.

Ralph M. Conner is superintendent of construction with the J. G. White Engineering Corporation on irrigation work in Mexico, and lives in Laredo, Tex. William H. Code is a member of the firm of Quinton, Code & Hill-Leeds & Barnard, consulting engineers, with offices in Los Angeles, Calif. Daniel W. Cole is with the Electric Bond & Share Co. of New York City. Harold Conkling is deputy in charge of water rights, division of water resources, Department of Public Works, Sacramento, Calif. L. J. Charles is with the United States Bureau of Public Roads at St. Paul, Minn. Jacob C. Clausen is engineer with the Municipal Securities Co., Los Angeles, Calif. Arthur P. Davis is chief construction engineer, Sradazvodhoz, at Tashkent, Turkestan, Union of Socialistic Soviet Republics. The Sradazvodhoz corresponds to our Bureau of Reclamation. Barry Dibble is engaged in private practice in Los Angeles, Calif., and lives in Redlands.

John F. Richardson is with the State highway commission at Mariposa Calif. Oliver T. Reedy is on highway work at Denver, Colo. D. W. Ross is a consulting engineer located at San Antonio, Tex.

J. M. Gaylord is with the Southern California Edison Co., in California. Julian Hinds is designing engineer with the Metropolitan Water District, Los Angeles, Calif. Frank W. Hanna is chief engineer and general manager of the East Bay municipal utility district, Oakland, Calif. C. H. Howell is chief engineer with the J. G. White Engineering Corporation on irrigation work in Mexico. Louis C. Hill is a member of the firm of Quinton, Code & Hill-Leeds & Barnard, consulting engineers, with offices in Los Angeles, Calif. Ernest G. Hopson has offices in the Railway Exchange Building at Portland, Oreg. Joseph B. Lippincott is a consulting hydraulic engineer at Los Angeles, Calif. J. L. Lytel is with Dwight P. Robinson & Co. at Buenos Aires, Argentine Republic.

L. M. Lawson is the American representative on the International Boundary Commission, United States-Mexico, and lives in El Paso, Tex. John S. Longwell is assistant to Mr. Hanna, chief engineer and general manager of the East Bay municipal utility district, Oakland, Calif. James Munn is chief of construction with the Metropolitan Water District, Los Angeles, Calif. E. A. Moritz is a consulting engineer and lives at Effingham, Ill. C. J. Moody is with the United States Indian Service at St. Ignatius, Mont. James H. Miner is with the United Engineers & Constructors (Inc.), with headquarters at Philadelphia, Pa. Daniel W. Murphy is a consulting engineer in Los Angeles, Calif.

Ira W. McConnel is vice president of Dwight P. Robinson & Co. (Inc.), also United Engineers & Constructors (Inc.) with headquarters in Philadelphia, Pa. Oro McDermith is with Dwight P. Robinson & Co. at Buenos Aires, Argentine Republic. Frederick H. Newell is engaged in private practice with an office in Washington, D. C. Herbert D. Newell is with the War Department at Vicksburg, Miss. J. H. Quinton is a member of the firm of Quinton, Code & Hill-Leeds & Barnard, consulting engineers, with offices in Los Angeles, Calif. Charles H. Paul is a consulting engineer at Dayton, Ohio, and managing director of the Dayton Industrial Association. Ralph H. Parshall is irrigation engineer, United States Department of Agriculture at Fort Collins, Colo. Walter W. Patch is a consulting engineer and lives in Hollywood. Calif.

O. H. Ensign is president and chief engineer of the Ensign Carbureter Co. at Los Angeles, Calif. Chester C. Fisher is construction engineer, Zakvodhoz, at Tiflis, Union of Socialistic Soviet Republics, and engaged in irrigation work. William A. Farish is chief engineer of the Wittman projects, Wickenburg, Ariz. Ralph H. Fifield is a consulting engineer and has an office in Billings, Mont. John E. Field has an office in the Kittredge Building, Denver, Colo.

Howard S. Reed is doing consulting work in Phoenix, Ariz. Wendell M. Reed is with the United States Indian Service at Washington, D. C. Hiram N. Savage is engineer in charge of municipal water supply, San Diego, Calif. Walter W. Schlecht's present address is Brooklyn, N Y.

George E. Stratton is with the Bureau of Lighthouses at Washington, D. C. Chester W. Smith lives at Newburyport, Mass. Robert S. Stockton is with the Canadian Pacific Railway at Strathmore, Alberta, Canada. Roy M. Snell is project engineer, Toro Negro power project, Villaba, P. R. George L. Swensden is chief engineer and general manager of the Fresno irrigation district at Fresno, Calif. Ross K. Tiffany is engaged in consulting work at Olympia, Wash. Edwin D. Vincent is a consulting engineer in Los Angeles, Calif.

Frank E. Weymouth is chief engineer of the Metropolitan Water District with headquarters at Los Angles, Calif. Andrew Weiss is resident engineer with the J. G. White Engineering Corporation on irrigation work at Estacion Cameron, N. L., Mexico. Charles P. Williams is in private practice in Los Angeles, Calif. John T. Whistler lives in Delhi, Calif. Charles E. Wells is doing consulting work at North Adams, Mass. W. L. Whittemore is with the United States Engineer Office at Chattanooga, Tenn. Walter Ward is president of the Ward Engineering Co. at San Francisco, Calif.

As engineers move on short notice, this list at the time of printing may in a few instances be incorrect as to the present whereabouts of these former Bureau of Reclamation employees.

Financial Operation of Boulder Canyon Project

(Continued from p. 226)

interest at the rate of 4 per cent per annum, estimated at $82,675,000.

Several studies of the financial operation of the project have been made upon various assumptions of operation. The tabulation accompanying this article sets out the adopted plan of financial operation.

THE New Mexico College of Agriculture and Mechanical Arts at Las Cruces, Rio Grande project, has added two buildings which will be placed in use very shortly. One, Foster Hall agriculture and biology building, is a big improvement and the most imposing building on the campus.

U. S. GOVERNMENT PRINTING OFFICE: 1930

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

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George O. Sanford, Assistant Director of Reclamation Economies

Denver, Colorado, Wilda Building

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Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills		do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superintendent	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	Acting supt	W. J. Chiesman	E. A. Peek	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	Superintendent	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	Constr. engr	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	Superintendent	N. O. Anderson	Denver office	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum.	Acting constr. engr.	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	Superintendent	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Willians	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Acting constr. engr.	Ronald E. Rudolph	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and powers system.
[5] Acting.
[6] Storage, main, and Tule Lake divisions.
[7] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] Reservoir, power plant and Willwood division.

Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen. supt. and chief engr.	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Ft. Belknap irrigation district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Ft. Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Ft. Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Ft. Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gerig, Nebr.
Do	Goshen irrigation district	Torrington, Wis	A. B. Reeves	do	Mrs. Nelle Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr.	D. R. Dean	do	Mrs. M. J. Thompson.	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Brecze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	

THE FRUITS OF AN IRRIGATED GARDEN ON THE MILK RIVER PROJECT, MONTANA

NEW RECLAMATION ERA

VOL. 21, NO. 12 DECEMBER, 1930

GIBSON DAM, SUN RIVER PROJECT, MONTANA

RECLAMATION

Shall Reclamation Be Continued?

FROM time to time there has been agitation of the fundamental question of whether or not the Federal Government should continue in the reclamation of arid lands. Objections have been founded chiefly on misconceptions of the supposed competition between these new lands and the older farming regions which are already burdened with overproduction. Actually only about seven-tenths of 1 per cent of the Nation's cultivated area is included in reclamation projects. The most important crops produced on reclamation projects are, in the main, of such a character and come into production at such a time that there is no substantial competition with eastern producing States. Reclamation is an investment in national wealth from which the Nation derives large returns. Last year the crops produced were worth over $160,000,000, or, roughly, the entire construction cost of all reclamation projects, exclusive of the cost of their operation and maintenance. The cumulative value of crops grown on Federal reclamation projects exceeds $1,600,000,000. Reclamation's 40,000 farms have a population of nearly 160,000 and, in addition, support 214 project cities and towns, with an additional population of over 470,000. About $250,000,000, including operation and maintenance charges, have been expended by the Federal Government for reclamation projects which has increased the value of the land and other properties on farms and in towns within reclamation enterprises by at least a billion dollars, or four times all Government expenditure.

Reclamation is the backbone of the far West. The fundamental question as to whether or not it shall continue should be answered in the affirmative so long as development is carried out along sound economic lines. In early days the brilliant engineering achievements of the Reclamation Service surpassed the attention given economic considerations, which was the natural result of lower per-acre costs then obtainable. There was a feeling that the settler would in some way dig in and succeed. In some areas there has resulted delay, disappointment, and failure. In others, the lower engineering costs of those days rendered economic considerations less important than at present. To-day the easy things have all been done. Irrigation costs ranged from $25 to $50 an acre in the beginning. The new projects range from $75 to $200. Hydroelectric power is one source of revenue to assist in meeting these costs. Contribution from benefited cities and areas protected from floods should be another source.

Extract from the Annual Report of the Secretary of the Interior for the fiscal year ended June 30, 1930.

NEW RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

RAY LYMAN WILBUR
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 21 December, 1930 No. 12

Interesting High Lights on the Federal Reclamation Projects

THE latter part of the month the lands of the Oregon & Western Colonization Co. on the Bully Creek East Bench, the last holdings of this company on the Vale project, were placed on sale. Numerous inquiries were received for literature regarding the project lands and 33 prospective settlers visited the office of the representative of the Vale-Owyhee Government Projects Land Settlement Association, as a result of which 464 acres of private land were sold to six purchasers.

DURING the month work started on a large packing shed and warehouse along the Southern Pacific tracks immediately south of the passenger depot at Yuma.

THE foreign market for fruit continued good on the Okanogan project and the domestic market showed some increase at the close of the month.

EARLY in October a shipment of 24 tons of honey left Fruitdale, Belle Fourche project, for Jersey City, N. J. This is a portion of about eight carloads of honey produced annually in the apiaries of the Belle Fourche Valley.

THE Currie canning factory at Delta, Colo., Uncompahgre project, had a good run from July 14 to the close of October. The season opened with table beets, 283 tons of which were canned. During a 6-week period the factory worked 24 hours a day in order to take care of 650 tons of string beans, most of which came from the Montrose district. The tonnage of carrots canned will probably reach 40 tons. It is estimated that around 300 tons of pumpkins were canned. This factory gave continuous employment to 60 to 75 persons during the canning season all of whom were residents of Delta.

MORE than 20 planes, members of the annual California goodwill tour, paid the Yuma project a brief visit early in November. The planes landed at Fly Field on the Yuma Mesa. This was the only stop made by the tour outside the State of California. Pictures were taken from the air of the newly improved field by members of the tour.

IT is estimated that sugar beets produced on the Uncompahgre project this fall will run close to 100,000 tons; that for a period of three to four months the operation of the factory will give continuous work to 10 men in the office and 170 men in the factory; and for a period of one and one-half to two months will employ on the beet dumps approximately 100 additional men.

THE harvesting of the fifth crop of alfalfa on the Orland project was completed on November 1, a sixth cutting was harvested on a number of stands, and it was anticipated that more would be matured by December 1.

THE first payment to beet growers of the Belle Fourche project for beets delivered in September amounted to $70,000. The November payment amounted to $650,000. The peak of the beet harvest was reached on October 28, when 150 carloads were received at the factory, representing 6,200 tons. One field on a farm near Newell yielded 23.9 tons per acre.

THE Mini-Cassia Cooperative Dairymen's Association on the Minidoka project purchased 62,440 pounds of butterfat in September, for which it paid approximately $30,000. The association now has 725 active patrons, which is an increase of 87 over the number at the corresponding season last year.

THE canning factory at Hatch, N. Mex., on the Rio Grande project, has canned 800,000 cans of tomatoes during the season.

AT the close of the month the Owyhee Dam, Owyhee project, was 46 per cent completed.

LIVESTOCK on the Milk River project is in excellent condition with plenty of feed available and a surplus of hay on hand. Feeding of stock, both cattle and sheep, upon beet tops will probably exceed that of last year. Almost every field was feeding some stock at the close of the month, all of which were in excellent shape and gaining rapidly.

EXCELLENT returns at guaranteed prices to the growers of sugar beets and cucumbers are being realized on the Belle Fourche project. These are the stable cash crops on the project.

THE Big Horn Canning Co. at Cowley, Shoshone project, has had a very successful season, during which it turned out 592,608 cans of peas, 908,544 of corn, 339,312 of beans, and 173,568 of pumpkins.

AT the recent opening on the Tule Lake division of the Klamath project 175 applications were received during the 10-day simultaneous filing period October 18 to 27 for the 24 farm units. Ten additional applications were received after the close of this period.

SEVERAL of the civic and commercial organizations on the Shoshone project are working on a plan to have the school district bonded sufficiently to construct a junior high school and gymnasium building for the Powell schools.

Air Mail and Passenger Service on the Federal Irrigation Projects

THE increasing importance of air service for carrying mail and passengers in the economic development of the country, led the Bureau of Reclamation recently to ascertain the extent of such facilities on the Federal irrigation projects. Reports received from practically all of the projects indicate that most of them have direct service available or are within easy rail distance from such service. A summary of these reports follows:

Denver, Colo.—There are two commercial air lines operating out of Denver, the Western Air Express and its subsidiary company, the Mid-Continent Air Express, and the United States Airways (Inc.). Both companies operate from the Denver municipal airport, which carries an A-1-A Department of Commerce rating.

In addition, the Mid-Continent Air Express operates daily passenger planes between Denver and El Paso, Tex., via Colorado Springs, Pueblo, Las Vegas, Santa Fe, and Albuquerque. At the latter point connections are made with Western Air Express planes bound for Los Angeles, giving Denver 10-hour air service to the Pacific coast. This same company also operates daily passenger planes between Denver and Dallas, Tex., via Colorado Springs, Pueblo, Amarillo, Wichita Falls, and Fort Worth. Eight Fokker Super-Universal 6-passenger cabin monoplanes are used in this service and more than 700 8-hour days have been spent in the air with a flying distance in excess of 600,000 miles, all without injury to any passenger, pilot, or employee.

The United States Airways (Inc.), has been in operation since April, 1929. This company operates daily passenger planes between Denver, Kansas City, St. Louis, Wichita, and Tulsa, with additional direct air connections to Fort Worth and Dallas, Tex. The equipment consists of 7-passenger, all-metal, Flamingo cabin monoplanes powered with 425-horsepower Wasp and 525-horsepower Hornet motors. A feature of this line is that direct rail connections for the East are made at St. Louis.

Yuma project, Arizona.—Yuma has a modern airport, Fly Field, located on the Yuma-Phoenix highway, about 5 miles from the city. A caretaker's house, steel and concrete hangar approximately 60 by 100 feet, and up-to-date airplane gasoline pumps are provided. Runways have been clay surfaced and a caretaker is in constant attendance. An Army Signal Corps radio and meteorological station is located on the field.

It is expected that within the next six months a shuttle route, Los Angeles to Phoenix via San Diego, El Centro, and Yuma, will be started, upon which Yuma will be designated as a regular stop. Before this service can be started, however, the Yuma field as well as the El Centro field must be lighted for night landing and emergency landing fields established every 30 miles. The Yuma field now has flares for night landing.

Some twenty-odd planes, members of the annual California goodwill tour, paid Yuma a brief visit on November 1. The planes landed at Fly Field on the Yuma Mesa. This was the only stop made by the tour outside the State of California. Pictures were taken from the air of the newly improved field by members of the tour and are to be used for advertising purposes.

Orland project, California.—There is no direct air mail or passenger service available on the Orland project. However, air mail is transmitted from Orland to Sacramento by train and there transferred to mail planes. Passenger service is also available from the airport and landing field, at Corning, 14 miles north of Orland.

Grand Valley project, Colorado.—At the present time all air mail is handled by trains to the nearest point on the established lines. Applications have been filed before the Public Utilities Commission of Colorado by two established airway companies for permission to extend their present transportation lines from Denver and Colorado Springs to Grand Junction. If this is done, it is probable that air mail service can be established.

Grand Junction has a municipal airport, located on land in the pumping division of the project immediately above the main canal. The facilities are leased to a local airplane company, which maintains two planes at this point at all times for general passenger business and to conduct a small school.

Uncompahgre project, Colorado.—Although there is an airport at Montrose, up to the present time no regular air mail or passenger plane service has been established. The airport is registered and is used by 10 or 12 passenger planes each year, which usually come in at the time of annual fairs or rodeos.

Boise project, Idaho.—This project is served by the main trunk of the Varney Air Lines which now has its headquarters in Portland, Oreg. The only regularly scheduled stop on the Boise project is at the Boise airport, at which point a force of mechanics and a relief plane is maintained. The Varney Lines extend from Salt Lake City, Utah, to Seattle, Wash., with scheduled stops at Boise; Pasco, Wash.; Portland, Oreg.; and Seattle, Wash. Two flights are made each way daily by large Boeing combination passenger and mail planes. By arrangement with the Railway Express agencies, express matter is also carried. Regular passenger service was inaugurated over these lines in May, 1930.

In addition to the Varney Lines, the Boise Flying Service, operating a fleet of four planes, gives flying instruction and will make short-notice flights to any point possible to land a plane. Individual planes are flown from the air fields at Caldwell and Nampa, Idaho.

During the winter of 1929, intermittent plane service was inaugurated between Boise and the Deadwood Reservoir site by the contractor for the clearing of the reservoir, operating under the name of the Western Airways Corporation. Flights were made from Boise and Cascade, Idaho, when snow permitted wheeled landings at both ends. Later, skis were attached to the plane and landings were made on the frozen surface of the lake at McCall, Idaho, and on the snow in Deadwood Basin. This service was invaluable during the period when the roads were blocked with snow, when Deadwood could be reached only by dog team or on snowshoes.

King Hill project, Idaho.—An emergency air field of approximately 100 acres, 2 miles south of the town of King Hill, has been properly equipped by the Government with lights consisting of a beacon and small lights around the margin of the field, which are operated during the night. This field, which was installed about three years ago, is not open to private use and is not used by the general public except in emergency cases.

There is no mail or passenger service connected with this landing field.

Minidoka project, Idaho.—Burley, the project headquarters, is situated on the air route operated by the Varney Air Lines (Inc.), from Salt Lake City, Utah, to Portland and Seattle. Regular night and day plane service both east and west is maintained by the company, but only emergency stops are made at Burley. However, the town has a well-graded landing field, with two runways, one of them 4,000 and the other 3,300 feet long, and equipped with border lights and an air beacon having a 2,000,000-candlepower light. The airport, with its equipment and improvements, except the beacon, was furnished by the city of Burley through a recent bond issue for $10,000. It is reported that the Government expects soon to erect a radio range beacon to aid in flying at night or in foggy weather.

The nearest air mail and plane service, however, is obtained at Pocatello, Idaho, about 75 miles distant on the main line

PROJECT AIR MAIL AND PASSENGER SERVICE

1, Denver Municipal Airport and 7-passenger all-metal "Flamingo"; 2, Mid-Continent Air Express plane operating out of Denver; 3, Yuma's modern airport; 4, Grand Junction Municipal Airport, Grand Valley project; 5, Carlsbad Travelair passenger plane; 6, hangar at Municipal Airport, El Paso-Rio Grande project; 7, Swan Island Airport, Portland, Oreg.; 8 McAllister Flying Service, Yakima, Yakima project.

of the Oregon Short Line Railroad. An air route is operated through this city from Salt Lake to Butte, Mont., by the National Parks Airways (Inc.). Planes operated on this line carry both mail and passengers, and both night and day service is given. These planes connect directly at Salt Lake City with east and west bound transcontinental planes, so that air mail leaving Burley in the morning is delivered to Pacific coast cities in California the same afternoon, while eastbound mail is equally expeditious.

Burley hopes that, having such a well-equipped landing field, and with the rapid development in aviation, it will become eventually a stopping place not only on the present east and west air route, but also on a projected north and south line into Nevada that will connect with the main air lines to California.

Huntley project, Montana.—Billings is the nearest point to the Huntley project, where air mail and passenger service is available. There are no airports or landing fields on the project.

Milk River project, Montana.—The nearest point for air mail and passenger service is at Great Falls. No portion of the Milk River project is located on the designated line of air travel, although there is an airport at Glasgow.

Sun River project, Montana.—There is no air mail or air passenger service on the Sun River project, but such service is readily available at Great Falls, only 40 miles distant.

Lower Yellowstone project, Montana-North Dakota.—There is no direct air mail or passenger plane service touching the Lower Yellowstone project. A passenger plane, operating triweekly between Spokane and St. Paul, touches Miles City, about 125 miles southwest of the project. The nearest air mail line extends from Salt Lake to Great Falls, operating each way daily.

North Platte project, Wyoming-Nebraska.—There is no regular air mail route that crosses the North Platte project. The Omaha-Cheyenne mail route passes 100 miles south. Privately owned planes are available at Torrington, Wyo., and Scottsbluff, Nebr., and may be hired for special trips.

Carlsbad project, New Mexico.—Carlsbad has a municipal air field, established in 1926, and located on the Cavern Road, about 3 miles from the city. Nothing much was done with this landing field until a little over a year ago when a local company, New Mexico Airways (Inc.), was organized and passenger service initiated. A year ago the company began operations with one Travelair plane. During the year it has purchased five planes, maintaining two first-class planes at all times. At the present time an average of 40 planes a month land at the Calsbad Field. The 2-plane hangar, constructed in April, is equipped with telephone and Delco lights for night work. Competent mechanics are available at all times.

Rio Grande project, New Mexico-Texas.—The Rio Grande project is well served with air passenger service and is soon to be on a transcontinental air mail route, as the Southern Transcontinental Airway passes through El Paso, which is one of its main stations. The aeronautics division of the United States Department of Commerce now has under construction or contracted for construction the improvement of the Southern Airway to comply with the department's specifications for air mail routes. Air mail contracts will be operated over this route as soon as it is prepared for night flying. The improvements under construction are installation of beacon lights, radio direction beacons, and emergency landing fields, all to be installed at intervals to comply with the department's specifications. Heretofore and until the construction of the airway is completed and the mail contracts become operative over it air mail connections from El Paso have been by rail to Denver or Fort Worth.

El Paso now has three airports. Bigsfield is the United States Army airport. The municipal airport is highly developed and improved and application for class A rating will soon be made. The third is the commercial airport of the Western Air Express. All of these airports are improved and provided with hangars and administrative buildings and other necessary equipment. There are landing fields at Las Cruces, in the valley above El Paso, and at Fabens, in the valley below El Paso.

Air passenger service has been available from El Paso to the four points of the compass for some time past. The Standard Airways established regular daily service each way between El Paso and Los Angeles. This line was later taken over by the Western Air Express, which, in addition to the Los Angeles service, now operates east from El Paso to Dallas and Fort Worth daily. Planes operated over these lines are Fokker super trimotor, 12-passenger planes. Connections are made at the El Paso port between the east and west planes.

The Mid-Continent Air Express, affiliated with the Western Air Express, operates super Universal Fokker 6-passenger planes daily both ways from El Paso to Denver.

The southern air transport division of the American Airways also operates daily both ways between El Paso, Fort Worth, and Dallas. These are single-motor planes.

The Corporacion Aeronautics de Transportes of Mexico operates planes daily each way between El Paso and Mexico City. This company uses 6-passenger Lockhead Vega planes. Leaving El Paso at 6 a. m., the plane arrives in Mexico City at 4.30 p. m. Formerly the time required to make the trip by rail was three and one-half days.

Both the Southern Air Transport planes and the Mexico City planes use the municipal airport.

There are privately owned planes as well as service planes which can be chartered for trips. The R and L Flying School is maintained at the municipal airport. This company has three planes, a Lincoln P T, an Eaglerock, and a Ryan 4-passenger.

All of the lines operating out of El Paso make intermediate stops at the larger cities and towns along the route, and make connections with affiliated or other air lines to all parts of the United States and Mexico now served by air transportation.

Umatilla project, Oregon.—There is no direct air mail or passenger service on the project, although it is on the direct air mail route between Portland, Oreg., and Pasco, Wash. Three beacon lights and one emergency landing field are on the project along this route. Air-mail service from the project is through Portland, Oreg., 184 miles distant from Irrigon, via Pasco, connecting with the Northern transcontinental air mail and passenger route. Three lines operate planes out of Portland, the Varney Air Lines (Inc.), the West Coast Air Transport Co. and the Pacific Air Transport Co., now affiliated as a division of the United Aircraft and Transport Corporation.

Vale project, Oregon.—Although Vale has no terminal of its own for the collection and delivery of air mail, there is fast mail train service between Vale and Boise, Idaho, about 85 miles distant, whence air mail is transported to points east, west, north, and south, thus indirectly affording Vale excellent air mail service. Vale has a landing field for airplanes, but is not equipped with a hangar. Passenger air service is furnished by established passenger planes which call for and deliver passengers upon request.

Klamath project, Oregon.—The project is not served regularly by mail or passenger planes, although there are a few locally owned planes.

Owyhee project, Oregon-Idaho.—The airport at Boise provides the most convenient air mail and passenger service to the Owyhee project.

Belle Fourche project, South Dakota.—There is no established air mail or regular

passenger plane service on the project. However, emergency service for the transportation of passengers is available through the Belle Fourche Air Lines of Belle Fourche, or the Rapid Air Lines of Rapid City, S. Dak. Landings are occasionally made at project towns to carry patients to hospitals or to transport passengers over the northwest country in times of bad roads. There is prospect of regular plane service being developed on the project in the near future.

Salt Lake Basin project, Utah.—Although there is no regular air mail or passenger plane service on the Weber division of the project, Salt Lake City is near by, where such service is readily available. Airplanes for special trips may be chartered at any time from the following companies in Salt Lake City: Western Air Express (Inc.), Columbia Airways (Inc.), Thompson Flying Service, Sea Gull Air Lines, and the Rankin School of Flying.

Municipal airports are maintained at Ogden, Provo, and Logan, Utah. The local and Ogden airports are equipped for night operating, and all the regular air routes from the city are lighted for night flying, with the exception of the Salt Lake City-Great Falls route, which is lighted to Pocatello only.

Yakima project, Washington.—Air mail service, recently established, brings Yakima within slightly less than 48 hours of Washington, D. C., twice daily, with corresponding service for intermediate points.

Regular passenger plane service, which was established about a year ago, was discontinued for lack of patronage, but passenger planes for special service may be secured from Wenatchee, if desired.

Yakima County has an 80-acre landing field, just outside the city limits of Yakima, which was secured about three years ago and is in daily use by local aviators.

Kittitas division, Yakima project, Washington.—There is no regular scheduled passenger plane service from any point on the Kittitas division of the Yakima project. The population is too sparse, and there are no towns of sufficient size to support such a service. The only service available is that by special chartered plane. One plane is available at Ellensburg, Wash., and at times a plane is called from Wenatchee, Wash., a town adjacent to the project, to take care of special charters.

It is contemplated that an east-west plane service, with a landing field in Ellensburg, Wash., will be established soon. If the proposed new service is put into effect a new landing field will probably be installed, equipped with flood lights, landing lights, and all the accessories essential to an up-to-date landing field.

Although no direct mail plane service is now directly available, there is an excellent detached service for the project. There is what is termed the "Business Man's Special" for daily evening plane departures from Pasco, Wash. There is also a service south to all Pacific coast points, etc. There are two air mail planes daily from Pasco, Wash., to the East, making practically 36-hour service from Ellensburg into Chicago, Ill., and 48-hour service into New York. Two air mail planes daily to the south from Seattle, Wash., give Ellensburg practically 24-hour service into San Francisco, Los Angeles, and San Diego, Calif.

Shoshone project, Wyoming.—Air mail service is not available on this project. There is a passenger plane located at Cody, Wyo., available for short flights. At Billings, Mont., which is about 100 miles from Powell, there is a regular established passenger service.

Air mail destined for the East is carried by train from Powell to Cheyenne, a distance of about 450 miles, where it is picked up by regular air mail planes. Air mail direct to western points is carried by train from Powell to Butte, Mont., where it is picked up by air mail planes.

Secret of Rural Success

George William Russell ("A. E."), the eminent agricultural economist from Ireland who is now lecturing in this country, lays down the following principle, which applies with special force to the irrigation community:

"I assert that there never can be any progress in rural districts or any real prosperity without farmers' organizations or guilds. Wherever rural prosperity is reported of any country inquire into it, and it will be found that it depends on rural organization. Wherever there is rural decay, if it is inquired into, it will be found that there was a rural population but no rural community, no organization, no guild to promote common interests and unite the countrymen in defense of them."

Committee on Conservation and Administration of the Public Domain Meets to Draft Report

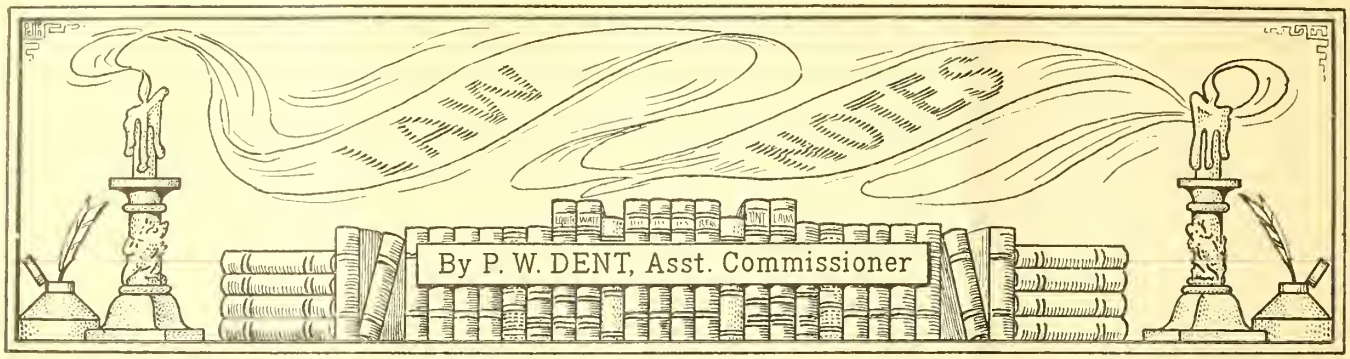
A meeting of the committee on the conservation and administration of the public domain was called by the chairman, James R. Garfield, of Cleveland, for November 10, at 10 a. m. in the Interior Department Building, Washington, D. C.

The committee, comprising 22 members, 13 of whom are from the 11 public-land States and 7 from the Eastern States, together with the Secretary of the Interior and the Secretary of Agriculture, ex officio members, was appointed by President Hoover to make a study of and report on the problems of the public domain and the disposition that should be made of the remaining public land. The personnel of the committee is as follows:

Ray Lyman Wilbur, Secretary of the Interior, and Arthur M. Hyde, Secretary of Agriculture, ex officio members; James R. Garfield, chairman, Cleveland, Ohio; Elwood Mead, Washington, D. C., representing the State of California; I. M. Brandjord, Helena, Mont.; H. O. Bursum, Socorro, N. Mex.; Gardner Cowles, Des Moines, Iowa; James P. Goodrich, Winchester, Ind.; W. B. Greeley, Seattle, Wash.; Perry W. Jenkins, Big Piney, Wyo.; Rudolph Kuchler, Phoenix, Ariz.; George Horace Lorimer, Philadelphia, Pa., George W. Malone, Carson City, Nev.; Charles J. Moynihan, Montrose, Colo.; I. H. Nash, Boise, Idaho; William Peterson, Logan, Utah; Mary Roberts Rinehart, Washington, D. C.; Huntley N. Spaulding, Rochester, N. H.; R. K. Tiffany, Olympia, Wash.; Wallace Townsend, Little Rock, Ark.; E. C. Van Petten, Ontario, Oreg.; Francis C. Wilson, Santa Fe, N. Mex. Hugh A. Brown, director of reclamation economics in the Bureau of Reclamation, is acting as executive secretary of the committee.

The first meeting of the committee, following the enabling legislation, was held early in June, after which as many of the members as found it possible visited the public-land States for a first-hand study of conditions. During their trips of investigation these members covered approximately 9,000 miles, largely by automobile, studying the problems of grazing, mineral resources, watershed protection, possible extension of national forests, Indian reservations, and national parks in their relation to the public domain, and Federal irrigation of arid and semiarid land.

The immense amount of information and data obtained by the members of the committee during the course of these inspection trips and furnished by the various bureaus and offices, both State and national, interested in the public domain and its proper disposition, will form the basis of the report to the President. The committee adjourned on November 26. During its session considerable progress was made in the drafting of the final report.



Qualifications of Bidders and Contractors

AWARD OR REJECTION OF BIDS

PARAGRAPH 16 of the standard Government instructions to bidders (construction and supplies), standard Form No. 22, provides:

"16. *Award or rejection of bids.*—The contract will be awarded to the lowest responsible bidder complying with conditions of the invitation for bids, provided his bid is reasonable and it is to the interest of the United States to accept it. The bidder to whom the award is made will be notified at the earliest possible date. The United States, however, reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the United States. It also reserves the right to reject the bid of a bidder who has previously failed to perform properly or complete on time contracts of a similar nature, or a bid of a bidder who is not in a position to perform the contract."

The several Government departments and independent establishments have at various times attempted to restrict bidding on important work to those known to be responsible. As a rather recent example may be mentioned the practice of the Bureau of Public Roads of the Department of Agriculture, as referred to in the Comptroller General's decision dated September 2, 1927 (A-19143), shown at 7 Comp. Gen. 181, wherein specifications were furnished only on a showing of financial ability and experience to perform the work contemplated. In that case, contract was awarded to other than the lowest bidder, owing to the opinion of the Government officer that the lowest bidder lacked experience and ability, and to the fact that the amount of his bid was considerably lower than the engineer's estimate of the cost. In passing on payments made by the fiscal agent under the contract as entered into with the next lowest bidder, the Comptroller General, in disapproving of the administrative procedure in that case, had the following to say:

LOWEST BIDDER MUST BE QUALIFIED

"In making an award of this character the main question to be determined is whether the lowest bidder was reasonably qualified to fulfill his agreement. The rejection of the lowest bid is not authorized in the absence of a clear showing of such facts as reasonably would justify the conclusion that the one submitting such bid could not or would not render satisfactory service. The opinion of a Government officer that a bidder might possibly be unable to fulfill the terms of the contract does not require or justify the rejection of a low bid, but is for consideration when the contractor, selected on the basis of the lowest bid, fails to fulfill the terms of the contract.

"From the engineer's statement quoted the reasons for the rejection of the lowest bid in the present case may be summarized as (1) lack of experience and ability and (2) that the amount of the bid was considerably lower than the engineer's estimate of the cost.

"In view of the provision in the 'Notice to contractor,' dated May 26, 1925, that 'Plans and specifications will be furnished contractors who contemplate bidding, on a showing of financial ability and experience,' it must be assumed from the fact that Mr. Harlowe was furnished the plans and specifications upon which to base his proposal that the requirement of a showing as to his experience was satisfactorily met. Former experience in placing crushed rock surfacing was not stipulated as one of the requirements of bidders, nor was the fact that he was inexperienced in that particular work held to disqualify him from submitting a bid. The fact that he had previously, and presumably satisfactorily, executed a $20,000 contract for the construction of 1 mile of concrete road, and that his other work had been chiefly concrete construction and structure excavation is evidence of his ability to perform other work of the same general character. Accordingly, the rejection of his bid on the ground of inexperience and of inability to perform the work appears to have been unwarranted. See 6 Comp. Gen. 210; *id.* 557.

"With respect to the rejection of the bid for the reason that it was considerably lower in amount than the district engineer's estimate and that Mr. Harlowe had admitted to the engineer in a personal interview he had neglected to take into account several important matters, it may be stated that there is nothing in the record to indicate Mr. Harlowe requested to withdraw his bid, nor is it established that such request, even if made, could properly have been granted. See 6 Comp. Gen. 504; *id.* 526; 24 Comp. Dec. 534; A-7062, April 18, 1925. The fact that his total bid was considerably less than the district engineer's estimate was not in itself a sufficient reason for its rejection, since the bid of Tieslau Bros., who appear to have satisfactorily performed the service, was approximately $5,300 lower then the engineer's estimate. The district engineer's estimate is not necessarily to be taken as absolutely correct; on the contrary, the bids may disclose vital errors of the district engineer which the the procedure followed in this case might cause to be uncorrected to the prejudice of the interests of the United States. Furthermore, a comparison of the bids of Harlowe and Tieslau Bros. discloses that on 5 of the 11 items on which bids were submitted Mr. Harlowe's bids exceeded those of Tieslau Bros.

"The requirements governing the services and materials to be furnished in connection with the road construction in question were clearly set forth in the plans and specifications, and if, as stated by the engineer, Mr. Harlowe's bid was so low that the services could have been furnished only at a loss to himself, that fact alone was not a concern of the district engineer, particularly as the Government's interests would have been protected against defaults and defects in the work by a performance bond which, in submitting his proposal, accompanied by a check for $3,800 as a guaranty of good faith, Mr. Harlowe agreed to execute

in the amount of $37,070.23. 6 Comp. Gen. 210, 557; A-12939, May 7, 1926."

In the Comptroller General's decision dated December 27, 1927 (A-20952), not published, in which case three bids were received for furnishing fighting tanks for the Army and the low bid was so much less than the other two, as well as the estimated cost, that the matter was submitted to the Chief of Ordnance, who instructed certain officers to visit the plant of the low bidder and make an inspection thereof and confer with the bidder, which was done, the officers reporting that the plant of the bidder was not equipped to handle the grade of work required by the specifications, and, when more particularly informed as to the methods of manufacture required, the bidder informed the officers that his bid was not predicated on such class of work, and thereupon requested permission to withdraw his bid, which was granted and the next lowest bid was accepted, the Comptroller General, in passing upon the question whether there had been a compliance with section 3709, Revised Statutes, said:

"The facts in the case are somewhat similar to those considered in 7 Comp. Gen. 181, with the difference that the low bidder in this case does not appear to have been reasonably qualified to produce the equipment required, did not understand the quality or character of the workmanship that would be required, and requested to withdraw his bid when informed thereof.

"The inspection of the low bidder's plant under the supervision of the Chief of Ordnance and the report as to lack of facilities and lack of experience in building Army tanks coupled with the request of the low bidder to withdraw his bid when the true character of the work required was explained to him, would seem to justify the conclusion that the granting of permission to withdraw his bid, or the acceptance of the next lowest bid was justified. However, the rejection of a bid because of alleged lack of experience or equipment of the bidder is not ordinarily authorized, and in no instance should administrative officers attempt to commit the Government to any liability to the next lowest bidder, or otherwise, until after the matter shall have been submitted to this office, pursuant to section 8 of the act of July 31, 1894, 28 Stat. 208, for decision."

The matter again came before the Comptroller General in connection with the Government construction program in the District of Columbia involving the erection of certain costly buildings, and in his decision dated November 15, 1928 (A-24906), shown at 8 Comp. Gen. 252, the Comptroller General held (quoting from the syllabus):

"While it is proper under section 3709, Revised Statutes to notify prospective bidders in the advertisement for proposals that they must submit with their proposals for erecting a public building, a statement of their business and technical organization and experience for the contemplated work, and of such ability to finance any part of the work not financed by the United States under article 16 of the standard Government construction contract to be used, and that such factors will be taken into consideration in accepting bids for the work, there is no authority under section 3709, Revised Statutes, to select bidders by requiring such a showing as a condition precedent to obtaining specifications and submission of proposals." A careful reading of this decision is commended to those particularly interested in the subject.

As a result of these decisions there has been adopted and is included in standard Government form of invitation for bids for important construction work (Standard Form 20), and in standard Government form of invitation for bids for important machinery or equipment (Standard Form No. 30), a paragraph to the following effect:

"All prospective bidders are hereby notified that, before any bid submitted in response to this invitation is considered for award, the Government may require the bidder to submit a statement of facts in detail as to the previous experience of the bidder in performing similar or comparable work and of the business and technical organization and financial resources and plant of the bidder available and to be used in performing the contemplated work. The Government expressly reserves the right to reject any bid on which the facts as to business and technical organization, plant, financial, and other resources, or business experience, compared with the work bid upon, justify such rejection."

Since the inclusion of the paragraph as just quoted in the standard Government forms of invitations for bids Nos. 20 and 30, the Comptroller General has had occasion to again consider the question whether a low bid submitted in accordance with the conditions of the invitation for bids may be rejected and contract made with the next lowest bidder, if in the opinion of the contracting officer reached as a result of an investigation after the opening of bids the low bidder was inefficient and unreliable and could not carry out the contract satisfactorily for the amount bid, such inefficiency and unreliability making it probable that if the contract should be awarded the low bidder the cost to the Government would be larger than if the next lowest bid were accepted, and it appearing that the next lowest bidder was considered competent and reliable and could perform the contract satisfactorily within the price stated and the time specified in the bid. In passing upon the question thus presented, the Comptroller General, in decision dated February 25, 1930 (A-30554), not yet published, had the following to say:

"The details with respect to this work were stated in the specifications and a number of drawings which were available for the inspection, etc., of prospective bidders. The work appears as of an ordinary constructive character open to builders generally and the specifications and the advertisement for proposals apparently were so issued. Facts set forth in specifications and advertisement for proposals as to the character of the work are the information from which prospective bidders are entitled to and must determine whether they have the qualifications and ability to undertake the work; and if special qualifications of bidders are an essential the specifications or descriptive facts of the work must be so informative and not merely an arbitrary general clause to that effect. See 8 Comp. Gen. 252, 258, where the requirement of the law was fully stated.

"The low bidder in this case has performed or has in course of performance a number of contracts with the Government. In contracts NOy-629, dated August 30, 1929, NOy 645, dated September 14, 1929, W-6616 QM 482, dated August 10, 1929, W-6616, QM 477, dated August 12, 1929, W-20-Mb-126, dated June 19, 1929, this contractor gave as surety the United States Fidelity & Guaranty Co. of Baltimore, Md., and in contract No. W-6616 QM 459, dated June 3, 1929, he gave as surety on the performance bond the National Surety Co. of New York. Also in contracts No. N-6616 QM-452, dated October 1, 1928, and W-6616-QM-457, dated January 22, 1929, he gave as surety the Maryland Casualty Co. It is noted that the surety given by this bidder on his bid bond is the United States Fidelity & Guaranty Co. While the fact is not controlling that this bidder has been able to secure the same surety for a number of contracts and two other sureties for other contracts, such fact is for consideration and entitled to due weight where the bidder is objected to for reasons such as are administratively given in the present matter. It evidences that the relation between the contractor and sureties was satisfactory in the performance of contracts.

"While it may be that the prices stipulated in the contracts of this bidder hereinbefore cited show the work performed thereunder to be of less magnitude than the work now to be performed, it does not follow the work was not of a character to demand careful performance and the skill of a proper contractor, and

whether more or less difficult than the present work. There can be no valid argument that a contractor may not, within reasonable limits, gradually extend the magnitude of his operations, but if he does so extend his operations he thereby becomes doubtful or irresponsible. This office is not informed of any legal or equitable consideration which would prevent a contractor from increasing the magnitude of his work, and especially when no facts are specially shown that make the conclusion necessary the work is out of the ordinary category of construction work.

"The constructing quartermaster of the Army at San Francisco has indicated in a letter dated January 23, 1930, that the contractor was slow and required supervision to secure the performance of one of the construction contracts in accordance with its terms, but if a contractor is to be excluded as unsatisfactory because the Government may charge him with, and deduct liquidated damages for delays in completion of some prior contract, then there are prominent contractors in the United States who would have to be eliminated in the consideration of their bids for the performance of Government contracts. The fact that a contractor may be charged with liquidated damages because of delay is not necessarily a disqualification of the contractor for the matter of liquidated damages was stipulated in advance and the Government is presumed to have paid through higher prices for such term in the contract. If the contractor delayed work under one of a number of contracts and permitted liquidated damages to accrue, such delay in itself does not necessarily constitute the contractor an irresponsible one, any more than the proper performance of other contracts constitutes him in all cases a responsible contractor. These are merely one of the many factors to be considered. It may be here said that other War Department contracts appear to have been satisfactorily completed without delay and payments were made accordingly, and so far as the records of this office disclose there have been no complaints with respect to the contractor's performance of Navy contracts. There also appears in the record a statement by another contracting concern that it has been unable to collect a small judgment ($434.01, plus interest) against Roth. It is for consideration but does not blacklist the contractor, and it is to be noted that the purpose of the performance bond required under the advertisement and the standard form of construction contract is to protect the Government against the defaults, if any, of the contractor and should the contractor delay or otherwise fail to perform the work in accordance with the terms of the contract, the Government has the right reserved in article 9 of the standard construction contract to protect its interests by either deducting liquidated damages for the delay or terminating the contract and charging the contractor and his surety with any excess costs of completion of the work. There is no showing that the exercise of either of these alternatives would not fully protect the public interests.

"While facts made of record may occasionally require such course in the public interest, it is a most serious matter for the United States to brand one of its citizens, or a group of citizens, associated together in business, as so unreliable and irresponsible as to require disregard of their low bid on Government work. In cases where the administrative office seeks to so disregard a low bid and award the work to a higher bidder not only the interests of the public treasury but the Government's duty to all citizens require that the facts of unreliability and irresponsibility be so clearly established and made of record as to leave little room for doubt.

"Answering your question specifically, you are advised that as the facts set forth in the specifications and advertised as the character of the work needed by the United States appear such as for builders generally in such character of work and the low bidder has submitted his bid accordingly, and since the low bidder has performed other Government contracts in an apparently satisfactory manner, the bid being the lowest for the performance of the work, may not be rejected for the purposes of accepting the next higher bid."

DEBARMENT OF BIDDERS

On the subject of qualifications of bidders and contractors, it might be well to also consider here the question of debarment of bidders, attention in this connection being invited to that part of the last sentence of paragraph 16 of the Standard Government Instructions to Bidders, as set out in the first paragraph hereof, which reads as follows:

"It also reserves the right to reject the bid of a bidder who has previously failed to perform properly or complete on time contracts of a similar nature, * * *."

In the Comptroller General's decision dated March 5, 1928 (A-21012), shown at 7 Comp. Gen. 547, in passing upon a complaint made by a bidder of the action of the General Supply Committee in refusing to consider complainant's bids submitted in response to invitations for bids, it was said:

"As a general rule there is no authority for the debarment of bidders, and all bids should be received and given consideration on an equal basis. The fact that a bidder in a previous transaction rendered unsatisfactory service or furnished supplies not in accordance with the specifications is no valid reason for continued refusal thereafter to give consideration to bids for furnishing supplies, etc. The requirement that all bids be accompanied by a guarantee and that the contract when awarded be supported by a bond, are intended to protect the United States from any loss or damage that might be sustained because of default or failure of a contractor. The proper procedure to be followed in event of failure to deliver supplies, etc., in accordance with the terms of the contract, is to purchase against the defaulting contractor's account. While a bond will, in most cases, safeguard the Government against monetary loss, there may be cases where the supplies or services are of such character as to require other safeguards, such as experience, technical knowledge, etc., necessary to insure complete performance. In such cases the facts should be clearly shown in support of the rejection of the bid.

"When the interests of the United States require the debarment of a bidder, no question will be raised by this office with respect thereto, provided the length of time of such debarment is definitely stated and not unreasonable, and the reasons for the debarment, with a statement of the specific instances of the bidder's dereliction, are made of record and a copy thereof furnished the bidder and this office. Such should be the procedure with respect to the debarment of bidders hereafter."

FAILURE TO PERFORM CONTRACT NO BAR TO FUTURE BIDS

The Comptroller General, in decision dated March 7, 1928 (A-21711), not published, had before him the question whether a bidder who had failed to perform a contract awarded to him owing to alleged mistake in submission of his bid on which the contract was based should be debarred from submitting further bids, and in that case it was said:

"Section 3709, Revised Statutes, provides that:

"'All purchases and contracts for supplies or services, in any of the departments of the Government, except for personal services, shall be made by advertising a sufficient time previously for proposals respecting the same, when the public exigencies do not require the immediate delivery of the articles or performance of the service. * * *'

"There is no punitive authority conferred by said section to debar an accepted bidder who refuses to perform on the ground that a mistake had been made in the submission of his bid and such punitive authority to debar a bidder is not to be implied in the law. Compare 7 Comp.

Gen. 322; 28 Op. Atty. Gen. 384. In the latter case, the question was whether a low bid could be rejected because the bidder had been held to be a party to an agreement in restraint of trade in violation of the antitrust law and the question was answered in the negative, it being said that the system of purchases on behalf of the Government:

"'* * * is defined and restricted by the terms of the statutes. The exceptions to the mode prescribed are only where an emergency exists arising from a public exigency or a shortness of time. To impose other restrictions upon this procedure of purchase or the qualification of bidders or the manner of award, would be to import into the act authorities which can only be established by legislative act, and are therefore beyond the office of departmental regulation.

"The authority to make rules and regulations conferred by the act of 1878 (supra), is to make such administrative regulations as are necessary to carry out the existing law. The right is not given to amend or enlarge the law. To restrict bidders of a certain class, or to exclude a certain class from the right to bid, is not within the provisions of any existing law. If Congress should delegate this power, it certainly has not done so in the statutes herein cited.'

"The hereinbefore quoted provisions from the advertisement prescribe the only penalty for the failure of a successful bidder to perform and that penalty has been exacted by the forfeiture of the check submitted as a guarantee of the bid.

"Answering your question specifically, you are advised that an accepted bidder may not be debarred or proscribed from the submission of proposals for the furnishing of Government supplies merely because of refusal to comply with some prior accepted bid on account of an alleged mistake therein."

BIDS MAY BE RECEIVED BUT CONTRACT REFUSED TO PREVIOUS FRAUDULENT CONTRACTOR

"The procedure to be followed in such matters is set forth in my decision of March 5, 1928, A-21012, copy herewith. See also my letter to you dated March 7, 1928, A-21711."

One of the most recent as well as interesting cases before the Comptroller General on this subject is that covered by the decision dated July 23, 1929 (A-28003), shown at 9 Comp. Gen. 23, wherein the facts disclosed an attempted fraud on the Government by contractor in furnishing inferior-quality supplies and the delivering thereof at hours other than specified in the contract in order to avoid inspection, notwithstanding that he had been repeatedly warned that the supplies must bear the inspector's approval stamp. The Comptroller General held in that case that, while there was not authority to disbar this contractor as a bidder, there was authority to refuse to accept a bid submitted by him until receipt of evidence tending to rebut the presumption of lack of responsibility raised by the experience in connection with the previous contract, and the following is quoted from that decision:

"Unquestionably these are reprehensible practices, and it is noted that in the inclosure of memorandum dated June 28, 1929, from the Judge Advocate General, and after a detailed recitation of the charges and counter charges in the matter, the statement is made that:

"'* * * It is, therefore, the opinion of this office that, until receipt of evidence tending to rebut the presumption of lack of responsibility raised by the experience of Government agencies in connection with previous contracts with this dealer, he may be considered as not responsible, and that the Secretary of War, in the exercise of the supervisory authority vested in him by law, may authorize the issuance of such instructions, based upon this unrebutted presumption, as may be deemed necessary for the protection of the interests of the United States.'

"This conclusion in this case meets with the approval of this office, but it does not follow that Jamison, or any other former contractor, may be permanently debarred from further bidding on supplies for the War Department. As was stated in decision dated September 8, 1928 (A-24103), to the Secretary of the Navy:

"'There is no authority under the provisions of said section 3722, Revised Statutes [or in section 3709, Revised Statutes] for the debarment of bidders, or the issuance of a debarred bidders' list. It would seem that the purpose and intent of said section is to authorize the Navy Department, after the receipt of bids from firms, individuals, etc., to reject said bids if the conditions involved in a prior default under a contract with the Navy Department are shown to require such action. In other words, the provisions of said section are for application only after bids have been received in response to the advertisement.

The Comptroller General's decision dated March 21, 1928 (A-20477), not published, had to do with the question of a "Debarred bidders' list" issued by one Government bureau, and whereon appeared, among others, the names of bidders who had, for one reason or another, not satisfactorily performed their contracts with other bureaus, and the Comptroller General had the following to say with respect to that practice:

"The reasons assigned in your letter for the issuance by the Commissioner of Indian Affairs of the debarred bidders' list are in substance that the said list was based on reports made from time to time by the Secretary of the Navy, giving the names of the bidders who have not satisfactorily performed their contracts with the Navy Department either by reason of refusal to make delivery, delay in delivery, or delivery of supplies not meeting the requirements of the specifications. You further state that the said list is a reproduction of the Navy Department list of July 1, 1927, revised to include debarments of other departments of the Federal Government where reasons for debarment are similar to those for which the Navy debars and that for this reason the list, as promulgated by the Commissioner of Indian Affairs, did not undertake to assign the reason or reasons for each debarment.

"Section 3709, Revised Statutes, provides that all purchases and contracts for supplies in any of the departments of the Government, except for personal services and except in cases of emergency, shall be made after advertising a sufficient time previously respecting same. It has been frequently held by the courts and by the accounting officers of the United States that the provisions of the statute were designed to give all manufacturers, etc., equal right to compete for Government business, to secure for the Government the benefits which flow from competition, to prevent favoritism by representatives of the Government in making purchases on public account and to prevent collusion and fraud in procuring supplies and letting contracts. See particularly 22 Comp. Dec. 302; 5 Comp. Gen. 330; *id.* 712. United States *v.* Pan-American Petroleum Co., 6 Fed. Rep. (2d) 43, 48, affirmed in 9 Fed. Rep. (2d) 761, 770. The purpose and requirements of the statute are inconsistent with an administrative authority in any of the departments of the Government, in the absence of specific statutory authority therefor, to debar bidders generally. And the fact that certain bidders may have been, either rightfully or wrongfully, placed on an unsatisfactory or debarred list by the Navy Department does not establish that the bidders can not or will not satisfactorily perform contracts with other departments of the Government. In other words, the fact that the Navy Department had placed a particular bidder on its so-called 'Debarred list' would not authorize or justify the Interior Department in refusing to give consideration to proposals submitted by such bidders. The fact of debarment by another branch of the Government is not alone

sufficient to exclude the contractor generally, and unless the facts involve fraud, etc., but the debarment is for consideration primarily with the view that if the bidder is otherwise acceptable the interests of the United States must be adequately protected. The requirements that all bids be accompanied by a guarantee and that the contract when awarded be supported by a bond are intended to protect the United States from any loss or damage that might be sustained because of default or failure of contractor."

The Comptroller General's decision of July 23, 1929, *supra*, concludes with the following paragraph:

"It will be noted that section 3722, Revised Statutes, is applicable solely to the Navy Department and that there is no such statute applicable to the War Department. It necessarily follows that under section 3709, Revised Statutes, there is no authority for permanently debarring a bidder from submitting proposals in response to advertisements of the War Department for the delivery of supplies. There is authority, however, as stated, to refuse to accept a bid of an unsatisfactory contractor who has attempted fraud on the Government until, as stated by the Judge Advocate General of the Army, 'receipt of evidence tending to rebut the presumption of lack of responsibility raised by the experience of Government agencies in connection with previous contracts with this dealer.' See 7 Comp. Gen. 547."

ARMAND OFFUTT,
District Counsel.

Cumulative 1930 Supplement to Federal Reclamation Laws Annotated

The legal division of the Washington office of the Bureau of Reclamation has issued a cumulative supplement, dated July, 1930, to the 1927 edition of Federal Reclamation Laws Annotated, prepared by Miss Glenna F. Sinclair, under the direction of P. W. Dent, assistant commissioner. The new supplement is an annotated compilation of the Federal reclamation statutes from the convening of Congress in December, 1927, to the close of the second session of the Seventy-first Congress in July, 1930, with supplemental annotations, based upon recent decisions, construing legislation contained in the original volume.

Under the provisions of the act of May 25, 1926, the Secretary of the Interior is authorized to enter into a contract with irrigation districts on the Federal irrigation projects providing for payment of the cost of constructing the project works within such term of years as he may find to be necessary, in any event not more than 40 years.

The farmers on the Federal irrigation projects are organized into water users' associations or irrigation districts, and they elect their governing boards.

Threshed wheat ready for market, Milk River project, Montana

Recently Enacted Legislation

PAIUTE INDIAN RESERVATION LANDS

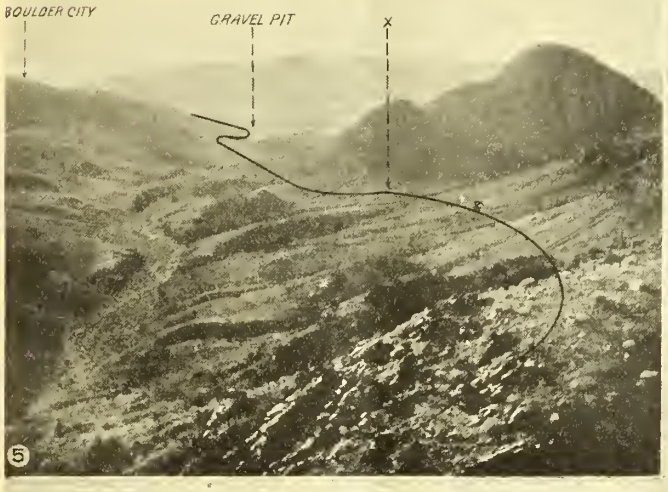
Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $6,000, or so much thereof as may be necessary, for paying the Truckee-Carson irrigation district, Fallon, Nevada, in sixty semiannual installments, as equally as may be, the proportionate share of the benefits received by four thousand eight hundred and seventy-seven and three-tenths irrigable acres of Paiute Indian lands within the Newlands irrigation project, for necessary repairs to the Truckee Canal to restore said canal to its original capacity, said payments to be made at the same time and at the same rate per irrigable acre as that paid to the Reclamation Bureau by said district for other irrigable lands located therein.

Approved, June 27, 1930.

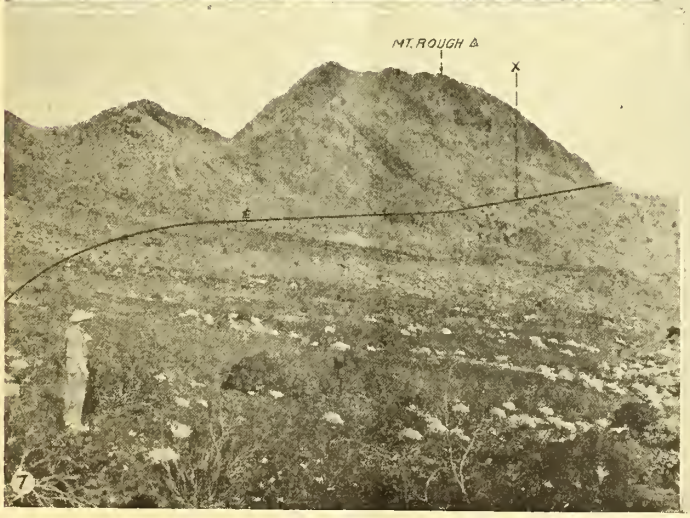
DESERT-LAND ENTRIES IN RIVERSIDE COUNTY, CALIF.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no desert-land entry heretofore made in good faith under the public land laws for lands in townships 4 and 5 south, range 15 east; townships 4 and 5 south, range 16 east; townships 4, 5, and 6 south, range 17 east; townships 5, 6, and 7 south, range 18 east; townships 6 and 7 south, range 19 east; townships 6 and 7 south, range 20 east; townships 4, 5, 6, 7, and 8 south, range 21 east; townships 5, 6, and sections 3, 4, 5, 6, 7, 8, 18, and 19, township 7 south, range 22 east; township 5 south, range 23 east, San Bernardino meridian, in Riverside County, State of California, shall be canceled prior to May 1, 1933, because of failure on the part of the entrymen to make any annual or final proof falling due upon any such entry prior to said date. The requirements of law as to annual assessments and final proof shall become operative from said date as though no suspension had been made. If the said entrymen are unable to procure water to irrigate the said lands above described through no fault of theirs, after using due diligence, or the legal questions as to their right to divert or impound water for the irrigation of said lands are still pending and undetermined by said May 1, 1933, the Secretary of the Interior is hereby authorized to grant a further extension for an additional period of not exceeding five years.

Approved, April 17, 1930.



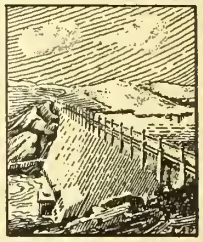
BOULDER CANYON PROJECT



1, Government survey camp near the summit; 2, team outfit building grade on Union Pacific section of branch railroad; 3, boat party on Colorado River in Black Canyon; 4, Commissioner Mead and Chief Engineer Walter in Black Canyon; 5, location of part of 8-mile gravel highway, Hoover Dam site to Boulder City town site; 6, construction railroad locatio skirting the hills; 7, section of Boulder City, Hoover Dam highway location (X shows point from which No. 5 was taken); 8, railroad location on Government section involving tunnel construction.

ENGINEERING

By C. A. BISSELL, Chief, Engineering Division



Tunnels Constructed by the Bureau of Reclamation

By P. I. Taylor, Engineering Division, Washington Office

IN the construction of the Federal reclamation projects by the Bureau of Reclamation, it has been found necessary to construct 124 tunnels with a total length of 176,700 feet, or about 33½ miles. In building a project distribution system through a country of uneven topography, tunnel sections occasionally take the place of the canal. This usually occurs on the main canals, before the irrigable lands are reached. One of the first important construction jobs undertaken by the bureau was the well-known Gunnison Tunnel in Colorado. In building the storage system on the Salt River project in Arizona, there were constructed 24 tunnels on the power canal and at the Roosevelt Dam. There are 19 tunnels on the distribution system of the Shoshone project in Wyoming, and 12 on the Uncompahgre project in Colorado. At the present time, important tunnel work is in progress on the Owyhee and Vale projects in Oregon and the Kittitas division of the Yakima project in Washington.

GUNNISON TUNNEL

In the irrigation plan for the Uncompahgre project, in western Colorado, it was necessary to provide for the diversion of water from the Gunnison River to supplement the flow of the Uncompahgre River. This was accomplished by means of a 6-mile tunnel and a 12-mile canal. Plans and specifications for the Gunnison Tunnel were approved by a board of consulting engineers in July, 1904, and contract for construction was awarded in October, 1904, the work to be completed by April, 1908.

Original plans called for lining the tunnel with concrete throughout its entire length and using four classes of lining depending upon the material encountered. However, many sections in solid rock were left unlined, amounting to about 47 per cent of the tunnel. In cross section, the tunnel is nearly square with an arched roof. The width in the clear is 11 feet and the height is 10 feet to the spring of the arch. In unlined rock, the minimum width is 12½ feet and the maximum height is 13 feet. The floor is lined throughout with concrete. The grade is 0.002, and with a theoretical velocity of about 10 feet per second, the tunnel when running full capacity will carry about 1,000 cubic feet per second. As completed, the tunnel is 30,582 feet long, all one tangent except for 210 feet of reverse curve near the headgates.

The contractors started work in February, 1905, but owing to difficult work and financial troubles the work was turned over to the Government in May, 1905. On readvertisement, the bids were not satisfactory and the Government proceeded to complete the work by force account. Work was carried on from four headings and under great difficulties as mud, gravel, and soft shale were encountered in the west portion, and in the hard schist and granite of the east portion soft seams were often found. Large quantities of water were met with, which resulted in several bad cave-ins. One of the headings was driven into a geologic fault and resulted in tapping a flow of more than 1,000,000 gallons an hour.

On July 6, 1909, the headings were holed through, and the tunnel was officially opened by President Taft on September 23, 1909. The first water for irrigation purposes was carried through the tunnel in the irrigation season of 1910. The concrete floor in the rock section was not placed until the winter of 1912–13. The cost of the Gunnison Tunnel was $2,905,000. In December, 1916, a board of engineers recommended the lining of an additional 1,650 feet of sides and roof, and 426 feet of sides only; also replacing a few hundred feet of ruptured sidewalls and the plastering of 6,600 linear feet of floor. This work was accomplished in the winters of 1916–17 and 1917–18.

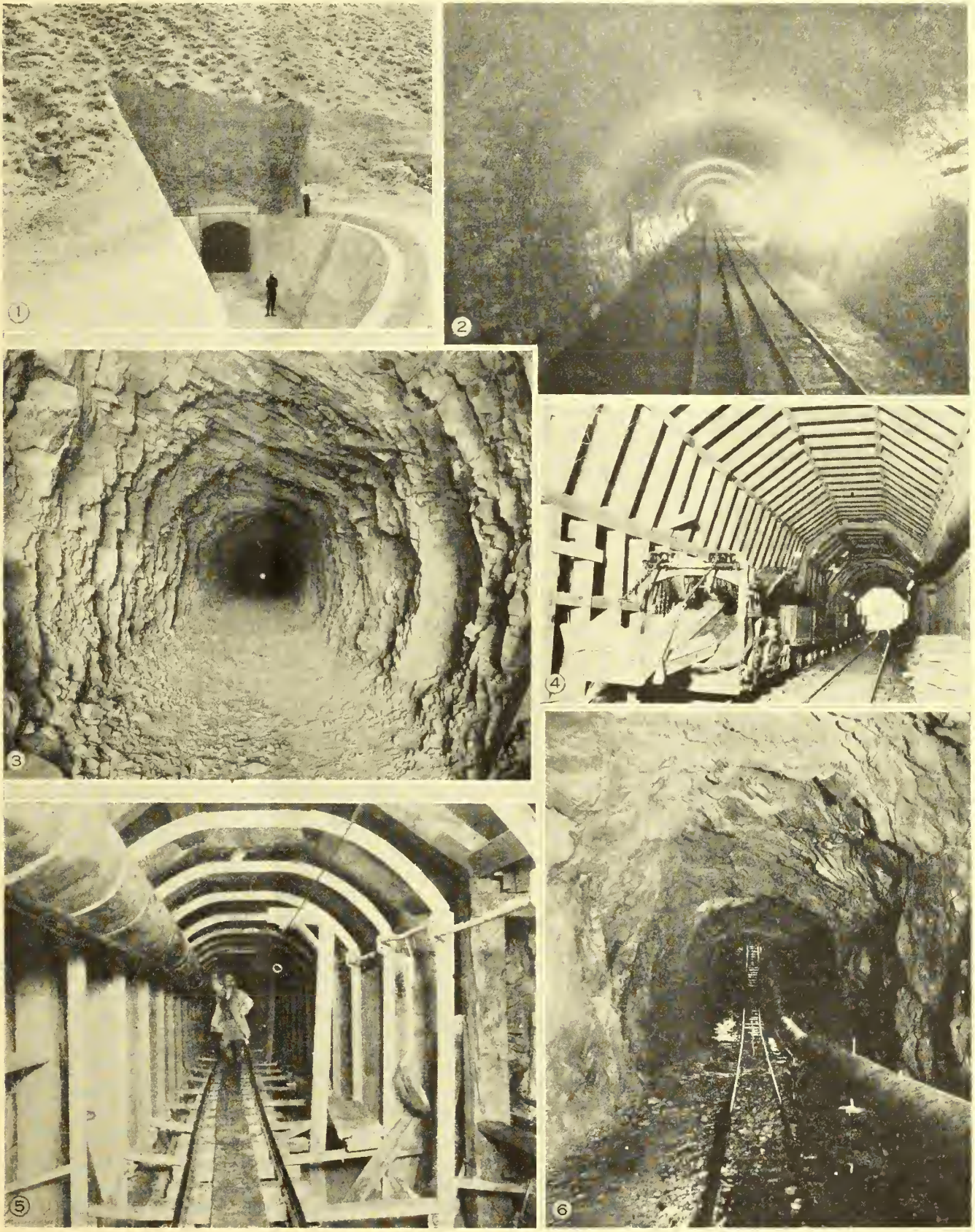
COLORADO RIVER SIPHON

On the Yuma project, Arizona-California, the main project canal leaves the Laguna diversion dam on the California side and is taken under the Colorado River, from California to Arizona (at Yuma) in order to reach the 100,000 acres of valley and mesa lands south and east of Yuma, Ariz. The main canal has a bottom width of 80 feet, a depth of 7 feet, and carries 1,400 second-feet at full capacity. Borings at the site indicated soft sandstone about 50 feet below the low-river bed in midstream and 80 feet below on the California side.. Overlying the sandstone there is about 25 feet of silt at low-water stage. Because of this silt blanket, it was assumed that a tunnel well inclosed in the sandstone would encounter very little water and might be driven without the aid of compressed air. It was proposed to sink a shaft well into the hard stratum on each side of the river, seal out the water and drive the tunnel through the sides of the shafts. The profile first selected gave the tunnel a minimum cover of 20 feet of sandstone, each shaft being 130 feet deep. When it was later found necessary to use the pneumatic process, the profile was raised about 35 feet to reduce the working pressure.

The structure was designed to pass 1,400 cubic feet of water per second with a loss of head of 2 feet. In cross section, the tunnel is 14 feet in diameter with a concrete shell 24 inches thick. Between centers of shafts, the tunnel is 955 feet in length. The shafts are concrete caissons, which were sunk by the "open" method. Each caisson was provided with a cutting edge in the form of a steel plate three-fourths inch in thickness and 3½ feet wide, reinforced with channel and plate. The Arizona shaft is 74 feet in depth with an inside diameter of 23 feet, while the California shaft is 17 feet in diameter for the first 39 feet and then tapers to a 14-foot diameter at a 44-foot depth. Both shafts have walls 3½ feet in thickness.

Preliminary operations at the Arizona shaft were started in November, 1909, and the caisson arrived in position in June, 1910, its cutting edge being 132 feet below the ground surface. The caisson when landed had a total weight of 2,500 tons. Work on the California shaft was begun in January, 1910, and was completed in September, 1910. The sinking of the shafts was accomplished with considerable difficulty, and divers were employed, who at times worked in a depth of over 100 feet of water.

During the sinking of the shafts the hard material surrounding their bottom



TUNNELS CONSTRUCTED BY RECLAMATION BUREAU

1, Gunnison Tunnel, East portal; 2, tunnel of Colorado River siphon; 3, tunnel No. 1, Vale Main Canal, before placing concrete lining; 4, lower end of Owyhee Tunnel, No. 1, mucker in foreground; 5, Strawberry Tunnel, showing forms for concrete lining; 6, Gunnison Tunnel, 300 feet in from East portal.

portions was shattered for varying distances beyond the outer skin. These spaces became filled with sand and water and an attempt was made to consolidate this material by injecting cement grout. Four-inch pipes were sunk around the Arizona shaft and extended to well below the cutting edge, through which grout was forced under pressures between 150 and 200 pounds per square inch. By raising the pipes, the material was thoroughly treated to a point 20 feet above the proposed tunnel roof. On the completion of grouting operations, a concrete plug 6 feet thick was placed under water at the bottom of the caisson, and the water was pumped out. On starting tunneling operations "blows" of sand and water occurred, showing that the grouting had not accomplished the desired purpose, and further efforts at open tunneling were then abandoned. A board of consulting engineers, after an examination of conditions recommended a change to tunneling by the pneumatic process, the work to be carried on from the Arizona shaft only. A compressor plant was rented and 20 experienced "sand-hogs" were brought in from the East. The work was done by Government force account from June, 1911, to June, 1912. The total number of different men employed on compressed air work at various times was 1,300, composed mostly of Mexicans and "floaters." Pressures up to 32 pounds per square inch were used.

The intake structure at the California shaft consists of a covered concrete basin surrounding the shaft and a cylindrical gate and operating machinery by which the basin may be cut off from the shaft. The gate, which might be described as a "bottomless tin can," consists of a hollow steel cylinder suspended from three points by threaded stems geared to an electric motor. On the Arizona side the outlet structure is much simpler in design, there being no control of the water, and consists of 3-foot retaining walls with a 1 in 12 batter on the back. The total cost of the siphon was $666,000, divided as follows: Arizona shaft $138,000; California shaft, $117,000; pressure tunnel, $411,000.

FORT LARAMIE TUNNELS

The Fort Laramie Canal, one of the two main canals of the North Platte project, Nebraska-Wyoming, takes out of the North Platte River at the Whalen diversion dam near Whalen, Wyo. In the construction of this 127-mile canal to carry water to the project lands south of the river, it was found necessary to construct three tunnels, known as tunnels Nos. 1, 2, and 3.

Tunnel No. 1 in the sixth mile of the canal is 2,700 feet in length, with a horseshoe section 14 feet high, and a 12-inch concrete lining which required 5,900 cubic yards. For about 2,100 feet, the material encountered was soft sandstone, and the remaining 600 feet was running sand. At the 14-mile point, Tunnel No. 2 was driven. It is 2,150 feet long with a similar section to No. 1. The material excavated was soft sandstone for 1,380 feet, and running sand, gravel, and cobblestones for 770 feet. Both tunnels were designed for a capacity of 1,420 cubic feet per second. They were built under contract in 1916–17.

The construction of Tunnel No. 3 was required to carry the canal through a high brule clay ridge from the Mitchell Valley to the Gering Valley. This tunnel has a horseshoe section 10 feet 3 inches high, is 6,500 feet long and lined with a 10-inch concrete lining. It was designed for a capacity of 360 cubic feet per second. A contract for the work was awarded in May, 1923, the contractor furnishing all materials except cement and steel. Approaches to the tunnel are 40 feet deep in clay loam and were excavated by Government drag lines.

The material encountered in the tunnel was earth for 1,390 feet at the north portal and 1,100 feet at the south portal, the remainder being clay. Work was started in June, 1923, driving the bore from both ends with two shifts a day. It was necessary to timber the tunnel throughout. Earth was loaded into cars by hand, while in the clay blasting was required. Very little water was encountered. The bore was holed through in April, 1924. After trimming, the floor was poured all the way through, except for an 800-foot section where most of the water came in. In concreting the barrel, 12-foot sectional wood forms were used. There were 7,888 cubic yards of concrete placed in the tunnel, portals, and transition. The entire cost of the tunnel to the United States was $353,000.

CORBETT TUNNEL

On the Shoshone irrigation project in Wyoming, water released from the storage reservoir behind the Shoshone Dam flows down the Shoshone River about 16 miles to the Corbett diversion dam. At the left abutment of this structure is a sluiceway and also headworks controlling the entrance to the Corbett Tunnel. This tunnel is 17,355 feet in length and emerges into the Garland Canal, the main canal for the Garland division of the project. It is 10.75 feet high by 11.5 feet wide, with a horseshoe section, and is lined with 9 inches of concrete. The material met with in excavation was principally sandstone, with some shale and clay.

The contractor started work in November, 1905, but it became necessary to suspend operations in August, 1906, as the work was not being prosecuted satisfactorily. At this time the construction was taken over by Government forces and completed in November, 1907. Excavation was carried on from both portals and from three adits and a shaft. During the greater part of the time the work was done with three 8-hour shifts per day. The tunnel is lined with concrete throughout, some portions being lined directly on the rock face of the excavation and other portions being timbered back of the lining. The cost of the tunnel was $1,166,000.

STRAWBERRY TUNNEL

Water from the Colorado River drainage basin is brought through the divide into the Great Basin by the Strawberry Tunnel, which extends from the Strawberry Reservoir on the east slope of the Wasatch Range to the headwaters of Diamond Creek, a tributary of Spanish Fork River on the western slope of the range. The tunnel pierces the mountains at a depth of 1,400 feet, has a total length of 19,897 feet, and is lined throughout with concrete. The tunnel has a capacity of 600 cubic feet per second and a slope of 3 feet in 1,000. The section inside the concrete lining is nearly square with an arched top, being 7 feet wide by 6½ feet high, with a 2-foot rise in the arch. Excavation was carried to a section 9 feet wide by 10½ feet high. In driving the tunnel, the rock encountered was mostly sandstone and limestone, which was usually hard but contained many seams and springs of water, with occasional strata of shale. This material disintegrated rapidly when exposed to air, and it was necessary to timber the tunnel very carefully.

Bids were advertised for in August, 1906, but none was received, and the Secretary of the Interior authorized construction by Government forces. A camp was installed near the west portal in September, 1906, and fair progress was made during the winter of 1906–7 by working two shifts. Drills were furnished with power by small direct-current motors driven by gasoline engines. In July, 1907, after 1,565 linear feet had been excavated, work was suspended to await development of electric power. With the installation of a power plant and substation, work was resumed in September, 1908, and was finally completed in June, 1912, at a total cost of $1,200,000, or $60.25 per foot. About 3 miles of the tunnel were driven from the west end and one-half mile from the east end. The reservoir and east portal are connected by a conduit consisting of 600 feet of open cut and 760 feet of circular reinforced-concrete cut and cover section. The intake to the tunnel is a reinforced-concrete structure consisting of columns and beams supporting a steel grating to prevent débris from being carried in. At the

western portal of the tunnel is a stilling basin to check the velocity of the water coming from the tunnel, and permit measurement over a weir.

GRAND VALLEY TUNNELS

The first 6 miles of main canal on the Grand Valley project, Colorado, are located in the canyon of the Colorado (formerly Grand) River. In this section are 3.6 miles of open canal and 2.4 miles in tunnel.

Tunnel No. 1.—This tunnel is 3,723 feet long, horseshoe shape in section, concrete lined, 14 feet high and 17½ feet wide, for 3,177 feet and 14 feet high by 16 feet wide for 546 feet, with a carrying capacity of 1,425 cubic feet per second, with a water depth of 12 feet. The tunnel was driven from both ends with four shafts provided for ventilation. About 150 feet consisted of fine sand and bowlders, 1,550 feet of hard blue sandy shale, and 2,000 feet of earth and bowlders, with layers of sandstone and shale. Construction of this tunnel was by Government forces. Work was started in November, 1912, and the tunnel was holed through in September, 1913. Excavation was done by hand until February, 1913, when a power plant was put in operation and from then on the drilling was performed by compressed-air drills and the tramming by electric locomotives. Lining of the tunnel with reinforced concrete was completed in March, 1914.

Tunnel No. 2.—One thousand, one hundred and ninety-five feet of this tunnel is of horseshoe section, concrete lined, and 460 feet is of rectangular section with no roof lining. Reinforcing steel was used in 651 linear feet of the lining. In heading No. 1, the material was sandstone, of sufficient stability in places to make timbering unnecessary. The material in heading No. 2 consisted of layers of sandstone, shale, and a dense rock resembling limestone, and timbering was required throughout. For about one-fourth of the length of the tunnel, the drilling was done by hand. The dimensions of this tunnel are, length, 1,655 feet; width, 16 feet; height, 14 feet. The capacity is 1,425 cubic feet per second, with a water depth of 12 feet. As at tunnel No. 1, the work was done by Government forces during the period from March, 1913, to November, 1914.

Tunnel No. 3.—This tunnel was 7,292 feet in length, the longest of the three main canal tunnels, but was smaller in section being designed to carry 670 cubic feet of water per second, with a water depth of 9 feet. It is 11 feet high, 11½ feet wide, with horseshoe section, and is lined with concrete throughout. In two of the four headings, the material encountered was adobe interspersed with bowlders and sand pockets, while in the other headings the material was almost entirely sandstone and shale. Timbering was necessary in all but 600 linear feet. Work was started in October, 1913, and completed in February, 1915, being done by Government forces.

The total cost of the three tunnels was $708,330, or $55.90 per linear foot.

KLAMATH MAIN CANAL TUNNEL

One of the principal features of the main canal of the Klamath project, Oregon-California, is a 3,300-foot concrete-lined tunnel located one-half mile below the Link River diversion dam at the head of Upper Klamath Lake. This tunnel is 11 feet high, 13½ feet wide, with an arched top having a rise of 3 feet 4½ inches. It is concrete-lined throughout, and has an 8-inch thickness in the roof and sides and a 6-inch floor. The tunnel has a slope of 0.001 and was designed to carry 1,500 cubic feet of water per second. The tunnel was excavated from headings at each portal and also from three shafts. Timbering was required for a distance of 2,200 feet.

OWYHEE TUNNELS

On the Owyhee project, now under construction in eastern Oregon, with irrigable lands in both Oregon and Idaho, the Owyhee storage and diversion dam is located in a canyon of the Owyhee River. The height of diversion is 85 feet below the top of the dam and 80 feet below high water. A tunnel (No. 1), 16 feet and 7 inches in diameter and 18,723 feet, or 3.55 miles, in length will carry the water from the point of diversion to Tunnel Canyon. Here it will be distributed to the north by the North Canal and to the east and south by a second tunnel (No. 5) 21,920 feet, or 4.15 miles, in length and 9 feet 3 inches in diameter. This second tunnel will feed the main canal for the Succor Creek division of the project.

Tunnel No. 1 is to be lined with 12 inches of concrete and will have a capacity of 1,840 cubic feet of water per second. Tunnel No. 5 will have a concrete lining 10 inches thick, and is designed to carry 650 cubic feet of water per second. Contracts were awarded in April, 1930, as follows: Upper portion of tunnel No. 1, T. E. Connolly, San Francisco, Calif., $982,116; lower part of tunnel No. 1 and upper part of tunnel No. 5, J. F. Shea & Co., Portland, Oreg., $1,569,011; lower part of tunnel No. 5, S. S. Magoffin & Co., (Inc.), North Vancouver, British Columbia, $530,684 The estimated total cost of these tunnels is: Tunnel No. 1, $2,500,000; tunnel No. 2, $1,219,000. In tunnel No. 1 there are involved about 214,000 cubic yards of excavation and 54,000 cubic yards of concrete lining. The comparative quantities for tunnel No. 5 are 81,000 and 23,000 cubic yards. A requirement of the contract is that the work is to be completed by the fall of 1933.

Electric power for construction purposes is available at Government substations in the vicinity of the work. The Government-owned railroad from Dunaway Siding on the Oregon Short Line Railroad to the Owyhee Dam site is also available to the tunnel contractors.

VALE MAIN CANAL TUNNELS

The irrigation plan for the Vale project, now under construction in eastern Oregon, includes the Harper diversion dam on the Malheur River, and a 70-mile main canal. Leaving the dam the canal route follows a narrow canyon and in the first three miles there are three tunnels. The first of these is 2,136 feet in length and takes out about 200 feet above the dam, and through an almost vertical rock wall. Tunnel No. 2 is 4,997 feet long and tunnel No. 3 is 1,360 feet long. Over these tunnels there is a maximum covering of 400 feet in depth.

The tunnels are designed to carry 660 cubic feet of water per second and all have a horseshoe section 10 feet 6 inches in diameter, with a 6 to 10 inch thickness of concrete lining. Material encountered in the tunnels was rock of volcanic origin and in the entire 8,493 feet excavated only 155 feet required timber supports. The concrete lining was placed by the use of concrete guns connected to a 6-inch discharge pipe and with a 3-inch air line. Steel forms in 20-foot lengths were used. The contractor's unit bid was $8.80 per cubic yard of concrete, the cement being furnished by the Government. The average number of cubic yards of excavation per linear foot of tunnel was 4.55, for which the contractor was paid $5.20 per cubic yard. The tunnels were included in a contract for constructing the Harper diversion dam and 2.4 miles of main canal, which contract was completed in January, 1930.

YAKIMA RIVER CROSSING

The main canal of the Kittitas division of the Yakima project parallels the Yakima River on the south side for a distance of approximately 26 miles from the Easton diversion dam. It then divides into the North Branch canal and the South Branch canal, the former requiring a crossing of the Yakima River and Swauk Creek to reach the irrigable lands on the north side.

Work was begun on the structure by the contractors in April, 1929, and it is scheduled for completion in December, 1930. It is a concrete-lined circular pressure tunnel with an internal diameter of 9 feet 3 inches. The over-all length

is 3,215 feet, which includes an inclined inlet shaft of 418 feet and an inclined outlet shaft of 401 feet. In stable rock the specifications call for lining the tunnel with a minimum of 9 inches and an average of 15 inches of concrete. Plate-steel liner plates are installed in reaches of the tunnel or shafts wherein permanent timbering is not permitted and where it is found infeasible to construct the tunnel without the use of supports for the surrounding material. Reinforcement steel is placed in the lining where it is found desirable. In the steel-lined section the specifications provide for an average lining thickness of 18 inches and in reinforced sections the thickness varies from 9 to 15 inches.

The slope of the inclined shafts is 1.48 to 1, while the slope of the first 828 feet (to the wasteway shaft) of the horizontal section is −0.003, and the remaining 1,568 feet to the outlet shaft has a slope of +0.003. An interesting feature of the work is an automatic wasteway connecting the tunnel and the Yakima River. It comprises a concrete and steel-lined vertical shaft 6 feet 6 inches in diameter. The rise of 147 feet from the tunnel bifurcates near the natural ground surface into 55-inch semisteel elbows and transition pipes to which will be attached two 42-inch internal differential valves to control the discharge of the wasteway.

The shaft at the wasteway structure was excavated first and headings then started in each direction. Basalt was encountered in one heading, while the other heading was mostly in tuff and later in tufaceous shale and sand with a considerable flow of water. In this material it was found necessary to drive the tunnel to receive 30-inch reinforced concrete lining instead of 15-inch plain concrete lining as originally planned. After the concrete lining is in place the material surrounding the tunnel and shafts is pressure grouted.

The tunnel is designed to carry 925 cubic feet of water per second.

HOOVER DAM DIVERSION TUNNELS

To divert the Colorado River at the site of Hoover Dam it will be necessary to construct four tunnels 50 feet in diameter through the rock of the canyon walls. There will be two tunnels on the Arizona side and two on the Nevada side of the river. The Arizona tunnels will be 3,650 and 4,140 feet in length and the Nevada tunnels 4,540 and 3,930 feet long. Construction of these tunnels will be included in the contract for the dam and appurtenant works to be let early in 1931. These

(Continued on p. 245)

PRINCIPAL TUNNELS[1] CONSTRUCTED BY BUREAU OF RECLAMATION

Name	Year completed	Project	State	Length	Dimensions		Costs		Capacity	Remarks
					Height	Width	Total	Per linear foot		
				Feet	*Feet*	*Feet*			*Sec. feet*	
Gunnison	1910	Uncompahgre	Colorado	30,582	10	11	$2,905,000	$95.00	1,000	15,445 feet granite, 2,000 feet water-bearing alluvium, 1,200 feet shale and gravel, 10,000 feet black shale, 2,000 feet fault zone.
Colorado River Siphon	1912	Yuma	Arizona-California	[2] 955	[3] 14	0	[4] 678,000	710.00	1,400	Driven by pneumatic process.
Fort Laramie Canal		North Platte	Wyoming-Nebraska							
No. 1	1917			2,700	14	14	168,271	62.30	1,420	Horseshoe curved section. Soft sandstone 2,100 feet and running sand 600 feet.
No. 2	1917			2,150	14	14	147,366	68.50	1,420	Horseshoe section, soft sandstone, 1,380 feet running sand and gravel 770 feet.
No. 3	1924			6,500	10.25	10.25	353,000	54.30	360	Horseshoe section. Earth, 2,500 feet; clay, 4,000 feet.
Corbett	1907	Shoshone	Wyoming	17,355	10.75	11.5	1,166,000	67.20	1,000	Horseshoe section, principally sandstone with some shale and clay.
Strawberry	1912	Strawberry Valley	Utah	19,897	8.5	7	1,200,000	60.25	600	Sandstone and limestone with occasional shale strata. Timbered throughout.
Grand Valley Main Canal		Grand Valley	Colorado							
No. 1	1914			3,723	[5] 14	[5] 17.5	265,641	71.37	1,425	Horseshoe section, 1,550 feet of hard shale, 2,000 feet of earth and bowlders with layers of sandstone and shale, 150 feet of fine sand and bowlders. Partly hand excavation.
No. 2	1914			1,655	14	16	116,536	70.40	1,425	1,195 feet of horseshoe section, concrete lined. 460 feet of rectangular section with no roof lining. Excavation partly by hand.
No. 3	1915			7,292	11	[6] 11.5	326,153	44.70	670	Horseshoe section, 6,700 feet, timbered.
Klamath main canal	1907	Klamath	Oregon-California	3,300	14.37	13.5	192,000	58.20	1,500	Timbered for 2,200 feet.
Owyhee		Owyhee	Oregon							
No. 1 [7]	(7)			18,723	[3] 16.6	0	[8] 2,500,000	[8] 133.00	1,840	
No. 5 [5]	(7)			21,920	[3] 9.25	0	[8] 1,219,000	[8] 56.00	650	
Vale main canal		Vale	Oregon							
No. 1	1929			2,136	10.5	10.5	93,136	43.20	662	Horseshoe section.
No. 2	1929			4,997	10.5	10.5	235,013	47.00	662	Rock of volcanic origin.
No. 3	1929			1,360	10.5	10.5	62,909	46.30	662	Only 155 feet of timbering required.
Yakima River Crossing [7]	(7)	Yakima-Kittitas	Washington	3,215	[3] 19.25	0	[10] 800,000	[10] 249.00	925	
Hoover Dam Diversion [9] [10]		Boulder Canyon	Arizona-Nevada	[10] 16,260	[3] 50	0	[11] 17,000,000	1,000.00	[12] 50,000	
Pishkun Canal No. 2	1915	Sun River	Montana	1,022	12	12	81,000	80.00	2,500	Horseshoe section, hard blue shale. No timbering required. Drilled by hand.
Pishkun Canal No. 3	1915	do	do	2,277	10.7	10.7	142,764	62.70	2,500	Horseshoe section, close-grained sandstone. Drilled partly by hand.
South Canal	1908	Belle Fourche	South Dakota	1,306	8	8	33,230	25.40	350	Horseshoe section, material blue-gray shale. Drilled by hand.
Truckee Canal No. 3	1905	Newlands	Nevada	1,515	12.35	12	85,000	56.10	1,245	Timbered throughout. Tunnel entirely in loose sand, silt, and cemented gravel.

[1] All concrete-lined except Gunnison, which is part lined.
[2] Pressure tunnel only; 1,100 feet, including shafts.
[3] Diameter.
[4] Includes shafts; pressure tunnel alone cost $410,575, or $430 per linear foot.
[5] Dimensions 14 feet high by 16 feet wide for 546 feet.
[6] 12.17 feet width for 3,629 feet.
[7] Under construction
[8] Estimated.
[9] Authorized.
[10] Four tunnels, 3,650, 4,140, 4,540, and 3,930 feet.
[11] Estimated cost (approximate) of 4 tunnels.
[12] 50,000 for each tunnel.

Hoover Dam and Power Plant Contracts to be Let

Work at the site of the Hoover Dam will be under way early in 1931, according to present plans. This is the answer of the Bureau of Reclamation to President Hoover's appeal for the speeding up of construction work in order to provide relief for unemployment. The construction program on the Boulder Canyon project has been advanced about six months. In the Denver office, the engineering force is putting in long hours on preparation of the plans and specifications for the dam, power plant, and appurtenant works. Chief Engineer Walter proposes to forward the specifications and drawings to the Washington office for printing soon after December 1. At the same time mimeographed copies of the specifications are to be made available to prospective bidders, so that they may have additional time to study the project and to prepare their bids. These specifications can be obtained at either the Washington, Denver, or Las Vegas office. It will take about one month to get the printing work done, and therefore the printed specifications will be available for distribution early in January, 1931, and bids can be opened in February. With no delays in this program, the successful contractor should be on the ground installing his camp and equipment and preparing for starting work on the diversion tunnels about April 1.

The estimated cost of the dam, power plant, and appurtenant works, according to the Sibert Board report is $108,800,000, of which $70,600,000 is for dam and appurtenant works and $38,200,000 for the power plant. This amount includes labor and materials furnished by the contractor and materials to be furnished by the Government. The items covered by this estimate are the dam, diversion works (tunnels and cofferdams), spillways, outlet works, power plant, construction railroad and reservoir right of way; the construction railroad is being handled by separate contracts. All principal materials, such as cement and steel, will be furnished by the Government.

In initiating work on the Hoover Dam and power plant, the most important features of the project, the contractor will be able to give early employment to a large number of men. But outside of the construction job itself, the cement mills, steel companies, and manufacturers of pipe, gates, valves, and electrical and hydraulic equipment will see renewed activity in their factories, and can give work to hundreds of men now seeking employment.

The Merritt, Chapman, Scott Corporation subcontract on the 22.7-mile section of the construction railroad, which covers the grading and structures, is scheduled for completion the latter part of December. Track will then be laid by the Los Angeles and Salt Lake Railroad Co. which will complete its contract early in 1931. It is planned to open bids in January for the remaining 10.5 miles of the construction railroad and also for about 8 miles of highway from Boulder City to the dam site. This will be followed by asking bids for constructing the inclined railroad from the top of the canyon to the power-plant site.

Plans are being prepared for the administration building, dormitory, garage, and several residences for Government employees in Boulder City; also for a waterworks system to pump water from the Colorado River to a reservoir in the town, with a lift of 2,000 feet. This will include a modern plant with all up-to-date facilities for clarifying and purifying the water. The southern Sierras Power Co. is proceeding with the construction of a 132,000-volt single-circuit transmission line from its main substation at San Bernardino, Calif., to the dam site, a distance of about 235 miles, and expects to have power for construction purposes ready for delivery about June 1.

Reclamation Tunnels Constructed

(Continued from p. 244)

diversion tunnels are larger than any tunnel ever driven anywhere, with but one exception—the Rove ship tunnel in France. This tunnel has a square invert 58 feet wide by 15 feet deep, with a semicircular arch of 36 feet radius. It has an area of 2,930 square feet, a length of 4½ miles and its construction involved 2,800,000 cubic yards of excavation. Each of the Hoover Dam tunnels has a sectional area of 1,980 square feet, but they are four in number, with a combined length of 3.1 miles and 1,900,000 cubic yards of excavation will be required.

Data on some of the principal tunnels which have been built by the Bureau of Reclamation are given in the accompanying table.

Large Generators

The world's largest hydroelectric generators are now being built by the General Electric Co. for the Dneiper River development at Kichkas, Ukraine, Union of Socialist Soviet Republics, says Engineering and Contracting in its October number. These generators are rated at 77,500 kilovolt-amperes each, the next largest being those at Niagara Falls, which are rated at 65,000 kilovolt-amperes each At the Dneiper River plant, the installed capacity will be about 650,000 horsepower, with 9 units. Each generator will weigh approximately 1, 760,000 pounds, and the rotor and shaft will weigh about 980,000 pounds. The maximum diameter will be 42 feet, and the overall height 40 feet 5 inches, with 17½ feet extending above the floor of the plant. It is interesting to note that present plans for the power plant at the Hoover Dam call for an installed capacity of 1,200,000 horsepower, with twelve 100,000-horsepower turbines.

The Denver office recently asked the manufacturers of hydraulic turbines for information and were advised that there would be no difficulty in designing and constructing turbines of 140,000 horsepower (150,000 kilovolt-amperes) capacity if it is found desirable to adopt units as large as this.

No Street Parking in Boulder City

The town in Nevada that will house the working force that will construct Hoover Dam will be provided with a ground plan, thought out in advance, that will furnish ample parking space and keep idle cars entirely off the streets.

No car will ever park at the curb in this town. There will be areas specially provided and conveniently arranged throughout the town to take care of this demand of a modern age.

This will be the first municipality purposely planned in advance of its development to be laid out with all the exigencies of an automobile age in mind. It will be so designated as to avoid all the inconveniences experienced in old-fashioned towns that grew of themselves in horse-and-buggy days.

This town will be on a great transcontinental automobile highway. That highway, however, will not pass through the business street of the town and interfere with local activities as so often happens, nor through the back yards or undesirable sections. Instead it will wind past the Government buildings, through parks and choice residence areas. The Government which owns all the land and assigns it for specific purposes will place the business section off the through road.

Notes for Contractors

Boulder Canyon project.—The specifications for the construction of the Hoover Dam, including the four 50-foot-diameter diversion tunnels, the cofferdams, power plant except the installation of machinery, and the dam itself, have been completed and invitations for bids for the construction work have been issued. The principal items and approximate quantities involved are as follows:

1,800,000 cubic yards all classes of open cut excavation;

1,900,000 cubic yards of tunnel and shaft excavation;

1,200,000 cubic yards of earth and rock fill in cofferdams and river channel protection;

4,400,000 cubic yards of concrete;

228,000 cubic feet of grout;

Placing 5,500,000 pounds of reinforcement bars;

Drilling 190,000 linear feet of grout and drainage holes;

Installing 1,900,000 pounds of small metal pipe and fittings;

Installing 32,500,000 pounds of large metal conduits;

Installing 10,600,000 pounds of structural steel; and

Installing 20,000,000 pounds of gates, hoists, and other metal work.

Specifications have been issued and bids will be opened Jan. 12 for the construction of the Government portion of the railroad leading to the dam site, together with side tracks and other facilities. This portion of the railroad is about 10½ miles long and runs from the summit or the end of the railroad now being constructed by the Los Angeles and Salt Lake (Union Pacific) Railroad Co., down to the dam site. The principal items and approximate quantities involved are as follows:

115,000 cubic yards of common excavation;

364,000 cubic yards of rock excavation;

163,000 cubic yards of unclassified borrow;

803,000 station cubic yards of overhaul;

287,000 cubic yards of long haul unclassified borrow "loaded into hauling equipment";

705,000 yard-miles of hauling and spreading "long haul unclassified borrow";

29,000 cubic yards of tunnel excavation;

200 M feet b. m. of permanent tunnel timbering;

800 cubic yards of structure excavation, common;

1,200 cubic yards of structure excavation, rock;

6,000 cubic yards of back fill;

220 cubic yards of concrete;

16,000 pounds of reinforcement steel;

2,100 cubic yards of rock riprap;

2,600 cubic yards of concrete cribwall;

1,600 linear feet of 24-inch corrugated pipe;

120 linear feet of 30-inch corrugated pipe;

180 linear feet of 36-inch corrugated pipe;

280 linear feet of 42-inch corrugated pipe;

200 linear feet of 48-inch corrugated pipe;

600 linear feet of 60-inch corrugated pipe;

30 M feet b. m. of bridge or trestle timbering;

200 pounds of rail stringers in rail top trestle;

2,000 linear feet of piling;

80 pile-point shoes;

22,800 cubic yards of ballasting;

7 miles of laying track (tie plated); and

10 miles of laying track (not tie plated).

Specifications have been completed and bids will be opened Jan. 7 for the construction of a highway from Boulder City to the Hoover Dam. The highway will be about eight miles long and will involve a large amount of solid rock excavation. The principal items and the approximate quantities involved are as follows:

113,000 cubic yards of common excavation;

266,000 cubic yards of rock excavation;

40,000 cubic yards of unclassified borrow;

250,000 station cubic yards of overhaul;

6,000 cubic yards of tunnel excavation;

30 M feet b. m. of tunnel timbering;

1,200 cubic yards of structure excavation, common;

600 cubic yards of structure excavation, rock;

2,100 cubic yards of back fill;

170 cubic yards of concrete;

8,500 pounds of reinforcement steel;

2,500 cubic yards of riprap;

5,000 cubic yards of concrete cribwall;

140 linear feet of 18-inch corrugated metal culverts;

1,380 linear feet of 24-inch corrugated metal culverts;

720 linear feet of 36-inch corrugated metal culverts;

1,100 linear feet of 48-inch corrugated metal culverts;

970 linear feet of 60-inch corrugated metal culverts;

420 linear feet of 72-inch corrugated metal culverts;

60 M feet b. m. of bridge timbering;

40,000 cubic yards of gravel surfacing placed;

80,000 station cubic yards of gravel surfacing in stock piles;

8.6 miles of highway treated with oil; and

2,700 linear feet of guard rail.

Prospective bidders may obtain copies of the above described specifications from the office of the Bureau of Reclamation, Washington, D. C.; Denver, Colo.; or Las Vegas, Nev.

Plans and specifications are being prepared for the construction of the water works, sewer system, lighting system, administration building, residences for Government employees and other buildings of a public nature for the Boulder City town site. Invitations for bids will be issued as soon as the plans and specifications can be completed.

Minidoka project.—Bids were opened at Denver on October 31 for furnishing a

Sand Hill area west of Yuma to be closed by All-American Canal

pumping unit and auxiliary electrical apparatus (specifications No. 514) for the South Side pumping station No. 2. The Pelton Water Wheel Co. was low bidder on item No. 7, a Pelton pump, and General Electric motor, with an f. o. b. bid of $13,836. Upon items 3, 4, 5, and 6 the General Electric Co. was low with a bid of $11,728 f. o. b. Fort Wayne, Ind.

Minidoka project, Gooding division.—Contract has been let to the Morrison-Knudsen Co., of Boise, Idaho, for the earthwork and structures between stations 313+97 and 3317+21 of the Milner-Gooding canal and the channel change and operation bridge at Little Wood River on the Gooding division of the Minidoka project under specifications No. 491-D, the total contract price being $208,969.50.

Owyhee project.—Plans and specifications are being prepared for the Mitchell-Butte division main canal between Tunnel Canyon and station 510+40. The principal structures on this reach of canal will be four tunnels, the Black Willow siphon which will be a monolithic concrete barrel structure, the Snively and Owyhee River siphons, both of which will be steel pipes, a wasteway structure, and a considerable length of concrete bench flume section placed on rock foundation.

Specifications (No. 516) and invitations for bids have been issued covering the purchase of three 48-inch internal differential needle valves for the irrigation outlet works at the Owyhee Dam. Bids will be received at the office of the Bureau of Reclamation, Denver, Colo., until 2 o'clock p. m., December 23.

Vale project.—Specifications (No. 515) and invitations for bids have been issued covering the earthwork and structures between stations 2060+50 and 2450 of the Vale Main Canal and the Bully Creek east bench lateral system. The principal items and estimated quantities involved are 582,350 cubic yards of excavation of all classes; 25,000 station cubic yards of overhaul; 8,400 cubic yards of backfill about structures; 1,890 cubic yards of concrete; placing 118,000 pounds of reinforcement bars; laying 5,590 linear feet of 12,15, 18, and 24 inch concrete pipe; installing 20,900 pounds of gates, gate lifts, and structural steel and erecting 22 M feet b. m. of timber in bridges. Bids will be received at the office of the Bureau of Reclamation, Vale., Oreg. until 10 o'clock a. m., December 19.

The reclamation act was approved June 17, 1902. Congress passed this act in order that large areas of lands suitable for irrigation farming in the arid States might provide homes for citizens, increase the agricultural area of the country, and make beneficial use of two of its national assets, land and water.

Nag Hammadi Barrage

The Nag Hammadi Barrage, with its 100 sluices and a lock on the east bank, stretches across a half-mile of the Nile, a few miles north of Luxor, Egypt. This is the first large irrigation work to be undertaken during the reign of King Fuad. It was started in 1927 and is now nearing completion with a total cost of about $10,000,000. This project will provide perennial irrigation for 500,000 acres in the Girgeh Province, now dependent on inundation.

Sir John Jackson Co. (Ltd.), an English company, is building the barrage. An interesting feature of the construction equipment is the great cableway, which is one of the largest single-span cableways ever erected, being 3,000 feet long. There are five cables, each with a capacity of 5 tons, and the entire work area can be covered by a lowering of the masts. These steel masts are 170 feet in height and can be swung either to right or left a distance of 25 feet by means of ball and socket at the base. Some 6,000 native workmen are employed and work day and night shifts. The flow of the Nile at the barrage in flood season is about 350,000 cubic feet per second, while at low stage it is only 25,000 cubic feet per second.

It is expected that the Ministry of Public Works will officially inaugurate the barrage with appropriate ceremonies during the coming winter. Thus Egypt advances one more step in the harnessing of the Nile.

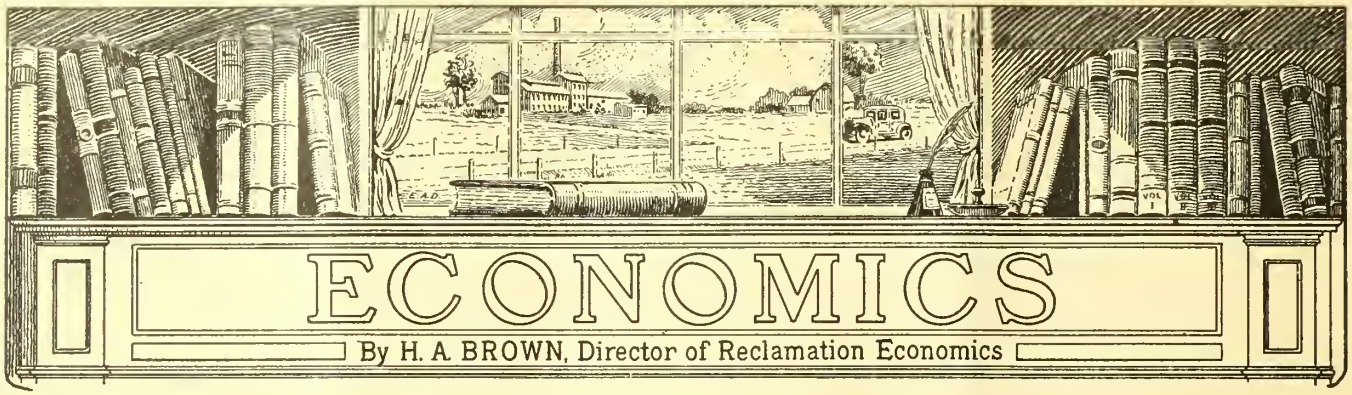
In the 960 miles of its course northerly through Egypt to the Mediterranean Sea, the Nile does not receive a single tributary stream. The river rises in Lake Victoria Nyzanza in east central Africa and flows north for 3,470 miles, one-half the length of the continent, to the sea. This lake has an area of 26,000 square miles, second only to Lake Superior, the largest in the world. In 1929, the Egyptian Government set aside $32,000,000 to begin additional irrigation works to ultimately cost $100,000,000.

Deadwood Dam Completed

The Deadwood Dam on the Deadwood River, Boise project, Idaho, was completed in November. It is deemed a noteworthy achievement of the contractor, the Utah Construction Co., that a dam 170 feet high, located in an isolated spot in the mountains, 67 miles distant across three mountain ranges from a branch railroad, should be built in a season with all cement hauled and all concrete poured in five months.

A contract was recently awarded to the Southwark Foundry & Machine Co., of Philadelphia, Pa., for furnishing a 4,000,000-pound capacity hydraulic testing machine to be installed in the Bureau of Standards laboratory in the new Federal building at Denver, Colo. The machine will be utilized by this bureau in the testing of concrete cylinders in connection with Boulder Canyon project construction work. The contract price is $31,900 of which amount this bureau contributes $25,000. Installation will be handled by the Bureau of Standards.

Owyhee Dam, Owyhee project, under construction



Production and Marketing of Irrigated Crops in the Lower Yakima Valley

AN illuminating article appeared in a recent issue of The Northwest describing some of the interesting things that have been taking place in the production and marketing of irrigated crops in the Lower Yakima Valley, Wash., and in the vicinity of Kennewick.

The growing of vegetables, small fruits, and tree fruits has brought special notice. Although one hears more frequently about these crops, they are not to be considered to the exclusion of other enterprises. Dairy herds, poultry, hogs, and feed crops also have an important place. Alfalfa is a stand-by of the dairyman and it yields heavily. The farms generally are small but maintain their operators frequently more satisfactorily than larger tracts in other regions.

DIVERSIFIED FARMING

The C. G. Campbell farm, a mile and a half southeast of Kennewick, is an example of one well diversified.

Mr. Campbell began farming on this place, consisting of 17⅓ acres, about 12 years ago. Later he bought 10 additional acres. During the 1929 crop season he had an acre and a half of asparagus. Two acres of corn a year ago yielded 45 tons of silage, and this more than filled his 30-foot silo.

Nine acres of old alfalfa and four and a half acres of new seeding supplied his cows with hay during the past winter and spring. The fourth cutting of the old alfalfa was pastured. Mr. Campbell that season also had six acres of permanent pasture carrying 19 head of stock. This is divided into five different lots, the oldest part of the six acres having been seeded down for the past 11 years. A practice is made of turning the stock into one of the lots at a time while the other four grow. The pasture consists of bluegrass and a little clover. The season usually is from May 1 to November 1, or 180 days. The economy in a long pasture season is a help to Kennewick diarymen.

HOGS ARE AN INCOME SOURCE

Mr. Campbell frequently plants a quantity of turnips or carrots, and they have at times produced at the rate of 32 tons to the acre. Four acres in cherry trees (Bings) are another income source.

Forty to sixty head of hogs are sold from the farm every year. A herd of about 15 cows is kept and, owing to dairy herd improvement association work, the owner knows what they are doing. The grains fed to stock are purchased.

Irrigation water for this farm has been costing on 17½ acres at the rate of $8.50 an acre. On 10 acres the rate has been $6.50. Water is certainly worth that much in a farming program so intensified.

ANOTHER FARMER'S PLAN

The operator of such a farm with interests diversified as outlined in the experiences of Mr. Campbell should enjoy reasonable remuneration and a fair return on the investment. He lives where the climate is pleasant and owns his own business.

Another farmer in this district follows a little different plan of diversifying his interests, as shown in the following paragraphs:

"We wouldn't move back where we used to live," said Mrs. Bernard Kempe. "When it's dry back there, the farmer can't do anything about it. Here we can. We irrigate."

Mr. and Mrs. Kempe, who have lived in the Kennewick district for over six years, are doing some 2-story farming. In the case of some vegetables they grow two crops a year. On one occasion they dug their early potatoes and the next day planted another variety. Some of the other vegetables tney raise are onions, spinach, cabbage, and asparagus.

PRODUCTS DISTRIBUTED EFFECTIVELY

A few cows and a few hundred head of hens tend to balance up the Kempe program. Alfalfa hay is raised, but most of the grain for the cows and poultry is purchased. When the Kempes came to their Kennewick farm they had been renting for 12 years. They paid cash for 10 acres and put on the buildings. Last fall they bought another 10 acres.

Much progress has been made at Kennewick in the effective distribution of the various products to the consuming public. In 1923 the first carload shipment of asparagus to go out from Kennewick was dispatched through a local growers' association. Eastern markets were developed and shipments increased. This year scores of carloads of that vegetable were shipped through the different existing agencies and were consumed in Chicago, Cleveland, Buffalo, Detroit, Toronto, Montreal, Rochester, Pittsburgh, Philadelphia, New York, and Boston.

This brief reference to Kennewick asparagus is an example of the growth of agriculture in the district. There also have been big increases in cherry production. Kennewick strawberries have become well known. The early season, quick warming, and fertile soils contribute their share toward crop production in this section.

MANY inquiries concerning the Riverton project were received during the month. One of a number of visitors to the project took a homestead and is making the advance water payment for 1931. Two others were expected to file applications in the near future. One farmer from Colorado had arranged to purchase a partly developed farm in private ownership with the expectation of moving to the project this winter.

THE cotton crop matured rapidly during the month on the Rio Grande project, picking was about 50 per cent complete, and yields were reported good. At the end of the month 15,624 bales had been ginned in El Paso Valley.

Dates on the Salt River Project

A recent article in the Arizona Producer describes the date harvest on the Salt River project, which shows how this product has increased in volume and importance in the past few years.

Between 80,000 and 90,000 pounds of dates were picked, ripened, processed, and packed this fall, worth from 35 cents a pound for the lowest class, comprising bulk fruit, up to $1 or more a pound for the select grades.

The names of the different varieties recall slow-moving caravans of laden camels wending their way across desert sands to the welcome oases where wells of sweet water and stately palms greet the traveller. Here in the Salt River Valley are grown such famous varieties as the Rhar, Iteemas, Khalasas, and Maktums.

The demand for these products of irrigation in the Salt River Valley is greater than the supply. Each year orders must go unfilled. It is estimated that 60 per cent of the crop is consumed in the State. The remaining 40 per cent—all choice fruit—is shipped outside to expensive hotels, fashionable clubs, railway dining cars, dealers who cater to wealthy customers, and to private individuals who have learned to appreciate the excellence of the fruit grown on the project.

Col. Dale Bumstead, whose packing plant disposes of a large share of the crop, has issued a folder setting forth some essential facts about dates in the old and new worlds. After describing the gardens of Solomon and Tutankhamen, he says of the Salt River dates:

Collecting pears in orchard, Rio Grande project, New Mexico-Texas

"These fresh dates are an entirely new gastronomic sensation in America; they bear no more relation to the dried dates of commerce than a spicy red apple bears to the dried apples of our youth."

The crop this year is the best in the history of the project, and will add materially to the income of the fortunate growers.

The largest poultry plant in the world, operated at Reseda, Calif., sells more than 150,000 old hens each year and maintains a flock of 500,000 hens.

Digging potatoes on the Shoshone project, Wyoming

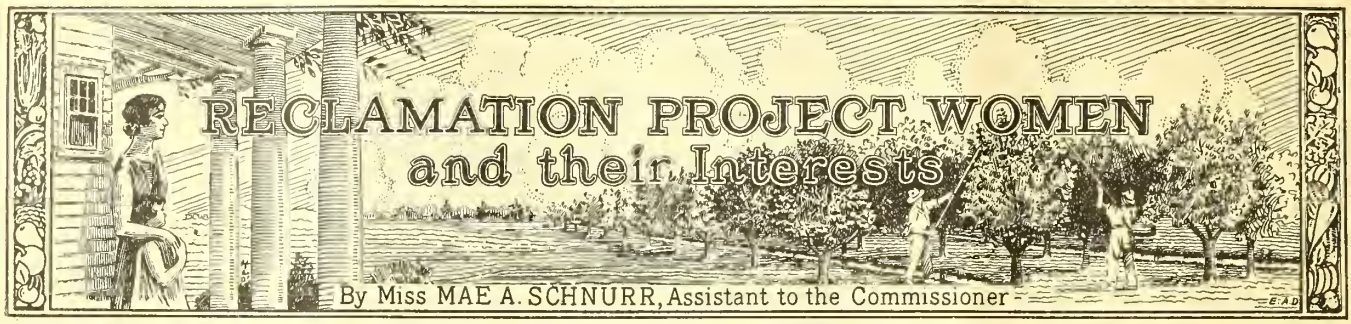
Record Potato Crop Grown on Milk River Farm

With what is regarded as a record crop in northern Montana Leo Geeting, a farmer in the Strater community near Malta, has joined the 500-bushel club sponsored by the extension service, his yield being 752 bushels from 0.95 of an acre of irrigated land.

The potatoes were weighed as they were taken from the field, and allowing for shrinkage, the yield will still be above the 500-bushel mark. The potatoes are certified Bliss Triumphs, and at the price at digging time the crop will bring about $540, or enough to pay all expenses, taxes on the entire farm, and all water charges, and still leave an additional profit.

Phillips County Agent H. L. Lantz says that careful cultivation, irrigation, and uniform moisture of the soil after blossoming time are responsible for the large crop. Fay Camp at Strater and J. C. Doyle also have exceptionally good potatoes.

THE community organizations of the Belle Fourche Valley mailed out 30,000 circulars during October calling attention to the advantages of farming on the project. These circulars, with return cards for reply, were distributed on all rural mail routes within a radius of 150 miles of Newell. This method was used to bring in additional farmers in order that the inactive tracts might be made to produce more intensively.



Country Women's Organizations

THERE is a decided movement in the United States for the formation of rural women's marketing organizations. In doing this, American women are following in the footsteps of women of foreign nations and have the benefit of their experiences.

That we are interested in taking advantage of such benefits and anxious for an exchange of ideas is evidenced by this country sending delegates to the eighth quinquennial meeting of the International Council of Women held in Vienna last summer. The object of the conference was to discuss subjects of interest to country and farm women, and to consider whether organizations of rural women throughout the world can be brought in touch with one another on an international basis to their mutual benefit.

It is thought that a review of what took place, what countries were represented, subjects considered, facts brought out, recommendations made, etc., will be of interest to the women's organizations and individuals on our projects.

The facts are made available through the International Institute of Agriculture at Rome.

The conference was attended by delegates and speakers from 26 countries, viz, Austria, Australia, Bulgaria, Canada, China, Czechoslovakia, Denmark, England, Estonia, East Africa, Finland, Germany, Hungary, India, Ireland, Lithuania, Netherlands, Palestine, New Zealand, Norway, Scotland, Sweden, Switzerland, Union of South Africa, United States of America, and Yugoslavia. Representatives of the United States Department of Agriculture, Extension Service, the Ministry of Agriculture (England and Wales), the International Labor Office (agricultural section), and the International Institute of Agriculture were also present.

The activities and objectives of the various national organizations of rural women necessarily differ somewhat in the different countries in accordance with the existing status of women in the respective countries and the conditions prevailing generally among the rural populations.

In certain countries the part played by women as agricultural producers is more definitely recognized, attention is given to the organization of marketing facilities among country women, and to the stimulation by educational and competitive methods of the quantity and quality of their output in the special branches of farming usually regarded as within their sphere. In others, the organizations lay stress on the function of woman as the rural home maker and on her power to raise the general standard of living in the country.

Very considerable interest attached to the item of the conference agenda "Marketing problems as affecting country women," the position in the United States and in Germany being described by expert speakers from the two countries.

UNITED STATES OF AMERICA

In the United States marketing by women producers has until comparatively recently been carried on either as direct marketing to wholesale merchants in business centers, or sales to private customers, or by selling from wayside stalls, curb markets, etc. The disadvantages attending such forms of marketing, arising from lack of knowledge of consumers' wants, absence of standardization, or defective business methods, are obvious, and difficult to correct in the case of the unorganized producer. Now, however, associations are being locally organized. Membership is growing, but there are still too few women who are members of an association. The United States Government assists these associations by the appointment of technical advisors in each district, whose sole function is to suggest lines of policy or business methods. The actual organization lies with the women themselves; membership is open only to those who can show that their products are up to standard, and in some cases a health certificate is required of intending members.

The women study market demands, set standards of grading and packing of products, and above all study costs of production. Efforts are being made to stabilize prices and although obvious difficulties exist in this respect, there are indications that the farm woman will become an important factor in the education of public opinion in the matter of the just and economic remuneration of the labor of the producer.

The advance in knowledge of rural economics and sociology which is taking place is benefiting also the American farm woman who is undoubtedly gaining a wider outlook on marketing and other rural problems. It may be added that results of research as regards nutrition values of the various products are being placed at the disposal of these women's marketing associations with a view to encouraging the production, and offering for sale, of the commodities best calculated to build up the health of the Nation. Other sources of information are open to the associations, including the research departments of many large commercial firms and of the Farm and Garden Union of the United States, an offshoot of the older institution of the same name existing in England. American farm women undertake marketing frequently as a means of supplementing the income made by the men on the land, so as to have additional resources for bringing home life up to the desired standard for education and recreation.

GERMANY

In Germany farm women's marketing organizations have been in existence from pre-war years, owing to the efforts of the Landfrauenvereine which date from the early part of this century. They proved of great value during the period immediately following the inflation period, both in stabilizing prices and in standardizing products. Organized farm women's depots exist all over Germany and do much to encourage standardized types of products, breeds of fowls, improved kinds of fruit and vegetables, etc., and also the grading and classifying of products.

As in the United States, use is made of all available sources of scientific and technical information. The recent intro-

duction of "conjuncture price barometers" has been an aid to stabilization.

AGRICULTURAL EDUCATION

Another subject of particular interest handled by the conference was that of the contribution made by women to agricultural output, as affected by agricultural education.

It would no doubt be exceedingly difficult to determine with any exactness the proportion of the contribution made by women to the total volume of agricultural production, but it is probable that the extent of this contribution is not always fully appreciated. It is broadly true of all countries that the women of the farms, in addition to their duties as rural home makers, have a large responsibility for the care of livestock (particularly young cattle and poultry), and that they also undertake field work, the extent of which varies according to the size of the holding, the prevailing type of agriculture, and the customs and economic condition of a given country.

In any case the utilization of farm produce in the farmhouse, which forms an integral element in the profit earning capacity of the farm, must necessarily fall to the woman and should be reckoned as part of her contribution to the farm economy. In short, the woman on the farm, no matter how small her share may be in actual physical labor, can not be said to be disassociated from the business of farming, in the way the wife of a business man, lawyer, or doctor, is often disassociated from her husband's profession.

WOMEN ENGAGED IN FARMING

Coming to the actual proportion of women engaged in farming, it was noted as of interest that in England and Wales, which are commonly regarded as industrial rather than agricultural countries, according to the 1921 census of agriculture, this industry comes third (after the textile and metal industries) as giving employment to women workers, the numbers being approximately 100,000 out of a total of about 800,000 agricultural workers. In addition the same census shows some 20,000 women farmers, out of an approximate total of 500,000 farmers (owners and tenants) while the figures representing the wives and daughters of farmers and small holders, and the women farm servants, may be roughly stated as upward of 1,000,000 persons, all making some contribution to agricultural output in the way of dairy work, poultry keeping, and care of young stock. In regard to women farmers, as such, it is becoming increasingly common for women with some capital and a liking for outdoor life and occupation to take up farming, and although many such farms are on a small scale, others are really large undertakings.

VOCATIONAL EDUCATION IN AGRICULTURE FOR WOMEN

Vocational education in agriculture is, as is well known, now provided in all progressive countries and made available for women and girls. It may be said that the tendency of this vocational instruction and training on the output of farm women should be, and increasingly is, as follows:

1. An improvement in quantity and quality of output.
2. An improvement in the status of the country women's work, raising it to the dignity of a career.
3. More women are attracted to an agricultural life, whether on their own account or as paid workers.
4. An improvement in rates of remuneration.

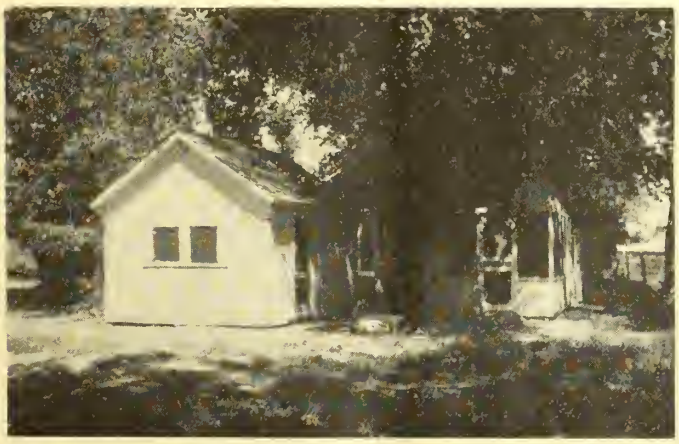
In addition the special form of agricultural education, known as rural domestic economy or farm household management, by making it possible to secure a better correlation between production of the farm and consumption in the farmhouse, is not only promoting better living in the country, but is enlarging the family income and virtually augmenting the agricultural output of the holding.

The fact that a technical training in agriculture is equally available to men and women is resulting in the gradual attainment by women of a place in the councils of the industry where their influence may eventually be felt in the direction of certain progressive measures, i. e., the furtherance of cooperative movements in agriculture, improvement of rural housing and other conditions affecting the workers' efficiency, humane slaughtering of animals for food, etc.

LEGAL PROTECTION OF AGRICULTURAL WORKER

The important question of the rights of the rural woman and child with respect to the laws made for the whole community was finally discussed. It was remarked that legislation is too often made with special regard to the requirements of the industrial worker, that the protection accorded by such laws is not applicable to the agricultural worker, and that the woman in particular is liable to suffer from the absence of such protection. Compensation for accidents during work, for example, is often unnecessarily difficult for a woman farm worker to obtain, no doubt partly owing to the less defined character of her activities. The inheritance laws are also often inequitable as regards women and it is more difficult in some countries for a woman to claim succession or inheritance rights than for a man.

In regard to child labor there is frequently no legal restriction on the work of children in agriculture and they are often employed for long hours on heavy work, such as potato lifting, which is really the work of full-grown men. Attention was called to the fact that the International Labor Office is about to make an inquiry into child labor in all



Old and new homes of Mrs. Dena Johnson, Newlands project, Nevada

countries, and the work of this inquiry would be greatly helped and facilitated if the rural women's organizations in the various countries would undertake to collect facts relating to child labor.

The action of the Women's Institutes of Canada in regard to the promotion of the political and legal rights of rural women is particularly vigorous, although conditions vary considerably in the different Provinces. Largely owing to the action of women on public bodies, the legislation in the western Provinces of Canada is of a very progressive character in this respect, rights of inheritance, of guardianship of children and similar rights of women being carefully protected.

Considerable emphasis was laid in the course of the conference on the betterment of the position of the woman farm worker, and it was the general opinion expressed by speakers from a number of countries that the presence of women on local government bodies was among the most important means for effecting such improvement, while in addition technical improvements, such as the extension of electricity in rural districts and its application to farmhouse processes, would largely come about as a result of the part already taken, or to be taken, by women in public affairs.

It is above all essential that the woman in the country should learn to think for herself and should develop an effective sense of responsibility in all matters relating to her own life and that of the Nation, and it is in this direction that the farm or country women's associations are doing some of their most important work.

It was agreed to continue an alliance of a somewhat informal character with the International Council of Women which would serve to link together the rural women's organizations which had been represented at this conference and at the previous one held in London in 1929.

A recommendation was passed urging on the rural women's associations to promote everywhere the training of all girls in home science and the household arts. A second recommendation urged that in villages of such countries as do not possess legislation protecting child labor in agriculture, information on child labor should be collected by the associations and forwarded to the International Labor Office at Geneva to be used in connection with the inquiry already mentioned. It was also recorded as the opinion of the conference that the activities of the International Institute of Agriculture at Rome should include provision for consultation on and promotion of the interests of rural women.

Bees are a profitable enterprise on the Belle Fourche project, and honey is produced in abundance.

Denver Reclamation Force Organized Gymnasium

Sixty members of the Denver office have organized a gymnasium class which meets twice a week throughout the winter months at the local Y. M. C. A. Fifteen minutes are spent in callisthenics, and an hour is devoted to volley-ball games. The group has been divided into four teams, called Electricals, Mechanicals, Civils, and Dams, for a tournament, and at the present time the Electricals and Civils are having a close fight for the leadership.

Some of the younger men have also formed a basket-ball team which will compete in the Y. M. C. A. Industrial League as the United States Reclamation team.

The progress of this organization will be of much interest to our project readers.

Cucumbers for pickles return up to $300 per acre on the Belle Fourche project, South Dakota.

Colorado River Board Meets in Denver

The members of the Colorado River board of engineers and geologists assembled in Denver on December 1 to consider approval of final plans for the Hoover Dam and appurtenant works. The personnel of the board is as follows:

Maj. General William L. Sibert, of Mobile, Ala., chairman.

Prof. Daniel W. Mead, University of Wisconsin, Madison.

Prof. Warren J. Mead, University of Wisconsin ,Madison.

Robert Ridgway, New York City.

Prof. Charles P. Berkey, Columbia University, New York City.

This board was appointed by the Secretary of the Interior with the approval of the President under authority of the joint resolution approved May 29, 1928, "to appoint a board of engineers to examine and report upon the dam to be constructed."

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- Boulder Canyon project construction features briefly described. Engineering and Contracting, November, 1930, vol. 69, p. 398.

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- Position of Mexico in connection with Boulder Dam project. International complications seen under certain conditions. U. S. Daily, Oct. 24, 1930, vol. 5, pp. 1 and 4 (pp. 2587 and 2590).

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McPhail, H. F.:
- Pumping plants of the Bureau of Reclamation, illus. with costs. Engineering and Contracting, November, 1930, vol. 69, pp. 406–408. (From Reclamation Era, June, 1930.)

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Weymouth, F. E.:
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Colorado River water suitable for all uses. Abstract of report, Western Construction News, Oct. 25, 1930, vol. 5, p. 515.
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Grunsky, C. E.:
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FIVE carloads, containing 2,000 packed boxes of grapefruit, were shipped from the Yuma auxiliary project by the end of October. The first four cars brought $4 per box, delivered on the Pacific Coast. The last car brought about $3.50 per box. These prices, which are considered good, brought the growers a gross profit above picking, packing, and marketing costs of 3 to 4 cents per pound.

Progress of Irrigation Program in Mexico

THE Mexican Government in 1926 inaugurated a program of irrigation works under the direction of a national irrigation commission. Since that time two projects have been completed and the irrigated lands are being brought under cultivation, while a third will soon be ready. The commission also has several other projects under study or under construction.

RIO MANTE PROJECT

The first project to be completed, although officially known as No. 2, was the dam on the Rio Mante (branch of Guayalejo) in the State of Tamaulipas, which is destined to irrigate 45,000 acres. About 4,000 acres in this district are now planted in sugarcane, and this acreage will be increased. A sugar factory with a capacity of 38,000 tons is now being constructed at Villa Juarez, and is due to be completed early in 1931. Citrus fruit is also being planted in the Rio Mante area, with a view to exportation to Canada. The irrigated lands are privately owned and no colonization is contemplated.

PRESIDENT CALLES PROJECT DEVELOPMENT

Project No. 1, known as President Calles in honor of the former President of Mexico, who initiated the irrigation program, is on the Rio Santiago, in the State of Aguas Calientes, with an auxiliary system on the Rio Pabellon in the same State. This project will eventually irrigate about 47,000 acres. The first unit of 25,000 acres is now completed. Of this area about 10,000 acres have become the property of the Federal Government in accordance with the irrigation law, which provides that the Government shall receive a percentage of the lands irrigated as compensation for installing the irrigation system.

The colonization in connection with this project is being carried out directly by the National Irrigation Commission, and to date about 25 colonists have taken lots. Preference is being given to former tenants and share workers of the vicinity who have had actual farming experience, to graduates of the Government agricultural schools, and to Mexican farmers now living abroad who wish to return to Mexico.

The land is being sold at $56.70 per acre, although the cost of bringing the water to the land is said to average $124.80 per acre. Details regarding terms of payment and methods of financing the colonists are still being worked out. It was originally intended to turn the colonization work over to the Banco Nacional de Credito Agricola, but this was later left in the hands of the irrigation commission. The Farm Credit Bank is now being reorganized, and it is understood that it will organize rural credit societies to finance the colonists who are settled on the irrigated lands, and will also maintain agents to advise the farmers regarding the best crops to plant, as well as to aid in the procurement of seed, work stock, implements, and other necessaries. At the present time each colonist is providing his own house. The maximum area of irrigated land to be sold to one head of a family is 370 acres, although a larger acreage may be obtained in case part of the land is fit only for pasture.

The altitude of the irrigated zone of project No. 1 varies from 6,110 to 6,290 feet. The principal crops heretofore grown on irrigated lands in that region have been corn, wheat, chillies, fruits, and vegetables. Corn and beans are usually grown on the unirrigated lands of the State. The livestock industry also has been of importance. The main line of the railway from El Paso to Mexico City intersects the irrigated zone of project No. 1.

PROGRESS ON PROJECTS NOS. 3 AND 4

Project No. 3 is on the Rio Tula, State of Hidalgo, which is located about 31 miles northeast of the City of Mexico. Already some 37,000 acres are irrigated by existing works, but it is proposed to double the capacity of the present system and also to build a spillway. About 300 men are now employed on this project. Most of the irrigated area included in this system is held in village commons or "ejidos," which were carved from large private estates in accordance with the agrarian reform movement.

Project No. 4, on the Rio Salado, is located on the borders of the States of Nuevo Leon and Coahuila. The principal railway station is Rodriguez, Nuevo Leon, on the main line from Laredo to Mexico City. This project is designed to irrigate eventually 160,500 acres. Early in 1930 the National Irrigation Commission purchased 97 tractors and is now preparing the soil of the first unit of 54,300 acres. About 14,800 acres are now said to be ready for settlement. Some 1,500 workers are employed by the commission on this preliminary ploughing, and it is expected that colonization will begin this fall.

The commission is studying the possibility of placing on these lands Mexicans who have been repatriated from the United States. The region which is being irrigated is very arid, the average precipitation during the last 25 years not

exceeding 10 inches. As a consequence the region is sparsely settled and it is necessary to look to other sections for settlers. It is believed that Mexicans who have lived for some time in the United States, and have worked in cotton or beet fields, will have acquired considerable practical knowledge of farming and will also have a desire for a higher standard of living than is generally attained by the field worker or peon of the Central Plateau. An experimental farm, maintained by the commission, has been in existence at Rodriguez for two years. It is believed that cotton, Sudan grass, milo, kafir corn, and malt barley are the crops best adapted to the soil. Experiments with different types of fertilizer are also being made.

Lands in project No. 4 will also be sold at $56.70 per acre. The commission has erected several model farmhouses, but it has not been decided whether all homes will be erected by the commission for the account of the settlers, or whether each colonist will be left to his own initiative in providing shelter for himself and family. Merchants and bankers of the city of Monterey, which is the principal distributing center adjoining the irrigated zone, are showing great interest in the development of the irrigated areas. Monterey capitalists are studying the possibility of organizing a farm-loan bank to finance the settlers.

SAN CARLOS PROJECT ACTIVITIES

Project No. 5 at San Carlos, Coahuila, is located on the Trevino estate. An old dam of this property had been practically abandoned since the outbreak of revolution in 1911 and is now being rehabilitated at a cost of approximately $500,000. Work has begun on a dam on the Rio Conchos, near Camargo, Chihuahua, and 400 men are employed on this project. The first unit to be constructed there will irrigate 37,000 acres, and eventually the system will embrace 99,000 acres.

OTHER PROJECTS UNDER CONSIDERATION

The National Irrigation Commission is studying several other projects, notably the advisability of constructing another dam below the Tepuxtepec Dam on the Lerma River in the State of Mexico, with the view to conserving and utilizing the waters of that river for irrigation purposes. The Tepuxtepec Dam and power house, with a capacity of 120,000 horsepower, is now being completed by the Mexican Light & Power Co. (Ltd.). The northern district of Lower California is now engaged in the construction of a dam known as Presa Rodriguez, to utilize the waters of the Rio Tia Juana. The area to be irrigated is estimated at 5,000 acres. The Federal Government is taking steps to encourage the State authorities to undertake irrigation works for their own account. The States of Nuevo Leon and Coahuila have shown considerable interest in such developments.

IN conformity with the policy of the Government and of its own program of employment, the General Construction is employing a total of 220 men in tunnel work at Owyhee Dam, in addition to the 100 men employed by the Government on the work.

Plant of the Holly Sugar Corporation, Sidney, Mont., Lower Yellowstone project

More Dams

The designing section of the Denver office is making preliminary designs and estimates of the Agency Valley dam on the Vale project, Oregon, an earth-fill structure; also the Conner dam on the Gila River, New Mexico, a 400-foot concrete gravity arch dam to store water for power, flood control, and irrigation; the Alma dam on the San Francisco River, New Mexico; the Sunshine dam on the Greybull project, Wyoming; and the Saratoga diversion dam on the Saratoga project in Wyoming. These are all in connection with secondary project investigations.

Through some inadvertence the Milk River project was given credit for the illustration appearing on the back cover page of the November issue of the Era. In reality this picture was taken on the Lower Yellowstone project, on the Alling farm 2 miles south of Sidney. The farmer, Henry Hafner, and his daughter are standing in the foreground exhibiting some of the fruits of their labors.

Farming is a business requiring skill, industry, and the use of capital intelligently directed to make it pay. The selection of a farm is an important step in the undertaking, to which careful consideration should be given.

When a turkey flock has been fed a growing ration of ground feeds throughout the growing period, it will not require as much feed or as long a period of fattening to put the birds in prime condition. This ground ration should be kept before them always, with the additional grains fed. Fattening turkeys always should have plenty of clean, fresh water to drink. Milk in any form makes an excellent addition to the fattening ration.

OCTOBER was a favorable month for harvesting crops on the North Platte project. Approximately 70 per cent of the sugar beets were delivered by November 1. The average yield was estimated at 14 tons per acre. The seven sugar factories on the project are employing over 3,000 men.

CORN was being picked or husked throughout the month on the Lower Yellowstone project and very good yields were reported. The extremely hot weather of the summer was favorable for corn wherever it was irrigated.

Accretions to the reclamation fund, repayments to the reclamation fund, and expenditures for construction and operation and maintenance of reclamation projects to June 30, 1930

(1) State and project	(2) Accretions to reclamation fund to June 30, 1930	(3) Collections (repayments to reclamation fund) to June 30, 1930	(4) Total accretions and collections (column 2+column 3)	(5) Expended for construction of reclamation projects to June 30, 1930	(6) Expended for operation and maintenance to June 30, 1930	(7) Total expenditures to June 30, 1930
Alabama	$60,127.13		$60,127.13			
Arizona:						
Salt River		$9,686,842.98		$15,106,942.10		$15,106,942.10
Yuma [1]		[2] 5,754,744.24		6,929,700.25	[3] $2,299,391.38	9,229,091.63
Yuma auxiliary		22,354.33			183,651.57	183,651.57
Total, Arizona	2,453,591.71	15,463,941.55	17,917,533.26	22,036,642.35	2,483,042.95	24,519,685.30
California:						
Orland		1,310,584.71		2,502,613.70	438,325.15	2,940,938.85
Yuma [1]		[2] 1,989,809.65		3,147,672.82	912,552.48	4,060,225.30
Klamath [1]		[2] 438,042.62		2,155,867.04	81,000.00	2,236,867.04
Total, California	15,506,856.47	3,738,436.98	19,245,293.45	7,806,153.56	1,431,877.63	9,238,031.19
Colorado:						
Grand Valley		829,758.12		5,338,934.91	129,720.24	5,468,655.15
Uncompahgre		2,853,911.04		7,928,760.97	1,020,544.89	8,949,305.86
Total, Colorado	10,410,861.78	3,683,669.16	14,094,530.94	13,267,595.88	1,150,265.13	14,417,961.01
Idaho:						
King Hill		130,224.99		1,905,318.80	156,734.25	2,062,053.05
Minidoka		12,224,190.17		15,036,028.86	2,137,206.72	17,173,235.58
Minidoka-Gooding division		266,469.94		1,890,818.49		1,890,818.49
Boise [1]		[2] 7,300,196.12		16,030,428.76	2,751,512.14	18,781,940.90
Owyhee [1]		[2] 4,273.67		762,350.55		762,350.55
Total, Idaho	6,935,384.51	19,925,354.89	26,860,739.40	35,624,945.46	5,045,453.11	40,670,398.57
Kansas: Garden City	1,032,764.48	58,002.27	1,090,766.75	395,831.78		395,831.78
Louisiana	20,413.71		20,413.71			
Montana:						
Huntley		1,203,682.09		1,562,302.99	1,014,943.79	2,577,246.78
Milk River		639,723.98		7,448,280.78	217,611.55	7,665,892.33
Sun River		803,357.41		7,187,721.71	304,163.41	7,491,885.12
Lower Yellowstone [1]		[2] 546,507.08		2,345,910.86	827,664.95	3,173,575.81
Total, Montana	16,025,369.79	3,193,270.56	19,218,640.35	18,544,216.34	2,364,383.70	20,908,600.04
Nebraska: North Platte [1]	2,093,754.36	[2] 5,747,732.44	7,841,486.80	14,953,360.92	2,656,484.64	17,609,845.56
Nevada: Newlands	996,298.37	2,682,824.91	3,679,123.28	7,956,917.16	1,453,490.54	9,410,407.70
New Mexico:						
Carlsbad		1,733,259.35		1,464,522.57	841,342.14	2,305,864.71
Hondo		34,956.70		381,573.39		381,573.39
Rio Grande [1]		3,911,934.12		8,547,138.33	1,610,779.50	10,157,917.83
Total, New Mexico	6,356,453.09	5,680,150.17	12,036,603.26	10,393,234.29	2,452,121.64	12,845,355.93
North Dakota:						
Buford-Trenton		17,873.93		223,423.06	74,781.07	298,204.13
Williston		591,766.47		517,630.09	904,662.04	1,422,292.13
Lower Yellowstone [1]		[2] 234,482.48		1,251,223.38	441,446.48	1,692,669.86
Total, North Dakota	12,276,579.13	844,122.88	13,120,702.01	1,992,276.53	1,420,889.59	3,413,166.12
Oklahoma	5,925,274.31		5,925,274.31			
Oregon:						
Baker		5,879.29		68,334.79		68,334.79
Umatilla		1,184,354.76		5,137,937.20	689,727.82	5,827,665.02
Vale		21,020.57		2,638,738.61		2,638,738.61
Klamath [1]		[2] 2,239,981.15		3,715,708.82	1,079,358.71	4,795,067.53
Owyhee [1]		[2] 9,896.43		1,765,472.63		1,765,472.63
Boise [1]		[2] 53,145.40		32,125.10	28,000.00	60,125.10
Total, Oregon	11,883,257.65	3,514,277.60	15,397,535.25	13,358,317.15	1,797,086.53	15,155,403.68
South Dakota: Belle Fourche	7,716,593.30	1,521,168.84	9,237,762.14	4,190,875.84	1,514,125.09	5,705,000.93
Texas: Rio Grande [1]		3,111,433.97	3,111,433.97	7,211,353.20	1,332,796.46	8,544,149.68
Utah:						
Strawberry Valley		2,166,204.22		3,519,935.39	437,856.39	3,957,791.78
Salt Lake Basin		58,476.95		2,363,024.31		2,363,024.31
Total, Utah	4,332,325.12	2,224,681.17	6,557,006.29	5,882,959.70	437,856.39	6,320,816.09
Washington:						
Okanogan		699,955.58		1,456,465.81	649,647.22	2,106,113.03
Yakima		11,105,546.81		14,509,196.64	4,236,112.29	18,745,308.93
Yakima-Kittitas division		70,618.77		6,583,745.47		6,583,745.47
Total, Washington	7,416,855.95	11,876,121.16	19,292,977.15	22,549,407.92	4,885,759.51	27,435,167.43
Wyoming:						
Riverton		148,898.15		3,835,484.30		3,835,484.30
Shoshone		2,134,648.15		9,752,118.45	911,740.50	10,663,858.95
North Platte [1]		[2] 743,258.27		5,206,657.03	95,486.48	5,302,143.51
Total, Wyoming	37,234,020.79	3,026,804.57	40,260,825.36	18,794,259.78	1,007,226.98	19,801,486.76
All States:						
Secondary investigations		903,759.79	903,759.79	2,900,836.52		2,900,836.52
Federal water power licenses	59,360.35		59,360.35			
Other collections (including general offices, Indian projects, etc.)		4,401,243.11	4,401,243.11			
Grand total	148,736,142.00	91,596,996.02	240,333,138.02	207,859,284.38	31,432,859.89	239,292,144.27

[1] Interstate projects, expenditures for construction and for operation and maintenance partly prorated on an area basis.
[2] Distribution between States of collections on interstate projects partly estimated.
[3] Levee maintenance reimbursed by or financed by General Treasury not included.

Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, commissioner, was one of three speakers to discuss the British mandate in Palestine, considered by the Foreign Policy Association at a meeting in Boston on December 6. The other speakers were Sir George Young, visiting professor of political science and international law, Clark University, and William Ernest Hocking, professor of philosophy, Harvard University. William Yandall Elliott, associate professor of government, Harvard University, presided. The Foreign Policy Association concerns itself with international matters of unusual importance. The interruption of Jewish settlement in Palestine by the British has made this mandate a subject of great interest.

L. N. McClellan, electrical engineer; E. B. Debler, hydraulic engineer; and B. E. Stoutemyer, district counsel, spent several days during the month on the Boise project in connection with studies relating to the necessity and feasibility of additional storage on the Boise River at Twin Springs.

A. W. Simonds, associate engineer in the Denver office, was at Boulder, Colo., the entire month in connection with proposed building and testing of models of the Hoover Dam.

Louis C. Hill, consulting engineer on important reclamation work in the Interior Department at large, who was released on August 10 to accept a temporary assignment with the American section of the International Water Commission, United States and Mexico, has been reappointed by the Interior Department, effective November 15. His first assignment in his present position is with the board of consulting engineers at Hoover Dam.

Prof. F. L. Ransome, a noted geologist, who has served the Bureau of Reclamation as consulting geologist in connection with several engineering projects and was in April, 1929, formally appointed consulting geologist in the Interior Department at large for consultation purposes on important reclamation work, has been assigned to the board of consulting engineers of the Hoover Dam.

F. F. Smith, construction engineer on the recently completed Echo Dam, on the Salt Lake Basin project, Utah, has been granted a three months' leave of absence in order to make a special investigation of an irrigation project near Torreon, Mexico, for the J. G. White Engineering Corporation.

C. A. Bissell, chief of the engineering division in the Washington office, for some months in charge of the investigation of the central California water resources, visited the Boulder Canyon project office during the month en route from Sacramento to Denver. After a two weeks' sojourn in Denver Mr. Bissell arrived in Washington on November 24.

Andrew Weiss, formerly superintendent of the North Platte project and now engaged in reclamation work in Mexico, visited the project office at Guernsey, Wyo., the last of the month.

S. O. Harper, general superintendent of construction, left Denver about the middle of the month to inspect the work in progress on the Minidoka project, Deadwood Dam on the Boise project, Owyhee, Vale, Yakima, Kittitas, and Sun River, projects, and returned the latter part of the month.

Joseph Markham, superintendent of Jackson Lake Reservoir, Minidoka project, called at the Washington office on November 29. Mr. Markham was returning to the West after a visit to his mother in Connecticut.

Clement S. Ucker, former chief clerk of the Department of the Interior and for a number of years connected with the work of the Bureau of Reclamation in its investigations of opportunities for planned group settlement in the South, died suddenly in Baltimore on November 28.

J. L. Savage, chief designing engineer; S. O. Harper, superintendent of construction; and A. J. Wiley, consulting engineer, visited Deadwood and Arrowrock Dams on the Boise project the latter part of the month.

R. J. Coffey, district counsel at Berkeley, Calif.; R. M. Priest, superintendent of the Yuma project; J. P. Corey, president of the Yuma County Water Users' Association; and L. P. Hamilton, chairman, spent some time in the Washington office during the month in connection with the proposed revision of the Yuma contract.

L. N. McClellan, electrical engineer, made a recent inspection of the power system and went over the proposed enlargement of the south side pumping stations on the Minidoka project, after which he conferred with officials of the Idaho Power Co. at Boise, Idaho, in regard to the disposition of power from the Twin Springs development.

B. E. Stoutemyer, district counsel at Portland, Oreg., arrived on the Yakima project early in the month to confer with officials regarding the Sunnyside water rights. He was later joined by E. B. Debler, hydrographic engineer, and a conference was held with reclamation and Indian Service officials concerning Yakima River problems.

W. J. Burke, district counsel at Billings, Mont., spent several days during the month on the Shoshone project.

E. W. Lane, engineer in the Denver office, spent almost the entire month at Fort Collins, Colo., making models for experiments on spillways and spillway channels for the Cle Elum Dam. He was assisted during part of the month by H. D. Fox, associate engineer.

H. H. Johnson, superintendent of the Milk River project, was called to Washington for an informal conference beginning November 15 in connection with the division of the waters of the St. Mary and Milk Rivers between the United States and Canada. This conference was preliminary to an international joint commission to meet some time later in the winter.

Messrs. F. E. Weymouth, former chief engineer, W. J. Wiley, and E. C. Van Petten were on the Owyhee project and visited the dam during the month.

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

RAY LYMAN WILBUR, SECRETARY OF THE INTERIOR

Jos. M. Dixon, First Assistant Secretary; **John Edwards,** Assistant Secretary; **E. C. Finney,** Solicitor of the Interior Department; **E. K. Burlew,** Administrative Assistant to the Secretary and Budget Officer; **Northcutt Ely,** Executive Assistant

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Assistant to the Commissioner
W. F. Kubach, Chief Accountant

P. W. Dent, Assistant Commissioner
C. A. Bissell, Chief of Engineering Division
C. N. McCulloch, Chief Clerk

Hugh A. Brown, Director of Reclamation Economics
George O. Sanford, Assistant Director of Reclamation Economics

Denver, Colo., Wilda Building

R. F. Walter, Chief Eng.; S. O. Harper, Gen. Supt. of Construction; J. L. Savage, Chief Designing Eng.; E. B. Debler, Hydrographic Eng.; L. N. McClellan, Electrical Eng.; C. M. Day, Mechanical Eng.; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative.

Projects under construction or operated in whole or part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	Fiscal agent	District counsel	
		Name	Title			Name	Address
Yuma	Yuma, Ariz	R. M. Priest	Superintendent	J. C. Thrailkill	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.
Boulder Canyon	Las Vegas, Nev	Walker R. Young	Constr. engr	E. R. Mills	Charles F. Weinkauf.	do	Do.
Orland	Orland, Calif	R. C. E. Weber	Superinteudent	C. H. Lillingston	C. H. Lillingston	do	Do.
Grand Valley	Grand Junction, Colo	W. J. Chiesman	do	E. A. Peek	E. A. Peek	J. R. Alexander	Montrose, Colo.
Uncompahgre	Montrose, Colo	L. J. Foster	do	G. H. Bolt	F. D. Helm	do	Do.
Boise [1]	Boise, Idaho	R. J. Newell	do	W. L. Vernon	Denver office	B. E. Stoutemyer	Portland, Oreg.
Boise, Deadwood Dam	Cascade, Idaho	do	do	C. B. Funk	do	do	Do.
Minidoka [2]	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	Miss A. J. Larson	do	Do.
Milk River [3]	Malta, Mont	H. H. Johnson	do	E. E. Chabot	E. E. Chabot	Wm. J. Burke	Billings, Mont.
Sun River, Greenfields	Fairfield, Mont	A. W. Walker	do	H. W. Johnson	H. W. Johnson	do	Do.
Lower Yellowstone	Savage, Mont	H. A. Parker	do	N. O. Anderson	Denver office	do	Do.
North Platte [4]	Guernsey, Wyo	C. F. Gleason	Supt. of power	A. T. Stimpfig [5]	A. T. Stimpfig	do	Do.
Carlsbad	Carlsbad, N. Mex	L. E. Foster	Superintendent	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Rio Grande	El Paso, Tex	L. R. Fiock	do	H. H. Berryhill	H. H. Berryhill	do	Do.
Umatilla, McKay Dam	Pendleton, Oreg	C. L. Tice	Reserv. supt		Denver office	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg	Chas. C. Ketchum	Superintendent	C. M. Voyen	C. M. Voyen	do	Do.
Klamath [6]	Klamath Falls, Oreg	B. E. Hayden	do	N. G. Wheeler	J. C. Avery	R. J. Coffey	Berkeley, Calif.
Owyhee	Owyhee, Oreg	F. A. Banks	Constr. engr	H. N. Bickel	F. P. Greene	B. E. Stoutemyer	Portland, Oreg.
Belle Fourche	Newell, S. Dak	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Billings, Mont.
Salt Lake Basin [7]	Coalville, Utah	F. F. Smith	Constr. engr	C. F. Williams	Denver office	J. R. Alexander	Montrose, Colo.
Yakima [8]	Yakima, Wash	John S. Moore	Acting supt	R. K. Cunningham	C. J. Ralston	B. E. Stoutemyer	Portland, Oreg.
Yakima, Kittitas	Ellensburg, Wash	R. B. Williams	Constr. engr	Ronald E. Rudolph [5]	do	do	Do.
Riverton	Riverton, Wyo	H. D. Comstock	Superintendent	R. B. Smith	Denver office	Wm. J. Burke	Billings, Mont.
Shoshone [9]	Powell, Wyo	L. H. Mitchell	do	W. F. Sha	do	do	Do.

[1] Arrowrock Reservoir, Boise diversion dam, and Black Canyon power plant.
[2] Jackson Lake and American Falls Reservoirs, power system and Gooding division.
[3] Malta, Glasgow, and Storage divisions.
[4] Pathfinder and Guernsey Reservoirs, and powers system.
[5] Acting.
[6] Storage, main, and Tule Lake divisions.
[7] Echo Reservoir.
[8] Storage, Tieton, and Sunnyside divisions.
[9] Reservoir, power plant and Willwood division.

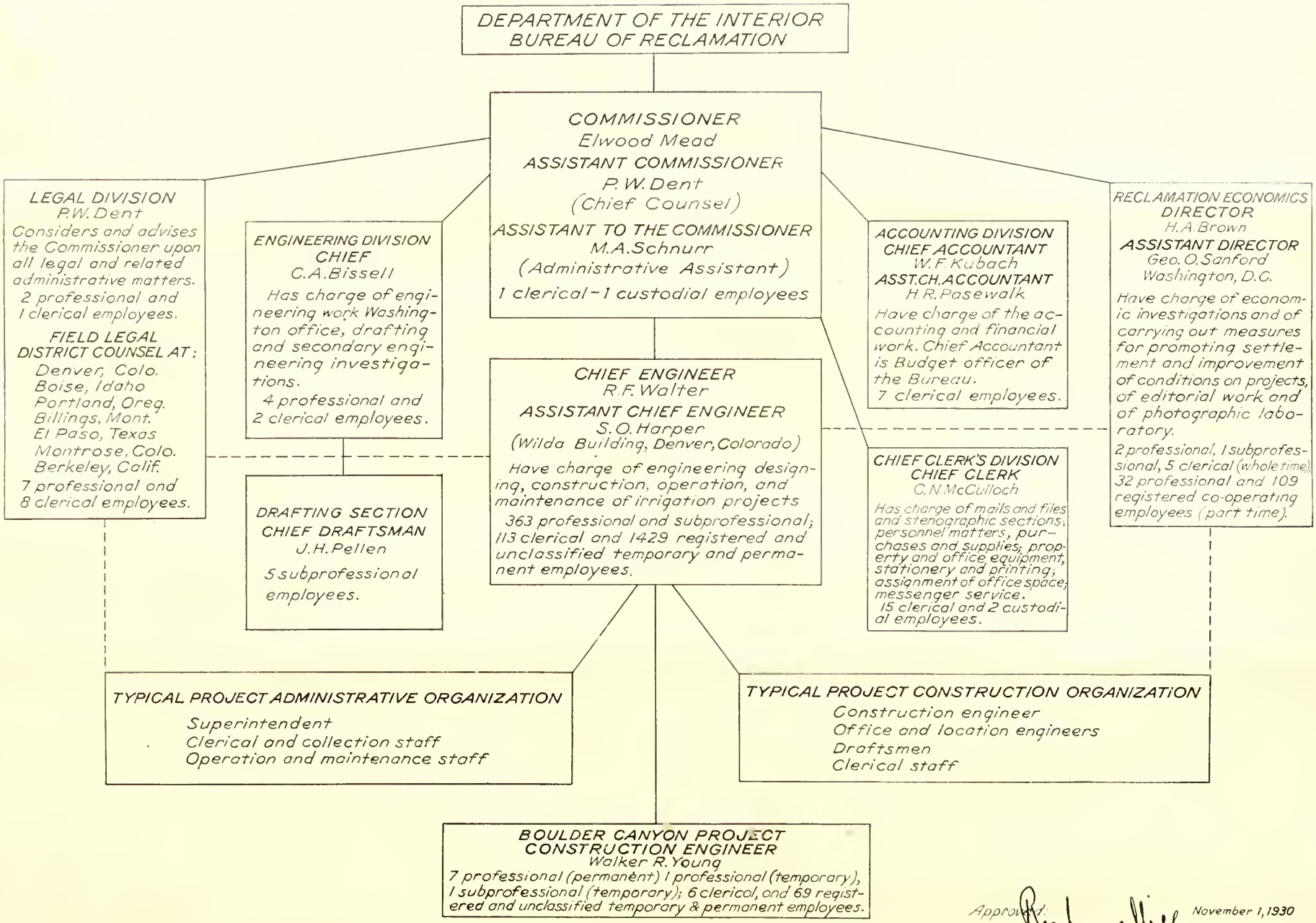
Completed projects or divisions constructed by the Bureau of Reclamation and operated by water-users' organizations

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Salt River	Salt River Valley, W. U. A	Phoenix, Ariz	C. C. Cragin	Gen.supt.and chief engr	F. C. Henshaw	Phoenix, Ariz.
Grand Valley, Orchard Mesa	Orchard Mesa irrig. district	Grand Junction	C. W. Tharpe	Superintendent	H. O. Lambeth	Grand Junction.
Boise [1]	Board of Control	Boise, Idaho	Wm. C. Tuller	Project manager	F. J. Hanagan	Boise, Idaho.
King Hill	King Hill irrigation district	King Hill, Idaho	F. L. Kinkade	Manager	Chas. Stout	Glenns Ferry.
Minidoka gravity	Minidoka irrigation district	Rupert, Idaho	R. L. Willis	do	W. C. Trathen	Rupert, Idaho.
Minidoka pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley, Idaho.
Huntley	Huntley irrigation district	Ballantine	E. E. Lewis	Superintendent	H. S. Elliott	Ballantine, Mont.
Milk River, Chinook division	Alfalfa Valley irrig. district	Chinook, Mont	A. L. Benton	President	R. H. Clarkson	Chinook, Mont.
Do	Fort Belknap irrig. district	do	H. B. Bonebright	do	L. V. Bogy	Do.
Do	Harlem irrigation district	Harlem, Mont	Thos. M. Everett	do	Geo. H. Tout	Harlem, Mont.
Do	Paradise Valley irrig. district	Chinook, Mont	R. E. Musgrove	do	J. F. Sharpless	Zurich, Mont.
Do	Zurich irrigation district	Zurich, Mont	John W. Archer	do	H. M. Montgomery	Do.
Sun River, Fort Shaw division	Fort Shaw irrigation district	Fort Shaw, Mont	H. W. Genger	Superintendent	H. W. Genger	Fort Shaw, Mont.
North Platte:						
Interstate division	Pathfinder irrigation district	Mitchell, Nebr	T. W. Parry	Manager	Mary McKay Kinney.	Mitchell, Nebr.
Fort Laramie division	Gering-Fort Laramie irrig. dist	Gering, Nebr	W. O. Fleenor	do	C. G. Klingman	Gering, Nebr.
Do	Goshen irrigation district	Torrington, Wis	A. B. Reeves	do	Mrs. Nelle Armitage.	Torrington, Wyo.
Northport division	Northport irrigation district	Northport, Nebr	D. R. Dean	do	Mrs. M. J. Thompson	Bridgeport, Nebr.
Newlands	Truckee-Carson irrig. district	Fallon, Nev	D. S. Stuver	Project manager	L. V. Pinger	Fallon, Nev.
Umatilla:						
East division	Hermiston irrigation district	Hermiston, Oreg	E. D. Martin	do	W. J. Warner	Hermiston, Oreg.
West division	West Extension irrig. district	Irrigon, Oreg	A. C. Houghton	Secretary and manager	A. C. Houghton	Irrigon, Oreg.
Klamath, Langell Valley	Langell Valley irrig. district	Bonanza, Oreg	R. S. Hopkins	Manager	R. S. Hopkins	Bonanza, Oreg.
Do	Horsefly irrigation district	do			Wm. F. B. Chase	Do.
Strawberry Valley	Strawberry W. U. A	Provo, Utah	Lee R. Taylor	President and manager	E. G. Breeze	Payson, Utah.
Okanogan	Okanogan irrigation district	Okanogan, Wash	J. C. Iddings	Superintendent	Nelson D. Thorp	Okanogan, Wash.
Shoshone:						
Garland division	Shoshone irrigation district	Powell, Wyo	Frank Roach	Irrigation superintendent	Geo. W. Atkins	Powell, Wyo.
Frannie division	Deaver irrigation district	Deaver, Wyo	Sydney I. Hooker	do	Edw. T. Hill	Deaver, Wyo.

[1] Boise, Kuna, Nampa Meridian, Wilder, New York, Big Bend, and Black Canyon irrigation districts.

Important investigations in progress

Project	Office	In charge of—	Cooperative agency
All-American canal	Denver, Colo	H. J. Gault	Imperial and Coachella districts.
Central California water resources	Sacramento, Calif	W. R. Young and C. A. Bissell	State of California.
Salt Lake Basin	Salt Lake City, Utah	E. O. Larson	State of Utah.
Columbia Basin	Spokane, Wash	H. W. Bashore	



Approved: Ray Lyman Wilbur November 1, 1930
Secretary.

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